The Illinois-Missouri Cooperative Mussel Project - Report of 1999 Mussel Surveys of Five Beds on Mississippi River Pool 24; Blackbird Island, Lower Hickory Chute, Champ Clark Bridge, Crider Bend, and Cash Island

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INTRODUCTION

OBJECTIVES

The objectives of this project were to: 1. Locate and determine the status of existing mussel beds in Mississippi River Pool 24; 2. Locate potential parent stocks of all species, especially federal and state listed species, for the purpose of future propagation; 3. Determine the status and location of rare and listed species within Pool 24, thus enabling the development of a management strategy for the species and their habitat.

BACKGROUND

Freshwater mussels comprise the largest group of species listed as endangered or threatened by the U.S. Fish and Wildlife Service. Of the close to 300 mussel species once found in North America, over half are either extinct, watch listed or listed as endangered or threatened (both state and/or federally). Present day mussel populations in the Upper Mississippi River are experiencing serious declines due to habitat loss, introduction of exotic species, pollution, overharvest and illegal harvest. This is cause for great concern as to the future of this species.

There have been prior efforts by a number of state and federal agencies and universities to sample scattered locations, using various methods, in the Mississippi River over the last 15-20 years. Although mussel populations have been of concern on the river, no concerted effort has been made to quantify existing mussel beds and to develop a consistent monitoring program.

The Illinois/Missouri Cooperative Mississippi River Mussel Program was created in 1997 to address the above issues and to develop a consistent and up-to-date mussel monitoring program on the Mississippi River bordering Illinois and Missouri. This program is/has been funded by both the Illinois Department of Natural Resources and the Missouri Department of Conservation. We are continually in search of funding for aide in this program's development.

This project, funded by the Wildlife Preservation Fund-FY00 Large Projects, concentrated on Mississippi River Pool 24. Sampling sites to be dove were chosen based on historical survey data, recent exploratory brailling and hand surveys, and suggestions from former commercial mussel harvesters. The data from these surveys will be used as a baseline for trend analyses in a five year monitoring program currently being developed for the Mississippi River Pools 20-26.

METHODS

Exploratory braillings and hand surveys were performed over a two year period by the Illinois Department of Natural Resources and the Missouri Department of Conservation to aide in choosing suitable sites for the dive surveys and to determine general bed dimensions. Five sites were chosen based on species number and diversity (Figure 1). The five sites were: Blackbird Island, right descending bank at river mile 291.5-292.0; Hickory Chute, left descending bank at river mile 284.7-285.5; Champ Clark Bridge Site, right descending bank at river mile 283.0-283.5; Crider Island Bend, right descending bank at river mile 278.5-279.3; Cash Island, left descending bank at river mile 277.2-277.8.

Quantitative sampling was used to determine species densities, diversity, and age distributions for each bed. This was accomplished by laying a predetermined number of equally spaced transects perpendicular to the river bank. The number of transects was determined by bed length. Ten 0.25m^2 substrate quadrat samples, 15cm in depth, were collected along each transect and sent to the surface in 20L plastic buckets. Each sample was sorted through a nested sieve with decreasing mesh size (12mm, 6mm). Mussels were identified, aged using an external annuli count, measured (length and width in mm), and returned to the river. A voucher of each species collected was taken and has been deposited into the Illinois State Museum.

Qualitative sampling was used to determine species diversity and presence of endangered or threatened species in each bed. Fifteen-minute time searches were conducted at predetermined points based on bed size and shape. All mussels were bagged and sent to the surface for processing. Live mussels were identified, aged, and measured, then returned to the river. Each point was designated by triangulation and recorded. Distances were measured (via laser range finder) at right angles from the point to a permanent structure on the nearest shore and to the nearest permanent structure up or down river.

At each bed only the first 25 individuals from each species were aged and measured. Other individuals were counted and recorded.

Dive services were provided by Mainstream Divers, Inc. for the project contractor, Ecological Specialists, Inc. (ESI). Samples were processed by Bernard Seitman of ESI, Travis Moore and George Smith of the Missouri Department of Conservation and Dean Corgiat, Tim Kelley, Joe Kath, and John Wilker of the Illinois Department of Natural Resources.

RESULTS AND DISCUSSION

The survey was conducted between October 11, 1999 to October 15, 1999. A total of 2,340 native mussels were observed. Four species (threeridge, washboard, threehorn wartyback, and mapleleaf) dominated the sample. These species comprised 81% of the total sample for all five sites.

A total of 24 species were collected from the five survey sites (Table 1). Twenty-seven species

Table. Species and number of unionids collected from Pool 24 sites of the Upper Mississippi River, October, 1999.

Species	Total Number of Animals	Number of Animals per Bed				
		Blackbird Island	Lower Hickory Chute	Champ Clark Bridge	Crider Bend	Cash Island
Black Sandshell	2	1	1	–	–	–
Butterfly	29	22	–	–	6	1
Deertoe	38	25	–	2	–	11
Fawnsfoot	18	15	1	–	–	2
Fragile Papershell	27	5	3	3	3	13
Giant Floater	16	5	–	1	1	9
Hickorynut	70	32	15	–	2	21
Mapleleaf	235	76	18	20	45	76
Monkeyface	2	2	–	–	–	–
Mucket	2	–	2	–	–	–
Paper Pondshell	2	–	–	1	–	1
Pimpleback	91	53	3	3	14	18
Pink Heelsplitter	1	–	–	–	–	1
Pink Papershell	20	4	5	3	–	8
Pocketbook	26	7	1	–	9	9
Rock Pocketbook	7	1	–	–	2	4
Spectaclecase	5	–	5	–	–	–
Threehorn Wartyback	409	132	17	19	18	223
Threeridge	670	235	44	21	114	256
Wabash Pigtoe	34	20	1	–	5	8
Wartyback	31	1	2	–	3	25
Washboard	575	12	85	97	328	53
White Heelsplitter	7	3	–	2	–	2
Yellow Sandshell	23	2	17	–	–	4
Total Number of Unionids	2340	653	220	172	550	745
Total Number of Species	24	20	16	11	13	20

have been recorded from this pool during past surveys (Table 2). Four species, ebonyshell, fat pocketbook, squawfoot, and pistolgrip, were not collected in our samples. One additional species that was collected that had not been previously documented in this pool was the spectaclecase.

Of the animals collected, six species are listed as either threatened, endangered, or watch listed in Illinois and/or Missouri (Table 3). The spectaclecase is probably the most significant find. It is listed as endangered in both states and is a former Category 2 species at the federal level.

Blackbird Island

This site differed from the other four sites in this survey in that it was sampled by divers in June of 1989. This allows for some interesting comparisons.

Total unionid density has plummeted from 14.83/m^2 in 1989 to 3.92/m^2 in 1999. Seven low-density species have disappeared from quantitative samples, while three new ones have appeared (Table 4). Of the remaining species, all but one (fragile papershell) have experienced declines of 55%-90%.

Species richness remains fairly high. Nineteen species were collected during quantitative sampling in 1989 (Qualitative samples were not taken.). Twenty species were collected during both quantitative and qualitative sampling in 1999 (Table 4).

Most species exhibited an even age distribution yet several (butterfly, deertoe, pimpleback, and pigtoe) showed a skewed population with older animals dominating (Table 5B).

Information on mean height, mean length, and height and length ranges can be found in Table 5A.

Lower Hickory Chute

On a tip from a former commercial sheller, we made an unplanned dive at this locale. We were informed of a 40-50 foot deep shelf that had held spectaclecase mussels at one time. Due to the depth, a limit on dive time was set. The diver was only able to spend one hour on the bottom. Because of this, only qualitative samples were collected.

A total of sixteen species were collected (Table 6). Five live spectaclecases were collected with three of the five found in dead washboard shell. All five spectaclecases were aged as either nine or ten years old (Table 7B).

Information on mean height, mean length, and height and length ranges can be found in Table 7A.

Table 2. Historical list of unionid species collected from Pool 24 of the Upper Mississippi River.

Scientific Name	Common Name
Actinonaias ligamentina	Mucket
Amblema plicata	Threeridge
Anodonta suborbiculata	Flat Floater
Arcidens confragosas	Rock Pocketbook
Ellipsaria lineolata	Butterfly
Fusconaia ebena	Ebonyshell
Fusconaia flava	Wabash Pigtoe
Lampsilis cardium	Pocketbook
Lampsilis teres	Yellow Sandshell
Lasmigona complanata	White Heelsplitter
Leptodea fragilis	Fragile Papershell
Ligumia recta	Black Sandshell
Megalonaias nervosa	Washboard
Obliquaria reflexa	Threehorn Wartyback
Obovaria olivaria	Hickorynut
Potamilus alatus	Pink Heelsplitter
Potamilus capax	Fat Pocketbook
Potamilus ohiensis	Pink Papershell
Pyganodon grandis	Giant Floater
Quadrula metanerva	Monkeyface
Quadrula pustulosa	Pimpleback
Quadrula nodulata	Wartyback
Quadrula quadrula	Mapleleaf
Strophitus undulatas	Squawfoot
Tritigonia verrucosa	Pistolgrip
Truncilla donaciformis	Fawnsfoot
Truncilla truncata	Deertoe
Utterbackia imbecillus	Paper Pondshell

TOTAL - 28 Species

Table 3. US Fish and Wildlife, Illinois, and Missouri species of concern collected from Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Bed Name	Federal Status	Illinois Status	Missouri Status
Black Sandshell	1	Lower Hickory Chute		T	S1 - S2
Black Sandshell	1	Blackbird Island		T	S1 - S2
Butterfly	22	Blackbird Island		T	
Butterfly	6	Crider Bend		T	
Butterfly	1	Cash Island		T	
Hickorynut	32	Blackbird Island			S2 - S3
Hickorynut	15	Lower Hickory Chute			S2 - S3
Hickorynut	2	Crider Bend			S2 - S3
Hickorynut	21	Cash Island			S2 - S3
Rock Pocketbook	4	Cash Island			S3
Rock Pocketbook	2	Crider Bend			S3
Rock Pocketbook	1	Blackbird Island			S3
Spectaclecase	5	Lower Hickory Chute	C2*	E	S3
Wartyback	1	Blackbird Island			S3
Wartyback	2	Lower Hickory Chute			S3
Wartyback	3	Crider Bend			S3
Wartyback	25	Cash Island			S3

US Fish and Wildlife Service Status Symbols: C2* - Former Category 2 Species (one step below Threatened)
Illinois State Status Symbols: T - Threatened, E - Endangered
Missouri State Status Symbols: S1 - Extremely rare and critically imperiled (Less than 5 occurrences in the state), S2 - Rare and imperiled (6 - 20 occurrences in the state), S3 - Rare and uncommon (21 - 100 occurrences in the state)

Table 1. Species collected by sample type and density of unionids from Blackbird Island, Pool 24 of the Upper Mississippi River, October 1999.

Species	Number of Animals	Percent of Sample	Qualitative	Quantitative	Number/M^2 1999	Number/M^2 1989
Black Sandshell	1	<1	–	1	0.04	–
Butterfly	22	3	19	3	0.08	1.04
Deertoe	25	4	7	18	0.52	1089
Fawnsfoot	15	2	1	14	0.40	1.05
Fragile Papershell	5	1	3	2	0.04	0.03
Giant Floater	5	1	5	–	–	0.21
Hickorynut	32	5	27	5	0.16	0.58
Mapleleaf	76	12	66	10	0.28	0.99
Monkeyface	2	<1	2	–	–	0.02
Pimpleback	53	8	46	7	0.20	1.24
Pink Papershell	4	1	3	1	0.04	–
Pocketbook	7	1	6	1	0.04	0.12
Rock Pocketbook	1	<1	1	–	–	0.05
Threehorn Wartyback	132	20	90	42	1.20	2.81
Threeridge	235	36	209	26	0.76	3.97
Wabash Pigtoe	20	3	17	3	0.08	0.44
Wartyback	1	<1	1	–	–	0.21
Washboard	12	2	10	2	0.04	0.32
White Heelsplitter	3	<1	3	–	–	–
Yellow Sandshell	2	<1	1	1	0.04	–
Ebonyshell	–	–	–	–	–	0.02
Paper Pondshell	–	–	–	–	–	0.03
Pink Heelsplitter	–	–	–	–	–	0.02
Total	653	100	517	126	3.92	14.83

Table 5A. Length and height ranges for selected species from Blackbird Island, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Length	Length Range	Mean Height	Height Range
Butterfly	**22**	**68**	**40 - 88**	**54**	**30 - 70**
Deertoe	**25**	**30**	**16 - 44**	**25**	**12 - 35**
Fawnsfoot	**15**	**15**	**6 - 23**	**10**	**3 - 14**
Hickorynut	**25**	**50**	**34 - 74**	**43**	**31 - 63**
Mapleleaf	**28**	**66**	**16 - 85**	**58**	**13 - 74**
Pimpleback	**28**	**54**	**15 - 74**	**52**	**14 - 68**
Threehorn Wartyback	**28**	**37**	**17 - 55**	**30**	**13 - 47**
Threeridge	**26**	**62**	**14 - 101**	**49**	**12 - 83**
Wabash Pigtoe	**20**	**62**	**22 - 78**	**58**	**21 - 76**
Washboard	**12**	**140**	**34 - 171**	**100**	**37 - 115**

Table 5B. Age information for selected species from Blackbird Island, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Age	Age Range	Comments
Butterfly	22	6.8	3 - 11	5 - 22%, 6 - 27%, 8 - 27%, 9 - 13%
Deertoe	25	3.7	2 - 5	3 - 32%, 4 - 28%, 5 - 28%
Fawnsfoot	15	2.3	1 - 4	even
Hickorynut	25	6.2	3 - 9	even
Mapleleaf	28	10.2	1 - 29	even to age 16
Pimpleback	28	8.6	2 - 16	54% are age 10 and older
Threehorn Wartyback	28	4.0	2 - 9	57% are age 3 and under
Threeridge	26	8.8	2 - 19	even
Wabash Pigtoe	20	10.7	5 - 18	50% are age 10 and older
Washboard	12	12.3	3 - 26	even

Table 6. Unionid species collected during qualitative samples at Lower Hickory Chute, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Percent of Sample
Black Sandshell	1	<1
Fawnsfoot	1	<1
Fragile Papershell	3	1
Hickorynut	15	7
Mapleleaf	18	8
Mucket	2	1
Pimpleback	3	1
Pink Papershell	5	2
Pocketbook	1	<1
Spectaclecase	5	2
Threehorn Wartyback	17	8
Threeridge	44	20
Wabash Pigtoe	1	<1
Wartyback	2	1
Washboard	85	39
Yellow Sandshell	17	8
Totals	220	100

Table 7A. Length and height ranges for selected species from Lower Hickory Chute, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Length	Length Range	Mean Height	Height Range
Hickorynut	**15**	**32**	**10 - 50**	**27**	**7 - 41**
Mapleleaf	**18**	**53**	**23 - 80**	**47**	**20 - 74**
Spectaclecase	**5**	**122**	**112 - 130**	**48**	**43 - 55**
Threehorn Wartyback	**17**	**39**	**15 - 54**	**32**	**11 - 50**
Threeridge	**25**	**69**	**29 - 115**	**55**	**26 - 82**
Washboard	**85**	**132**	**17 - 173**	**100**	**13 - 137**
Yellow Sandshell	**17**	**92**	**15 - 116**	**47**	**7 - 59**

Table 7B. Age information for selected species from Lower Hickory Chute, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Age	Age Range	Age Distribution Comments
Hickorynut	15	4.7	1 - 7	even
Mapleleaf	18	7.6	4 - 10	78% between 7 and 9
Spectaclecase	5	9.4	9 - 10	
Threehorn Wartyback	17	4.9	3 - 7	even
Threeridge	25	8.2	5 - 12	even
Washboard	85	10.6	2 - 15	9 - 21%, 10 - 22%, 11 - 14%, 12 - 15%
Yellow Sandshell	17	5.1	1 - 8	even between ages 4 and 6

Champ Clark Bridge - Louisiana, MO

The area around and upstream from this bridge historically held ebony shells. Part of this site had been surveyed qualitatively in 1990 by the Missouri Department of Conservation, but the data was never processed or summarized and was eventually lost.

The river bottom at this site is bedrock with interspersed mounds of gravel. Unionids were collected quantitatively from these piles and fissures in the bedrock.

No live ebony shells were collected during the survey. Five full and a single valve of relic ebony shells were identified. Dead shell far outnumbered live shell in the total sample. The assemblage of live unionids collected contained species that are common to this reach of the river (Table 8).

Length, height, and age measurements from the four most abundant species were similar to those at other sites (Tables 9A and 9B).

Crider Bend

This bed was sampled by both qualitative and quantitative means. The most notable statistic for this bed was the number of washboards collected. At a density of $1.72/m^2$, this bed has one of the highest densities recorded in the last 10 years. An explanation may be that the washboards from this bed had a reputation among commercial shellers as being of poor quality and having little market value.

The densities of other unionids were low to fair (Table 10). Length and height measurements were similar to other beds (Table 11A). Age distribution was even for most species except mapleleafs and washboards. These species exhibited older population characteristics (Table 11B). However, one-year old juveniles of both species were collected at this site. More juveniles may have been present but not found due to the staggering amount of dead zebra mussel shell in the substrate.

The quality of this bed may be held in question if observers look only at the number of species collected (Table 10). However, the high density of washboards would lead one to believe that this could be a "washboard bed" as has been suggested by other researchers.

Cash Island

Initial brailling and hand surveys of this bed led us to believe that it was large, diverse, and highly populated, but spread over a large area. The dive survey confirmed our beliefs. Through conventional quantitative sampling it was shown that mussels were sparse at the upper reach of the bed but increased in number further downstream.

An initial qualitative sampling effort at the upper reaches of the bed indicated that a diverse unionid community existed at this site (Table 12). A second set of qualitative samples was

Table 8. Unionid species collected during qualitative samples at the Champ Clark Bridge, Louisiana, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Percent of Sample
Deertoe	2	1
Fragile Papershell	3	2
Giant Floater	1	<1
Mapleleaf	20	12
Paper Pondshell	1	<1
Pimpleback	3	2
Pink Papershell	3	2
Threehorn Wartyback	19	11
Threeridge	21	12
Washboard	97	56
White Heelsplitter	2	1
Total	172	100

Table 9A. Length and height ranges for selected species from the Champ Clark Bridge, Louisiana, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Length	Length Range	Mean Height	Height Range
Mapleleaf	20	61	21 - 82	55	28 - 68
Threehorn Wartyback	19	41	27 - 50	32	21 - 43
Threeridge	21	69	28 - 115	55	24 - 84
Washboard	97	133	77 - 164	100	54 - 119

Table 9B. Age information for selected species from the Champ Clark Bridge, Louisiana, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Age	Age Range	Age Distribution Comments
Mapleleaf	20	8.7	3 - 13	even between ages 6 and 13
Threehorn Wartyback	19	4.6	3 - 6	even
Threeridge	21	8.2	3 - 13	even
Washboard	97	11.3	8 - 15	10 - 22%, 11 - 24%, 12 - 28%, 13 - 10%

Table 10. Species collected by sample type and density of unionids from Crider Bend, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Percent of Sample	Qualitative	Quantitative	Number/M^2
Butterfly	6	1	3	3	0.08
Fragile Papershell	3	<1	1	2	0.04
Giant Floater	1	<1	1	--	--
Hickorynut	2	<1	--	2	0.04
Mapleleaf	45	8	38	7	0.20
Pimpleback	14	3	9	5	0.16
Pocketbook	9	2	7	2	0.04
Rock Pocketbook	2	<1	2	--	--
Threehorn Wartyback	18	3	6	12	0.36
Threeridge	114	21	94	20	0.56
Wabash Pigtoe	5	1	4	1	0.04
Wartyback	3	<1	2	1	0.04
Washboard	328	60	268	60	1.72
Total	550	100	435	115	3.28

Table 11A. Length and height ranges for selected species from Crider Bend, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Length	Length Range	Mean Height	Height Range
Mapleleaf	**34**	**62**	**8 - 89**	**54**	**4 - 74**
Pimpleback	**14**	**58**	**30 - 80**	**54**	**27 - 70**
Threehorn Wartyback	**18**	**45**	**31 - 56**	**36**	**24 - 45**
Threeridge	**44**	**63**	**41 - 116**	**49**	**33 - 94**
Washboard	**328**	**129**	**13 - 173**	**91**	**8 - 120**

Table 11B. Length and height ranges for selected species from Crider Bend, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Age	Age Range	Age Distibution Comments (Age) - (% Composition)
Mapleleaf	34	8.5	1 - 12	8 - 14%, 9 - 23%, 10 - 11%, 11 - 117%
Pimpleback	14	9.0	7 - 12	even
Threehorn Wartyback	18	6.0	4 - 8	even
Threeridge	44	6.9	5 - 15	even
Washboard	328	10.7	1 - 15	9 - 14%, 10 - 23%, 11 - 22%, 12 - 20%, 13 - 10%

Table 12. Species collected by sample type and density of unionids from Cash Island, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Percent of Sample	Qualitative	Quantitative	Number/M^2
Butterfly	1	<1	1	--	--
Deertoe	11	1	10	1	0.04
Fawnsfoot	2	<1	2	--	--
Fragile Papershell	13	2	13	--	--
Giant Floater	9	1	8	1	0.04
Hickorynut	21	3	21	--	--
Mapleleaf	76	10	69	7	0.20
Paper Pondshell	1	<1	--	1	0.04
Pimpleback	18	2	18	--	--
Pink Heelsplitter	1	<1	--	1	0.04
Pink Papershell	8	1	7	1	0.04
Pocketbook	9	1	8	1	0.04
Rock Pocketbook	4	1	4	--	--
Threehorn Wartyback	223	30	220	3	0.08
Threeridge	256	34	248	8	0.24
Wabash Pigtoe	8	1	8	--	--
Wartyback	25	3	25	--	--
Washboard	53	7	53	--	--
White Heelsplitter	2	<1	1	1	0.04
Yellow Sandshell	4	1	4	--	--
Total	745	100	720	25	0.8

collected on the last day of the survey. This set of 3, 15 minute dives was conducted approximately 200 meters downstream of the initial survey area. This sample set produced 45% of the total sample, 52% of the threeridges, and 95% of the washboards collected.

Quantitative sampling also confirmed that this was a low-density mussel bed. Total unionid density in the upper portion of the bed was less than 1 /m^2.

Length, height, and age distribution was similar to those at other beds (Tables 13A and 13B).

CONCLUSIONS AND RECOMMENDATIONS

The results of this survey were both exciting and discouraging. On the positive side, we were able to document the presence of a spectaclecase population in the lower portion of the Upper Mississippi River. Since dive time was limited due to depth, a more extensive survey of the bed and especially the parallel rip rap would provide better information on this population.

At this point, the zebra mussel population seems to be on the decline. This is good news for our native mussel populations. However, zebra mussel populations are known to fluctuate wildly. We may only be experiencing a low point in the population cycle.

The discovery of large populations of reproductive-aged and juvenile washboards at two sites is encouraging. It appears that the closure of the pool to commercial harvest in the mid-1990's is working to protect the larger animals. Twenty percent of the washboards would have been legal to harvest during our survey. Many more would have been legal within the next two years. As we continue to monitor these beds, we hope to document significant washboard recruitment.

It was interesting to see the difference in numbers between washboards and threeridges at each bed. In all cases, one species would out number the other by at least a 2:1 margin. Since threeridges are shorter-lived and achieve successful spawns more frequently, it would be expected that they would be more prevalent than washboards where both species occur in the same bed. However, since washboards outnumbered threeridges at two of the sites, it can safely be assumed that there are differences between them. This raises some interesting and unanswered questions: Are there differences in flow, microhabitat, fish absence/presence or some other physical factor? Could it be that threeridges are more of a generalist specie that can easily colonize a host of different sites with varying habitats? Or are threeridges able to out-compete other mussel species for prime locations within a given site? If we consider that threeridges also outnumbered all other mussel species at all sites, the concept of competition between species appears to be a possibility.

An alarming statistic is the 70% decline in mussel density at Blackbird Island. Habitat destruction is the likely culprit. Much of the area around and downstream of the chute's closing structure was covered by a thick layer of silt. Notching the structure to allow flow and natural flushing could potentially improve the site and should be pursued and monitored. This situation is a good example as to why we need a sound monitoring regime for high quality mussel beds throughout the Mississippi River. If this bed had not been looked at ten years ago, we would

Table 13A. Length and height ranges for selected species from Cash Island, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Length	Length Range	Mean Height	Height Range
Deertoe	11	38	31 - 51	29	26 - 38
Fragile Papershell	13	95	58 - 143	64	37 - 90
Hickorynut	21	49	30 - 71	42	26 - 57
Mapleleaf	25	55	32 - 87	49	27 - 76
Pimpleback	18	43	30 - 59	41	28 - 55
Threehorn Wartyback	26	43	31 - 64	36	24 - 52
Threeridge	39	71	29 - 124	57	28 - 93
Wartyback	25	49	30 - 65	46	29 - 59
Washboard	53	146	85 - 175	104	63 - 123

Table 13B. Age information for selected species from Cash Island, Pool 24 of the Upper Mississippi River, October, 1999.

Species	Number of Animals	Mean Age	Age Range	Age Distribution Comments
Deertoe	11	4.9	3 - 7	5 - 54%
Fragile Papershell	13	5.4	3 - 10	76% between ages 4 - 6
Hickorynut	21	6.7	5 - 9	even
Mapleleaf	25	6.9	3 - 14	56% are ages 6 or 7
Pimpleback	18	7.2	4 - 11	6 - 44%
Threehorn Wartyback	26	5.3	3 - 9	5 - 46%, 6 - 23%
Threeridge	39	8.2	2 - 14	even
Wartyback	25	7.4	4 - 10	even
Washboard	53	11.3	7 - 16	even

have had no idea that the population had declined so drastically. We may have even considered this bed as "good quality," never knowing that at one time it was a highly diverse and healthy bed. By knowing "historic" habitat conditions of the bed, we can also look at restoring the habitat. Are these closing structures on chutes beneficial to mussels that exist in these areas? By having data that can provide us with information on population trends and river conditions at several quality mussel beds on each river pool, it is an eventual possibility that we could develop effective management plans for any bed, anywhere on the river, just by looking at the situation surrounding the bed and relating it to the data we have accrued from our "chosen" beds.

One of the objectives of this project was to locate potential parent stock and release sites for propagation studies. By locating good washboard populations, a population of spectaclecase mussels, and decent numbers of other endangered and threatened species, it appears that we have a good start on meeting this objective. However, we say "good start" because there are many more species that continue to exist in very low densities. These species may be imperiled if we do not locate additional sources and release sites. We should continue this effort to ensure the existence of these species in the Upper Mississippi River.

Through this work and the few other surveys that have been conducted on the Illinois/Missouri boundary waters of the Upper Mississippi River, we are one step closer to completing initial baseline data gathering on the **known** high quality beds. This work must continue so that we can maintain up-to-date information on species status. This continued monitoring will also allow us to better manage and preserve these species.

A final concern that we feel needs to be addressed is the division of the Mississippi River by political boundaries. With many states looking at changing practices from traditional management to ecosystem management, it makes no sense to split an ecosystem such as the Mississippi River into a left bank/right bank entity that is managed under two (more if you count the Army Corps, Fish and Wildlife Service, etc.) different sets of objectives. We feel we could be more effective at managing and preserving high quality mussel beds if we were allowed to disregard state lines. Such designations as **Natural Areas** and **Land and Water Reserves** (that are "state specific") could aid in the protection of these sites and should be afforded to all qualified beds on all parts of the river, not just those that lie on the "left side" of the channel. Cooperative work between states is a step in the right direction, but we should be looking more at strengthening and building upon such management "teams" as the Upper Mississippi River Conservation Committee (UMRCC).

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