

Quantitative Ecological Survey of a Mussel Bed at Ohio River Mile 617.0 to 617.5

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Abstract. We conducted a quantitative survey of mussels in a bed located between Ohio River miles 617.0 and 617.5. Thirty-five 0.5-m² quads were sampled along 10 depth transects by surface-supply divers. Mussel densities in the bed averaged 6.3 individuals/m² (SD = 8.5) and ranged from 0 to 36 individuals/m². Mussels were collected in water depths ranging from 3 m to 9 m. Twelve species of live mussels and twelve species of dead mussels were collected. Forty-six live mussels were collected and the assemblage was dominated by *Obliquaria reflexa* and *Ellipsaria lincolata*, each representing 19.6% of the total number of mussels collected. Three dead specimens of endangered species were collected: *Plethobasus cooperianus*, *Cyprogenia stegaria*, and *Epioblasma torulosa*. We observed zebra mussels in every quad sampled that contained hard substrates and all of the live mussels collected had zebra mussels attached. Hundreds of shells collected of recently dead unionids (particularly *Megalonais nervosa*) and *Corbicula fluminea* were covered by zebra mussels. It is probable that a major portion of the unionid mortality observed was due to zebra mussel infestation.

Introduction

We conducted a quantitative survey of mussels in a bed located between Ohio River miles 617.0 and 617.5. The study area is near a historically productive mussel bed that extends from Ohio River mile 617.5 (the approximate mouth of Knob Creek) upstream to Ohio River mile 613.5. The objectives of the survey were threefold: (1) determine the distance from shore to the boundary of the mussel bed; (2) quantitatively determine the species composition and abundance of mussels in the bed; and (3) determine the presence/absence of federally endangered species in the mussel bed.

Study Site

The study site was located along the right descending bank (RDB) of the Ohio River from 60 m upstream of the Floyd County/Harrison County line to 60 m downstream of the mouth of Knob Creek. The Ohio River at this site was approximately 945 m wide and the river stage during the study (27-29 June, 1995) ranged from 4.5 to 4.6 m.

Methods

Ten transect markers were placed along the bank from the mouth of Knob Creek to 60 m upstream of

the Floyd County/Harrison County line (Table 1). For sample collection along each transect, a ruled (3 m intervals) line was attached to a bank marker and a weighted buoy placed 75 m from shore. Quantitative mussel samples were taken by surface-supply divers at 15, 23, 30, 46, and 60 m from shore for transects 1 through 5, and at 46 and 60 m from shore for transects 6 through 10. Quantitative samples were collected using a 0.5-m² weighted aluminum quad-frame placed on the bottom by a diver at the required distance from shore along a transect line. The diver used a trowel to remove the top 10-15 cm of sediment from the quad into a 20-liter bucket which was carried by the diver to the surface. Water depth was noted for each quad location. Samples were sieved on shore (0.5-mm mesh) and all live and dead mussels were removed and identified. The specific location of any threatened/endangered species was noted. Additionally at each transect, the diver moved along the transect line from shoreline to the beginning of the mussel bed, noting the distance from shore that the bed began.

Results

The results of the quantitative mussel survey are given in Tables 1 and 2. Live mussel densities in the bed averaged 6.3 individuals/m² (SD = 8.5) and ranged from 0 to 36 individuals/m². Mussels were

collected from as close as 15 m from shore (transect 4, 183 m upstream of Knob Creek) to 40 m from shore (transect 8, 700 m upstream of Knob Creek) (Table 1). With the exception of transect 4, the mussel bed was at least 23 m from shore. Mussels were collected in water depths ranging from 3 to 9 m. Twelve species of live mussels and twelve species of dead mussels were collected (Tables 2 and 3). Forty-six live mussels were collected and the assemblage was dominated by *Obliquaria reflexa* (threehorn wartyback) and *Ellipsaria lineolata* (butterfly), each representing 19.6% of the total number of mussels collected (Table 2).

Three dead specimens of federally endangered species were collected: *Plethobasus cooperianus* (orange-foot pimpleback) and *Cyprogenia stegaria* (fanshell) from transect 4, quad 3; and *Epioblasma torulosa* (tubercled blossom) from transect 8, quad 4 (Table 2).

A qualitative survey was made for mussels along a transect 60 m downstream of Knob Creek. Past qualitative studies have noted that the downstream limit for the mussel bed was the mouth of Knob Creek. Divers surveyed from the shore to 60 m offshore and found no indication of the presence of a mussel bed.

Discussion

The mussel bed between Ohio River miles 613.5 and 617.5 has been qualitatively surveyed by Williams and Schuster (1989) and Clarke (1994, U.S. Army Corps of Engineers unpublished data). The results of their surveys are given in Table 3. Williams and Schuster (1989) found 19 species of live mussels and reported that the bed had relatively moderate densities of mussels in relation to other beds in the Ohio River. Clarke (1994, U.S. Army Corps of Engineers unpublished data) reported eight live species of mussels from the bed. Neither of these qualitative surveys yielded any endangered species. However, *Plethobasus cooperianus* has been found in mussel beds in the Ohio River. Payne et al. (1994), in a 1992 quantitative survey of mussels in a large bed in the lower Ohio River (RM 967.4 – 967.6), reported densities ranging from 15.0 individuals/m² at nearshore sites and 81.8 individuals/m² at midshore sites. The mussel bed was dominated by *Fusconaia ebena*, *Amblema plicata*, *Truncilla donaciformis*, and *Obliquaria reflexa*. In addition, the federally endangered *P. cooperianus* also was collected.

One important observation made during this survey was the prevalence of the introduced zebra mussel, *Dreissena polymorpha*. *Dreissena polymorpha*

is a small (maximum shell length usually less than 3 cm) mussel introduced into the Great Lakes from northern Europe during 1988. In the past 7 years the zebra mussel has extended its range to include the entire length of the Mississippi River and most of the major Mississippi River tributaries including the Ohio River. We observed zebra mussels in every quad sampled that contained hard substrates. We also observed that all of the mussels collected had zebra mussels attached. Along with the live mussels collected, hundreds of shells from recently dead mussels were collected that were covered by zebra mussels. It is probable that a major portion of the mussel mortality observed was due to zebra mussel infestation. We also encountered hundreds of dead shells of the introduced Asiatic clam, *Corbicula fluminea*, and the snails, *Pleurocera canaliculata* and *Lithasia* sp., which are typically found in high densities in mussel beds in the Ohio and Mississippi Rivers. These shells were also covered by attached zebra mussels. Very few live individuals of *C. fluminea*, *P. canaliculata*, and *L. sp.* were encountered.

The mussel bed surveyed contained a moderately diverse and abundant mussel assemblage including evidence of three federally endangered species. It is apparent that the mussel bed has undergone considerable changes in recent years due to the invasion of the zebra mussel, *Dreissena polymorpha*. These changes have probably resulted in a pronounced decrease in overall densities of mussels and a shift in assemblage dominance from large mussels (*Megalonaia nervosa*, *Amblema plicata*) to smaller species (*Obliquaria reflexa*). We recommend that a more detailed survey of the mussel bed be carried out in an attempt to locate live specimens of any federally protected species for relocation.

Literature Cited

- Payne, B.S., A.C. Miller, and D. Shafer. 1994. An analysis of freshwater mussels (Unionidae) in the lower Ohio River at two beds near Olmsted, Illinois: 1992 studies. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report. EL-94-2.
- Williams, J.C., and G.A. Schuster. 1989. Freshwater mussel investigations of the Ohio River: mile 317.0 to 981.0. Kentucky Department of Fish and Wildlife Resources, Division of Fisheries, Frankfort. 57 pp.

Table 1. Results of the quantitative mussel survey, June 26-29, 1995.

Transect	Quad	Upstream Distance from Knob Creek (m)	Distance from Shore (m)	Distance from Shore to Mussel Bed (m)	Water Depth (m)	No. Mussels per Quad	Mussel Density (no./m ²)
1				27			
	1	0	15		1.2	0	0
	2		23		1.2	0	0
	3		30		2.4	0	0
	4		46		3.4	0	0
	5		60		4.3	1	4
2				23			
	1	15	15		1.8	0	0
	2		23		3.4	4	8
	3		30		4.6	0	0
	4		46		5.2	0	0
	5		60		5.5	1	4
3				30			
	1	46	15		2.1	0	0
	2		23		2.7	0	0
	3		30		5.2	1	4
	4		46		6.4	4	16
	5		60		6.1	2	8
4				15			
	1	183	15		4.9	1	4
	2		23		6.1	0	0
	3		30		7.6	0	0
	4		46		8.5	1	4
	5		60		9.1	2	8
5				27			
	1	335	15		2.7	0	0
	2		23		4.9	0	0
	3		30		4.6	1	4
	4		46		7.9	0	0
	5		60		7.9	3	12
6				30			
	4	488	46		7.0	1	4
	5		60		7.6	0	0
7				37			
	4	579	46		7.6	1	4
	5		60		9.1	6	24
8				40			
	4	700	46		7.6	0	0
	5		60		7.6	5	20
9				24			
	4	914	46		7.3	1	4
	5		60		7.6	0	0
10				34			
	4	975	46		9.1	2	8
	5		60		9.1	9	36

Table 2. Mussel species collected during the Ohio River mussel survey, June 26-29, 1995.

Species	Common Name	Number Collected	Percent of Total
Live			
<i>Amblema plicata</i>	threeridge	5	10.9
<i>Elliptio crassidens</i>	elephant-ear	4	8.7
<i>Ellipsaria lineolata</i>	butterfly	9	19.6
<i>Fusconaia ebena</i>	ebonyshell	3	6.5
<i>Fusconaia flava</i>	Wabash pigtoe	1	2.2
<i>Ligumia recta</i>	black sandshell	2	4.3
<i>Megalonaias nervosa</i>	washboard	5	10.9
<i>Obliquaria reflexa</i>	threehorn wartyback	9	19.6
<i>Potamilus alatus</i>	pink heelsplitter	3	6.5
<i>Quadrula pustulosa</i>	pimpleback	2	4.3
<i>Quadrula quadrula</i>	mapleleaf	2	4.3
<i>Tritogonia verrucosa</i>	pistolgrip	1	2.2
Dead			
<i>Actinonaias ligamentina</i>	mucket		
<i>Cyprogenia stegaria</i>	fanshell		
<i>Epioblasma torulosa</i>	tubercled blossom		
<i>Lampsilis teres</i>	yellow sandshell		
<i>Obovaria olivaria</i>	hickorynut		
<i>Obovaria subrotunda</i>	round hickorynut		
<i>Plethobasus cooperianus</i>	orange-foot pimpleback		
<i>Plethobasus cyphus</i>	sheepnose		
<i>Pleurobema cordatum</i>	Ohio pigtoe		
<i>Pleurobema pyramidatum</i>	pyramid pigtoe		
<i>Quadrula metanevra</i>	monkeyface		
<i>Quadrula nodulata</i>	wartyback		

Table 3. Results of previous qualitative studies of the mussel bed located between Ohio River miles 613.5 and 617.5.

Species	Clarke, 1994	Williams and Schuster, 1989
<i>Actinonaias ligamentina</i>		x
<i>Amblema plicata</i>	x	x
<i>Cyclonaias tuberculata</i>		x
<i>Ellipsaria lineolata</i>	x	x
<i>Elliptio crassidens</i>	x	x
<i>Fusconaia ebena</i>	x	x
<i>Fusconaia flava</i>		x
<i>Lampsilis cardium</i>	x	x
<i>Ligumia recta</i>		x
<i>Megalonais nervosa</i>	x	x
<i>Obliquaria reflexa</i>	x	x
<i>Plethobasus cyphus</i>		x
<i>Pleurobema cordatum</i>		x
<i>Potamilus alatus</i>		x
<i>Quadrula metanevra</i>	x	x
<i>Quadrula nodulata</i>		x
<i>Quadrula pustulosa</i>		x
<i>Quadrula quadrula</i>		x
<i>Tritogonia verrucosa</i>		x
Total	8	19