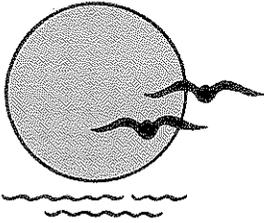


*Malacology
referral
1996*



BARRY A. VITTOR & ASSOCIATES, INC.

ENVIRONMENTAL RESEARCH & CONSULTING

8060 Cottage Hill Road

Mobile, Alabama 36695

Phone (334) 633-6100

Fax (334) 633-6738

May 23, 1996

Dr. Richard J. Neves
Virginia Cooperative Fish and Wildlife
Research Unit
Virginia Tech
Blacksburg, VA 24061

Dear Dr. Neves:

Enclosed is a copy of our report from last year's work on the Ohio River as per your request. We will be happy to cooperate with you in any way regarding efforts to save threatened and endangered species. We will wait to hear from you regarding anything you would desire we do. Please advise whenever your plans gel. Depending on the water level, we plan to conduct our next survey the week of ~~June 24-28~~.

We will look forward to hearing from you.

2nd week of July 8-13

Sincerely,

Douglas N. Shelton

Douglas N. Shelton
Staff biologist (Malacologist)

*300-400 live mussels
in 1995*

DNS/gs

*last year they had
lots of zebra mussels
attached*

QUANTITATIVE ECOLOGICAL SURVEY OF A MUSSEL BED
AT OHIO RIVER MILE 617.0 TO 617.5

Prepared for

THOMPSON ENGINEERING TESTING, INC.
3707 COTTAGE HILL RD.
MOBILE, AL 36691

Prepared by

BARRY A. VITTOR & ASSOCIATES, INC.
8060 COTTAGE HILL RD.
MOBILE, AL 36695

12 July 1995

TABLE OF CONTENTS

LIST OF TABLES	iii
LIST OF FIGURES	iv
STUDY SITE	1
METHODS	1
RESULTS	6
DISCUSSION	6
RECOMMENDATIONS	13
LITERATURE CITED	16
APPENDIX I. Species list, number of live species collected, and shell lengths of live specimens from the TET mussel survey, 26-29 June, 1995.	

LIST OF TABLES

Table 1. Results of the quantitative mussel survey, June 26-29, 1995. 4

Table 2. Live mussel species collected during the TET mussel survey, June 26-29, 1995. 7

Table 3. Dead shells of mussel species collected during the TET mussel survey, June 26-29, 1995... 8

Table 4. Results of qualitative studies of the mussel bed located between Ohio River miles 617.5 and 613.5 by Williams and Schuster (1989) and Clarke (1994, US Army Corps of Engineers unpublished data). 12

LIST OF FIGURES

Figure 1.	US Army Corps of Engineers navigation chart showing location of survey site between Knob Creek and the Harrison County/Floyd County line.	2
Figure 2.	Upstream (top photo) and downstream (bottom photo) photographs of the Ohio River in the vicinity of the TET mussel survey taken from the right descending bank.	3
Figure 3.	Relative abundance of live mussel species collected during the TET survey.	9
Figure 4.	Photographs of the federally endangered species collected during the TET mussel survey.	10
Figure 5.	Locations of transects along the proposed construction site.	11
Figure 6.	Photographs of <i>Megalonais nervosa</i> (top photo) and <i>Obliquaria reflexa</i> (bottom photo) collected during the TET mussel survey, illustrating incrustation of zebra mussels.	14

Thompson Engineering Testing, Inc. (TET) contracted Barry A. Vittor & Associates, Inc. (BVA) to perform a quantitative ecological survey of a mussel bed in the Ohio River along property to be developed for placement of a Caesars' Indiana gaming facility near Bridgeport, Indiana. The proposed construction site is adjacent to an historically productive mussel bed which 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 three-fold: (1) determine the distance from shore to the boundary of the mussel bed along the length of Caesars' property; (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 200 ft. upstream of the Floyd County/Harrison County line to 200 ft. downstream of the mouth of Knob Creek (Fig. 1). The Ohio River at this site was approximately 3100 ft. wide and the river stage during the study (27-29 June, 1995) ranged from 14.8 to 15.1 ft. (Fig. 2).

METHODS

Ten transect markers were placed along the bank from the mouth of Knob Creek to 200 ft. upstream of the Floyd County/Harrison County line (Table 1). For sample collection along each transect, a ruled (10 ft. intervals) line was attached to a bank marker and a weighted buoy placed 250 ft. from shore. Quantitative mussel samples were taken by surface-supply divers at 50, 75, 100, 150, and 200 ft. from shore for transects 1 through 5, and at 150 and 200 ft. 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. Allometric measurements were taken on the shells of live specimens. 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.

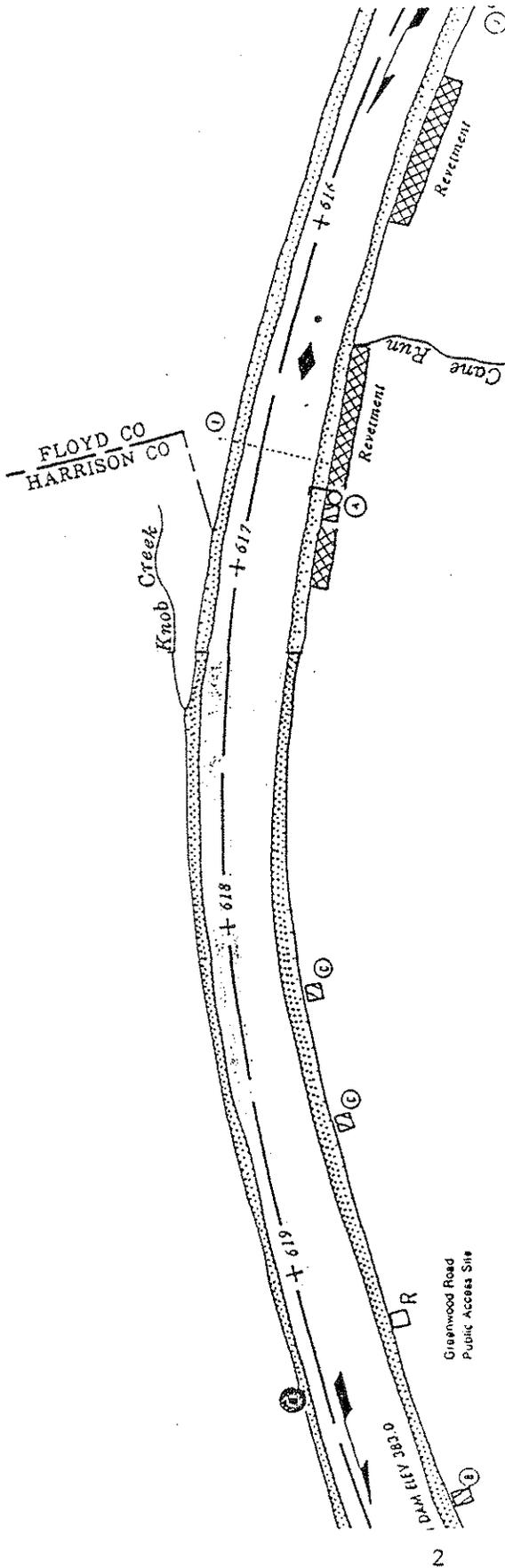


Figure 1. U.S. Army Corps of Engineers navigation chart showing location of mussel survey site between Knob Creek and the Harrison County/Floyd County line, Indiana.



Figure 2. Upstream (top photo) and downstream (bottom photo) photographs of the Ohio River in the vicinity of the TET mussel survey taken from the right descending bank. 27 June 1995.

Table 1. Results of the TET quantitative mussel survey, June 27-29, 1995.

Transect	Quad	Upstream Distance Knob Creek (ft)	Distance from Shore (ft)	Distance from Shore to Mussel Bed (ft)	Water Depth (ft)	No. Mussels per quad	Mussel Density no/m ²
1				90			
	1	0	50		4	0	0
	2		75		4	0	0
	3		100		8	0	0
	4		150		11	0	0
	5		200		14	1	4
2				75			
	1	50	50		6	0	0
	2		75		11	4	8
	3		100		15	0	0
	4		150		17	0	0
	5		200		18	1	4
3				100			
	1	150	50		7	0	0
	2		75		9	0	0
	3		100		17	1	4
	4		150		21	4	16
	5		200		20	2	8
4				50			
	1	600	50		16	1	4
	2		75		20	0	0
	3		100		25	0	0
	4		150		28	1	4
	5		200		30	2	8
5				90			
	1	1100	50		9	0	0
	2		75		16	0	0
	3		100		15	1	4
	4		150		26	0	0
	5		200		26	3	12

Table 1. (Cont'd).

Transect	Quad	Upstream Distance Knob Creek (ft)	Distance from Shore (ft)	Distance from Shore to Mussel Bed (ft)	Water Depth (ft)	No. Mussels per quad	Mussel Density no/m ²
6				100			
	4	1600	150		23	1	4
	5		200		25	0	0
7				120			
	4	1900	150		25	1	4
	5		200		30	6	24
8		2300		130			
	4		150		25	0	0
	5		200		25	5	20
9				80			
	4	3000	150		24	1	4
	5		200		25	0	0
10				110			
	4	3200	150		30	2	8
	5		200		30	9	36

RESULTS

The results of the quantitative mussel survey are given in Tables 1, 2, and 3 and Appendix I. 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 50 ft. from shore (transect 4, 600 ft. upstream of Knob Creek) to 130 ft. from shore (transect 8, 2300 ft. upstream of Knob Creek) (Table 1). Mussels were collected in water depths ranging from 11 ft. to 30 ft. Twelve species of live mussels and 12 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 and Fig. 3).

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 3, Appendix I, Fig. 4).

The distance from shore to the mussel bed varied along the property line from as close as 50 ft. for transect 4 to 130 ft. for transect 8 (Table 1, Fig. 5). With the exception of transect 4, the mussel bed was at least 75 ft. from shore. A qualitative survey was made for mussels along a transect 200 ft. 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 200 ft 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, US Army Corps of Engineers unpublished data). The results of their surveys are given in Table 4. 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, US Army Corps of Engineers unpublished data) reported 8 live species of mussels from the bed. It should be noted that qualitative braille surveys typically underestimate the presence of mussel species. The qualitative surveys did not yield any endangered species. However, *Plethobasus cooperianus* is commonly 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

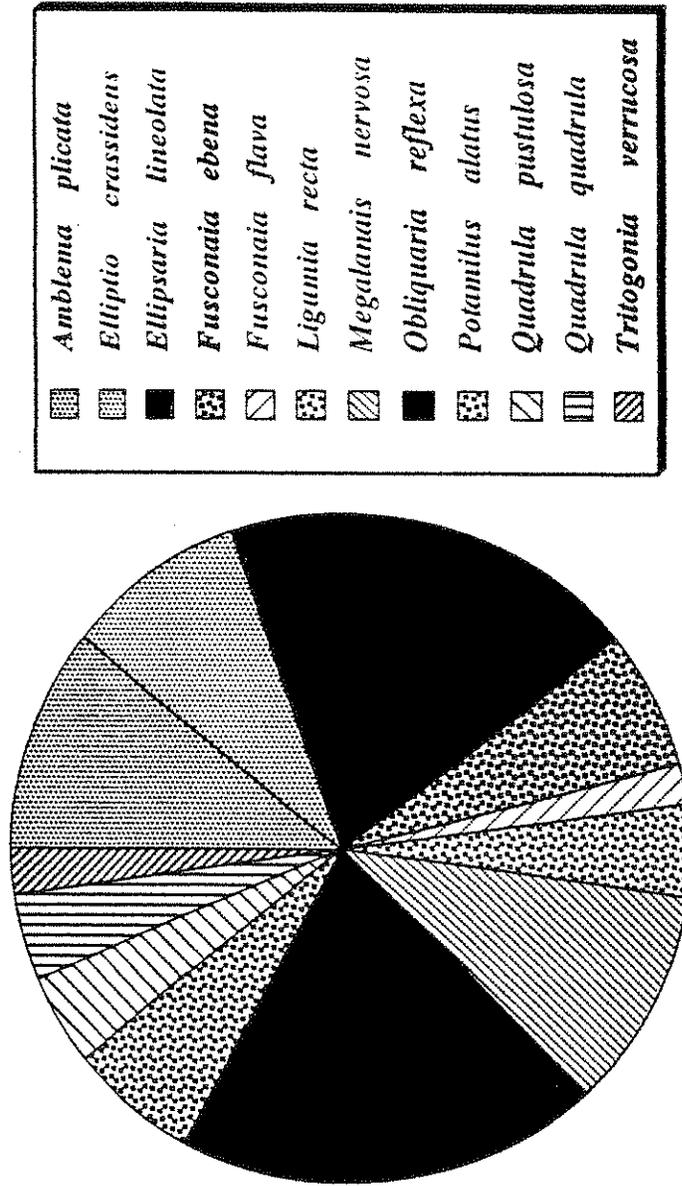
Table 2. Live mussel species collected during the TET mussel survey, June 27-29, 1995.

Species	Common Name	Number Collected	Percent of Total
<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>Megalanais nervosa</i>	washboard	5	10.9
<i>Obliquaria reflexa</i>	threehorn wartyback	9	19.6
<i>Potamilus alatus</i>	pink healsplitter	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
		46	

Table 3. Dead shells of mussel species collected during the TET mussel survey, June 27-29, 1995.

Species	Common Name
<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

Figure 3. Relative abundance of live mussel species collected during the TET mussel survey, June 27-29, 1995.



Relative Abundance

Figure 4. Photographs of the federally endangered species collected during the TET mussel survey, June 27-29, 1995.
A = *Plethobasus cooperianus*; B = *Epioblasma torulosa*; C = *Cyprogenia segaria*.

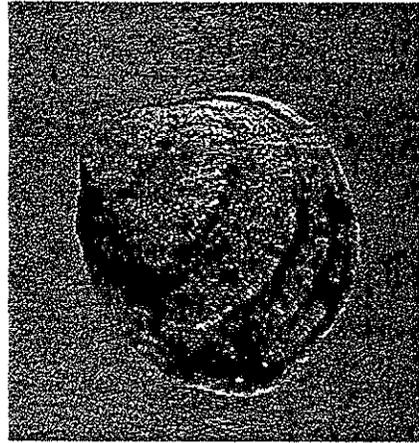
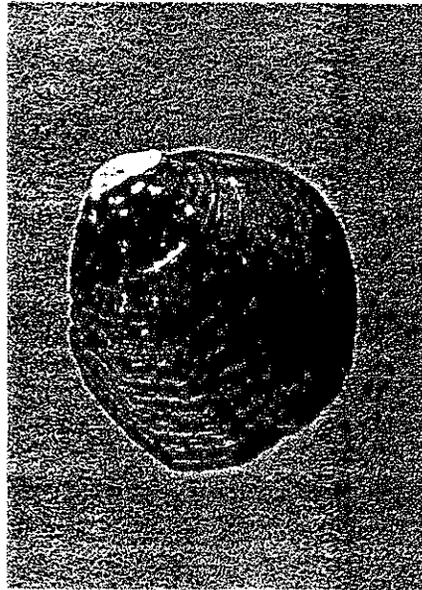
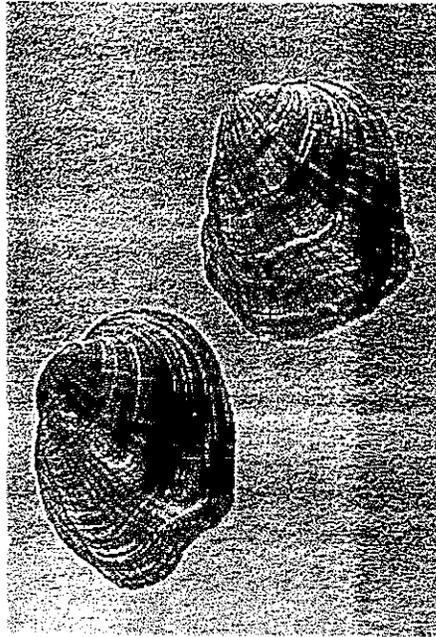


Figure 5. Location of transects along the proposed construction site. Numbers beside each transect marker denote distance in feet from the shoreline to the beginning of the mussel bed. *Qualitative sampling location above Knob Creek.

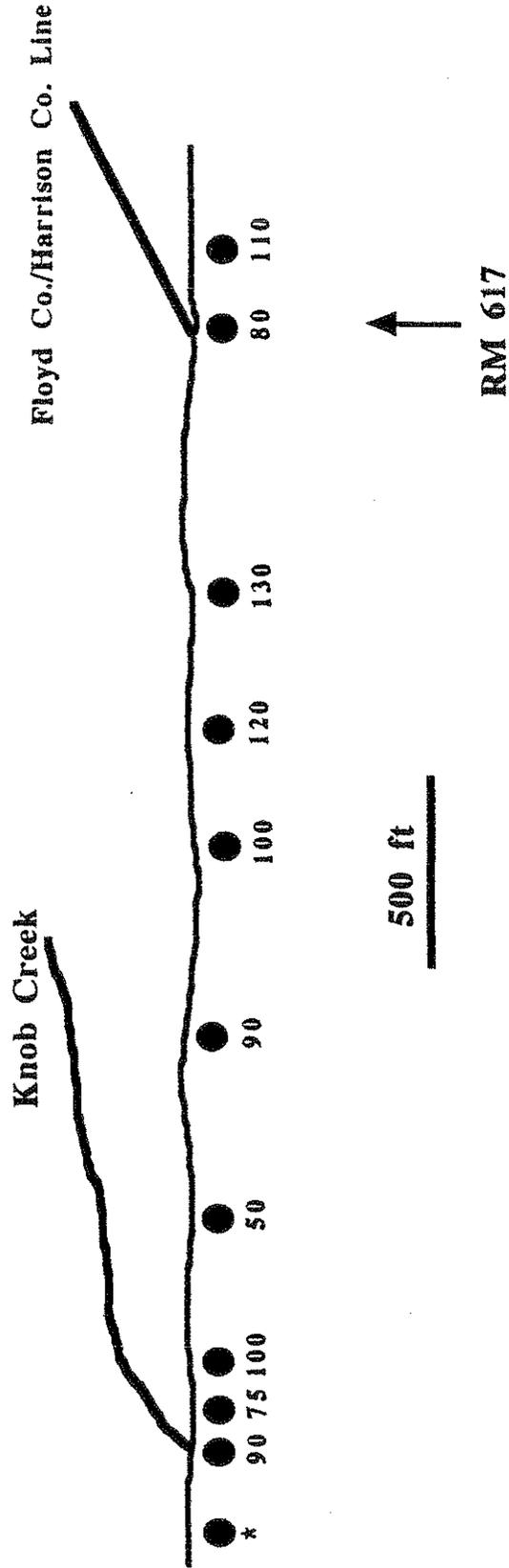


Table 4. Results of qualitative studies of the mussel bed located between Ohio River miles 613.5 and 617.5 by Williams and Schuster (1989) and Clarke (1994, US Army Corps of Engineers unpublished data). Data represent live mussels collected.

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 ventricosa</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
	8	19

sites and 81.8 individuals/m² at midshore sites. The mussel bed was dominated by *Fusconaia ebena*, *Amblema plicata*, *Truncilla donaciformis*, and *Obliquaria reflexa*, and the endangered *P. cooperianus* was collected.

One important observation made during this mussel survey was the prevalence of the introduced zebra mussel, *Dreissena polymorpha*. *D. 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 6 years the zebra mussel has extended its range to include the entire length of the Mississippi River and most of the major Mississippi River drainages including the Ohio River. *D. polymorpha* has a planktonic larva which passively drifts on currents making riverine transport of this mussel a means of passive dispersal. The zebra mussel has a byssus thread which it uses to attach to any hard substrate encountered including native mussels. A single native mussel can have several thousand adult zebra mussels attached to it. The byssal attachments of zebra mussels can become so dense that they can prevent a native mussel from opening its valves to feed and respire leading to a slow death. We observed zebra mussels in every quad sampled which contained hard substrates. We also observed that 100% of the mussels collected had zebra mussels attached (Fig. 6). Along with the live mussels collected, hundreds of shells from recently dead mussels were collected which 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 canaliculatum* and *Lithasia verrucosa*, 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. canaliculatum* and *L. verrucosa* were encountered.

RECOMMENDATIONS

The mussel bed surveyed along the proposed construction site contained a moderately diverse and abundant mussel assemblage including evidence of three federally-listed 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 (*Megalonais nervosa*, *Amblema plicata*) to smaller species (*Obliquaria reflexa*). We recommend that appropriate construction procedures be implemented to minimize impacts and additional stress to the mussel bed. We also recommend that a more

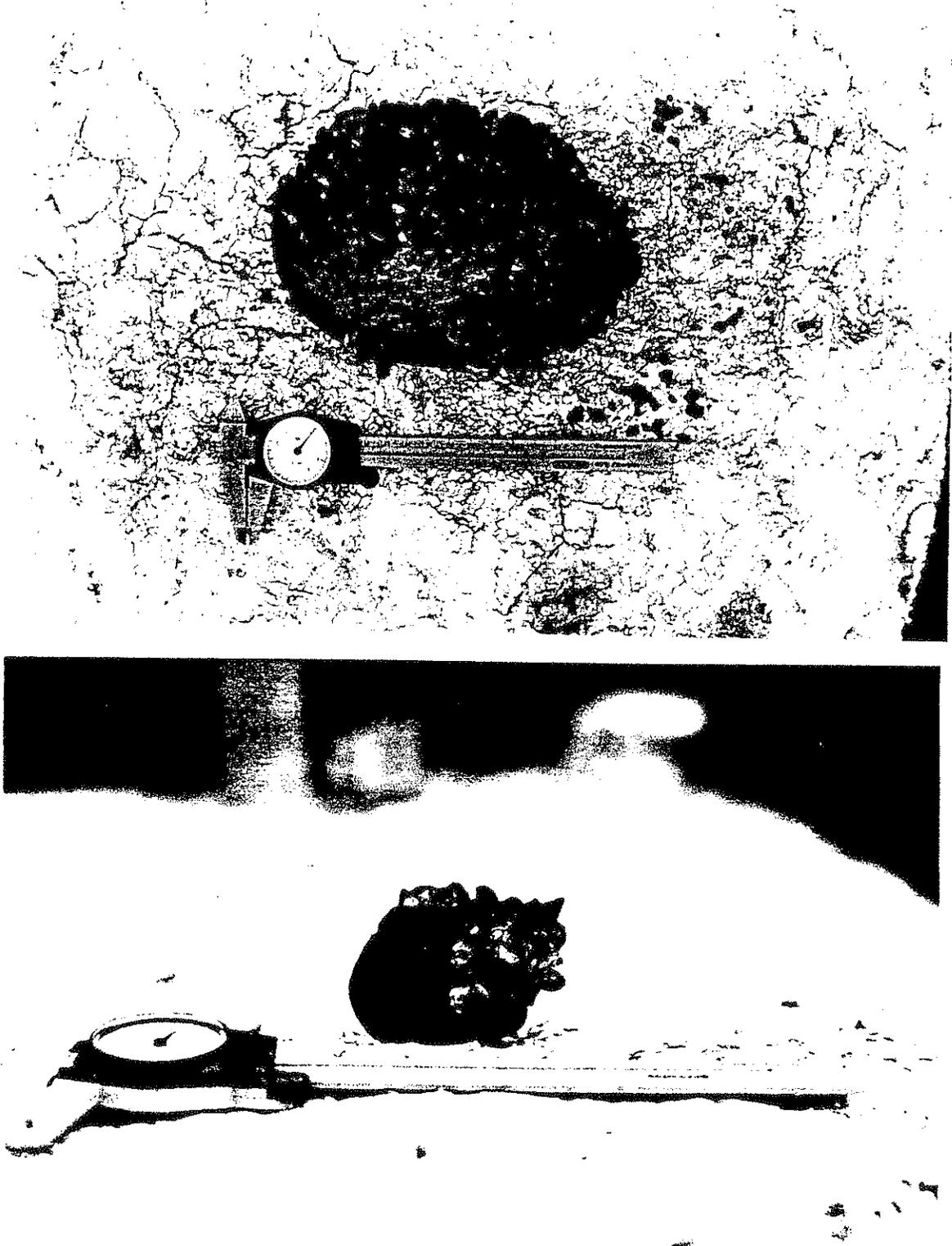


Figure 6. Photographs of Ilva Haggblom's specimen (top photo) and Oblique's collyre (hercynite) collected during the 1981 cruise survey. Arresting crustation of white fissels.

✓ detailed survey of the mussel bed be carried out in the immediate vicinity of the proposed bank excavation site, 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, MS, Technical Report. EL-94-2.
- Williams, J.C. and F.A. Schuster. 1989. Freshwater mussel investigations of the Ohio River: Mile 317.0 to 981.0. Kentucky Dept. of Fish and Wildlife Resources, Frankfort, KY.

APPENDIX I Species list, number of live species collected, and shell lengths of live specimens from the TET mussel survey, 26-29 June, 1995.

Appendix I. Species list, number of live specimens collected, and shell lengths of live specimens from the TET mussel survey, 27-29 June, 1995.

Species	Common Name	Live	Dead	Federally		Total	Shell Length (mm) of Live Mussels
				Endangered	Live		
<i>Fusconaia ebena</i>	ebonyshell	x	x			3	24.9, 85.1, 75.0,
<i>Ligumia recta</i>	black sandshell	x				2	144.6, 138.3
<i>Ambelma plicata</i>	threeridge	x	x			5	75.9, 22.3, 25.5, 91.3, 108.2
<i>Obliquaria reflexa</i>	threehorn wartyback	x	x			9	32.7, 34.7, 45.8, 45.0, 38.5, 53.7, 50.9, 48.3, 44.8
<i>Megalanais nervosa</i>	washboard	x	x			5	105.8, 130.2, 99.9, 149.8, 154.5
<i>Obovaria subrotunda</i>	round hickorynut		x				
<i>Fusconaia flava</i>	Wabash pigtoe	x	x			1	75.3
<i>Pleurobema cordatum</i>	Ohio pigtoe		x				
<i>Ellipsaria lineolata</i>	butterfly	x	x			9	56.3, 41.4, 78.1, 77.1, 51.2, 43.5, 71.7, 59.1, 58.2
<i>Plethobasus cyphus</i>	sheepnose		x				
<i>Obovaria olivaria</i>	hickorynut		x				
<i>Elliptio crassidens</i>	elephant-ear	x	x			4	106.5, 108.7, 95.6, 103.6
<i>Quadrula pustulosa</i>	pimpleback	x	x			2	47.9, 44.4
<i>Quadrula nodulata</i>	wartyback		x				
<i>Quadrula metanevra</i>	monkeyface		x				
<i>Potamilus alatus</i>	pink heelsplitter	x	x			3	104.1, 73.8, 100.7
<i>Plethobasus cooperianus</i>	orange-foot pimpleback		x		x		
<i>Cyrogenia stegaria</i>	fanshell		x		x		
<i>Quadrula quadrula</i>	mapleleaf	x	x			2	61.4, 58.0
<i>Actinonaias ligamentina</i>	mucket		x				
<i>Epioblasma torulosa</i>	tubercled blossom		x		x		
<i>Lampsilis teres</i>	yellow sandshell		x				
<i>Tritogonia verrucosa</i>	pistolgrip	x	x			1	98.8
<i>Pleurobema pyramidatum</i>	pyramid pigtoe		x				