A Mussel Survey of the Sunrise River

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INTRODUCTION

A mussel study of the Sunrise River was initiated in response to reports by field investigators with the MN Pollution Control Agency (PCA) of extremely high mussel densities near one of their sampling sites on the Sunrise River. They described the site, below the Kost Dam in Kost MN, as having substrate entirely composed of mussels. Because of this, and in response to our confirmation of PCA's findings, we proposed to the MN Natural Heritage Program that the River be surveyed in its entirety. They concurred, and this study was conducted during September and October, 1996.

The Sunrise River is a major tributary of the St. Croix River. In 1968 the St. Croix National Scenic River Way was established under the National Wild and Scenic River Act. This has provided the St. Croix River with a certain amount of protection and has preserved most of it in its free-flowing condition. Because of this and the geologic setting and soil types, many of the negative impacts associated with urbanization, agricultural development and other human activities which so often degrade large riverine systems have been avoided or reduced. As a result, the St. Croix River is a high quality, species rich ecosystem.

Among the St. Croix River's faunal assemblages are Unionid freshwater mussels, a group considered by many scientists to be the most endangered of Earth's aquatic organisms. Mussel surveys of the St. Croix have identified 40 species (Hornbach, 1996), which, based on historical surveys of the Mississippi and Minnesota Rivers, may represent the number of species present at the time of European settlement. Two of these (*Lampsilis higginsi* and *Quadrula fragosa*) are listed today as Federally Endangered species. Minnesota has listed twenty five species of mussels as being Endangered (E), Threatened (T) with endangerment, or of Special Concern (SC) within the state and all but one of these species have been found in the St. Croix. Tributaries of the St. Croix are thought to have good mussel habitat capable of supporting excellent mussel populations with high species richness. However, only the St. Croix's largest tributary, the Namekagon, has been completely surveyed for mussels.

Geology & General Description of the Area

A catchment area of approximately 100 square miles drains into the Sunrise River (Waters, 1977). This area is made up of materials from glacial end moraines, stratified drift, and outwash sediments (St. Croix Task Force, 1969). The headwaters of the Sunrise River arise in or near and flow through the 23,291 acre Carlos Avery Wildlife Management Area (Waters, 1977) and through two lakes whose outlets have been dammed. Along its path the Sunrise passes through mostly agricultural lands, but also swamp forests and old lake meadows, in some places it is diverted around and erodes

into higher elevation end moraines. It eventually makes its way to the St. Croix River near St. Croix RM 77. The St. Croix River Valley, which was carved by the torrential outflow from Glacial Lake Duluth (Waters,1977), provides a low lying gorge for receiving the Sunrise River catchment runoff.

The Sunrise has three branches, the North Branch which flows into the main branch approximately two miles from the mouth, and the South and West Branches, which drain into Mud Lake (map 1). The main branch of the Sunrise is approximately 25 miles long with a width ranging from 5 to 25 meters.

The River substrate varies from large boulders and pockets of sand near the mouth to sand and organic detritus in its upper reaches. Below the dam at Kost the river substrate is composed of mussels and old shells underlain by gravel and small rubble. With this exception the river bed material is typical of a stream traversing glacial till and outwash deposits overlain by fine soils.

Methods

Sites were selected based on access logistics and proximity to important river features such as dams and tributaries. Qualitative sampling was done at every site visited whereas the more labor intensive quantitative methods were employed at only a few selected sites. Combining these two types of sampling is a cost effective way to improve our overall understanding of mussel species distribution and abundance. Qualitative searches help to establish species presence at many sites by allowing time efficient investigations over a large area of the stream. Quantitative searches, or sampling, are the best way to estimate mussel population size, species demographics and community characteristics.

Shell(s) of each species found at each site were vouchered with the James Ford Bell Museum of Natural History, University of Minnesota. Locations of sampling sites and listed species will be maintained in the Minnesota Department of Natural Resource's Natural Heritage Information System.

QUALITATIVE METHODS

To determine the presence or absence of mussel species at each site, we waded in an upstream direction looking for mussels, mussel siphons and old shells. Periodically we felt beneath the river bed for the familiar shape and texture of mussels. Our searching typically took us upstream two to five hundred meters, during which time we placed representative specimens of each species into a mesh bag. Both living mussels and empty shells were accumulated for later examination and recording. Shallow depths allowed wading at all but one site where SCUBA equipment allowed us to examine the ten to fifteen foot depths of the old plunge pool below the abandoned NSP hydropower dam at Sunrise, MN.

When we were satisfied that we had searched most of the micro and macro habitat types represented at a site, we returned to our starting point, sorted and recorded our specimens by species and wrote qualitative notes about the abundance of each species and the site's riverine characteristics such as bed material composition, depths and current velocities.

QUANTITATIVE METHODS

To quantify a site's mussel community and population characteristics, one quarter meter square samples were taken using a circular frame that was randomly placed on the river bottom. All material (including mussels) to a depth of fifteen centimeters was removed and placed in a 6.35 mm (one quarter square inch) mesh screen and sieved to remove silt, sand and small gravel. Mussels from each sample collected at each site were placed in a mesh bag and stored in the stream until sampling was completed.

The following were recorded for each mussel collected: identifying frame number, species, length (greatest distance from anterior to posterior and approximately parallel to hinge line), height (greatest distance dorsal to ventral and perpendicular to length) and width (greatest distance perpendicular to both length and height) measured with calipers to the nearest millimeter; age (from annual growth arrest line counts). Other data recorded included a qualitative description of substrate type and current velocity, and stream depth.

Sampling effort (number of frames) for each site was determined subjectively according to stream size and estimated variability in mussel density. Density was calculated for each frame sampled by multiplying the number of mussels within it by four to give density of mussels per meter square, and then averaging the density figures from all frames collected at a site. Size distribution by 5mm increments was plotted as histograms for abundant species.

Results and Discussion

General

Altogether, fifteen sites were sampled, five of them quantitatively (map 1). Twenty one species of mussels were collected from the Sunrise River during this survey (table 1), twenty of them living. An empty shell of one species, *Cyclonaias tuburculata* (T), was found at the village of Sunrise below the old hydropower dam. Of the twenty living mussels species, eight are listed in Minnesota; *Actinonaias ligamentina* (T), *Alasmidonta marginata* (T), *Ellipsaria lineolata* (T), and *Pleurobema coccineum* (T), *Elliptio dilatata* (SC), *Lasmigona compressa* (SC), *Lasmigona costata* (SC), and *Ligumia recta* (SC).

Species richness was greatest from the village of Sunrise upstream to the Kost Dam. From the Kost

Dam to hwy 14, five fewer species were found in the mussel community. From the Hwy 14 crossing to the North Pool Dam, four other species disappeared. Of the remaining six mussel species, *Amblema plicata* was most abundant followed by *Lampsilis siliquoidea*, *Fusconaia flava* and *Anodonta grandis*. *Lasmigona compressa* (SC), and *Strophitus undulatus* were present, but less common.

Average mussel density at these sites ranged from eight per meter square at the North Pool Dam (fig. 5) to 188.8 per meter square at Kost Dam site 1 (fig. 4).

Sample Sites

Horse trail Bridge site

Near the confluence of the Sunrise and St. Croix Rivers five live species were collected, as were empty shells of seven others (Table 2). *Actinonaias ligamentina* (T) and *Alasmidonta marginata* (T), and *Ligumia recta* (SC) were among those collected. Mussel density was low at this site. Large boulders and rapids were the most common habitat. Maximum depth was 1.5 meters, average depth ranged from 0.3 - 0.6 meters. These conditions make searching for mussels difficult and do not offer high quality habitat for mussels.

SUNRISE VILLAGE SITE

A partially dismantled NSP hydropower dam is located within the town of Sunrise. Just below the old dam is a 5 meter deep pool that was thoroughly searched for mussels using SCUBA, however, none were found. Immediately below and above the pool, a reach of the river was qualitatively searched and produced fifteen live species of mussels and five species represented by empty shells (table 3). This is the only site where any evidence of *Cyclonaias tuberculata* (T) was found. Other state listed species found at this site were *Actinonaias ligamentina* (T), *Alasmidonta marginata* (T), *Ellipsaria lineolata* (T), and empty shells of *Pleurobema coccinium* (T), *Lasmigona compressa* (SC), *Lasmigona costata* (SC), *Elliptio dilatata* (SC) and *Ligumia recta* (SC). The most common species found at this site were *Actinonaias ligamentina* (T), *Lasmigona costata* (SC), *Lampsilis ventricosa (cardium), and Lampsilis siliquoidea (luteola).*

Mussel numbers were somewhat higher at this site than at the horse trail bridge. Except in the pool area, depths ranged from 0.1 to 0.6 meters and the river bed was composed of gravel and sand with occasional boulders and woody tree debris.

STATE HIGHWAY 95 BRIDGE SITE

State highway 95 crosses the Sunrise River approximately two miles upstream of Sunrise Village. Qualitative samples were collected from an area between the bridge and upstream of the bridge approximately 150-200 meters to the head of a riffle area. The river here is up to 0.6 meters deep

and its bed is mostly sand and gravel strewn with small boulders and occasional wind-fallen trees. Along the edges there is soft silty substrate that also supports mussels. Rocky and shallow riffle areas were well-defined and about 0.3 meters deep or less. Pool areas were less well defined with a steady current and only small side eddies present.

Fifteen species were collected live at this site and two were represented by dead shell only (table 4). Most abundant at this site was the state listed *Actinonaias ligamentina* (T). Other listed species present were *Alasmidonta marginata* (T), *Ellipsaria lineolata* (T), *Pleurobema coccinium* (T), *Lasmigona costata* (SC), *Elliptio dilatata* (SC) and *Ligumia recta* (SC). Species represented by only empty shells were *Potamilus alatus and Quadrula pustulosa*. Most common at this site were *Actinonaias ligamentina* (T), *Lasmigona costata* (SC), *Lampsilis ventricosa (cardium), and Lampsilis siliquoidea (luteola).*

Eight quantitative samples were collected at the Highway 95 bridge. Mussel density averaged 43.5 per meter square (fig 1). *Actinonaias ligamentina*(T) was the most abundant species collected by this method. Length and age frequency distribution indicates a population of mostly reproductive age individuals of this species, and no recent recruitment was evident.

KOST DAM SITE

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Just upstream of Kost, MN is an old power dam and public park. The Sunrise River at this site is divided into two channels between the dam and the county road bridge. These channels are very shallow, from just a few centimeters to a maximum of about 0.6 meters. Both channels have rubble and gravel substrate littered with old shells. Mussels were most abundant in the deeper, left descending channel. Downstream of the bridge the single river channel is wider, deeper and slow moving. Here the river bottom was mostly composed of mussels and old shells. Areas less than 0.3 meters deep were sand, silt and fine gravel, but still dotted with mussels. Depths ranged up to 1.3 meters, but were typically around 0.6 meters deep in the middle three-fourths of the channel.

We searched the area from the dam to about 250 meters below the bridge. Seventeen mussel species were found alive in this stretch of the river (table 5). Most abundant were state listed *Actinonaias ligamentina* (T) followed in abundance by *Lasmigona costata* (SC). Other listed species found at this site were *Alasmidonta marginata* (T) and *Pleurobema coccinium* (T), *Elliptio dilatata* (SC) and *Ligumia recta* (SC).

Five quantitative samples were collected from two subsites at Kost. Kost 1 subsite was located in the left descending channel between the bridge and the dam, immediately upstream of the old turbine tunnel. Mussel density from five samples averaged 88.8/m^2 (fig 2). Species densities were clearly dominated by *Actinonaias ligamentina* (T). At subsite 2, densities averaged 188.8/m^2, highest density of mussels found during this survey (fig. 3). Again, *Actinonaias ligamentina* (T) was clearly the most abundant species present, representing nearly one half of the mussels present. This is significant in that this species represents less than 10% of the mussel fauna of the nearby St. Croix River (Hornbach, 1996). Densities of several other species were high at this site also. Density of *Lasmigona costata* (SC) was nearly 30/M^2 at this site.

Population size and age demography for *Actinonaias ligamentina* (T) are shown in fig. 3 and length frequency data for *Lasmigona costata* (SC) and *Leptodea fragilis* at Kost subsite 2 are depicted in fig. 4. These graphs indicate ongoing recruitment of all three species at Kost. Fourteen juveniles with byssal threads attached were collected during quantitative sampling indicating recruitment within the past year. *Actinonaias ligamentina* (T) populations were distributed into two size and age categories, generally 1-3 year old and 8-12 year old individuals. *Lasmigona costata* (SC) sizes were more evenly distributed, but larger size classes were most abundant. *Leptodea fragilis* size classes were more abundant in the middle of the range, but smaller (indicating younger) and larger (indicating older) sizes were also represented.

HIGHWAY 14 BRIDGE

Physical conditions at the Hwy 14 site were quite different than at the Kost dam. Depths ranged from 1.3 to 0.3 meters. Substrates were generally fine, especially downstream of the bridge. Silts and sands predominated, with occasional small boulders. Banks were steep and muddy and the surrounding landscape was mostly wooded hillsides. Some aquatic plants were present. As we searched upstream, substrates became more coarse, the water shallower and mussels more abundant. Many empty shells littered the banks and bottom of the river, especially above the bridge.

We conducted a qualitative search in an area from 200 meters below the bridge to about 700 meters above it. Twelve species were collected at this site, ten of them alive (table 6). *Amblema plicata* and *Lampsilis siliquoidea* were notably abundant. A single *Actinonaias ligamentina* (T) was collected at this site below the bridge. Many empty shells of *Pleurobema coccinium* (T) and *Elliptio dilatata* (SC) were found indicating a former abundance that we could not detect at the time of the survey. Two species were collected as dead shell only, *Ligumia recta* (SC) and *Lampsilis ventricosa*.

It is significant that the mussel fauna of the Sunrise is not dominated by *Actinonaias ligamentina* (T) above the Kost Dam, but rather by more common species. *Amblema plicata* is the most common and abundant mussel species in the Sunrise River above Kost Dam, just as it is in the Mississippi River. But it was not always so on the Mississippi. Surveys conducted in the early part of this century listed other species as more common. Of particular interest is the now state Endangered *Fusconaia ebena* which, before dams were built on the Mississippi River disrupting the movement of its host fish, was in many places the most abundant species (Coker, 1919). It seems reasonable to conclude that the dam at Kost has similarly disrupted the mussel fauna of the Sunrise River, isolating populations above and below the dam.

NORTH POOL DAM

A stretch of river below the dam was searched qualitatively. The river here flows through low lying land suggestive of an old lake bed, the wooded hillsides present downstream were visible in the distance. Substrates ranged from soft mud to sand and woody debris, the large boulders present at

other sites were notably absent. Aquatic plants were common and sometimes abundant here, especially coontail. The river was generally shallow, often less than 0.3 meters deep, seldom more than 1.0 meters deep.

Six species of mussels were found including a single specimen of *Lasmigona compressa* (SC), the creek Heelsplitter (table 6). This is half the number of species found just a few miles downstream. Although mussels were not very abundant at this site quantitative samples were collected (fig.5). *Amblema plicata* was the most abundant species here followed by *Anodonta grandis,* and *Lampsilis siliquoidea. Amblema plicata* length and age frequency analysis shows rather even distribution of size and age classes.

We assumed that the very different habitat conditions present at this site accounted for the reduction of species present. There are no dams on the river between this site and the Hwy 14 bridge. We further speculated that perhaps habitat quality was affected by the low gradient, fine sediments associated with the underlying old lake bed and perhaps operations of the dam which could result in sudden changes in discharge or even desiccation of portions of the river bed when flows are interrupted during pool filling.

CANOE FLOAT (Map 2)

In order to better determine the fate of the four state listed species missing from the fauna at the North Pool Dam [*Actinonaias ligamentina* (T), *Pleurobema coccineum,* (T) *Elliptio dilatata* (SC), and *Lasmigona costata* (SC)], we canoed the stretch of river between the dam and the Hwy 14 bridge.

Shifting sandy substrates were common and *Lampsilis siliquoidea* was the most abundant species of mussel for the first mile or so of stream. After crossing beneath a power line, the river turned North and entered a much different physical environment. Boulders and gravel appeared in the river as it entered a hilly region with wooded riparian corridor. Suddenly, *Actinonaias ligamentina* (T), *Pleurobema coccineum* and *Lasmigona costata* (SC) shells were strewn across the river bed as were shells of *Lampsilis cardium*, all species found either dead or alive near the Hwy 14 bridge. Further downstream live individuals of *Actinonaias ligamentina* (T), *Pleurobema coccineum,* (T) *Elliptio dilatata* (SC), *Lasmigona costata* (SC) and *Elliptio dilatata* (SC) and dead shells of *Ligumia recta* (SC) were found.

Changes in physical habitat seem to explain the distribution of species through this reach of the Sunrise River. Substrate type and stability of stream channel apparently determine the presence of mussel species between the Hwy 14 bridge and the North Pool Dam.

NORTH POOL INLET

This site is characterized by marshy areas, fine organic sediment with some sand in the swifter portion of the channel. Aquatic vegetation was common and included elodea, river pond weed and sago pondweed. Qualitative searching revealed very few mussels here, probably due to poor habitat conditions. Only two live species were found, *Amblema plicata* and *Anodonta grandis*, both are species that tolerate a wide range of habitat conditions. Empty shells of *Fusconaia flava* and *Lampsilis siliquoidea* were also found (table 7.).

MUD LAKE DAM

Several hundred meters of river were searched below the dam that impounds Mud Lake. Shallow water, aquatic plants and substrate of sand and small gravel were characteristic of this site. Mussels were numerous and both qualitative and quantitative sampling was done.

Six species of live mussels were collected by both methods of sampling (table 7). Quantitative samples showed *Amblema plicata* to be by far the most abundant species followed by *Strophitus undulatus*, *Lampsilis siliquoidea*, *Anodonta grandis, Lasmigona compressa* (SC) and *Fusconaia flava*. Most unique at this site is the abundance of *Strophitus undulatus,* a species typically present in low numbers within a Minnesota mussel community according to our experience (fig.6). Overall density of mussels at this site was $44/M^2$, a good indicator of stable, good quality mussel habitat. Length and age frequency analysis of *Amblema plicata* showed that the population is represented by several age classes although no recruitment appears to have taken place for 2-3 years.

Of the 55 mussels sampled quantitatively, 13 had recently died as evidenced by the presence of fleshy parts. No definitive reason for this unusual number of dead mussels was observed, however, the extremely shallow water in which they were found suggests the possibility that they may have been recently exposed to the atmosphere and suffocated. Although mussels can respond to gradually falling water levels by moving towards deeper water, this event could have been the result of a sudden change in water level associated with dam operation (we did not attempt to corroborate this).

Accumulations of empty mussel shells at this site were frequently observed to be inhabited by tadpole madtoms, a small species of fish belonging to the family Ictaluridae.

WEST BRANCH, SUNRISE RIVER

Lakes and marshes make up the landscape of the site we sampled on the West Branch of the Sunrise River. The river is small here, three to seven meters wide but often 0.6 - 1.0 feet deep and forms a connection between lakes. Substrate is mostly silt with some sandy silt.

Mussels were fairly common, five species were collected during qualitative searching (table 8). *Amblema plicata* was most abundant and the remaining species were the same as found at Mud Lake

Dam except that *Lasmigona complanata* (SC) was absent.

NORTH BRANCH, SUNRISE RIVER

Three sites were sampled on the North Branch, which is considerably larger than the West Branch. Substrates at all three sites were suitable for mussels.

No live mussels or empty shells were found at any of the sites. After sampling two sites downstream of the town of North Branch, we thought that some source of pollution might explain the strange absence of mussels here. We subsequently sampled a site upstream of North branch but found no evidence of mussels which we feel indicates a problem other than a source of pollution emanating from the town. The absence of mussels in the North Branch remains a mystery to us.

CONCLUSIONS

1. Significant native mussel species assemblages and populations exist in the Sunrise River.

2. Several species of listed mussels are alive and reproducing in the Sunrise River and could potentially be a stock source for reintroduction to other rivers and streams.

3. Mussel density for the first kilometer or two downstream of the Kost Dam are extremely high and represent the highest density of the state Threatened species *Actinonaias ligamentina* presently known in Minnesota.

3. Mussel species distribution, community composition and population density in the Sunrise River differs significantly above and below the Kost Dam.

4. With the threat of zebra mussels in the nearby St. Croix River, the Sunrise River may become an important refuge for native mussels, very few boats use the Sunrise and it is therefore less likely to have zebra mussels introduced to it.

5. Land holdings and land use patterns within the Carlos Avery WMA no doubt has a positive influence on water quality and hydrodynamics in the Sunrise River. More intensive agricultural and urban land use and associated degradation of water quality on the North Branch of the Sunrise could explain the absence of mussels there.

RECOMMENDATIONS

1. A comprehensive watershed protection plan should be developed in collaboration with the counties of Anoka, Isanti and Chisago for the Sunrise River. This would serve to protect existing native mussel resources.

2. Enforcement of mussel harvest regulations should be a priority for conservation officers whose area encompasses the Sunrise River.

3. Additional mussel surveys should be conducted between Kost Dam and the Hwy 95 crossing to determine the extent of the high density mussel bed and population of *Actinonaias ligamentina* (T).

4. A float between the Hwy 14 site and the Kost Dam should be done to determine where and why fewer species were found above the dam.

5. Mussel surveys of other St. Croix River tributaries, most notably the Kettle and Snake Rivers, should be a high priority for the Department due their potential for supporting important populations of listed mussels.

Literature Cited

Coker, Robert E., 1919. Fresh-Water Mussels and Mussel Industries of the United States. Bulletin of the Bureau of Fisheries, vol. XXXVI, pp13-89.

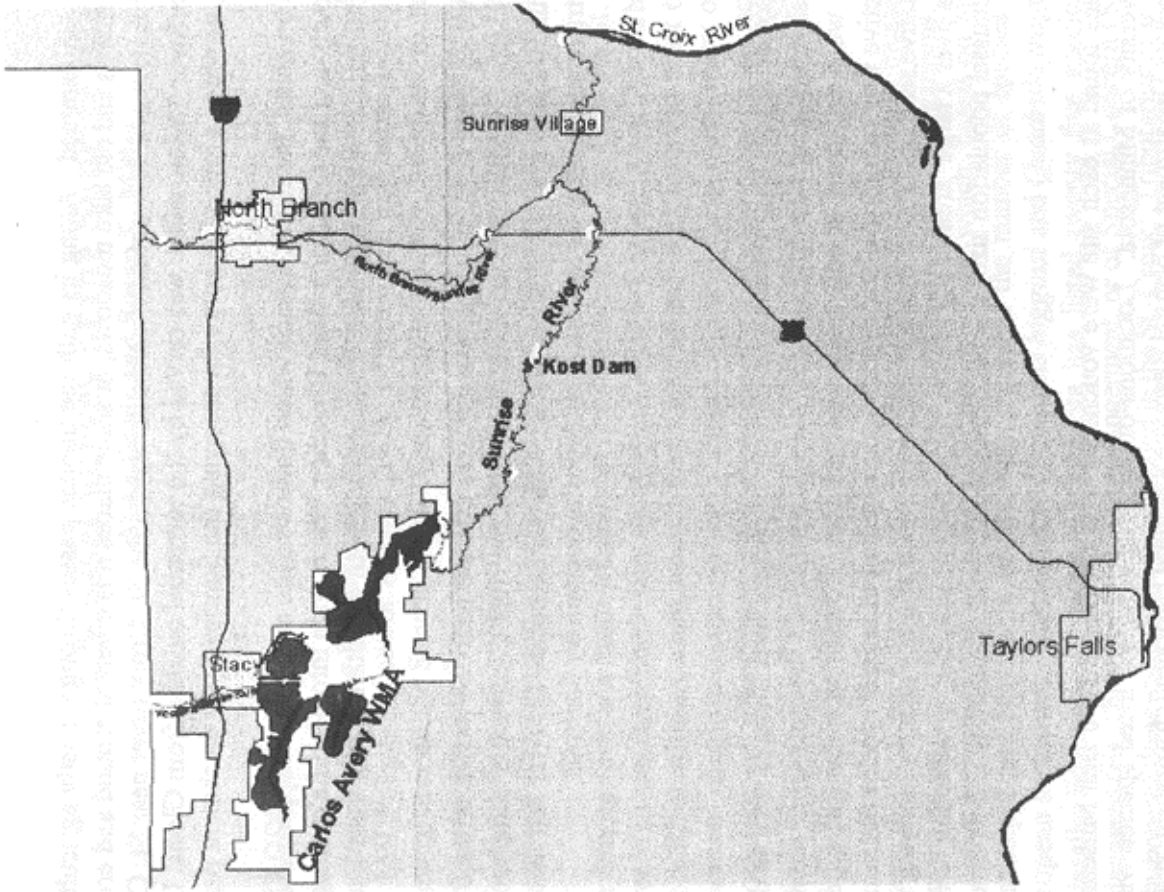
Hornbach, Daniel J., 1996. Bivalves in the St. Croix River a Report for the Watershed Management Project, National Park Service.

St. Croix Task Force, 1969. Wild Waters of the St. Croix - addendum pg. 76

Waters, Thomas F., 1977. The Streams and Rivers of Minnesota. University of Minnesota Press, Minneapolis, MN.

Map 1: Sunrise River Mussel Survey, 1996

Sample Site Locations:



Map 2: Canoe Float

Route taken during canoe float to search for missing mussel species.

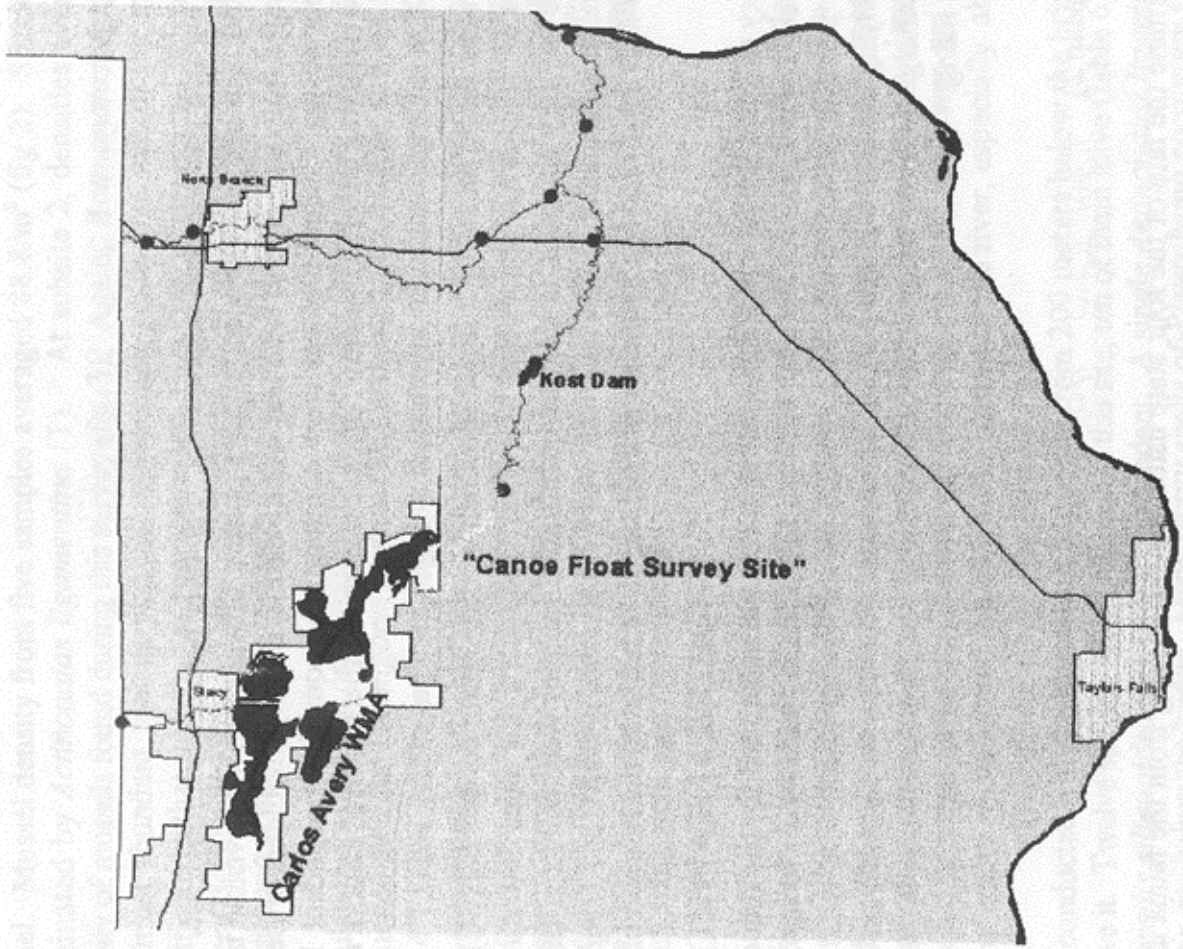


Figure 1: Quantitative Sampling Hyw 95 Bridge Site, Sunrise River 1996. Species densities and relative abundance are presented along with overall mussel density for this site. Length and age frequency distribution are shown for *Actinonaias ligamentina (T)*, the most abundant species at this site.

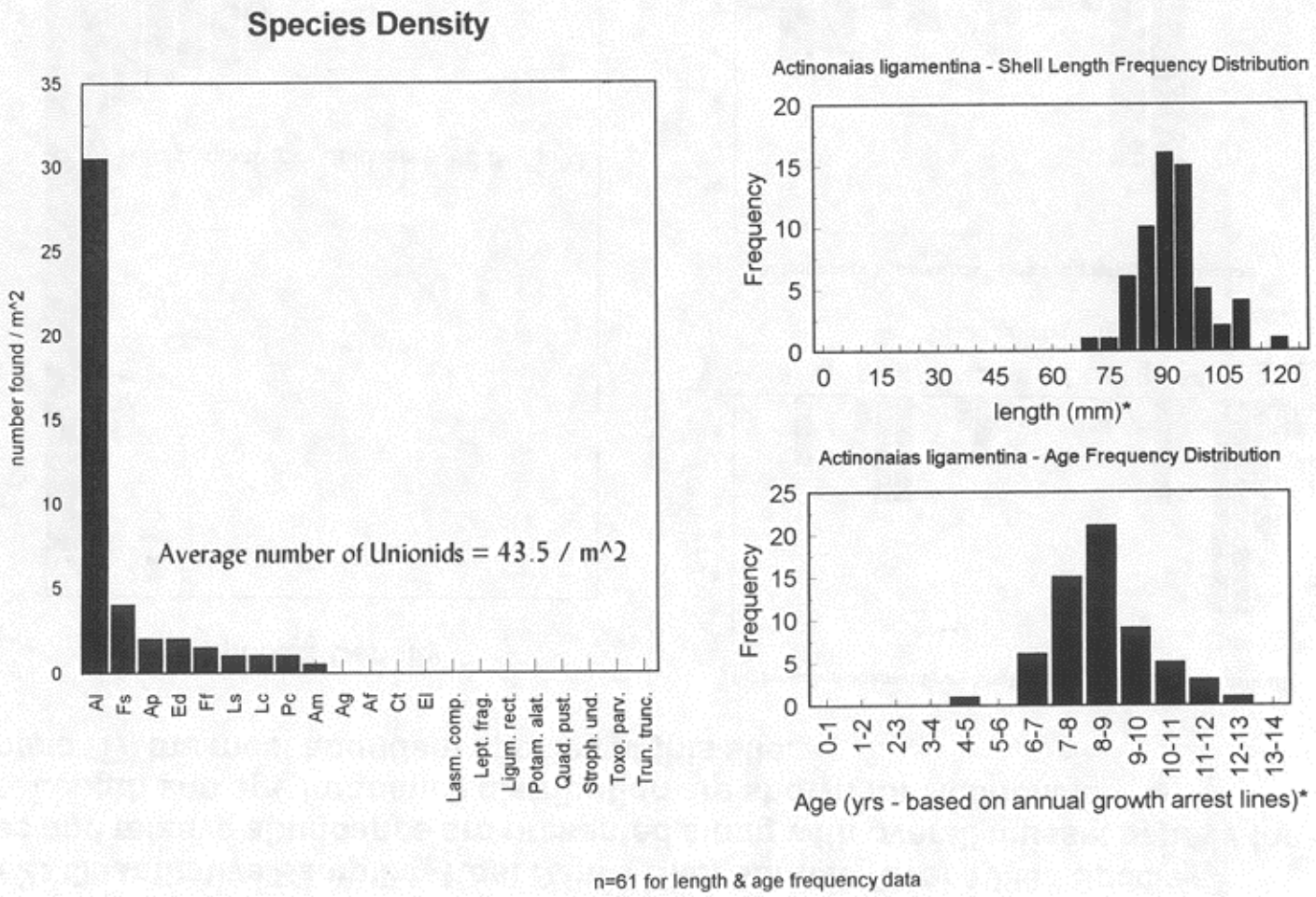
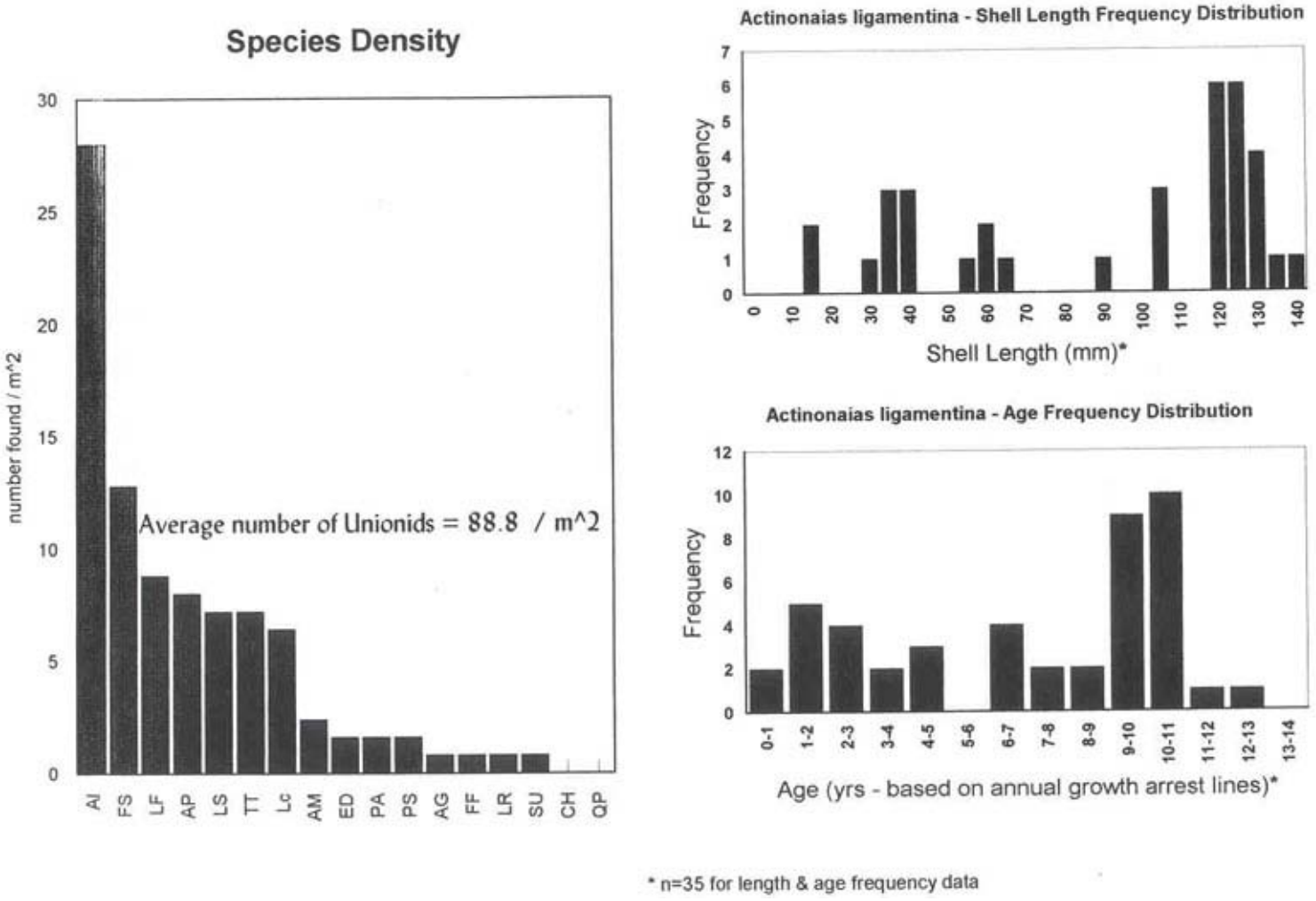
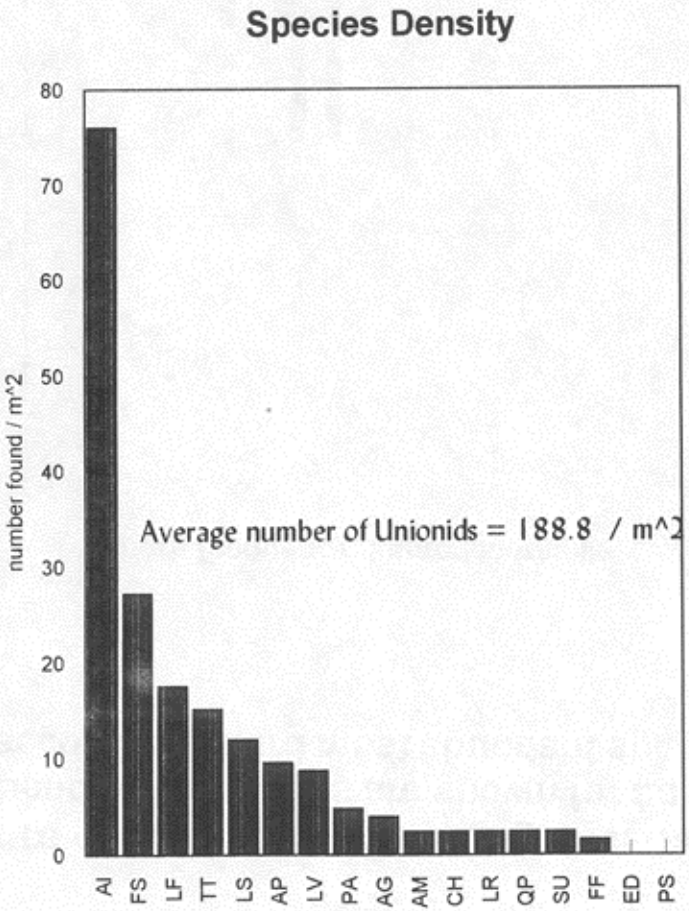


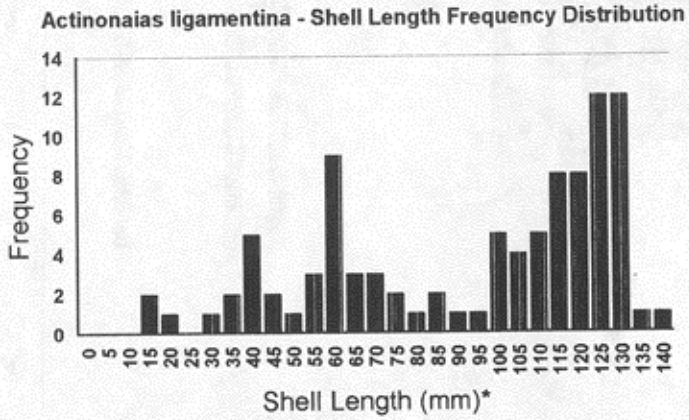
Figure 2: Quantitative Sampling Kost Dam 1 Site, Sunrise River 1996. Species densities and relative abundance are presented along with overall mussel density for this site. Length and age frequency distribution are shown for *Actinonaias ligamentina (T)*, the most abundant species at this site.

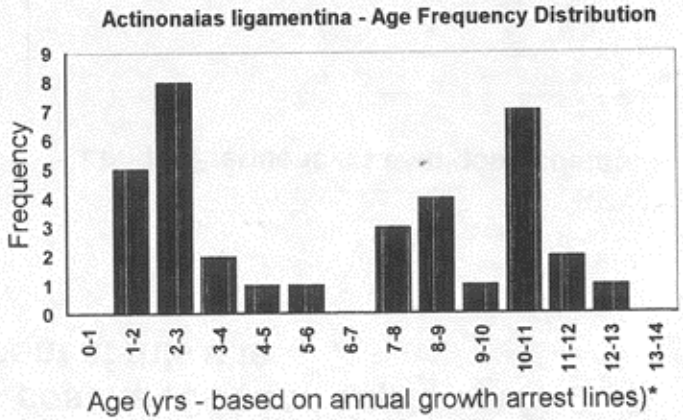


* n=35 for length & age frequency data

Figure 3: Quantitative Sampling Kost Dam 2 Site, Sunrise River 1996. Species densities and relative abundance are presented along with overall mussel density for this site. Length and age frequency distribution are shown for *Actinonaias ligamentina (T)*, the most abundant species at this site.

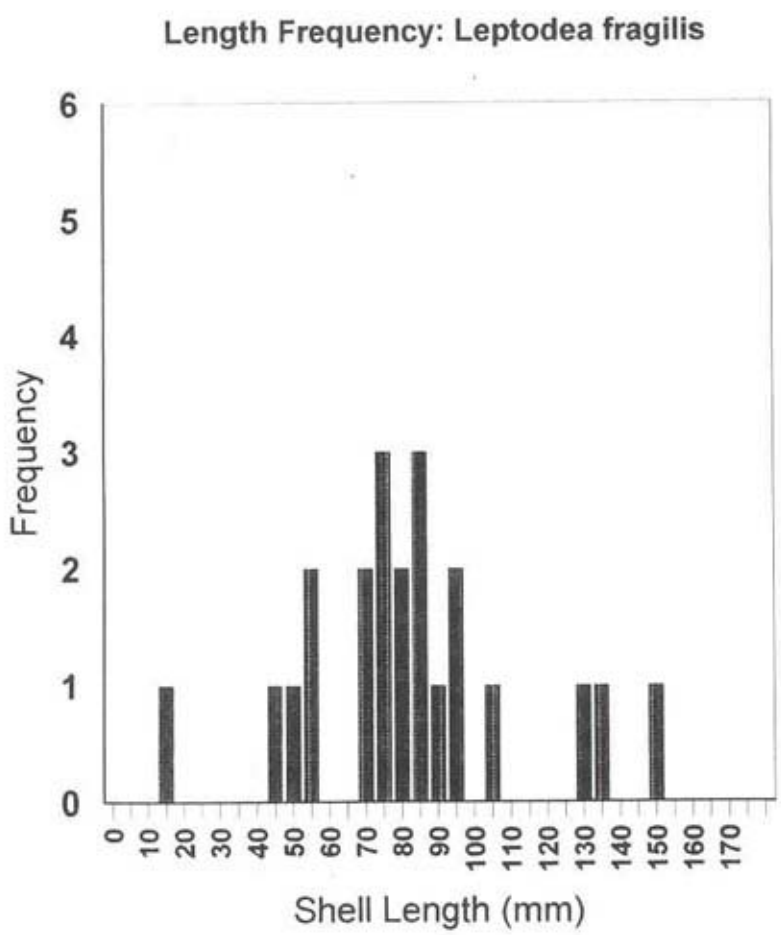






* n=95 for length & age frequency data

Figure 4: Quantitative Sampling Kost Dam 2 Site, Sunrise River 1996. Length frequency distributions are shown for *Lasmigona costata (SC)* and *Leptodea fragilis*, the second and third most abundant species present at this site.



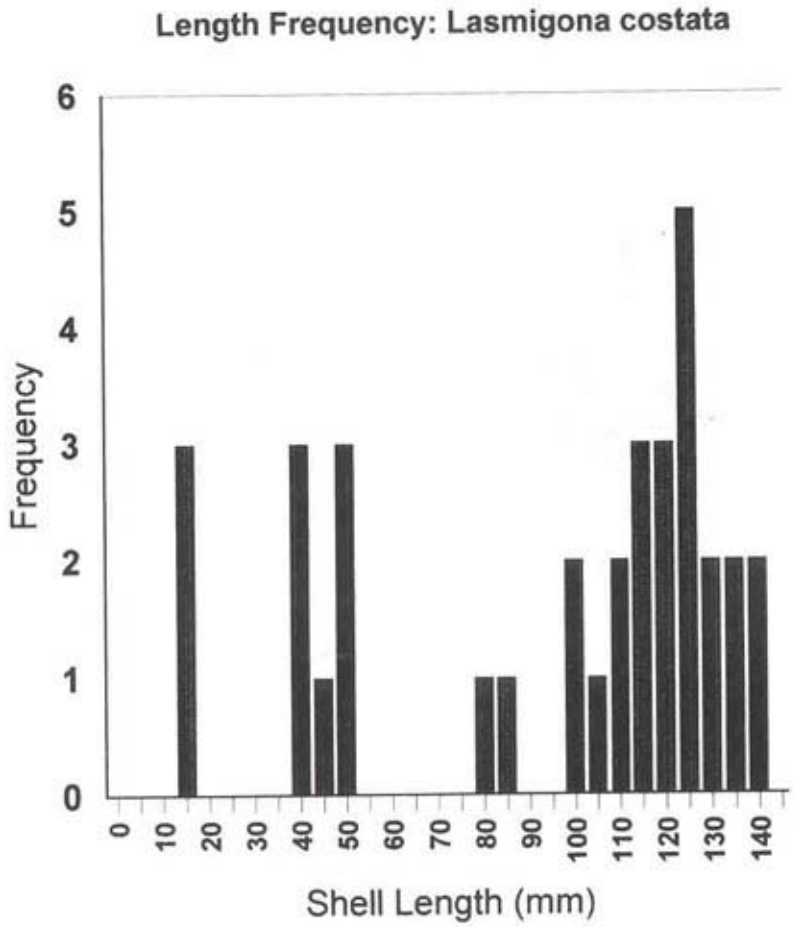
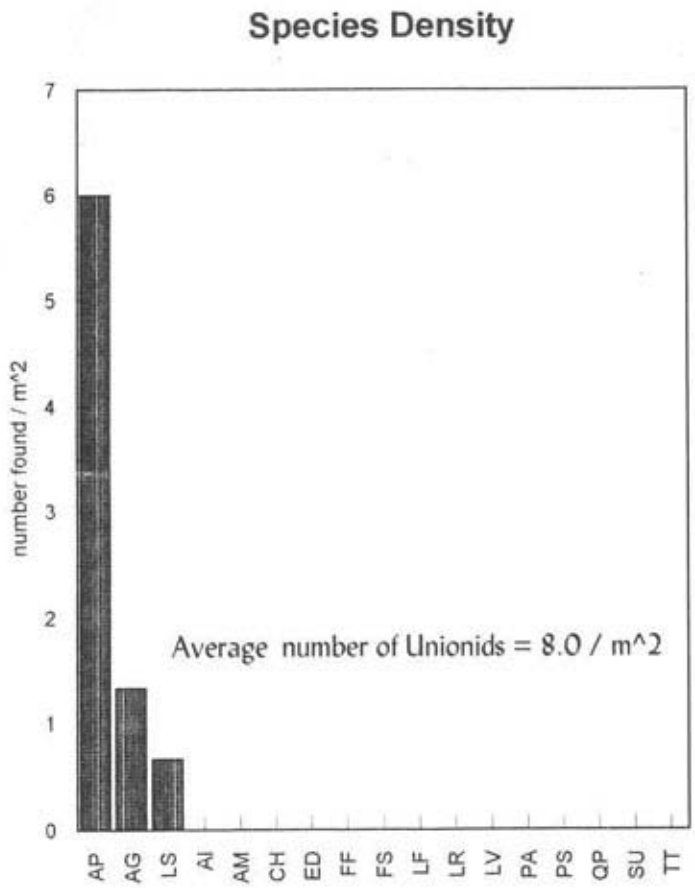
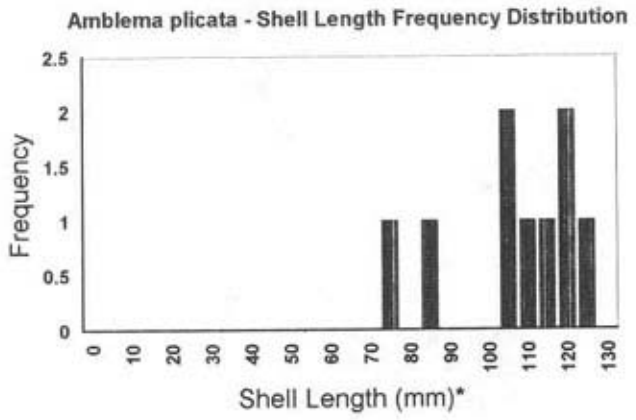
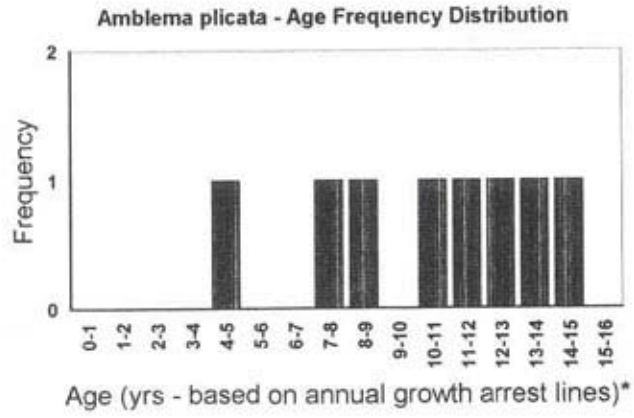


Figure 5: Quantitative Sampling at North Pool Lake Dam Site, Sunrise River 1996. Species densities and relative abundance are presented along with overall mussel density for this site. Length and age frequency distribution are shown for *Amblema plicata*, the most abundant species at this site.

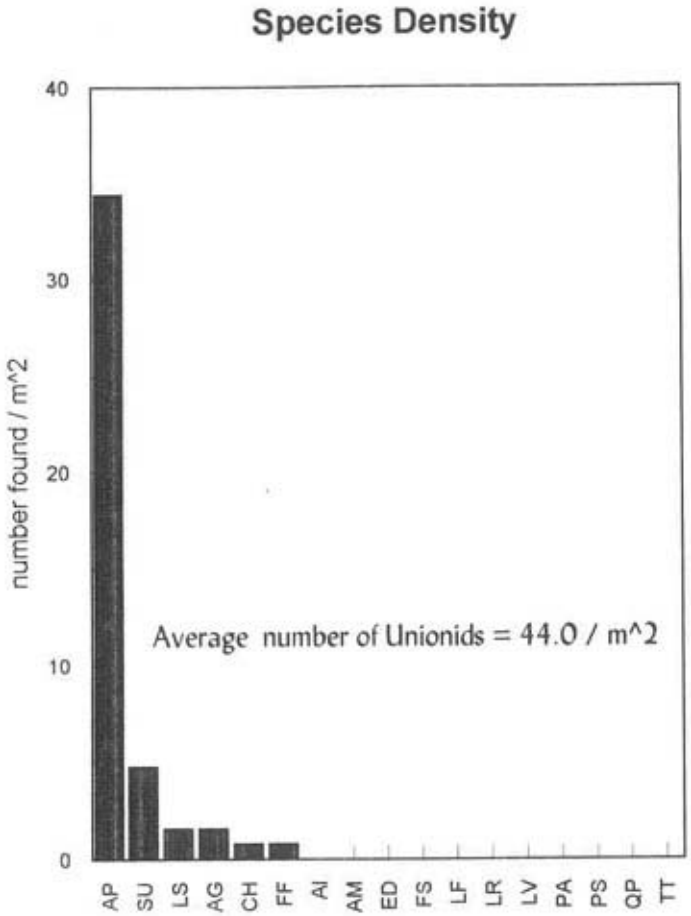


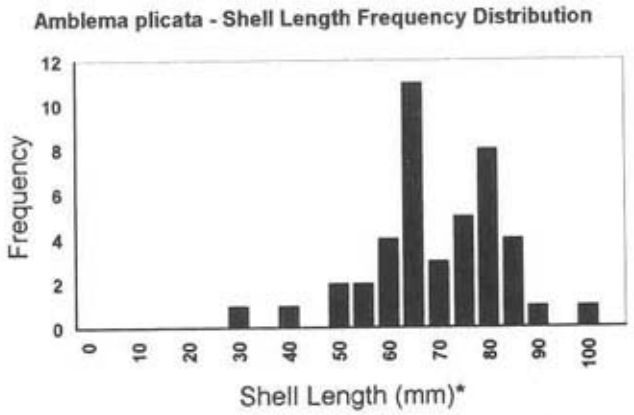


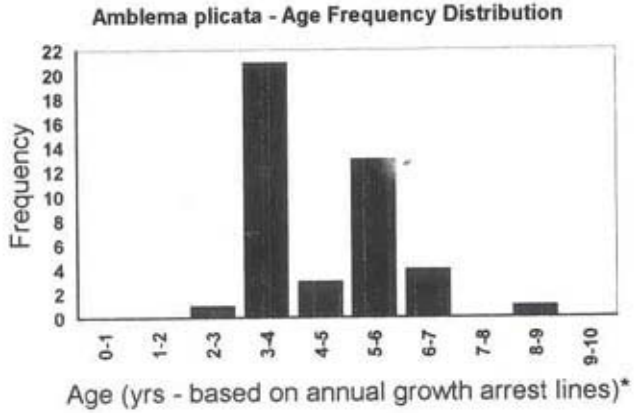


* n=9 for length & age frequency data

Figure 6: Quantitative Sampling at Mud Lake Dam Site, Sunrise River 1996. Species densities and relative abundance are presented along with overall mussel density for this site. Length and age frequency distribution are shown for *Amblema plicata*, the most abundant species at this site.







* n=43 for length & age frequency data

Table 1

SUNRISE RIVER - 1996
SPECIES LIST FROM ALL SITES COMBINED

Live mussels

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Actinonaias ligamentina	mucket	Threatened
Alasmidonta marginata	elktoe	Threatened
Ellipsaria lineolata	butterfly	Threatened
Pleurobema coccinium	round pigtoe	Threatened
Elliptio dilatata	spike	Special Concern
Lasmigona compressa	creek heelsplitter	Special Concern
Lasmigona costata	fluted shell	Special Concern
Ligumia recta	black sandshell	Special Concern
Anodonta grandis	floater	
Anodontoides ferussacianus	cylinder mussel	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Leptodea fragilis	fragile papershell	
Lampsilis cardium	pocketbook	
Lampsilis siliquoidea	fat mucket	
Potamilus alatus	pink heelsplitter	
Quadrula pustulosa	pimpleback	
Strophitus undulatus	strange floater	
Toxolasma parvus	lilliput	
Truncilla truncata	deertoe	

Dead shell

Cyclonaias tuberculata	purple wartyback	Threatened

Sunrise River - Horse Trail Site

Live Mussels - 5 Species

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Actinonaias ligamentina	mucket	Threatened
Alasmidonta marginata	elktoe	Threatened
Ligumia recta	black sandshell	Special Concern
Lampsilis cardium	pocketbook	
Lampsilis siliquoidea	fat mucket	

Dead Shell - 9 Species

Elliptio dilatata	spike	Special Concern
Lasmigona costata	fluted shell	Special Concern
Anodonta grandis	floater	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Lampsilis cardium	pocketbook	
Lampsilis siliquoidea	fat mucket	
Quadrula pustulosa	pimpleback	
Strophitus undulatus	strange floater	

Sunrise River - Village of Sunrise Site

Live Mussels - 15 Species

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Actinonaias ligamentina	mucket	Threatened
Alasmidonta marginata	elktoe	Threatened
Ellipsaria lineolata	butterfly	Threatened
Elliptio dilatata	spike	Special Concern
Lasmigona compressa	creek heelsplitter	Special Concern
Lasmigona costata	fluted shell	Special Concern
Ligumia recta	black sandshell	Special Concern
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Leptodea fragilis	fragile papershell	
Lampsilis cardium	pocketbook	
Lampsilis siliquoidea	fat mucket	
Quadrula pustulosa	pimpleback	
Toxolasma parvus	lilliput	
Truncilla truncata	deertoe	

Dead Shell - 5 Species

Cyclonaias tuberculata 37	purple wartyback	Threatened
Pleurobema coccinium 61	round pigtoe	Threatened
Anodonta grandis	floater	
Anodontoides ferussacianus	cylinder mussel	
Strophitus undulatus	strange floater	

Sunrise River - Highway 95 Bridge Site

Live Mussels - 15 Species

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Actinonaias ligamentina	mucket	Threatened
Alasmidonta marginata	elktoe	Threatened
Ellipsaria lineolata	butterfly	Threatened
Pleurobema coccinium	round pigtoe	Threatened
Elliptio dilatata	spike	Special Concern
Lasmigona costata	fluted shell	Special Concern
Ligumia recta	black sandshell	Special Concern
Anodonta grandis	floater	
Anodontoides ferussacianus	cylinder mussel	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Leptodea fragilis	fragile papershell	
Lampsilis cardium	pocketbook	
Lampsilis siliquoidea	fat mucket	
Strophitus undulatus	strange floater	

Dead shell

Potamilus alatus	pink heelsplitter	
Quadrula pustulosa	pimpleback	

Sunrise River - Kost Dam Site

Live Mussels - 17 Species

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Actinonaias ligamentina	mucket	Threatened
Alasmidonta marginata	elktoe	Threatened
Pleurobema coccinium	round pigtoe	Threatened
Elliptio dilatata	spike	Special Concern
Lasmigona costata	fluted shell	Special Concern
Ligumia recta	black sandshell	Special Concern
Anodonta grandis	floater	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Leptodea fragilis	fragile papershell	
Lampsilis cardium	pocketbook	
Lampsilis siliquoidea	fat mucket	
Potamilus alatus	pink heelsplitter	
Quadrula pustulosa	pimpleback	
Strophitus undulatus	strange floater	
Toxolasma parvus	lilliput	
Truncilla truncata	deertoe	

Dead Shell - None

Sunrise River - Highway 14 Bridge Site

Live Mussels - 10 Species

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Actinonaias ligamentina	mucket	Threatened
Pleurobema coccinium	round pigtoe	Threatened
Elliptio dilatata	spike	Special Concern
Lasmigona costata	fluted shell	Special Concern
Lasmigona compressa	creek heelsplitter	Special Concern
Anodonta grandis	floater	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Lampsilis siliquoidea	fat mucket	
Strophitus undulatus	strange floater	

Dead shell

Ligumia recta	black sandshell	Special Concern
Lampsilis cardium	pocketbook	

Sunrise River - North Pool Dam Site

Live Mussels - 10 Species (none dead)

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Lasmigona compressa	creek heelsplitter	Special Concern
Anodonta grandis	floater	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Lampsilis siliquoidea	fat mucket	
Strophitus undulatus	strange floater	

Sunrise River - North Pool Lake Inlet

Live Mussels - 2 Species

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Anodonta grandis	floater	
Amblema plicata	threeridge	

Dead shell

Fusconaia flava	pigtoe	
Lampsilis siliquoidea	fat mucket	

Sunrise River - Mud Lake Dam Site

Live Mussels - 6 Species (none dead)

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Lasmigona compressa	creek heelsplitter	Special Concern
Anodonta grandis	floater	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Lampsilis siliquoidea	fat mucket	
Strophitus undulatus	strange floater	

Table 8

Sunrise River - West Branch

Live Mussels - 5 Species (none dead)

SCIENTIFIC NAME	COMMON NAME	MINNESOTA STATUS
Anodonta grandis	floater	
Amblema plicata	threeridge	
Fusconaia flava	pigtoe	
Lampsilis siliquoidea	fat mucket	
Strophitus undulatus	strange floater	

Sunrise River - North Branch

No Mussels Live or Dead found from 3 sites