

**RESULTS OF TWO QUALITATIVE MUSSEL DIVE  
SURVEYS AND STATUS REPORT OF FAT  
POCKETBOOK MUSSELS (Potamilus capax) SIX  
YEARS AFTER REINTRODUCTION TO THE UPPER  
MISSISSIPPI RIVER, MISSOURI**

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Approved:

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12/19/95  
Date

## INTRODUCTION

During 1989 a total of 2,301 fat pocketbooks, Potamilus capax, were relocated to two sites in the Upper Mississippi River (Koch, 1990). The objective was to reestablish a reproducing population in the river. One thousand and forty-nine mussels were placed near Blackbird Island, MRM 291.5 (Figure 1), and 1,252 mussels were placed near Fox Island, MRM 356.5 (Figure 2). Each mussel had an assigned number etched into one shell valve. A "V" marking was then placed on the shell margin of the opposite valve so that future growth could be measured.

Both populations were surveyed by brail in 1990 and by diving in 1992 and 1995. This report documents the results of the 1995 survey and compares results with those obtained in 1992.

## METHODS

Dive services were provided by Tom Niffen Diving of Louisiana, Missouri, a firm experienced in collecting mussels from the river bottom. Air was supplied to the diver through a hose attached to an air compressor in a boat at the surface. The diver was instructed to pick up all shell material and place it into a mesh bag to be brought back to the surface. All dead shell material, except those of fat pocketbooks, was discarded and is not included in survey statistics. Live mussels of all species were identified and examined for the presence of zebra mussels, then were returned to the water.

The survey at Blackbird Island was conducted on September 19, 1995. A total of six dives were conducted, three within the relocation site and three within 100 meters below the site. Dive duration was dependant upon mussel encounters and ranged from 30 to 75 minutes, averaging 54 minutes per dive. Total dive time was 5 hours, 20 minutes.

The survey at Fox Island was conducted on September 20, 1995. One boundary post could not be found at this site so the relocation area was determined based on the recollections of individuals present during previous surveys. Three dives were conducted within the relocation site and three within 100 meters downstream of the site. Dive duration ranged from 45 minutes to 60 minutes, averaging 50 minutes. Total dive time was 5 hours.

## RESULTS AND DISCUSSION

### Blackbird Island

During our 1992 dive survey, only one live fat pocketbook mussel was collected at this site. Shells of 28 dead individuals were recovered; but only 11% exhibited post-transplant growth, indicating that most relocated mussels did not survive their first winter (Koch, 1993).

No live fat pocketbooks were collected from this site in 1995; however, we recovered shell from three relocated specimens. We also found one relic fat pocketbook shell which did not have the mark of a relocated specimen. No juvenile fat pocketbooks were collected. All fat pocketbook shells were found in the 100 meter section downstream of the relocation site.

None of the relocated fat pocketbook shells recovered in 1995 exhibited growth, suggesting that they died soon after being relocated (Table 1). Minor differences in length, height, and width measurements between 1989 and 1995 are probably due to measurement variability or shell margin erosion.

Eighteen other species of native mussels were represented by 937 live individuals in our 1995 collection. Six species comprised 85% of the sample -- the threehorn wartyback, threeridge, mapleleaf, pink papershell, fragile papershell, and wartyback (Table 3). No federally listed rare or endangered species were collected, however 30 specimens of the hickorynut (on the Missouri Watch List) were collected.

The threehorn wartyback had the highest occurrence of zebra mussel attachment, but only 4% were affected (Table 3). Only six other species had zebra mussels attached, four of which had only one individual. One fat pocketbook shell (#40) had approximately 20 zebra mussels attached to its inner side. These zebra mussels were less than four years old, so they could not have been responsible for this fat pocketbook's demise. At current zebra mussel densities, we cannot conclude that any native mussels are being adversely affected.

Our diver made the following observations at this site: 1) All of the exposed portions of a partially buried metal barrel were covered with zebra mussels; 2) Only papershells and heelsplitters were found where substrate was 100% sand. All species were present in the area within ten meters of shore where the substrate consisted of a mixture of sand, silt, and woody debris; and 3) Specimens were more abundant near woody debris than in open water.

## Fox Island

During our 1992 survey, 13 live fat pocketbook mussels were collected at this site. Shells of 61 dead individuals were recovered; but only 21% exhibited post-transplant growth (Koch, 1993).

No live fat pocketbooks were recovered from this site in 1995; however, we recovered shell from 17 relocated specimens. No juvenile fat pocketbooks were collected. All fat pocketbook shells were found in the 100 meter section downstream of the relocation site.

Only five of the 17 fat pocketbook shells recovered in 1995 exhibited growth (Table 2). One of these, number 1106, was collected alive and released during the 1992 survey. Unfortunately, it seems that this individual died shortly after being handled, because 1995 and 1992 length and height measurements were almost identical. The growth increment between 1992 and 1995 could not be measured because only one shell valve was collected and the growth mark was on the other shell valve. The other four specimens, numbers 1170, 979, 750, and one with an unreadable number, grew by 11, 5, 1, and 11 millimeters, respectively (Table 2). Minor differences between 1989 and 1995 length, height, and width measurements of other fat pocketbooks are probably due to measurement variability or shell margin erosion.

Eighteen other native mussel species were represented by 552 individuals in our 1995 collection. The threeridge, threehorn wartyback, mapleleaf, pimpleback, and hickorynut comprised 86% of the sample (Table 3). No federally listed rare or endangered species were collected.

We found zebra mussels attached to only four species at this site, and the degree of infestation was light (Table 3). One zebra mussel was 31 millimeters long and thought to be age 4+.

Our diver commented that the gravel/cobble substrate he recalled predominating this site in 1992 had become silty sand by 1995. Leroy Koch's 1992 field notes support this observation.

## CONCLUSIONS AND RECOMMENDATIONS

Unfortunately, we were unable to establish fat pocketbook populations at the Blackbird Island or Fox Island sites in the early 1990's. We do not know if this failure is due to site conditions, relocation techniques, or both. However, it is reasonable to assume that environmental conditions potentially responsible for local extirpation may still exist, thereby thwarting restoration efforts.

We learned from this project that in future mussel relocation projects, both valves of all relocated specimens should be numbered and marked so that survival and growth can be accurately documented, even if the mussel dies and its valves become separated.

Recently, we learned the results of research which may have increased the likelihood of success of this mussel reintroduction project. Researchers elsewhere have found that reducing holding time may decrease the amount of environmental stress on mussels. Other results suggest that relocating mussels in the spring (pre-spawn and when water temperature is low) may also reduce handling stress, thereby improving the odds of survival for relocated specimens (pers. com., Upper Mississippi River Conservation Committee, 1995). This information would have been especially useful during the project's planning phase because Missouri experienced droughts and high air and water temperatures in 1988 and 1989. The adverse environmental conditions and sometimes lengthy holding time (up to two weeks) may have negatively affected mussels that were already physically stressed.

One additional factor which may have affected project outcome was relocation site selection. Fat pocketbook mussels prefer mud and sand bottoms in slack current areas of large rivers (Cummings and Mayer, 1992). Current velocities we observed at both sites may have been excessive for fat pocketbook survival. The presence of a gravel/cobble substrate rather than a mud/sand substrate at the Fox Island site in 1989 also may have affected the mussels.

Until more is known about the physiological ecology of fat pocketbook mussels, attempts to relocate and restore populations of this endangered species are likely to fail, especially if restoration efforts are undertaken in habitats being colonized by exotic zebra mussels. For this reason, we recommend that no further attempt be made to restore fat pocketbook mussels into the Upper Mississippi River in Missouri at this time. Furthermore, we urge our academic institutions and the National Biological Service to perform basic research on this animal, so that aquatic resource managers may one day possess the knowledge required to successfully restore this species in suitable habitat.

#### REFERENCES CITED

- Koch, L. M. 1990. Reintroduction of Potamilus capax to portions of the Upper Mississippi River in Missouri. Missouri Department of Conservation, District 2 Palmyra Field Office, (Report). 10pp.
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- Cummings, K. S. and C. A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey Manual 5. 194 pp.
- Upper Mississippi River Conservation Committee. October 16-18, 1995. The Conservation and Management of Freshwater Mussels: Initiatives for the Future (mussel symposium relocation discussion).

Figure 1. Location of Blackfoot Island F-1 pocketbook transplant site.

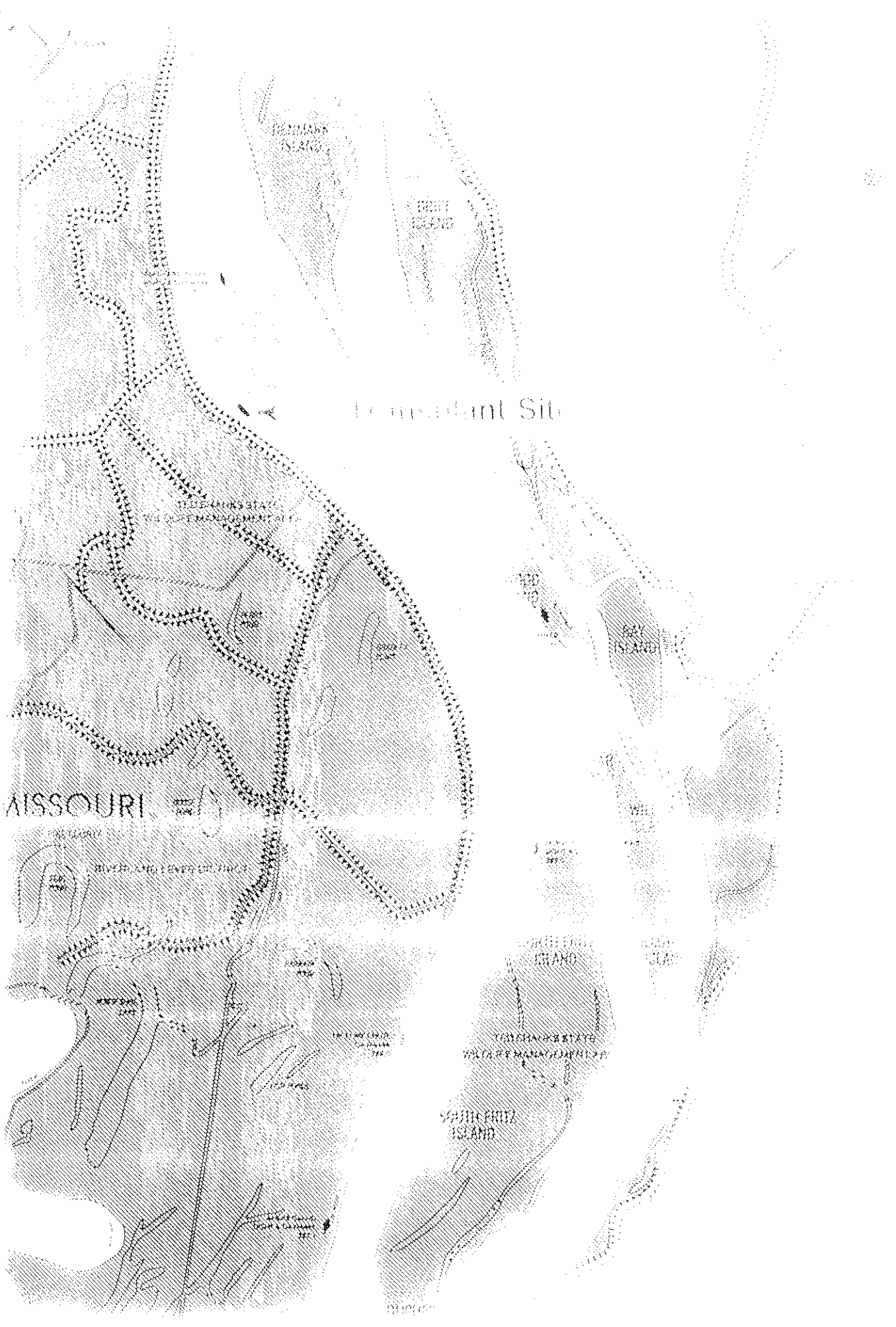


Figure 2. Location of Fox Island fat pocketbook transplant site.

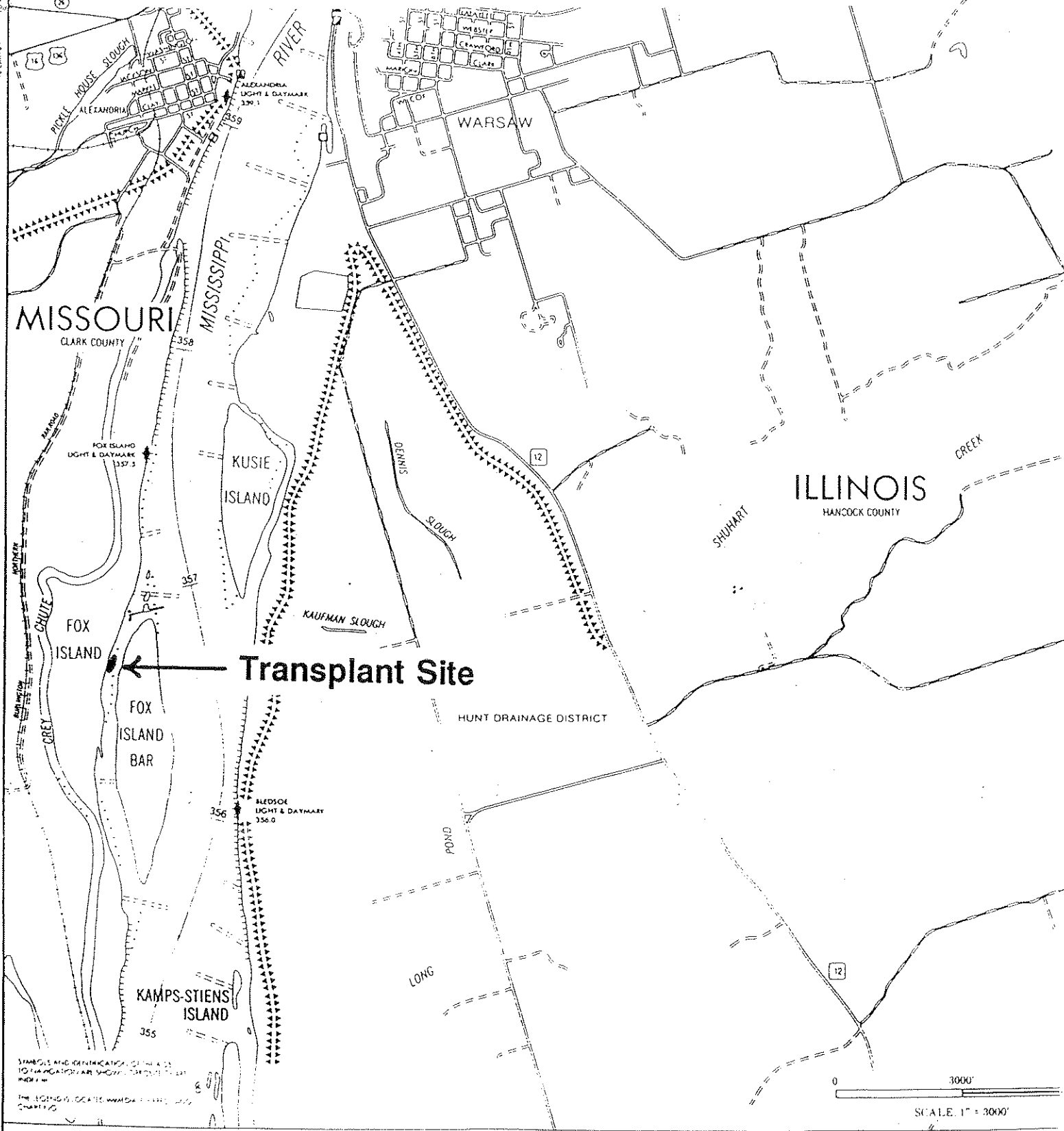


Chart 81

Chart No.	Mileage AOR	Location	Owner or Operator	Type of Service	Shelter or Warehouse	Cargo Handling Equipment	R/R Connect	Remarks
81	359.2 R	Alexandria, Mo	Morgan Oil Co	Transfer & storage of petroleum products	2 steel tanks 1,827,000 gals cap	6" pipeline 700 gal/min	None	None
81	359.7:	Warsaw Ill	Hancock Grain	Storage & shipment	Cement elevator 120,000 bu cap	Loading spout 1,250 bu/hr	I.P. & W	None



**Table 1.** Number, size measurements, and growth measurements of fat pocketbook mussels recovered from Blackbird Island, September 19, 1995.

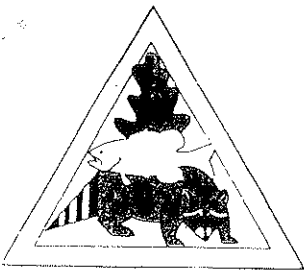
Mussel No.	Year Measured	Length (mm)	Height (mm)	Width (mm)	New Growth (mm)
156	1995	93	68	58	0
	1989	94	69	59	
40	1995	118	86	70	0
	1989	119	87	71	
889	1995	96	72	62	0
	1989	98	69	62	
Relic Shell	1995	111	85	64	NA

**Table 2.** Number, size measurements, and growth measurements of fat pocketbook mussels recovered from Fox Island, September 20, 1995.

Mussel No.	Year Measured	Length (mm)	Height (mm)	Width (mm)	New Growth (mm)
865	1995	79	58	49	0
	1989	81	59	50	
828	1995	100	74	61	0
	1989	103	74	61	
750	1995	105	76	61	1
	1989	105	74	61	
158	1995	77	56	48	0
	1989	79	56	48	
1106	1995	108	72	NA	NA
	1992	108	69	67	1
	1989	108	71	66	
357	1995	90	66	53	0
	1989	91	67	65	
720	1995	115	83	72	0
	1989	113	82	70	
786	1995	86	61	54	0
	1989	88	61	53	
26	1995	104	75	60	0
	1989	104	75	61	
761	1995	120	85	75	0
	1989	120	84	74	
1183	1995	119	87	76	0
	1989	120	85	75	
1233	1995	84	60	55	0
	1989	86	60	55	
711	1995	125	92	NA	0
	1989	123	91	74	
1170	1995	85	60	55	11
	1989	78	54	49	
979	1995	93	69	60	5
	1989	91	63	57	
1200	1995	108	80	67	0
	1989	107	79	67	
Unreadable	1995	89	65	48	11

Table 3. Number of native mussels (excluding fat pocketbooks), percent of site sample, and number of mussels with zebra mussel attachment recorded from qualitative dive surveys conducted at Blackbird Island and Fox Island, September 1995.

SPECIES	Blackbird Island			Fox Island		
	No.	Percent of sample	Number w/zebras	No.	Percent of sample	Number w/zebras
THREERIDGE	187	20.0	2	222	40.2	1
THREEHORN WARTYBACK	200	21.3	8	85	15.4	-
MAPLELEAF	177	18.9	5	57	10.3	4
PIMPLEBACK	7	0.7	-	72	13.0	3
PINK PAPERSHELL	101	10.8	-	7	1.3	-
FRAGILE PAPERSHELL	69	7.3	1	5	0.9	-
HICKORYNUT	30	3.2	1	39	7.1	-
WARTYBACK	58	6.2	1	5	0.9	-
POCKETBOOK	5	0.5	-	14	2.5	-
GIANT FLOATER	41	4.3	-	14	2.5	3
PINK HEELSPLITTER	34	3.6	-	7	1.3	-
PIGTOE	4	0.4	-	16	2.9	-
FAWNSFOOT	11	1.2	-	-	-	-
ROCK POCKETBOOK	3	0.3	-	1	0.2	-
MONKEYFACE	-	-	-	1	0.2	-
YELLOW SANDSHELL	5	0.5	-	-	-	-
BUTTERFLY	-	-	-	2	0.4	-
BLACK SANDSHELL	-	-	-	1	0.2	-
PAPER PONDSHELL	2	0.2	-	-	-	-
WHITE HEELSPLITTER	2	0.2	-	3	0.5	-
DEERTOES	1	0.1	-	5	0.9	-



# MISSOURI DEPARTMENT OF CONSERVATION

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December 19, 1995

Dear Colleague:

Because of your involvement with the UMRCC Mussel Ad Hoc Committee, or your known interest in mussel resources, I thought you might be interested in the enclosed report by Fisheries Management Specialist Travis Moore. We are disappointed to report the failure of our attempt to re-establish populations of endangered fat pocketbook mussels in two Missouri pools of the Upper Mississippi River. In order for any such effort to be successful, we need some basic information on the physiological ecology of the organism. I encourage our academic institutions and the National Biological Service to conduct basic research on substrate preference, optimum current velocity, age and size at maturity, life span, and fish host for this species. With such knowledge, we may be able to successfully re-introduce fat pocketbook mussels to suitable portions of their native range.

I apologize if I have omitted from the distribution list anyone who may find this information useful, and I trust that those of you who receive the report will share a copy with such colleagues. Please call Travis Moore at 314-248-2530 if you have any questions about our methods or results.

Sincerely,

Dave Neuswanger  
Fisheries District Supervisor

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