

Del *Hayes et al*
1996



1996 ANNUAL REPORT

DEVELOPING TECHNOLOGY FOR LONG-TERM HOLDING
OF MUSSELS IN CAPTIVITY

James B. Layzer, Lesa M. Madison, Robert Quinn, and Olivia J. Westbrook
Tennessee Cooperative Fishery Research Unit
Tennessee Technological University
PO Box 5114
Cookeville, TN 38505

October 1996

cc: Dick Biggs
Bill Beaver
David McKinney
Robb Todd } *10/10/96*

QUARANTINE EXPERIMENTS

In 1995, we began quarantining all mussels for a 30-day period prior to translocating them to either Shoal Creek, TN and AL or one of the long-term holding facilities. Our first attempt to quarantine *Fusconia ebena* resulted in an overall survival rate of 73% during quarantine and 66% survival after being held one year at Birdsong. Subsequently, we quarantined 17 other species of mussels. Survival rates for these mussels were highly variable (Table 1). At this time, there is no clear pattern to the variation in survival rates among species or between quarantine dates. For instance, only 50% of the *Obliquaria reflexa* quarantined during August survived but 100% of the *O. reflexa* quarantined in November survived. In contrast, survival of *Potamilus alatus* quarantined in August was 87% but was only 57% for those quarantined in November. Except for the *F. ebena*, all mussels were translocated to Shoal Creek following quarantine.

In May 1996, we initiated experiments to determine the effects of density and feeding on survival of *F. ebena* during quarantine. Survival rates exceeded 95% for all treatments (Table 2). We also collected 660 *Amblema plicata* from Kentucky Lake during May and 99% of these mussels survived the 30-day quarantine. Following quarantine, all *F. ebena* and 215 of the *A. plicata* were transported to Center Hill Lake, TN where they are being held to monitor long-term survival. The remaining *A. plicata* were translocated to Shoal Creek. To evaluate survival in the lake for mussels that had not been quarantined, 121 *A. plicata* were collected from the Duck River at Columbia, TN and transported directly to Center Hill Lake. Our ongoing research is focusing on the effects of mussel density during quarantine on long-term survival.

CAPTIVE POPULATIONS

Frankfort Hatchery, KY

Because of the high mortality of mussels during the summers of 1994 and 1995 at the Frankfort Fish Hatchery, the remaining mussels were removed from the hatchery pond and returned to Elkhorn Creek in March 1996 (Table 3). This facility will no longer be used for holding mussels.

Kentucky Lake, TN

Survival was greater than 70% after 2 years for most species held at the American Pearl Company facility located at the Birdsong Marina, Kentucky Lake (Table 4). Nonetheless, long-term (5-10 years) holding of adult mussels at this facility will require larger numbers of individual species to allow for the continuous, albeit low mortality rate.

Laurel Hill Wildlife Mgt. Area, TN

Survival of most species held in a pond for 2 years has been good (Table 5). In particular, there has been 100% survival of *Ellipsaria lineolata*. Generally, this species is more difficult to handle and seems quite sensitive to stress.

Minor E. Clark Fish Hatchery, KY

After 2 years, survival of all species held in a raceway (#1) has been high at the Minor E. Clark Fish Hatchery (Table 6). In 1995, a second raceway (#2) was made available for our use. In September 1995, we collected 218 *Pleurobema* spp. from the Barren River, Kentucky and placed them in this second raceway. Nearly all of these *Pleurobema* spp. have survived 9 months in captivity (Table 7).

Normandy Fish Hatchery, TN

In July 1995, we collected 602 mussels of 12 species from the Duck River and transported them to the Normandy Fish Hatchery. About one-third of the mussels were placed in a concrete raceway that contained a 15 cm layer of a sand-gravel mixture. The remaining mussels were divided into two groups; one group was broadcasted throughout a pond; the other group was placed in pocket nets and suspended from floats in the same pond.

We started holding mussels at the Normandy Hatchery before it became fully operational. Consequently, we had to modify our study plans. For instance, because the water supply pipeline for the hatchery was not insulated, it had to be shutdown for winter. Because we felt that the raceway might go dry overwinter, we removed most mussels from the raceway and held them in pocket nets in the pond for the winter. Similarly, we anticipated that the pond would be drawn-down once, instead, it was drained on three occasions. Despite these operational problems, survival of most mussel species that originally went into the raceway was good; however, survival of mussels that were in the pond was only fair (Table 8). At this time, we cannot make a judgement as to the general suitability of the Normandy Hatchery for holding mussels because of the operational problems during the first year.

MUSSEL SPAWNING

Periodically during the expected period of gravidity, mussels at the Normandy and Minor Clark hatcheries were examined. Gravid *Lexingtonia dollabelloides* and *Eiipio dilatata* were found at the Normandy Hatchery. Both of these species are

short-term brooders. Since these mussels were introduced to the raceway the previous year, spawning had obviously occurred in the raceway. Similarly, *E. dilatata*, *Pleurobema coccineum*, *P. cordatum* and *P. pyramidatum*, all short-term brooders, successfully spawned and became gravid in the raceways at the Minor Clark Hatchery. Also, the long-term brooder, *Actinonaias ligamentina*, held at the Minor Clark Hatchery became gravid for the second year. Natural infestations of host fishes occurred in the raceways of both hatcheries.

Table 1. Species, numbers, and percent survival during a 30-day quarantine.

Date Collected	Species	Number	Survival (%)
June 20, 1995	<i>Fusconaia ebena</i>	328	73
August 1, 1995	<i>Amblema plicata</i>	15	100
	<i>Cyclonaias tuberculata</i>	97	89
	<i>Elliptio crassidens</i>	25	96
	<i>Ellipsaria lineolata</i>	72	64
	<i>Fusconaia ebena</i>	135	77
	<i>Ligumia recta</i>	9	78
	<i>Megalonaias nervosa</i>	2	100
	<i>Obliquaria reflexa</i>	24	50
	<i>Potamilus alatus</i>	15	87
	<i>Quadrula cylindrica</i>	4	75
	<i>Quadrula metanevra</i>	118	81
	<i>Quadrula pustulosa</i>	228	66
	<i>Quadrula quadrula</i>	34	100
	<i>Tritogonia verrucosa</i>	9	78
November 30, 1995	<i>Amblema plicata</i>	430	99
	<i>Arcidens confragosus</i>	6	100
	<i>Ellipsaria lineolata</i>	2	100
	<i>Fusconaia ebena</i>	90	99
	<i>Fusconaia flava</i>	28	96
	<i>Leptodea fragilis</i>	5	0
	<i>Megalonaias nervosa</i>	47	100
	<i>Obliquaria reflexa</i>	18	100
	<i>Potamilus alatus</i>	46	57
<i>Quadrula apiculata</i>	31	94	

Table 1. Continued.

Date Collected	Species	Number	Survival (%)
	<i>Quadrula metanevra</i>	1	100
	<i>Quadrula nodulata</i>	14	100
	<i>Quadrula pustulosa</i>	21	100
	<i>Quadrula quadrula</i>	112	100
	<i>Tritogonia verrucosa</i>	1	100

Table 2. Percent survival of *Fusconaia ebena* during 30-day quarantine. Mussels were collected from Kentucky Lake on May 16, 1996.

Density (number/757 liters)	% Survival	
	Fed	Not Fed
50	96	98
100	98	--
150	99	--
200	100	98
250	98	--
300	100	--

Table 3. Numbers and percent survival of mussels held in a pond at the Frankfort Fish Hatchery.

Species	Number Held	% Survival	Months Held
<i>Actinonaias ligamentina</i>	50	0	14
<i>Amblema plicata</i>	31	35	19
<i>Ellipsaria lineolata</i>	40	0	12
<i>Elliptio dilatata</i>	170	3	21
<i>Lampsilis cardium</i>	1	0	13
<i>Lampsilis fasciola</i>	3	0	11
<i>Lampsilis siliquoidea</i>	54	74	21
<i>Lasmigona costata</i>	22	41	21
<i>Megalonaias nervosa</i>	2	0	13
<i>Potamilus alatus</i>	2	0	13

Table 4. Numbers and percent survival of mussels held in an embayment of Kentucky Lake, Tennessee. *Cyclonaias tuberculata* was collected in September 1993; all other mussels were collected in July and August 1995.

Species	Numbers Held	% Survival	
		September 1995	June 1996
<i>Actinonaias ligamentina</i>	50	88	72
<i>Cyclonaias tuberculata</i>	101	99	97
<i>Elliptio dilatata</i>	101	91	78
<i>Lasmigona costata</i>	8	100	75
<i>Pleurobema coccineum</i>	13	85	77
<i>Ptychobranthus fasciolaris</i>	59	73	54

Table 5. Numbers and percent survival of mussels held in a pond at the Laurel Hill Wildlife Management Area, TN. All mussels were collected from the Cumberland River in September 1994.

Species	Number Held	% Survival	
		September 1995	June 1996
<i>Ellipsaria lineolata</i>	14	100	100
<i>Megalonaias nervosa</i>	4	25	0
<i>Pleurobema cordatum</i>	175	94	80
<i>Ptychobranthus fasciolaris</i>	1	100	100
<i>Quadrula metanevra</i>	5	100	100
<i>Quadrula nodulata</i>	1	100	0
<i>Quadrula pustulosa</i>	2	50	50
<i>Quadrula quadrula</i>	20	75	45

Table 6. Numbers and percent survival of mussels held in raceway #1 at the Minor E. Clark Fish Hatchery. Mussels were collected from the Licking River in July and August 1994.

Species	Number Held	% Survival	
		September 1995	June 1996
<i>Actinonaias ligamentina</i>	50	94	90
<i>Elliptio dilatata</i>	104	93	91
<i>Lampsilis cardium</i>	4	100	100
<i>Pleurobema coccineum</i>	26	100	100
<i>Ptychobranthus fasciolaris</i>	50	81	72
<i>Tritogonia verrucosa</i>	38	100	100

Table 7. Numbers and percent survival (as of June 30, 1996) held in raceway #2 at the Minor E. Clark Fish Hatchery, KY. Mussels were collected from the Barren River in September 1995.

	Number	Survival (%)
<i>Pleurobema coccineum</i>	9	100
<i>Pleurobema cordatum</i>	198	99
<i>Pleurobema pyramidatum</i>	11	91

Table 8. Numbers, percent survival, as of June 30, 1996, and location of mussels held at the Normandy Fish Hatchery. All mussels were collected from the Duck River, July 21, 1995.¹

Species	Numbers and Percent Survival		
	Raceway	Pond Cages	Pond Bottom
<i>Amblema plicata</i>	--	50 (50%)	50 (50%)
<i>Cyclonaias tuberculata</i>	--	99 (63%)	100 (89%)
<i>Elliptio dilatata</i>	52 (77%)	--	--
<i>Fusconaia barnesiana</i>	5 (80%)	--	--
<i>Lasmigona costata</i>	29 (97%)	--	--
<i>Leptodea fragilis</i>	7 (43%)	--	--
<i>Lexingtonia dolabelloides</i>	45 (87%)	--	--
<i>Obliquaria reflexa</i>	--	6 (67%)	--
<i>Plethobasus cooperianus</i>	7 (71%)	--	--
<i>Quadrula cylindrica</i>	1 (100%)	--	--
<i>Quadrula pustulosa</i>	--	51 (53%)	50 (48%)
<i>Tritogonia verrucosa</i>	41 (80%)	--	--
<i>Truncilla truncata</i>	--	16 (13%)	--

¹*Plethobasus cooperianus* were transferred from TVA.