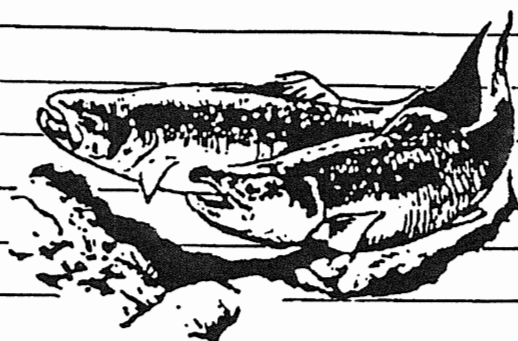




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Use of Ponds to Protect Native Freshwater Mussels

The exotic zebra mussel (*Dreissena polymorpha*) is spreading rapidly throughout the interior basin rivers of the United States. Since its introduction into Lake St. Clair in 1986, it has eliminated the native freshwater mussel fauna from Lake St. Clair, much of Lake Erie, the Detroit River, and other localized areas in this region. Zebra populations now infest native mussel beds in the upper Mississippi River, Illinois River, lower Ohio River, Tennessee River, Hudson River, and numerous other mainstem rivers throughout the central United States. Our prognosis for native mussel populations is decimation, with widespread extirpations and some extinctions expected before the year 2000. This project is evaluating the use of ponds as refugia for mussel species at greatest risk of extirpation or extinction in large rivers.

Ponds as Refugia

To protect native species at greatest risk from this exotic mussel, a project was initiated in 1992 to test the feasibility of pond refugia for riverine mussel populations. Samples of adult mussels

were collected from the Tennessee and New rivers and are being held in suspended cages within a 0.10-ha farm pond at Critz, Virginia. Mussels are held in 1- × 1- × 0.5-m plastic-screen cages fastened to PVC float collars. Large species are held unrestricted on the cage bottoms. Small species are held within 100-mm mesh plastic sleeves hung horizontally from the cage tops.

In 1993, three ponds at the state fish hatchery in Marion, Virginia, were made available to expand the project. Adult mussels collected from the Tennessee and Cumberland rivers in summer-fall 1993 are being maintained at this hatchery. Because these mussels were collected within the known range of the zebra mussel, they were scrubbed at the collection site and transported to a small quarantine pond (36 × 36 m) at Virginia Tech, in Blacksburg, Virginia. This lined irrigation pond has no inlet or outlet, and has a maximum depth of about 2 m. Mussels were quarantined for 1 month, inspected for zebra mussels, and then transported to the hatchery ponds for long-term monitoring.

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Survival in Farm Pond

After 1 year, survival in the farm pond at Critz was 72% overall. There were significant differences in percent survival among species (Table 1). *Elliptio* spp. exhibited high survival, whereas survival of *Pleurobema cordatum* and *Lampsilis ovata* was lower. We suspect that low alkalinity (17 mg/L) of the pond may be a limiting factor for some species (Table 2). Dissolution of the umbral region of valves of *L. ovata* was evident after several months, and perforations likely contributed to mortality of this species.

Survival in Hatchery and Quarantine Ponds

Survival of most mussel species has been good after 6 months of confinement (Tables 3 and 4). The variation in survival among study sites, however, was considerable. We suspect that the deposition of particulates derived from unconsumed trout pellets at the cages contributed to the low survival at the Marion Hatchery. Mussels on the cage bottoms experienced greater mortality than those suspended in the cage, likely due to reduced dissolved oxygen or ammonia production from pelleted feed decomposition. Most of these deaths were recorded after 5 months of confinement.

Because many populations of federally listed and state-protected freshwater mussels will be colonized by zebra mussels, we encourage natural resource agencies to consider ponds or other refugia as a means to protect native species from the impending impacts anticipated by the continuing spread of this prolific competitor and fouler. We presently maintain about 1,500 mussels of 15 species and will continue to monitor survival and reproductive condition in 1995. Additional species will be collected in 1995 to expand our captive stocks. We anticipate that caged mussels will spawn and become gravid, so that glochidia will be available for ongoing propagation efforts in field and laboratory experiments.

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Table 1. Survival of mussels being held in the farm pond at Critz after 1 year.

Species	Number held	Percent survival
<i>Pleurobema cordatum</i> (Ohio pigtoe)	39	54
<i>Elliptio dilatata</i> (spike)		2990
<i>Elliptio complanata</i> (eastern elliptio)	53	87
<i>Elliptio producta</i> (Atlantic spike)	13	77
<i>Cyclonaias tuberculata</i> (purple wartyback)	33	91
<i>Lampsilis ovata</i> (pocketbook)		1414

Table 2. Water chemistry of holding ponds in Virginia, summer 1993.

Location	Chemical Measurement		
	Alkalinity (mg/L)	pH	Dissolved oxygen (mg/L)
Critz	17	8.0–8.5	10–12
Marion	154	8.5–9.0	10
Blacksburg	154–205	8.0	10–11

Table 3. Survival of adult mussels in the quarantine pond at Blacksburg.

Species	Number held	Percent survival
<i>Elliptio crassidens</i> (elephant-ear)	120	88
<i>Ellipsaria lineolata</i> (butterfly)	34	15
<i>Lasmigona c. complanata</i> (white heelsplitter)	59	92
<i>Megalonaias nervosa</i> (washboard)	102	72
<i>Pleurobema cordatum</i> (Ohio pigtoe)	213	74
<i>Quadrula p. pustulosa</i> (pimpleback)	144	83

Table 4. Survival of adult mussels at the Marion State Fish Hatchery.

Species	Number held	Percent survival
<i>Elliptio crassidens</i> (elephant-ear)	120	50
<i>Ellipsaria lineolata</i> (butterfly)	60	33
<i>Megalonaias nervosa</i> (washboard)	90	22
<i>Pleurobema cordatum</i> (Ohio pigtoe)	120	34
<i>Quadrula metanevra</i> (monkeyface)	30	73
<i>Quadrula p. pustulosa</i> (pimpleback)	120	35