

**MOLLUSCAN SURVEY OF THE ROANOKE RIVER
BETWEEN ROANOKE RAPIDS AND WELDON,
NORTHAMPTON COUNTY, NORTH CAROLINA**

**FOR
FISH AND WILDLIFE ASSOCIATES, INC.**

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INTRODUCTION

As part of Virginia/North Carolina Power Company's relicensing process for the Gaston/Roanoke Rapids Project, a mussel survey was conducted in the Roanoke River between Roanoke Rapids and Weldon, Northampton County, North Carolina on November 4-6, 1996 (Figure 1). The primary purpose of the survey was to collect data on the native mussels in the river including species present and relative abundance. According to Alderman (1993) and Johnson (1970), 13 species of freshwater mussels have been documented to occur in the lower Roanoke River (Table 1). Alderman (pers. com.) believed an additional species, *Ligumia nasuta*, should also occur in the Roanoke River. Three species were collected from the river below the Roanoke Rapids Dam (Alderman 1993). These included *Elliptio complanata*, *Elliptio icterina* and *Anodonta implicata*.

SITE DESCRIPTION

The mussel survey was conducted in the Roanoke River between the gaging station at Roanoke Rapids and the railroad bridge at Weldon, a distance of just over three miles (Figure 1). The gaging station is approximately three miles downstream of the Roanoke Rapids Dam and approximately 1.6 miles downstream of the Hwy 48 bridge (Exhibit 1). The areas within the Roanoke River (as represented by Exhibit 2) where intense surveys were conducted can be divided into seven zones.

- Zone 1: Roanoke River from gaging station to approximately 1500 ft downstream and includes Island 1;
- Zone 2: Roanoke River, south channel, approximately 4000 ft downstream of gaging station (adjacent to upper section of Island 2) to approximately one mile downstream of gaging station (over 1000 ft section of channel searched);
- Zone 3: Roanoke River, south channel, just downstream of I-95, beginning at approximately 1.25 miles downstream of gaging station and extends for approximately 1000 ft downstream (adjacent to lower section of Island 2);
- Zone 4: Roanoke River, south channel, approximately 3000 ft downstream of I-95. The length of the study reach approximated 500 ft;
- Zone 5: Roanoke River, north channel, approximately 4000 ft downstream of gaging station (adjacent to upper north side of Island 1) with a study reach of approximately 500 ft;
- Zone 6: Roanoke River, north channel, just downstream of I-95 and extending for approximately 2000 ft; and
- Zone 7: Roanoke River, north channel, approximately 1500 ft upstream of railroad bridge with a study reach of 1000 ft.

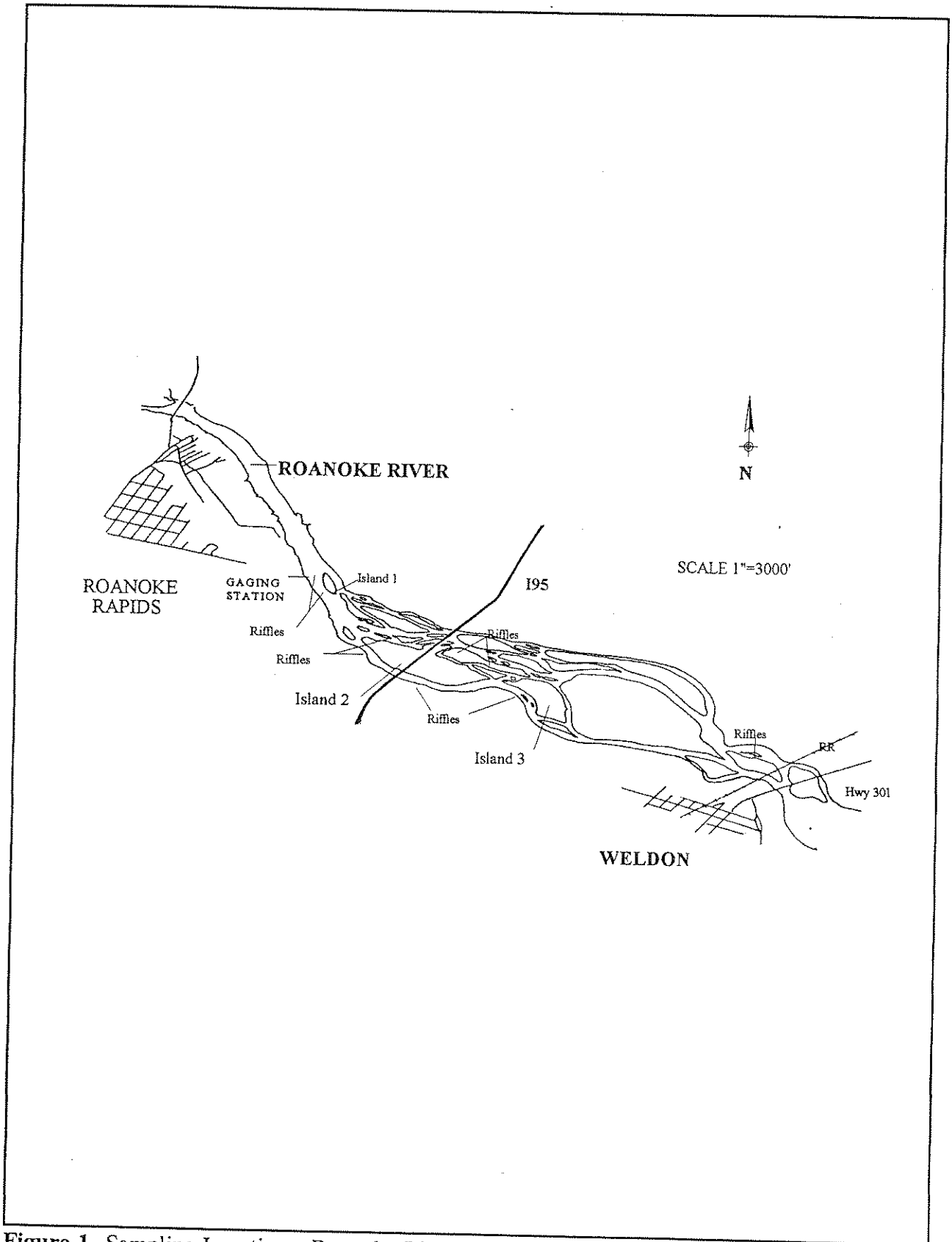


Figure 1 Sampling Locations, Roanoke River, Northampton County, North Carolina.

MATERIALS AND METHODS

Field work was preceded by a review of the mussel literature for the region and primarily included the works of Burch (1975), Clark (1986), Fuller (1973) and Johnson (1967 and 1970). Mr John Alderman, malacologist with the North Carolina Wildlife Resources Commission, was also contacted for additional information on species within the Roanoke River Drainage.

The principle channels (north and south) were chosen to be surveyed. These channels provide much of the suitable mussel habitat. Access to the river was facilitated by a small boat. A variety of methods were utilized to search individual stream segments. Low flows (2200 cfs discharges maintained by Roanoke Rapids Dam) and good water visibility (at least three feet) made SCUBA unnecessary. Thus, collections were made by wading and viewing the substrate with a view box and by snorkeling. Riffles, runs, pools and back water habitats were searched using these two techniques. In addition, islands, shorelines, under cut banks and muskrat middens were surveyed to determine the occurrence of relic specimens. Areas of high density were to be analyzed quantitatively (Isom and Gooch, 1986). However, with the exception of *Corbicula fluminea*, no areas of high density were encountered.

All live specimens were identified, counted, weighed, and measured; and most were returned to the substrate. As requested by Alderman, six specimens of *Elliptio lanceolata* and seven specimens of *Anodonta implicata* were sent to the USFWS in Gainesville, Florida for electrophoretic analyses. Specimens and relic shells collected on November 4 and 5 were verified by John Alderman who retained several specimens. Scientific and common names follow those provided by the American Fisheries Society (1988).

RESULTS AND DISCUSSION

A list of mussel species, past and present, known to occur in the Roanoke River is presented in Table 1. Table 2 contains a list of mollusk species taken during the survey and the numbers of unionid individuals found at all locations within the three mile study reach. Copies of the field sheets including all data dealing with height, width and weight measurements are found in the Appendix. Examples of each mussel species are shown in Exhibits 3 through 11.

Thirteen species of unionids were known to occur in the Roanoke River drainage and current expectations were to find only three species (*Anodonta implicata*, *Elliptio complanata* and *Elliptio icterina*) in the area under study. In the three mile section of the Roanoke River, eight species of unionids, the Asian clam, *Corbicula fluminea*, the pleurocerid snail, *Leptoxis carinata* (the crested mudalia), and the viviparid, *Campeloma decisum* comprised the mollusk fauna (Table 2). During the three day collecting effort, 126 living individuals (2 were recent dead of *Lasmigona subviridis* with portions of the soft parts still present) of unionids and 66 recent relic shells were collected.

Corbicula fluminea was dominant throughout the substrate at all locations with hundreds to thousands of individuals per square meter. In some areas, living individuals and dead shells of *Corbicula fluminea* (Exhibit 3) were a foot deep and were the primary substrate. On the large substrate (cobble to boulder size), the pleurocerid snail *Leptoxis carinata* was the dominant species.

The unionid fauna was comprised of eight species, seven of which have been recorded from the Roanoke River. The triangle floater, *Alasmidonta undulata*, (Exhibit 4) which was not

listed as occurring in the Roanoke River, but is a common species on the Northern Atlantic slope, was also taken. According to Johnson (1970), *Alasmidonta undulata* occurs in North Carolina in the Cooper-Santee, Pee Dee, Cape Fear, Neuse and Pamlico river systems. Johnson (1970) lists *Alasmidonta undulata* as preferring smaller streams, most often headwaters, with moderate flow having gravel and sand substrates.

The unionid populations were of extremely low density. Thus, no effort was made to quantify the community structure. The most commonly collected species was *Anodonta implicata*, alewife floater, (Exhibit 5) which comprised 40.5% of the living individuals and 71.2% of the relic shells collected. The second most taken species was *Lampsilis radiata radiata*, eastern lampshell, (Exhibit 9) comprising 23% of the living specimens and 10.6% of the relic shells. *Elliptio lanceolata*, yellow lance, (Exhibit 7) was the third most collected species making up 15.1% of living individuals and 1.5% of the relic shells. *Elliptio complanata*, eastern elliptio, (Exhibit 6) was the fourth most commonly collected species comprising 12.6% of living specimens and 12.1% of the relic shells. All other species (*Alasmidonta undulata*, Exhibit 4; *Elliptio cf. roanokensis*, Exhibit 8; *Lasmigona subviridis*, Exhibit 10; and *Leptodea ochracea*, Exhibit 11) individually made up less than 5% of living individuals and relic shells (Table 2, Appendix).

Zone 1, in the vicinity of the gaging station and along the southern channel of Island 1, had the highest density of individuals with *Anodonta implicata*, *Lampsilis radiata radiata*, and *Elliptio lanceolata* the most commonly collected species (Table 2). These three species were found primarily in the sand substrate. The one specimen of *Elliptio cf. roanokensis* was taken

from gravel substrate in a run between large boulders. The numbers of the three most common species decreased from Zone 2 to the end of the study area. The numbers of *Elliptio complanata* increased in the braided channels within Zones 4, 5 and 6 (Table 2). Individuals of *Elliptio complanata* were taken primarily in the gravel substrate of the riffle areas of the stream.

Overall density of the unionid mussels from the downstream zones was very low, with extensive search efforts producing low numbers of individuals. Many of the specimens recovered from the study reach exhibited extensive shell erosion, occasionally breaching the protection of the shell and exposing the mussel directly to exposure to the water. The unionid populations are directly or indirectly affected by a variety of environmental conditions including increased sedimentation from poor land use practices, industrial and municipal waste discharges from multiple water usage, regulated hydraulic conditions, and isolation of populations. The cause of low density unionid populations in the section of the Roanoke River under study was not ascertained.

TABLE 1. UNIONIDAE OF THE ROANOKE RIVER DOWNSTREAM OF ROANOKE RAPIDS DAM.

SPECIES	COLLECTION*	COLLECTION NOVEMBER 1996	STATE STATUS**
<i>Alasmidonta undulata</i> triangle floater		Present	T
<i>Anodonta cataracta cataracta</i> eastern floater	Historic		
<i>Anodonta implicata</i> alewife floater	Recent	Present	SC
<i>Elliptio complanata</i> eastern elliptio	Recent	Present	
<i>Elliptio icterina</i> variable spike	Recent		
<i>Elliptio lanceolata</i> yellow lance	Historic	Present	T
<i>Elliptio cf. roanokensis</i> Roanoke slabshell	Historic	Present	T
<i>Fusconaia masoni</i> Atlantic pigtoe	Historic		T
<i>Lampsilis radiata radiata</i> eastern lamp mussel	Historic	Present	SC
<i>Lasmigona subviridis</i> green floater	Historic	Present	E
<i>Leptodea ochracea</i> tidewater mucket	Historic	Present	SC
<i>Ligumia nasuta</i> eastern pond mussel			SC
<i>Strophitus undulatus</i> squaw foot	Historic		T
<i>Unio merus tetralasmus</i> pond horn	Historic		
<i>Villosa constricta</i> notched rainbow	Historic		SR

*Data provided by John Alderman

**State Status Ranking: R=Rare; SC=Special Concern; T=Threatened; and E=Endangered.
No federal species of concern are known to occur in the area (Le Grand and Hall 1995).

TABLE 2. MOLLUSCA TAKEN FROM THE ROANOKE RIVER DOWNSTREAM OF ROANOKE RAPIDS DAM, NOVEMBER 4-6, 1996

SPECIES	ZONE 1 (Near Island 1)	ZONE 2 (Near Island 2)	ZONE 3 S. Channel just below 1-95)	ZONE 4 (S. channel 1/2 mile south 1-95)	ZONE 5 (N. channel near Island 2)	ZONE 6 (N. channel just below 1-95)	ZONE 7 (N. channel 2000' below 1-95)	ALL TOTAL
<i>Bivalvia</i>								
<i>Unionoida</i>								
<i>Unionidae</i>								
<i>Alasmidonta undulata</i>				1	1***			2
<i>Anodonta implicata</i>	29	8	6	2	5			51
<i>Elliptio complanata</i>	1		1	3	7	3	1	16
<i>Elliptio lanceolata</i>	13	4	2					19
<i>Elliptio cf. roanokensis</i>	1							1
<i>Lampsilis radiata radiata</i>	23	1	3		2			29
<i>Lasmigona subviridis</i>				2***				2
<i>Leptodea ochracea</i>		1	1	2		2		6
<i>Veneroida</i>								
<i>Corbiculidae</i>								
<i>Corbicula fluminea</i> *	*	*	*	*	*	*	*	*
<i>Gastropoda</i>								
<i>Mesogastropoda</i>								
<i>Pleuroceridae</i>								
<i>Leptoxis carinata</i> **	**	**	**	**	**	**	**	**
<i>Viviparidae</i>								
<i>Campeloma decisum</i>	2							
TOTAL NUMBER OF UNIONIDAE INDIVIDUALS	67	14	13	10	15	5	2	126
TOTAL NUMBER OF UNIONIDAE SPECIES	5	4	5	5	4	2	2	8

*Extremely high densities (100+ to greater than 1000 individuals/M²) throughout substrate at all locations.
 **Abundant on all cobble and boulder substrates at all locations.
 *** Recent dead individuals

REFERENCES

- Alderman, J.M. 1993. Current freshwater mussel species found in the Roanoke River at Roanoke Rapids. Unpublished. North Carolina Wildlife Resources Commission
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- Burch, J.B. 1975. Freshwater Unionacean Clams (Mollusca: Pelecypoda) of North America. Malacological Publications, Hamburg, Michigan. 204 pp.
- Clark, Arthur H. 1986. *Elliptio judithae*, New Species (Bivalvia, Unionidae), from the Neuse River, North Carolina. Malacology Data Net, Vol. (4): 78-96.
- Fuller, Samuel L.H. 1973 *Fusconaia masoni* (Conrad 1834) (Bivalvia: Unionacea) in the Atlantic Drainage of the Southeastern United States. Malacological Review, 6:105-131.
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- Johnson, Richard I. 1967. *Carunculina pulla* (Conrad), an overlooked Atlantic Drainage Unionid. Nautilus 80(4): 127-131.
- Johnson, Richard I. 1970. The Systematics and Zoogeography of the Unionidae (Mollusca:Bivalvia) of the Southern Atlantic Slope Region. Bulletin of the Museum of Comparative Zoology, 140(6): 263-449.
- Le Grand, Harry E. and Stephen P. Hall. 1995. Natural Heritage Program List of the Rare Animal Species of North Carolina. North Carolina Natural Heritage Program, Division of Parks and Recreation, Department of Environment, Health and Natural Resources, Raleigh, NC. 67pp.

APPENDIX



Exhibit 1. Roanoke River Approximately 1.5 miles downstream of Hwy 48 Bridge..

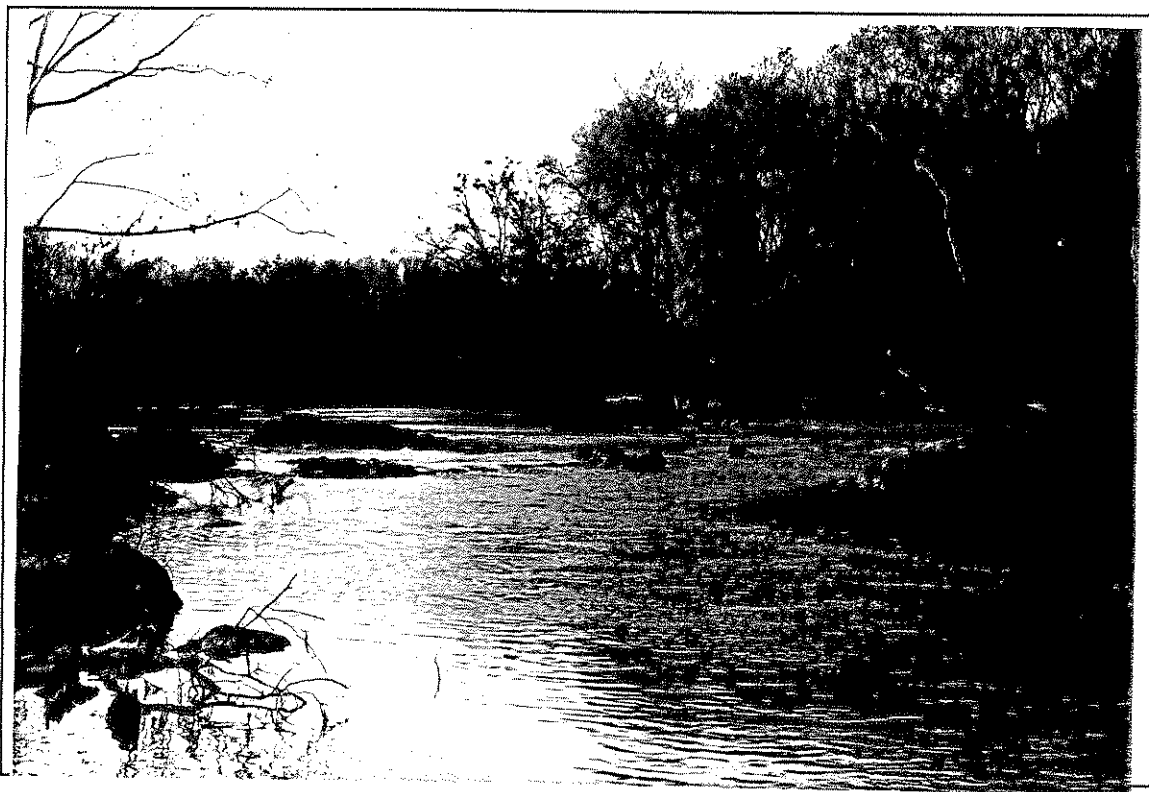


Exhibit 2. Roanoke River Approximately 1/2 mile downstream of I-95.



Exhibit 3. *Corbicula fluminea*

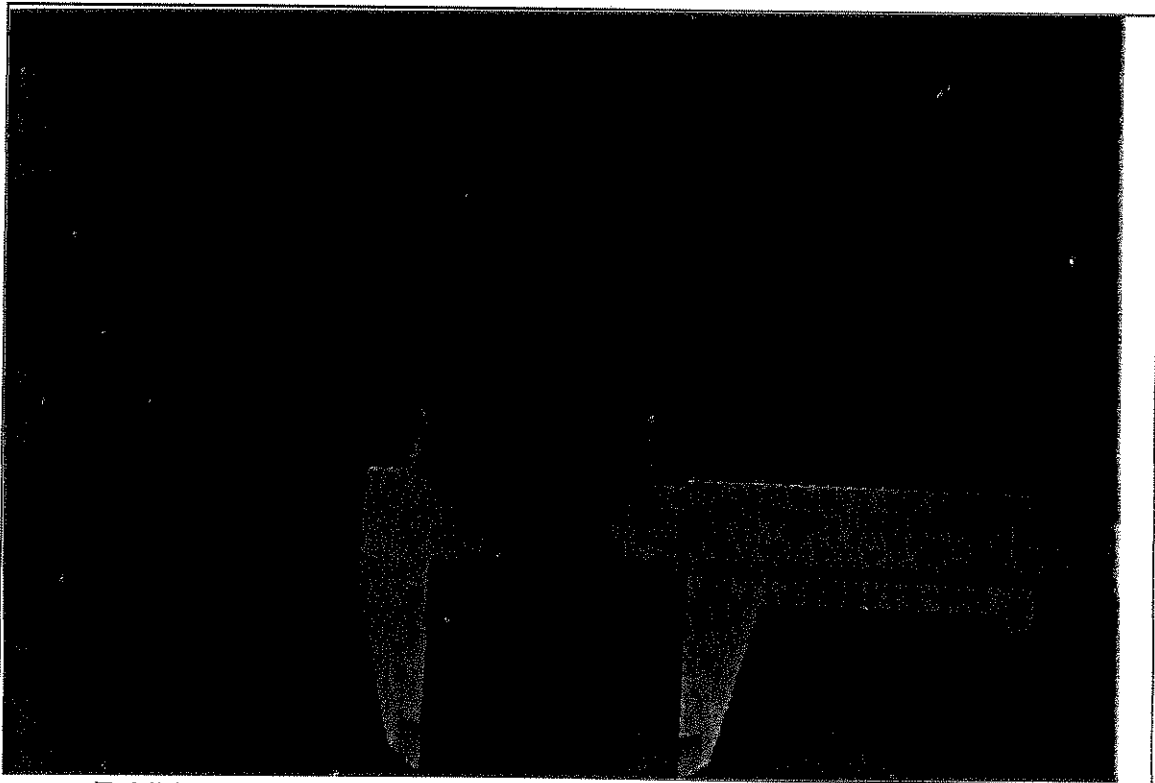


Exhibit 4. *Alasmidonta undulata*

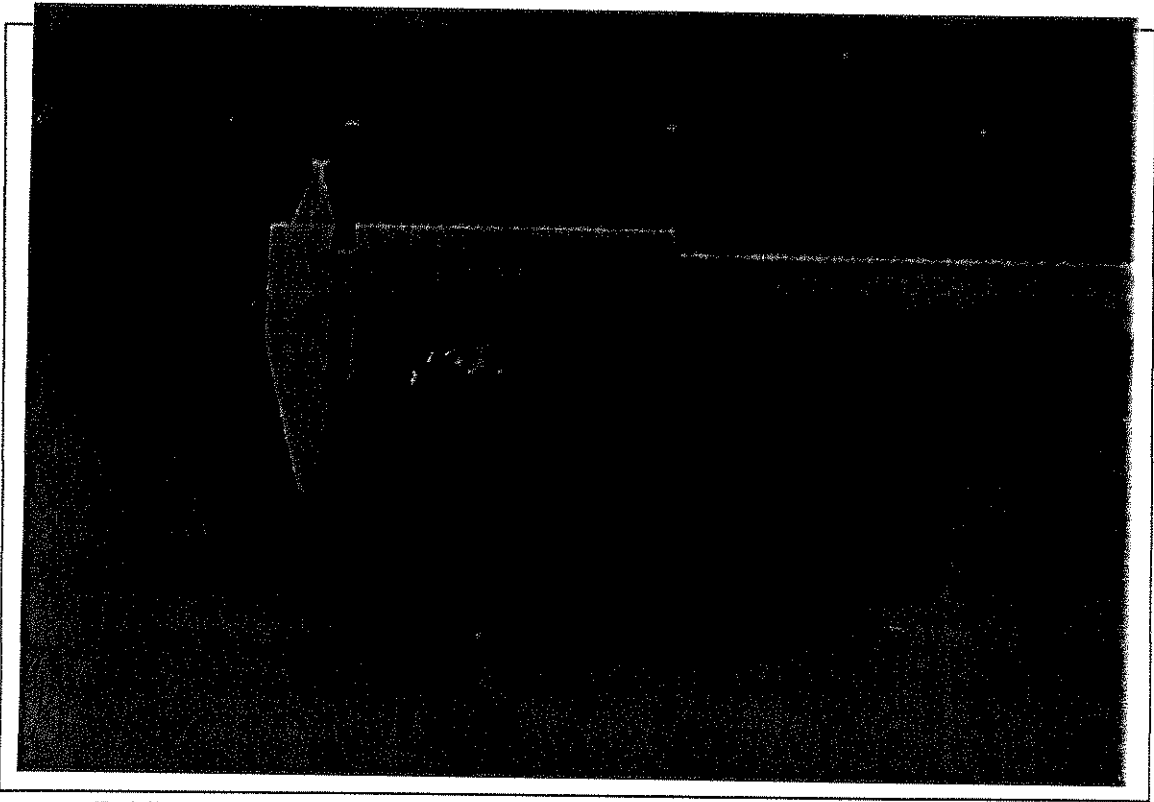


Exhibit 5. *Anodonta implicata*

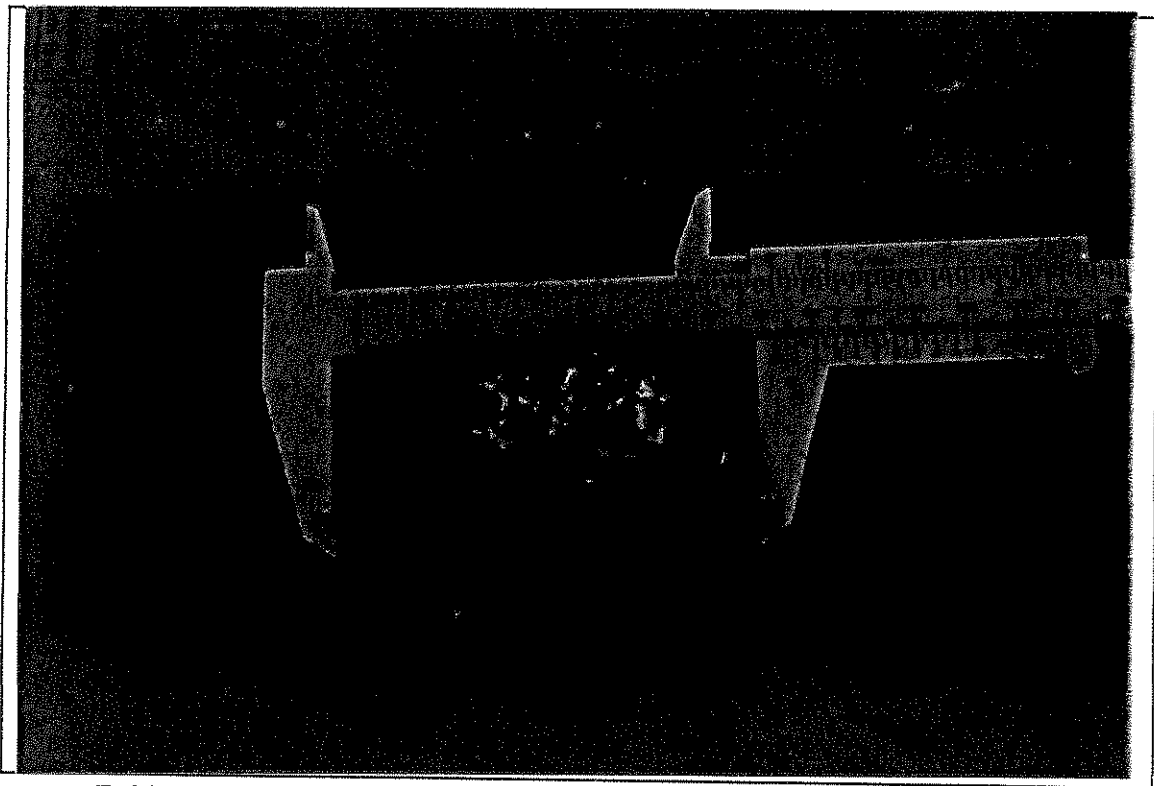


Exhibit 6. *Elliptio complanta*

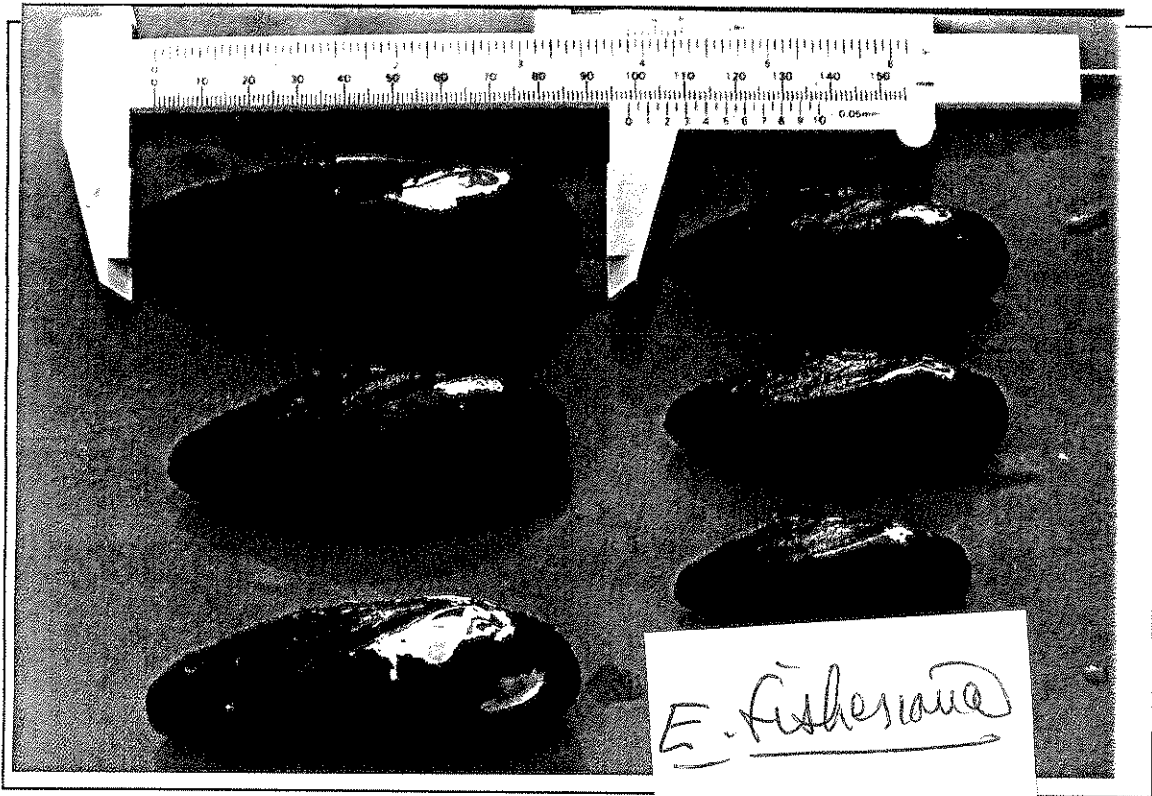


Exhibit 7. *Elliptio lanceolata*

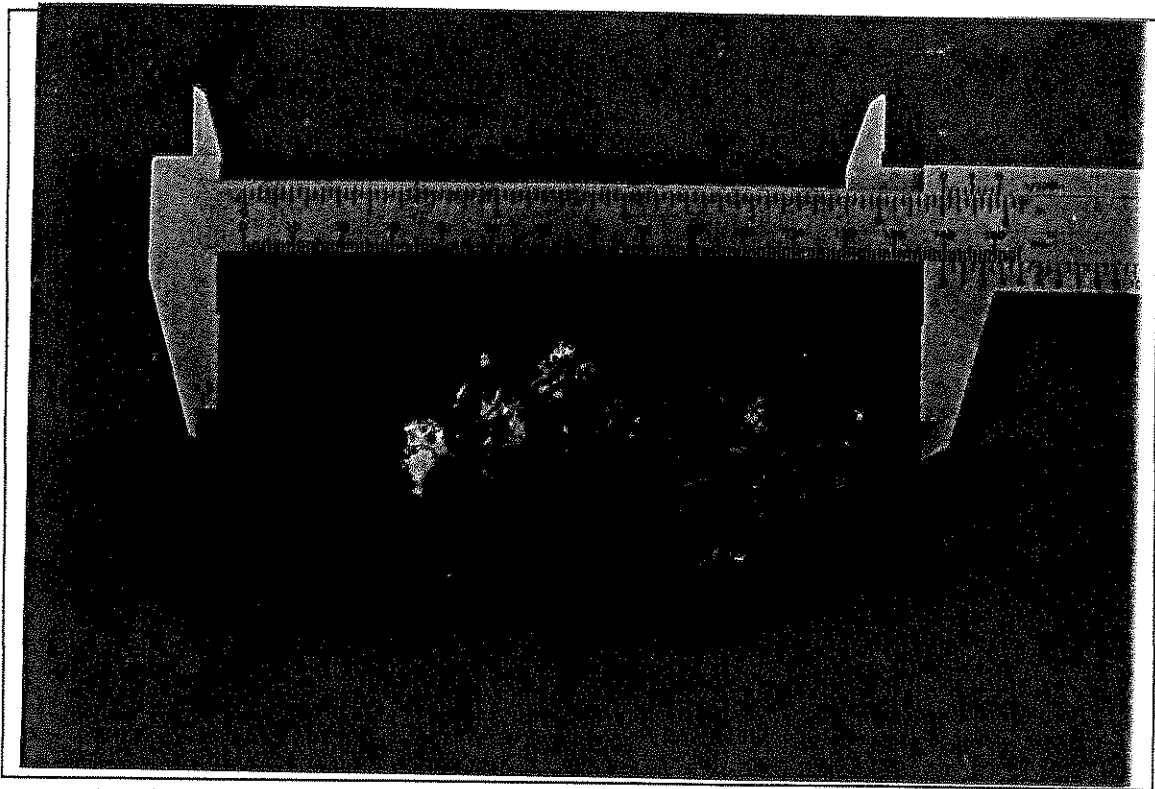


Exhibit 8. *Elliptio cf. roanokensis*

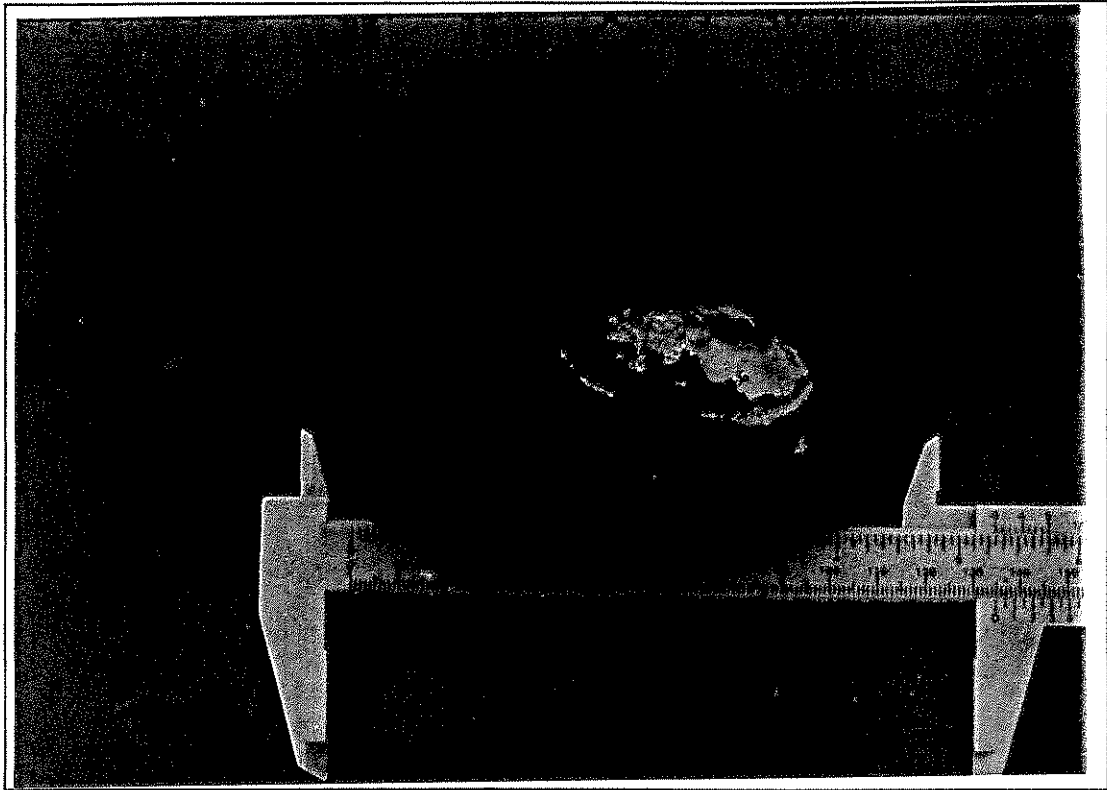


Exhibit 9. *Lampsilis radiata radiata*

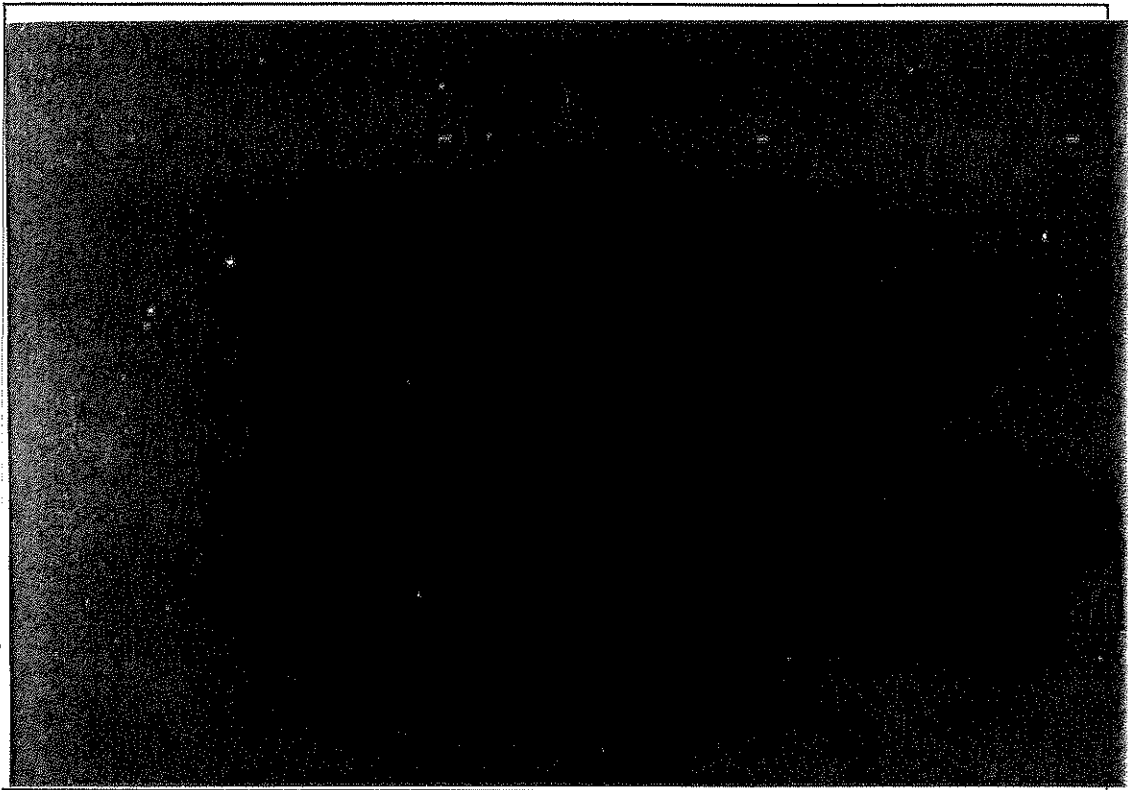


Exhibit 10. *Lasmigona subviridis*

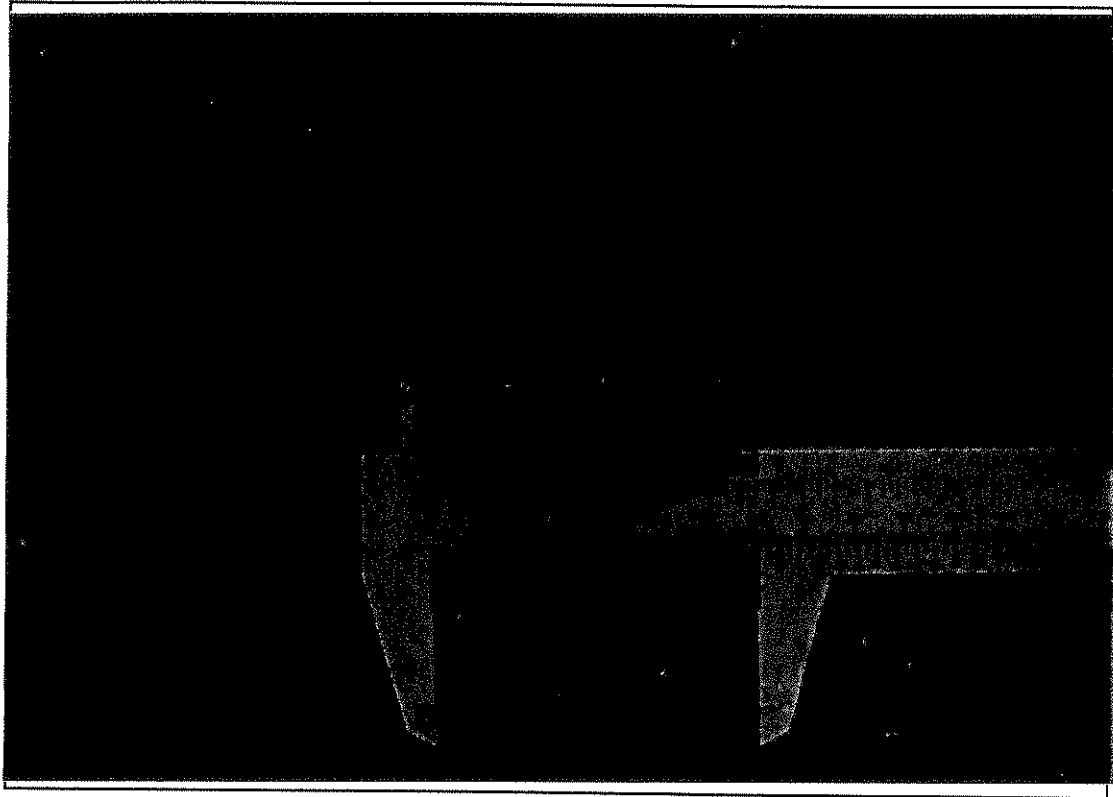


Exhibit 11. *Leptodea ochracea*

MUSSEL SURVEY DATA SHEET

Page 1
Gage

Project: Roanoke Rapids

PAI #:

Date: 11/4/96 Time: _____

Location: Roanoke River ~ 1 mile below Hwy 48 Bridge

Transect No: Gage - South Bank

Transect Location: Gage

Collector: W. Pennington, Steve Holdenman

Comments: _____

SPECIES	TRANSECT	QUADRAT	LENGTH (mm)	HEIGHT (mm)	AGE weight	OBSERVATIONS
<i>Anodonta imbecilis</i>	Gage		135	70	290	Anodonta along banks in sandy substrates concentrated in pool areas
"	"		130	66	360	Roll 1 Shot 25-27
"	"		99	51	90	Roll 2 Shots 1-3
"	"		113	54	160	"
"	"		110	53	130	"
"	"		111	52	120	"
"	"		113	53	160	"
"	"		107	51	110	"
"	"		108	51	110	"
"	"		117	53	150	Roll 2 Shots 6-8
"	"		126	65	225	
"	"		118	59	170	
<i>Elliptio lanceolatus</i>	"		75	31	30	Roll 2 Shots 9-11
? <i>Elliptio complanatus</i>	"		78	41	50	
? <i>Lampsilis radiata</i>	"		104	48	120	12-13
"	"		112	58	175	14-15
						16-17

Rolls
Pools
Pools

MUSSEL SURVEY DATA SHEET

1 of 2

Project: Roanoke River PAI #: _____
 Date: 11/4/96 Time: _____
 Transect No: _____
 Collector: W. Pennington, Steve Holdeman

Location: 1st Island ~ 1 mile downstream of Hwy 48 - All but 2nd along South Bank
 Transect Location: _____
 Comments: _____

SPECIES	TRANSECT	QUADRAT	LENGTH (mm)	HEIGHT (mm)	W. AGE	OBSERVATIONS
<i>Anodonta implicata</i>	1st Island		126	60	190	Behind Island 1st transect
<i>Elliptio ? reanotensis</i>			124	61	150	In Run adjacent to Island 1
<i>Anodonta implicata</i>			117	58	170	
"			118	60	180	
"			108	53	150	
"			111	48	110	
<i>Anodonta ? ? ? ? ?</i>			95	49	65	
"			96	48	70	
"			91	46	70	
"			98	44	70	
"			76	40	40	
"			77	38	40	
"			78	38	50	
<i>Elliptio lanceolata</i>			92	35	40	
"			82	32	30	
"			87	34	50	
"			69 69	27	20	
"			69	27	20	
"			00	24	15	
"			50	21	10	

Along S. Bank

2072

MUSSEL SURVEY DATA SHEET

Project: Roanoke River

PAI #:

Date: 11/4/96 Time: _____

Location: 1st Is. land at 1 mi. to downstream of Hwy 98-

Transect No: _____

Transect Location: _____

Collector: W. Pennington, S. Holdeman

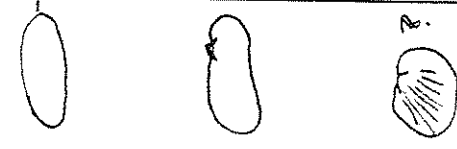
Comments: _____

SPECIES	TRANSECT	QUADRAT	LENGTH (mm)	HEIGHT (mm)	AGE at collection (days)	OBSERVATIONS
? <i>Lampsilis radiata</i>			113	58	180	R0113 56 to 58 & 4
<i>Lampsilis radiata</i>			125	60	260	" 5 & 6
			124	71	250	7 & 8
			117	58	200	" "
			107	58	160	R0113 9-14
			94	48	100	6000
			80	43	60	R0113
			110	59	180	Prohibited
			101	55	150	
			108	60	150	
			112	63	190	
			109	60	160	
			101	56	150	
			103	45	110	
			100	56	125	
			110	56	160	
			112	63	170	
"			101	55	130	
"			93	52	110	
"			85	42	70	

MUSSEL SURVEY DATA SHEET

Project: Roanoke River PAI #: _____
 Date: 11/5/96 Time: _____ Location: Just Below I-95
 Transect No: _____ Transect Location: _____
 Collector: W. Pennington, S. Frealy, S. Holdman Comments: _____

SPECIES	TRANSECT	QUADRAT	LENGTH (mm)	HEIGHT (mm)	WEIGHT (grams)	OBSERVATIONS
<i>Anodonta imbecilis</i>			100	57	120	
<i>Elliptio complanata</i>			90	51	50	
<i>Anodonta imbecilis</i>			128	60	215	Returned
"			127	60	200	Returned
"			95	47	80	Returned
"			97	46	100	Returned
"			92	45	70	Returned
<i>Lemysilis reidiana</i>			107	52	140	Returned
"			100	50	80	
"			97	43	90	
<i>Elliptio lanceolatus</i>			71	29	20	Returned
"			58	23	10	Returned
<i>Leptodea ochracea</i>			61	38	25	Reys Roll 3 - 15-18
"						



MUSSEL SURVEY DATA SHEET

Project: Roanoke River

PAI #:

n 1/2 mile down of 295
3rd Island - South Canal

Date: _____ Time: _____

Location:

Transect No: _____

Transect Location:

Collector: W. Pennington, S. Waldman, S. Fratey

Comments:

SPECIES	TRANSECT	QUADRAT	LENGTH (mm)	HEIGHT (mm)	MS WEIGHT	OBSERVATIONS
<i>Dnodonta implicata</i>			118	59	190	Returned
" "			117	56	140	"
<i>Leptodea ochracea</i>			90	57	120	
" "			77	49	70	
<i>Elliptio complanata</i>			74	40	30	
" "			75	38	30	
" "			61	31	10	
<i>Alasmodonta undulata</i>			40	25	<10	Roll 3 - shot 20 & 21
<i>Lasimigona subviridis</i>						Rec'd Relect - four complete valves



MUSSEL SURVEY DATA SHEET

Project: Roanoke Rapids PAI #: _____
 Date: 11/6/96 Time: _____ Location: 1/4 mile upstream B95 North Channel
 Transect No: _____ Transect Location: _____
 Collector: W. Pennington, S. Holdeman Comments: _____

SPECIES	TRANSECT	QUADRAT	LENGTH (mm)	HEIGHT (mm)	AGE in weeks	OBSERVATIONS
<i>Elliptio complanata</i>			96	50	100	Returned
"			93	51	100	
"			84	40	90	
"			74	35	35	
"			70	34	25	
"			60	30	15	
"			57	30	15	
<i>Anodonta imbecilis</i>			95	44	80	
"			96	48	80	
"			99	47	90	
"			93	48	95	
<i>Alasmidonta undulata</i>						Relict Shell (Fresh)
<i>Lamprolaima radiata</i>						Relict Shell (Fresh - young)
<i>Anodonta imbecilis</i>			123	53	170	Returned

