

Observations on the Release of Superconglutinates by *Lampsilis perovalis* (Conrad 1834)

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Abstract. Field observations were made on timing and duration of the release of superconglutinates in *Lampsilis perovalis* from three Alabama stream reaches during the spring of 1995. Also, seven mussels were placed in an aquarium along with substratum and water from their stream of origin for observation and photography. All observed releases, both in the field and aquarium, began in morning hours. Reproductive condition (gravid or spent) of the majority of females in different stream reaches appeared to be related to the extent of stream canopy development, indicating that release may be stimulated by water temperature, light, or both. Superconglutinate release, from emergence of the glochidial mass from the excurrent aperture to release of the strand, was usually completed in 8 hours or less. The duration of the event may be related to temperature, individual variation, or both.

Introduction

Superconglutinate release is an extraordinary method of glochidial expulsion/host fish attraction recently identified in several species of freshwater mussels inhabiting the southeastern United States (Haag et al. 1995). A superconglutinate consists of all glochidia from both marsupial gills released in a compact mass, or "lure," that mimics a small fish in appearance as well as action if water current is present. The "lure" remains temporarily attached to the issuing female mussel by means of a transparent, double mucilaginous strand, or "line" (Figure 1). Eventually the line is detached from the issuing mussel, either intentionally or incidentally. Once detached, the line may become snagged on woody debris, rocks, or other instream objects, where the lure continues its swimming action if current is present. In 1993, superconglutinate release was found in the orange-nacre mucket, *Lampsilis perovalis*, a federally threatened species (USDI/FWS 1993).

Lampsilis perovalis was described in 1834 from the city of Claiborne on the lower Alabama River, Mobile River Basin, Alabama. This basin is the largest Gulf of Mexico drainage east of the Mississippi River. Museum and literature records indicate *Lampsilis perovalis* historically inhabited large rivers to small creeks in the Mobile River Basin. Today the species is found in numbers only in a few streams originating in and flowing through U.S. Forest Service lands in northwest Alabama (Sipsey Fork/Black Warrior River drainage). Live animals are occasionally found in the upper Tombigbee and

Black Warrior River drainages. Since the discovery of superconglutinates in 1988 (Williams and Butler 1994), only a few mussels have been observed during the process of release.

Study Area

This paper summarizes observations made in the spring of 1995 on timing and duration of superconglutinate release by *Lampsilis perovalis* in several tributaries of the Sipsey Fork of the Black Warrior River in Bankhead National Forest, Winston County, Alabama (Figure 2; Figures 2-7 are on p. 14). Observations were made in Brown, Flanagan, and Rush creeks between 2:30 p.m., 27 March, and 2:30 p.m., 29 March 1995. Each of the sites was known to

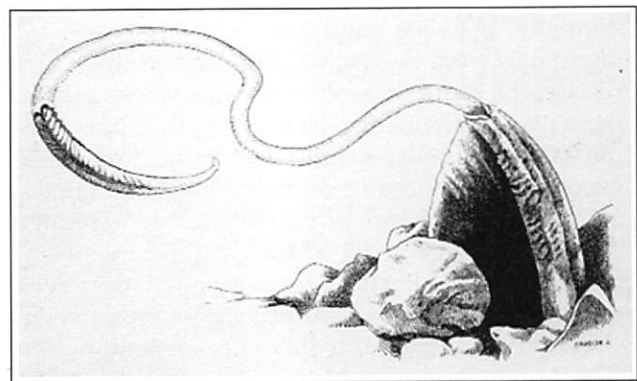


Figure 1. Illustration of female *Lampsilis perovalis* with attached "line" and "lure."

support good populations of *L. perovalis*. Stream width in the areas examined varied from 5 to 10 m; depths rarely exceeded 0.5 m. Substratum in all three streams was composed primarily of bedrock, cobble, and gravel in riffles and runs, with clean sand and sandy gravel in pools.

Results

An approximately 100-m reach of Brown Creek was searched during the early afternoon of 27 March 1995. The reach has a moderate gradient, high banks, and a complete canopy. Water temperature the morning of 29 March was overcast and cooler than the previous 2 days. Gravid mussels were monitored at the original Brown Creek site from 8:00 a.m. to 2:30 p.m. Water temperature did not rise above 13°C. At 8:00 a.m. we encountered a mussel that had expelled a superconglutinate and about 3.0 cm of "line." By the time of departure at 2:30 p.m., the superconglutinate was still attached to the mussel by less than 1.0 m of line. No other release activity was observed. Three gravid females along with 5 gallons of substratum (sand, gravel, and cobble) and 5 gallons of creek water were collected to be returned to the lab.

On 30 March the three gravid *L. perovalis* were placed in a 10-gallon aquarium arranged with the substratum and water from Brown Creek. The mussels moved around the tank for that day and night with about one half of their shells exposed. By the next day they were relatively stationary, siphoning, and undulating their mantle flaps. At approximately 10:00 a.m., 1 April 1995, a superconglutinate began to emerge from the excurrent siphon of one female. Aquarium water temperature was 22°C. By 10:45 a.m., the superconglutinate and about 3.0 cm of line had cleared the siphon. At 11:30 a.m., about 20 cm of line had been discharged. At 3:15 p.m., the female released the line and began siphoning normally. Between 1 and 2 m of line had been discharged from the female. Throughout the release, the incurrent siphon remained closed, and there was no mantle flap activity. By 9:00 p.m., the mussel was completely buried with only its siphons exposed. The other two captive females siphoned and undulated their flaps normally for an additional 2 days. On 4 April 1995, all three captive mussels were returned to Brown Creek. Many of the gravid mussels that had been observed the previous week were spent and had buried into the substratum.

Another four gravid mussels were located and collected from the site along with 5 gallons of fresh creek water, and returned to the lab. All of the

mussels acclimated rapidly, establishing position, siphoning, and undulating their mantle flaps. On 6 April, at 10:00 a.m., one of the mussels began discharging a superconglutinate. The release was similar to the previous aquarium discharge described above. At 12:30 p.m. the mussel released the line (1-2 m in length) and began siphoning normally shortly thereafter. By the next morning the animal was completely buried in the substratum. The following week all mussels were returned to Brown Creek.

Discussion

In late winter, *L. perovalis* females move vertically in the substratum to expose one-half to two-thirds of their shells above the stream bottom (Figures 2 and 3; these and remaining figures are on page 22). It is hypothesized that this position elevates the line and lure off the bottom, reducing abrasion and improving its action for attracting potential fish hosts. It may also facilitate mantle flap movements and marsupial aeration.

Female *L. perovalis* have well-developed mantle flaps bordered by papillae (Figure 3), similar to other lampsiline species (Gordon and Layzer 1989). At least 1 to 2 weeks prior to discharge of the superconglutinate, the female exhibits vigorous rhythmic undulations of the flap. The undulations occur at 8- to 15-second intervals and last for about a second. The mantle flap movements cease with the release of the glochidia as in other lampsiline species (Kraemer 1970), and are probably associated with marsupial aeration.

Superconglutinate release by *L. perovalis* has been observed between 15 March and 15 June; however, the majority of animals appear to synchronize their releases between the last week of March and the first week of April when water temperatures approach 15°C. The period of sperm release and fertilization is unknown; however, by September the marsupia of most females are fully developed and the glochidia are mature.

The release of superconglutinates may be influenced by temperature, light, or both. As noted in the late March 1995 observations, females from populations inhabiting stream reaches with open canopies were mostly spent, while the majority of females from stream reaches with closed canopy were still gravid.

The superconglutinate releases observed, from emergence of the glochidial mass from the excurrent aperture to release of the strand, have taken 8 hours or less. The duration of the process may be related

to temperature, individual variation, or both. As noted above, two individuals observed releasing superconglutinates *in situ*, produced over 40 cm of line/hr at 16°C. However, another individual monitored *in situ* throughout release took approximately 8 hours to complete the process, and produced less than 10 cm/hr of line at 14°C.

In the aquarium, where water temperature was 22°C, two individuals produced about 1-2 m of line and completed the release process in about 5 hours (Figures 4-5). Both field and aquarium releases began in the early hours of daylight between approximately 7:00 a.m. and 10:00 a.m. The total length of observed *L. perovalis* superconglutinate lure and lines ranged from between 0.5 m to approximately 2.5 m. The length of the lures ranged between approximately 20 and 60 mm, and was correlated with the size of the producing mussel and its marsupium. Following release of the superconglutinate, the issuing female mussel usually reburied in the substratum within a few hours.

The typical lure mimics a generalized "minnow" with black eye spots and lateral stripe (Figures 6-7). The lower superconglutinate in Figure 7 is atypical. This was a marsupial discharge with offset conglutinates giving the lure a checkered appearance. The "swimming" action and appearance of this lure resembled a darter. Another unusual variation observed in the field consisted of the uneven discharge of the two marsupia, resulting in the appearance of two minnows swimming in tandem about 10 cm apart at the end of a 2 m line. Unfortunately, this lure was released and swept away before it could be photographed. On several occasions, fresh lures were observed with the posterior half missing, possibly the result of a strike by a predator.

The superconglutinate strategy of *Lampsilis perovalis* appears worthy of any good angler. Populations focus most of their "fishing" effort in the early spring as temperatures rise and fish feeding activity increases. Superconglutinates are produced early in the day, when feeding activity is great and there is sufficient light for the fish to see the lure. The mussels extend their shells above the substratum to provide more height to the lure and line. Additionally, they take advantage of natural currents and eddies to "play" the lure in order to attract predators. The efficacy of the lure strategy to attract host fish is evident in the numbers of snagged lines observed without lures during synchronized releases on this as well as previous visits to these streams.

Acknowledgments

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Figures 2-7 for Hartfield and Butler, pages 11-13

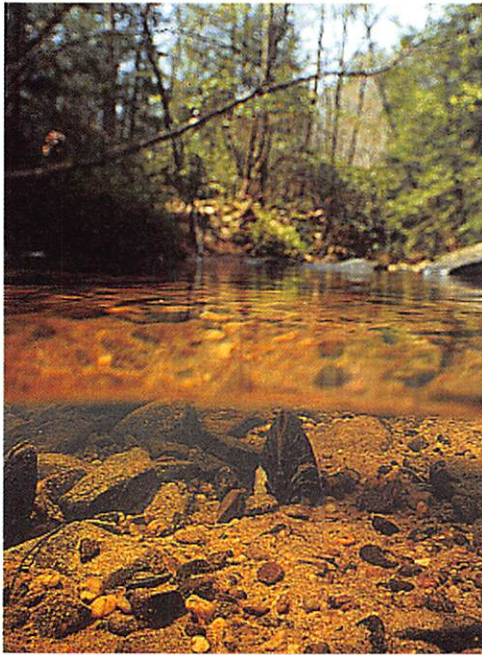


Figure 2. Brown Creek, Bankhead National Forest, Winston County, Alabama. Gravid *Lampsilis perovalis* in the lower foreground.

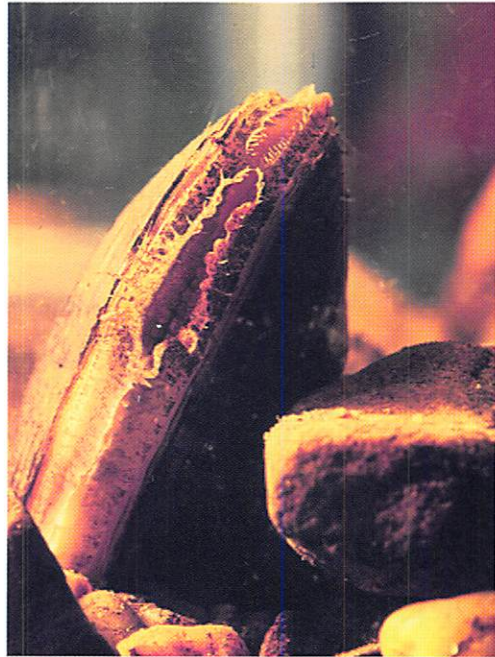


Figure 3. During late winter, gravid *Lampsilis perovalis* expose their shells above the substratum and rhythmically undulate their mantle flaps.



Figures 4-5. Sequence of superconglutinate release from a captive specimen.



Figures 6-7. Variation in superconglutinate "lures."

Figures 1 and 2 for Barnhart and Roberts, pages 16-20

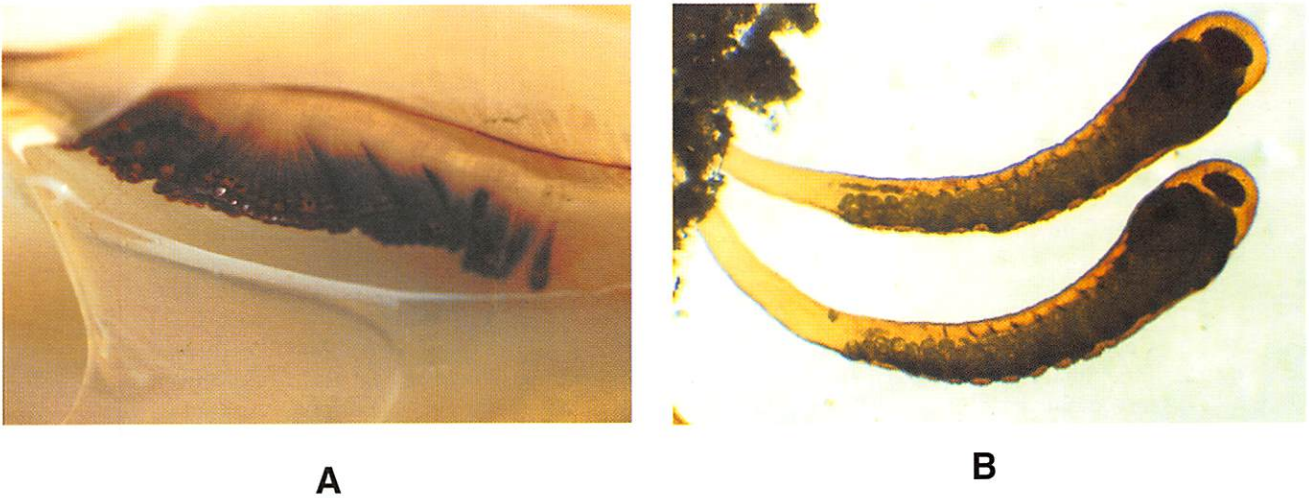


Figure 1. Glochidia packets of *Ptychobranchus occidentalis* from the North Fork of the White River, Douglas County, Missouri. **A.** Marsupial demibranch of female with the glochidia packets visible through ventral margin. **B.** Individual packets after release. The markings and dimensions are suggestive of larval fish or insects and the packets are readily attacked by potential host fish (darters). Total length of the packets is 1–1.5 cm. Note adhesion of “tails” to detritus.



Figure 2. *Lampsilis reeveiana brevicula* displaying mantle flap lure. This individual was collected from the Finley River, Christian County, Missouri. Length of the lure is approximately 4.5 cm. The fish in the background is a male rainbow darter (*Etheostoma caeruleum*).