

lots (Table 8). It appears that the most efficacious concentration of Du-Ter is also lethal to a substantial portion of the salmonid eggs. Further studies using other concentrations and exposure times with coho salmon, brook, brown, and rainbow trout eggs are in progress.

Once the hatched fry develop to the swim-up stage, they are observed for abnormalities. Abnormalities, mostly deformed spinal columns, in rainbow trout fry treated as eggs were more prevalent in lots exposed to 5 mg/L of Du-Ter (25%) than in control lots (8%).

#### ECOLOGICAL STUDIES

##### Endangered Mussel *Lampsilis higginsii*

Preliminary studies were conducted on the endangered mussel, *Lampsilis higginsii*. Specimens were obtained from Pool 10 of the Upper Mississippi River on July 8, 1981. Two female and six male Higginsii eye mussels were collected just below the Prairie du Chien bridge in Pool 10 of the Upper Mississippi River. The mussels were placed in a tank with a sand substrate and flow-through water system at the National Fishery Research Laboratory-La Crosse. The system was maintained at ambient temperature.

A short study was conducted from July 13 to July 16 to determine the mussel's burrowing rates in silt, silt-sand, sand, gravel, and rock substrates. The burrowing time was the time it took for the individual to bury itself about 75% into the substrate after initial digging. Mean burrowing times (minutes) in the different substrates were as follows: silt, 21, silt-sand, 33; sand, 32; and gravel, 63. In the rock substrate, the mussels merely righted themselves, but they were unable to actually burrow. A female with an undulating

mantle and extruded, swollen marsupial gill was noted in August and was used to obtain glochidia for host specificity studies. The mussel was gently forced open with a reverse pull pliers technique, to reveal the marsupial gill. An 18-gauge needle and syringe were used to penetrate the gill and to force water into the structure. This flushed glochidia out of the gill and into a finger bowl. The glochidia remained in the bowl for 15 minutes and were then used to infect potential host fishes. Some glochidia were placed in a 1% NaCl solution to check viability; about 80% were viable.

Nine species of hatchery-raised fish were treated with L. higginsii glochidia in September. Fish were first anesthetized with tricaine methane-sulfonate and glochidia were then injected into the right gill cavity of each. Although transformed juveniles were not obtained from any of our tests to date, it is clear that several of the test species of fish may be acceptable hosts for this endangered clam. The studies will be repeated in the spring.

Glochidia longevity without host attachment was also tested. Larvae were placed in an aerated 1-gallon tank of water. The NaCl test was used to check loss of viability with time; 80% of the glochidia were initially viable (i.e., responded to the salt treatment by snapping shut. Only 70% were responsive after 14 hours and only 50% were responsive after 48 hours. No glochidia demonstrated viability after 72 hours.

#### Bone Development in Larval Fishes

Fishes of the genus Ictiobus are a major component of the commercial fishery of the Mississippi River. Of the three species in this genus, Ictiobus bubalus, I. cyprinellus, and I. niger, only the former two, the bigmouth