

**Mussel Propagation, Culture, and Stocking
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For most mussel species, propagation is relatively straightforward; however, the conditions necessary for long-term culture of newly metamorphosed juveniles of most species remain unknown. During the past 12 months, we have focused our efforts on identifying some of these conditions for culturing juveniles of nonlisted species, and testing these conditions for culturing listed species.

We designed two experiments to determine if survival and growth of juveniles varied among sediment particle sizes. One-day old juveniles were cultured in 0.25-mm-mesh baskets containing one of two sediment particle sizes or no sediment. The baskets were arranged in a 3 X 3 Latin square design and suspended in a hatchery raceway. After 120 days, mean length of *Lampsilis cardium* was significantly greater in the largest particle size (2-4 mm) used. Although survival of *Actinonaias pectorosa* was low in all treatments, the largest individuals occurred in the 2-4 mm sediment. We also examined the effect of flushing fines (≤ 0.25 mm) from the heterogeneous substrate in one of two raceways used for juvenile culture at the Minor Clark Hatchery in Kentucky. Equal numbers of glochidial infested fish were introduced into each raceway. At the end of the growing season, we found juvenile mussels of two species in the flushed raceway but none in the unflushed raceway.

Prior to 1999 we covered the raceways at the Normandy and Minor Clark hatcheries with 1 layer of 70% shade cloth. Although the shade cloth greatly reduced growth of filamentous algae, sufficient light penetrated the shade cloth to maintain some algal growth. To reduce raceway maintenance, we covered all

raceways with a double layer of shade cloth in 1999. The double layer was highly effective in preventing algal growth; however, we now believe that this double layer also greatly reduced the production of smaller algal species and hence limited the available food supply for juvenile mussels. At the Minor E. Clark Hatchery only one layer of shade cloth covered the raceways in 1996, and *L. cardium* averaged 21.5 mm long after 120 days. In contrast, with two layers of shade cloth in 1999, *L. cardium* juveniles averaged only 13.4 mm in length after 120 days. The small size (< 6mm) of two juveniles, tentatively identified as *Villosa iris*, collected in September suggests that more juveniles of other species may also have been present but were too small to locate. Based on our low efficiency in recovering small juveniles (1999 cohort) at the Minor E. Clark Hatchery, we chose not to disrupt the substrate at the Normandy Hatchery. Instead, we plan to 'harvest' the 1999 cohort of endangered species in September 2000. In all, 591 fish were infested with glochidia of endangered species and released into hatchery raceways in 1999 (Table 1). Currently, we have >2,000 juvenile *Lampsilis abrupta* in our indoor culture system. Additionally, we are culturing > 2,400 mussels of five unlisted species ranging in age from 1 to 5 years (Table 2). These individuals were propagated between 1995 and 1999. Adults of endangered species in captivity are listed in Table 3.

We did not release any propagated endangered species into the wild. However, we did release 246 individuals of three unlisted species that were 1 to 4 years old (Table 4); two of the species released had been cultured throughout

their entire life-cycle, and females were gravid at time of stocking. In 2000, we do not intend to release any propagated mussels unless they are ≥ 10 mm in length.

Table 1. Numbers of juvenile mussels of endangered species produced in the last 12 months for endangered or threatened species. Juveniles have not been released into the wild, but have been retained in nursery facilities. (UK = unknown).

Species	Number of Juveniles
<i>Epioblasma capsaeformis</i>	73
<i>Lampsilis abrupta</i>	2,180
<i>Lampsilis abrupta</i> ^a	UK
<i>Lampsilis ovata</i>	7,004
<i>Lemiox rimosus</i> ^b	UK
<i>Pegias fabula</i>	7
<i>Villosa trabalis</i>	10
<i>Villosa trabalis</i> ^c	UK

^a Released 164 bass into Normandy Raceway that were infested with *Lampsilis abrupta*. Number of juveniles produced from these fish is unknown.

^b Released 164 darters into Normandy Raceway that were infested with *Lemiox rimosus*. Number of juveniles produced from these fish is unknown.

^c Released 193 darters into Normandy Raceway and 70 darters into Minor Clark Raceway that were infested with *Villosa trabalis*. Number of juveniles produced from these fish is unknown.

Table 2. Numbers of 1-5 year old mussels in hatchery raceways, and indoor culture facilities. These individuals were propagated between 1995 and 1999.

Species	Age (years)	Number
<i>Actinonaias pectorosa</i>	1	1,000
<i>Lampsilis cardium</i>	4	404
<i>Lampsilis cardium</i>	1	460
<i>Lampsilis fasciola</i>	5	34
<i>Lampsilis ovata</i>	1	500
<i>Villosa iris</i>	3	31

Table 3. Endangered mussels (adults) in captivity at the Normandy Hatchery.

Species	Number
<i>Cyprogenia stegaria</i>	3
<i>Epioblasma capsaeformis</i>	5
<i>Lampsilis abrupta</i>	28
<i>Plethobasus cicatricosus</i>	6
<i>Plethobasus cooperianus</i>	12
<i>Pleurobema plenum</i>	3

Table 4. Species, age, and numbers of cultured mussels released into the wild in 1999.

Species	Age (years)	Number	Stream
<i>Actinonaias ligamentina</i>	3	2	Licking River
<i>Lampsilis cardium</i>	1	24	Licking River
<i>Lampsilis cardium</i> *	3	150	Horse Lick Creek
<i>Lampsilis fasciola</i> *	4	70	French Broad River

*Individuals were reproductively mature.