IT WAS THE LEAST I COULD DO... THE LEAST BROOK LAMPREY, THAT IS!

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This is a fish story-perhaps unlike any other fish story that you have heard—and I'm sure that you have heard some doozies. This story starts in March of 2005, soon after my family moved into our neighborhood in rural Johnston County, North Carolina. Chris, my then 14-year-old son, saw some long skinny fish in the stream behind our house and asked what they were. I dipped one up with a net and expected it to be an American Eel Anguilla rostrata. I immediately knew it was not and recognized the lamprey-like appearance. A quick phone conversation with Wayne Starnes, then Curator of Fishes at the North Carolina Museum of Natural Science, revealed that it was the Least Brook Lamprey Lampetra aepyptera (Figure 1). This is a small (4–7 inches), nonmigratory and non-parasitic freshwater lamprey unlike the more well-known Sea Lamprey Petromyzon marinus that is both migratory and parasitic. There were so few records of Least Brook Lamprey from the state that Wayne was glad to get a few specimens for the museum's research collection.

The stream where we found them is so small that you can step across it in most places (Figure 2). It is a clear running stream with an average depth of only about 6 inches on a gravel and sand bed. The stream originates in the mixed wooded area behind my house and is probably spring fed. Most people would not give the stream a second thought and probably would lump it in the category of a "drainage ditch." For the Least Brook Lamprey (and who knows what else), however, this little stream and others like it is their whole world. They live here, feed here, reproduce here, and die here! These little streams are not just special to them—they are essential.

The Least Brook Lamprey belongs to the family Petromyzontidae, which includes nine species of freshwater brook lampreys

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As with other brook lampreys, the Least Brook Lamprey starts in a larval fish form, called an ammocoete, that is hatched from



Figure 1. Adult Least Brook Lamprey male. (Photo by Scott Smith)



Figure 2. The stream where lamprey spawn (Johnston County, North Carolina) shot in 2019. The stream has widened since flooding from Hurricane Mathew in October 2016.



Figure 3. Least Brook Lamprey nest.

the eggs produced during spawning. As ammocoetes, the lampreys live in the stream sediment and filter feed on algae and other organic material. The ammocoetes do not have eyes in this form. They live for 3 to 7 years in this larval stage (Rohde et. al. 1976), living in the stream bed and generally hidden from sight. Only when the lampreys have transformed to the adult form and emerge in the spring to spawn do they become easy to see. And what a show they put on!

The adult lampreys work in small groups (3–10 +) creating nest depressions in the sand and gravel substrate of the stream (Figure 3). Working in shallow water with a steady current, they are almost always swimming upstream and using their suckerlike mouth to move rocks from the depression (Figure 4). They also anchor to larger rocks and vigorously undulate their body churning sand and smaller rocks out of the depression. They rest by anchoring to a rock, floating just under the stream surface. Using a GoPro camera, I filmed the spawning behavior and underwater videos are available on YouTube at https://youtu.be/4yhFPMtjcFg and https://youtu.be/Uh1YSUy-IFo.

Intervals of spawning occur during the nest building activity. The female anchors to a larger rock, and then a male will attach with his mouth on top of the female's head. He then curls the posterior of his body around the female and both vigorously wriggle (Figure 5). Eggs and sperm are being released at this time. The sticky eggs fall and stick to the sand and gravel substrate. Hatching is presumed to happen within a few days. And thus, the ammocoete phase of their life begins.

The adult lampreys do not feed at all and die soon after the spawning season. Since the larval lampreys take several years to mature, it is presumed that each year's group of spawning adults is from spawning events that occurred a few years ago. So, it would be expected that the number of adults observed will vary from year to year based on reproductive effort in a previous year and on stream conditions in the intervening years before maturity that would have affected the growth and survival of the larval lampreys.



Figure 4. Least Brook Lamprey mouth disc. (Photo by Scott Smith)

I began systematically documenting the lampreys spawning effort in 2015 by surveying the section of stream immediately behind my house every day during the two to three-week spawning season. In 2015, my highest daily count was 14 lampreys. In 2016, my highest count was 43 lampreys.

It is a short show, but it is a fascinating thing to watch when the lampreys are spawning. Towards the end of the spawning season, the few remaining lampreys just hang out in or near the nest attached to a rock and limply swaying with the current as their life comes to an end. It is a little sad, but this is the way of their life on earth.

The small streams, or brooks, that lampreys need for their life on earth are also a dying breed. These small clear running streams don't fare well with nearby construction of commercial and residential projects. It would only take one faulty siltation fence or failure of a retention pond from a nearby construction project to smother such a stream under a blanket of mud and silt. The lampreys and all the other inhabitants of the stream would suffer greatly.

So, relish those small streams. Spend some time in them to discover the wonderful diversity of life they support. And keep an eye on them to make sure they don't suffer from any construction projects that might be nearby. Once lost, it is hard to get them and all the life that once was there back. The Least Brook Lamprey may



Figure 5: Spawning Least Brook Lampreys. (Photo by ©Todd Pusser)

not be the prettiest animal you will ever see, but they certainly are one of the more interesting animals. Ensuring their continued survival in our world is the *least* that we can do!

LAMPREY EPILOGUE (SPRING 2020)

Since first writing about the Least Brook Lamprey in 2016, I have continued to monitor their annual spawning behavior in the stream behind my house in Johnston County, North Carolina. I begin daily visual surveys of the stream on February 1 to make sure that I document their first appearance as adults to spawn in the stream. (Figure 6).

My surveys cover 168 meters (550 feet) of the stream beginning just below a small cascade over a rock terrace. No lampreys have been observed above this point. I do spot checks downstream of this section during the spring spawning period but do not include those numbers in my daily survey. I have varied survey times and find that I get the highest counts in mid-day when the sun and water temperatures are highest. Though the stream is coursing through mixed hardwoods, the stream receives full sunlight during this time of year before the trees leaf out.

I usually walk the stream twice, upstream and downstream, to make sure I don't miss any lampreys. I note lampreys, gravel nests and their locations in the stream using landmarks or survey flags. I define a nest as a depression in the gravel/sand stream bed created by the rock-moving and swimming action of two or more lampreys. I note how many lampreys are active in each nest and if I see spawning in addition to nest building. I am counting many of the same individuals on subsequent daily counts plus new ones that have may have been hidden or not active on previous days.



Figure 6. Annual highest daily counts. (*I may have missed peak of spawning activity in 2015.)

Some may have scars or colorations that allow me to recognize individuals, but for the most part I do not recognize individuals.

The goal of my surveys is to document first appearance, highest daily count and last appearance of the lampreys. The lampreys demonstrate strong fidelity to the nest. Even when all the other lampreys are gone, the last lamprey will stay in or near the nest by itself until it too disappears. Some may die, but many are probably eaten by predators. It's quite sad to see a lone lamprey simply hanging on a rock and waving in the current for days until it's gone. But that's their way, and hopefully they have contributed to the next generation of lampreys.

I deploy trail cameras along the stream aimed at nest areas to document predators. Though raccoons routinely patrol the stream at night, I have not seen any evidence of them finding/ eating lampreys. During the daylight hours I have documented numerous occasions of Red-shouldered Hawks preying on them. Cameras catch them plunging feet first into the stream, grabbing lampreys with their talons, and eating or flying off with them. Great Blue Herons also patrol the stream periodically, but I have not recorded them eating any lampreys. One Common Grackle was seen with a lamprey in its beak trying to eat it. Screech Owls have also been recording standing in the stream near nests on two occasions.

Flooding events after heavy rains certainly impact the lamprey population in the stream. The highest daily count was 43 lampreys in 2016, dropping down to 4 in 2017 after Hurricane Matthew in October of 2016. Hurricane Matthew produced heavy rains that created a major flooding event in the stream, with significant scouring of the stream bed. I cannot imagine any stream denizen surviving or physically remaining in the stream after that event. The numbers appear to be rebounding in subsequent years except for this year. Just the day before the first 2020 appearance, 4 inches of rain created a significant flooding event. Not on the scale of Hurricane Matthew but enough to scour the stream bed. The drop in highest daily count drop in 2020 from the 2019 count may be at least partially attributed to this. Of course, such flooding events are natural, and the lampreys certainly have managed to survive such events in the past.

I hope that I can continue to monitor this population of Least Brook Lamprey for many more years. I look forward to their first appearance in February. I have tried to bring attention to this little-known fish in our local streams with talks, articles and social media. I send out alerts when they begin spawning in my stream and encourage people to look for the lampreys and help us document where they occur. It was just luck that I moved into a house next to a stream with Least Brook Lampreys. I hope that I can contribute to our knowledge of this fish and encourage conservation measures to ensure that they always have clean running streams to live in. That is the least that I can do!

Reference

Rohde, F. C., R.G. Arndt, and J.C.S Wang. 1976. Life History of the Freshwater Lampreys, *Okkelbergia aepyptera* and *Lampetra lamottenii* (Pisces: Petromyzonidae), on the Delmarva Peninsula (East Cost, United States). *Bulletin of the Southern California Academy of Sciences*: 75(2).