COLLECTING AND SPAWNING THE LEAST BROOK LAMPREY, Lampetra aepyptera (Abbott, 1860)

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The question "Why lampreys?" is one that's often asked and indeed deserving of an entire article unto itself. For considerations of space and disdain for philosophical discourse, it's a topic that won't be treated here. Accepting my interest in these near-fishes as a given, what follows is an account of a recent collecting trip and captive spawning of the Least Brook Lamprey, Lampetra aepyptera.

L. aepyptera is a member of a large family (Petromyzonidae--often misspelled Petromyzontidae) with circumpolar distribution in both the northern and southern hemispheres. The salient characters distinguishing lampreys from "true" (bony) fishes include the entirely cartilaginous skeleton, the absence of paired fins, seven paired gill openings, and a suctorial disc in lieu of jaws. The genus Lampetra is represented by about eighteen species on three continents: North America, Europe, and Asia. It is composed of both parasitic (most anadromous) species and non-parasitic brook lampreys that complete their entire life histories within the confines of a single stream or stream system.

Classification

While most lampreys exist as species pairs or groups--a parasitic species with one or more non-parasitic derivatives--L. aepyptera is a distinctive species that has at times been referred to the monotypic genus Okkelbergia Creaser and Hubbs. Remaining equivocal on its proper generic position, Hubbs and Potter (1971) chose as a "provisional and non-committal course" to place the species in Okkelbergia, citing its extremely degenerate dentition as the main obstacle to inferring with any degree of certainty the ancestral group from which aepyptera has been derived. Rohde (1960) considered L. meridionale (Vladykov, Kott, and Pharand-Coad, 1975) to be the closest relative of L. aepyptera, if not a junior synonym.

Range & Life History

L. aepyptera displays a disjunct distribution in the eastern U.S. It occurs west of the Appalachians from Pennsylvania west to Missouri and Arkansas, and south to Alabama and Mississippi; and east of the Appalachians from extreme southeastern Pennsylvania south to North Carolina (Rohde and Jenkins, 1980). Its habitats are typical of those for non-parasitic lampreys--small streams of intermittent flow with areas of gravelly riffles, as well as silty bottoms, often with decaying organic material. Individuals remain as filter-feeding larvae (called ammocoetes) buried in the soft mud subdstrate for their first two to seven years. Upon metamorphosis to the adult stage, they emerge only to reproduce and die. They don't feed as adults, the entire gastrointestinal system having become non-functional. While the timing and duration of the various life stages are somewhat species-specific, all brook lampreys share this same general life histroy. Parasitic species, on the other hand, descend as adults to the sea or

(depending on the species) large bodies of fresh water to live off the body fluids of the piscine hosts to which they attach.

Although L. aepyptera is a small species even for a brook lamprey, the common name "Least Brook Lamprey" is somewhat of a misnomer, since the adults of at least several other species (e.g., L. minima, Ichthyomyzon gagei) attain smaller maximum sizes than aepyptera's seven inches (c. 180 mm).

Collecting Them

On April 7, 1984, I convened a small but dedicated group of like-minded collectors (read: masochists) on the Delmarva Peninsula, where there are numerous records of both L. aepyptera and L. appendix. Apparently L. aepyptera has been recorded only from those streams draining the western slope of the Peninsula (Chesapeake side), and L.appendix only from those draining the eastern slope (Atlantic side)(Cooper, 1983; Rohde, Arndt, and Wang, 1974 and 1975). Besides L. aepyptera and myself, the principals in this endeavor were Buz Allen and AMERICAN CURRENTS editor Bruce Gebhardt--both of Philadelphia, Pa.--and John Eccleston, then of Swarthmore, Pa., now of London, England. A three-hour random search for suitable lamprey habitat in Cecil County in extreme northeastern Maryland proved unsuccessful, and was eventually abandoned in favor of a specific search for Perch Creek in Cecil County, from which there is a record of L. aepyptera cited in Rohde and Jenkins (1980). A stop at a local police station (about the size of my bathroom) and a call to a friend of a friend of a friend provided me with a sketchy cognitive map. After several more hours of searching, we finally found a section of Perch Creek well off the beaten path which indeed looked like prime lamprey habitat--short courses of shallow, rapid riffles between areas of deeper, slower flow. Allen and I drove to the farmhouse of what appeared to be the owner of the land through which the stream flowed, and waited a short while for the old lady to return from shopping. After more than a few suspicious glances, she granted us permission to collect on her property. (Some advice for prospective lamprey hunters: Never tell such people that you're after lampreys. If they don't know what a lamprey is, you'll only confuse them. If they do know what a lamprey is, they'll think you're crazy and call the police.)

In any event, after five or six hours of fruitless driving and periodic exploring in a cold, stinging drizzle, our spirits were now high. Having parked our vehicles well off the small country road, we lugged our collecting and photographic equipment about a hundred yards downstream through thick mud and skunk cabbage, until we came upon a section of stream which seemed likely to yield adult lampreys, if indeed there were any to be found. This was a straight section of the stream, approximately thirty to fifty feet in length, eight feet across, and varying in depth from one to five feet, but mostly two to three feet. The bottom was of firm sand, mud, and/or clay, with patches of gravel usually in the shallower areas. There were few large rocks, and few plants except for some very nice Fontinalis. The current was very swift from recent heavy rains, but the water was surprisingly clear. Water temperature was 42°F (6°C), and chemical tests branded the water as hard and alkaline. Air temperature was 48°F (9°C), though a strong, relentless north wind made it seem much colder (and much more unpleasant).

We made several passes with our four-foot-high, quarter-inch-mesh seine, its ends rolled up to accommodate the width of the stream, but each came up empty. We quickly opted for a method Allen and I--and no doubt countless others--have used with great success in collecting lampreys, sculpins, darters, and other fishes inhabiting swift and relatively shallow waters. That is to keep the seine stationary, positioned so that it spans the entire width of one of the swifter areas of the stream, its bottom weighted down with rocks, so that it becomes an impassable barrier to dispersing fishes. With Gebhardt and Eccleston holding the ends of the seine buried in the stream banks, Allen and I entered the water about twenty feet upstream and, moving in a downstream direction, kicked up the bottom of the stream until we reached the seine, whereupon it was raised out of the water. In this way, any fishes hiding under rocks, in vegetation, on or around the stream bottom, or under the banks would be dislodged and carried by the swift current into the net. It's a very efficient method, and our first attempt yielded our first specimen of L. aepyptera, a four-inch (10cm) adult male.

We continued collecting in the same area until we had about ten adult specimens, ranging in length between four and five inches (c. 10-13cm), and surprisingly comprised of about equal numbers of males and females. (One of the most vexatious aspects of collecting L. appendix for me had always been the disproportionately large number of males to females collected, usually five to one or greater.) Sexing adult brook lampreys is an easy task. Adult males have higher and more highly ramified dorsal fins (particularly the second dorsal) than do females. Males are also thinner and have a prominent penis. Females, in addition to having smaller fins, show a bulbous enlargement immediately posterior to the urogenital opening. When ripe, the body becomes turgid with eggs, which can be seen quite easily through the skin on the ventral surface of the body.

One of the nice things about collecting lampreys is that nobody wants them, and I usually get to keep the entire catch. So, given the favorable sex ratio, ten specimens seemed sufficient. We moved our operation slightly downstream to a bend in the stream where the current slowed and the bottom was composed of soft mud and decomposing organic material. It was here that we planned to search for ammocoetes.

Ammocoetes

Collecting ammocoetes is quite a different endeavor from collecting adult lampreys. Instead of nets, five-gallon plastic buckets are used to scoop up mud from the prospective ammocoete beds. The mud is dumped on the bank and fingered through in search of the larvae, which range in size from less than an inch (almost impossible to find in the mud) to greater than the adult size (since there is a diminution in size upon metamorphosis from the larval to the adult stage in brook lampreys). Regardless of size, ammocoetes are easily distinguishable from adults by having a horseshoe-shaped hood where the adult has a circular oral disc; eyes covered by skin; and gill openings connected by a groove. The fins are also very poorly developed in the larval stage.

Hard though it may seem to believe, fingering through organic muck for ammocoetes is not everybody's idea of fun--indeed, taking your girlfriend ammocoete-hunting is almost guaranteed to keep you single--so it usually

takes a little longer to get my quota of ammocoetes, while the rest of the collecting party bows out of this activity. Since adult lampreys will also burrow on occasion, a few additional adults were taken during the search for larvae.

Having obtained about a dozen ammocoetes, we moved back upstream to fill our buckets with clean water from the habitat for transporting our specimens home. I kept all the lampreys, while Allen and Gebhardt each took one pair of what were the most magnificent specimens of Tesselated Darter (Etheostoma olmstedi) I've ever seen--beautifully marked three-inch (8cm) nuptially colored males, and two-inch (5cm) females distended with eggs. (Despite high hopes for breeding, both females ultimately died, very possibly killed by their respective mates in captivity. Gebhardt suggests using dither fishes, or, optimally, multiple females, along with sufficient cover, for future breeding attempts with this species.)

Bringing Them Back Alive

Traditionally, my chest waders serve but a decorative function, and this day was no exception. A leak somewhere around the knees kept me in 42°F water for the several hours we spent collecting, and I was by now as concerned with getting myself to where I was going alive as I was for my fishes. So, I packed my five-gallon buckets in the trunk, took off my pants, turned my heater on full blast, and headed north on Route 213. Certainly the most satisfying aspect of the entire trip for me occurred about an hour after our party had split up and we'd gone our separate ways. Driving to Washington, DC to stay with a friend for the weekend, I stopped to buy beer in a small store in Maryland and was "proofed" (asked for proof of age)--the counter girl didn't believe I was more than eighteen years old. One must understand that at the age of thirty-three, and with a neurotic fear of aging in general and impending death in particular, little things like being proofed--the bane of any highschooler's existence--are all-too-infrequent experiences to be savored.

Still euphoric from having been mistaken for a teenaged punk, I arrived in DC. My specimens were set up with several adults and/or ammocoetes to a five-gallon bucket. Additionally, several half-gallon plastic jars held one specimen each. All containers were filled with clean water from the collecting site plus an equal amount of established aquarium water. No new (biologically sterile) water was used. My friend offered the use of her balcony, where nighttime temperatures kept the containers at a cool 40° to 50°F (c. 5°-10°C). As a control, several of the small containers were kept at room temperature of 65° to 70°F (c. 18°-21°C) throughout. Over the course of the ensuing thirty-six hours, no fish were lost in any containers.

Further observation during this time showed that two of the presumed lampreys were, in fact, small American Eels (Anguilla rostrata), demonstrating that Perch Creek's short run west to the Chesapeake Bay was free of obstructions to these catadromous migrants. Such an observation points up the danger of making identifications of fishes in the net, or while viewed from above in holding buckets. Although not closely related phyletically, the similar superfical morphology, undulating out-of-water movements, and

(here only coincidentally) comparable sizes of the adult lampreys and the young eels were enough to fool at least one veteran lamprey-watcher.

Spawning

Thirty-six to forty-eight hours after capture, my specimens were set up in my fishroom. Initially placed in bare, slate-bottomed tanks with sunken nylon mops (used for spawning killifishes), the ammocoetes were subsequently transferred to small aquaria containing sand (i.e., #0 gravel) substrates. Two adult males and one adult female were transferred to a planted ten-gallon (37 l.) tank with a substrate of coarse river gravel and undergravel filtration. This tank was to be used for photographing, general observation, and, I hoped, spawning. The other adults were left in the aforementioned bare tanks with sunken nylon mops for cover. Photoperiod was typically eighteen hours of light; ambient fishroom temperatures ranged between 57° and 62°F (c. 14°-17°C). Of course, no foods are offered adult brook lampreys. As of this writing (3/85), several ammocoetes are still alive under the sand of their small aquaria. They survive on what microorganisms naturally occur in the water. All adults either died a natural death or, though alive and healthy, were preserved within one month of capture. The last surviving specimen, a male, died of apparently natural causes on May 7, 1984. Such an adult, post-spawning life span is consistent with that observed previously in L. appendix, L. richardsoni, and Ichthyomyzon gagei. All of the following observations refer to the spawning trio in the planted ten-gallon tank, as well as to the eggs and larvae resulting from their spawning.

Within a day of being placed in the aquarium, the two males had fanned out several conspicuous depressions. This is done by attaching to a stone (or, in the aquarium, the glass) with the oral disc and thrashing the body about wildly. On subsequent days, the female was also observed exhibiting this same behavior. Eggs (1mm in diameter) were first found after three days in the spawning tank--less than one week after the fish were collected. At this time, the female's vent area was red and swollen; the mouth was bloody as well. Presumably near death, she was preserved along with one of the males, apparently still in good condition. The eggs were left untouched (by me), most of them settling into the crevices between the relatively large pebbles comprising the river gravel. A strong flow of water through the gravel by means of undergravel filtration was thought to be beneficial to the incubating eggs. Since I work mostly with killifishes, a conscious effort is periodically required to tune in to the very different characteristics of the eggs of other fishes. The eggs of lampreys, for example, possess several characteristics that would not be observed in a healthy killifish egg, most prominent of which is their opaque white coloration. The simple fact that the eggs were not attacked by fungus--some aquarists contend that a healthy egg will never succumb to fungus attack--maintained my faith in their viability during the ensuing incubation period. At temperatures ranging between 58° and 60° F (14.5°-15.5°C), mean 59.7°F, mode 60°F, the first eggs were observed to have hatched after eight days. Upon hatching, the larvae measured three millimeters in length, and were boomerang-shaped, with one side longer than the other. Still opaque white, they resembled maggots more than anything fishlike. In lieu of my crude drawings--I have no microscope attachment for my camera--I direct the reader to an excellent photographic sequence of embryogenesis and ontogenesis appearing in Piavis (1971), based on material of landlocked Petromyzon marinus.

For future photographic purposes, small groups of live ammocoetes were preserved (initially in 10% formalin, subsequently transferred to isopropyl alcohol) at intervals of five, nine, and seventeen days after hatching. Individuals in this last group had already begun to assume the gray coloration typical of older larvae. Whether because they settled progressively farther down into the gravel, or for whatever reasons had begun to die off, or both, no living ammocoetes from this spawning were observed after three weeks post-hatching. Subsequent attempts to stir them from the gravel bed proved unsuccessful, so I'm not optimistic on the prospect of still having any tank-bred ammocoetes in my possession. Short of completely breaking down the aquarium (which is still in constant use as a photographing tank), I would not state with any degree of certainty that none still exist. Several wild-caught ammocoetes, on the other hand, are still alive and well under the sand of their biologically rich aquaria, having withstood summer temperatures approaching 78°F (c. 26°C). It should, of course, be pointed out that sand and gravel are not the preferred media for maintaining ammocoetes. Serious attempts to propagate lampreys would seem to indicate the use of a soft mud substrate similar to that in which they are found in the wild.

As I write this in early March, 1985, I'm still uncertain as to which species of lamprey I'll be after this spring. Whatever I collect, however, an effort will be made to provide conditions better suited to the long-term maintenance of tank-bred larvae. And, assuming that you haven't already read more about lampreys than you'd ever want to read, I hope that such information will eventually find its way into the pages of future issues of AMERICAN CURRENTS.

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