

Table 1. Summary of collection and quarantine-related conditions and procedures, and recommended guidelines for preventing introduction of zebra mussels during native mussel conservation activities.

Condition or procedure	Reference		Recommended guidelines
	Gatenby <i>et al.</i> (2000)	Newton <i>et al.</i> (2001)	
Collection setting			
Time of collection	July, September, October 1995	May 1995	Early spring, before zebra mussel spawning begins or mid to late fall when natives have greater energy reserves and juvenile zebra mussels are visible
Species of native mussels	<i>Amblema plicata</i> , <i>Quadrula pustulosa</i> , <i>Elliptio crassidens</i> , <i>Pleurobema cordatum</i> , <i>Obliquaria reflexa</i> , <i>Potamilus alatus</i>	<i>Amblema plicata</i> , <i>Fusconaia flava</i> , <i>Leptodea fragilis</i> , <i>Obliquaria reflexa</i> , <i>Quadrula quadrula</i>	--
No. of native mussels	2700	768	--
Native mussels analyzed for disease and pathogens before relocation	No	Yes	If possible

Air temperature (°C)	--	6-18	Early spring or late fall temperatures; minimize differences between air and water temperature
Water temperature (°C)	20-28	11-14	Early spring or late fall temperatures; minimize differences between air and water temperature
Mechanism for removing zebra mussels from native mussels	Hand scrubbed with plastic-bristled brushes	Hand scrubbed with plastic-bristled brushes under 2X magnification	Hand scrub with plastic-bristled brushes under magnification
Method for holding scrubbed native mussels at collection site	Mesh bags in river*	Hatchery truck with aerated well water	Hold in zebra mussel-free water after scrubbing
Emersion time (min) during collection and processing	20	5	Keep to minimum, but <20
Transportation to quarantine facility	Between moist burlap in coolers with ice (no direct contact of mussels and ice)	Between moist burlap in coolers with ice (no direct contact of mussels and ice)	Between moist burlap in coolers with ice in plastic bags; no direct contact of mussels and ice
Quarantine facility			
Type	Above-ground tanks, 14-500 L	Pond (0.04 ha), mussels held in 8-2720 L mesh bags	--
Mussel density (no./m ²)	150-250	39-159	Keep to minimum, but <150

Water source	Well water	Well water	Well water
Water temperature (°C)	2-28	13-27	<28
Dissolved oxygen (mg/L)	6-14	6-20	>6
pH	7.2-8.5	7.8-10.6	6.5-9.0
Potassium (mg/L)	1.6	2.6	<4
Alkalinity (mg CaCO ₃ /L)	90	110-160	>15
Hardness (mg CaCO ₃ /L)	90	180-200	>50
Total ammonia nitrogen (mg/L)	≤1.0	0.03-0.2	<1.0
Unionized ammonia (μg/L)	2-66	2-20	<25
Total residual chlorine (mg/L)	–	--	<26
Nutrition/feeding	≥1 x 10 ⁶ cells/mL three times per week in quarantine; relocation ponds were fertilized with a nitrogen:phosphorous (N:P) ratio of 10:1 (1.0 mg/L N, 0.1 mg/L P) with NH ₄ NO ₃ and NaHPO ₄ salts	8.3 g/m ³ of 10:10:10 N:P:K fertilizer added to quarantine pond 2 weeks prior to adding unionids; relocation ponds were not fertilized	1 x 10 ⁵ cells/mL or 4.0 mg dry wt./L twice daily or 2.0 - 5.0 x 10 ⁴ cells/mL or 1.9 mg dry wt./L on a continuous basis

Days in quarantine	Minimum of 30, but up to 120; re-inspected under 4X magnification	35; re-inspected under 2X magnification	Minimum of 30; re-inspect under magnification
Disinfection of equipment and supplies	Chlorine solution of 25 mg/L Dessication for up to 4 d	Not specified	Chlorine solution of 25-250 mg/L, depending on type of material; dessication in warm dry air for 3-5 d
Monitoring			
Temperature, dissolved oxygen, and pH	Twice daily	Daily	At least daily
All other water quality variables	Daily to weekly	Daily to weekly	Daily to weekly
Disease and mortality	Not specified	Not specified	At least weekly

*All native mussels were rinsed with a high pressure hose before being placed into the quarantine facility.