Lower St. Croix River Baseline Monitoring

Fisheries Inventory

MWBC = 2601400

Prepared by
Heath M. Benike and William J. Michalek, Jr.
Wisconsin Department of Natural Resources
West Central Region
December 2001

Abstract

The Wisconsin Department of Natural Resources (WDNR) water program staff sampled the lower St. Croix River during the 1999 and 2000 field seasons as part of the nonwadeable baseline monitoring strategy for Wisconsin's large rivers. A total of sixty-four species of fish were collected from the lower St. Croix River using a variety of techniques. Fourteen new species of fish were documented from the lower St. Croix River during our sampling efforts. Six species of fish that were collected during the Wisconsin Fish Distribution Survey in the 1980's were not collected during our sampling efforts. Of those sixty-four species of fish captured, ten are listed on the state endangered, threatened or special concern list. Index of Biotic Integrity sampling (IBI) indicates that the lower St. Croix Fish community is in excellent condition. Species diversity and biomass is high, riverine specialists are common and the fish assemblage composition is represented by a diverse and specialized large river fish community.

Golden redhorse was the most abundant fish captured during the IBI sampling runs. During the gamefish and endangered and threatened species runs (GET), smallmouth bass were the most abundant gamefish on the lower St. Croix River followed by walleye and northern pike. State listed threatened species sampled during this survey include the river redhorse, greater redhorse, blue sucker, gilt darter and black buffalo. Special concern species captured during this survey included the western sand darter, mud darter, american eel, silver chub and lake sturgeon.

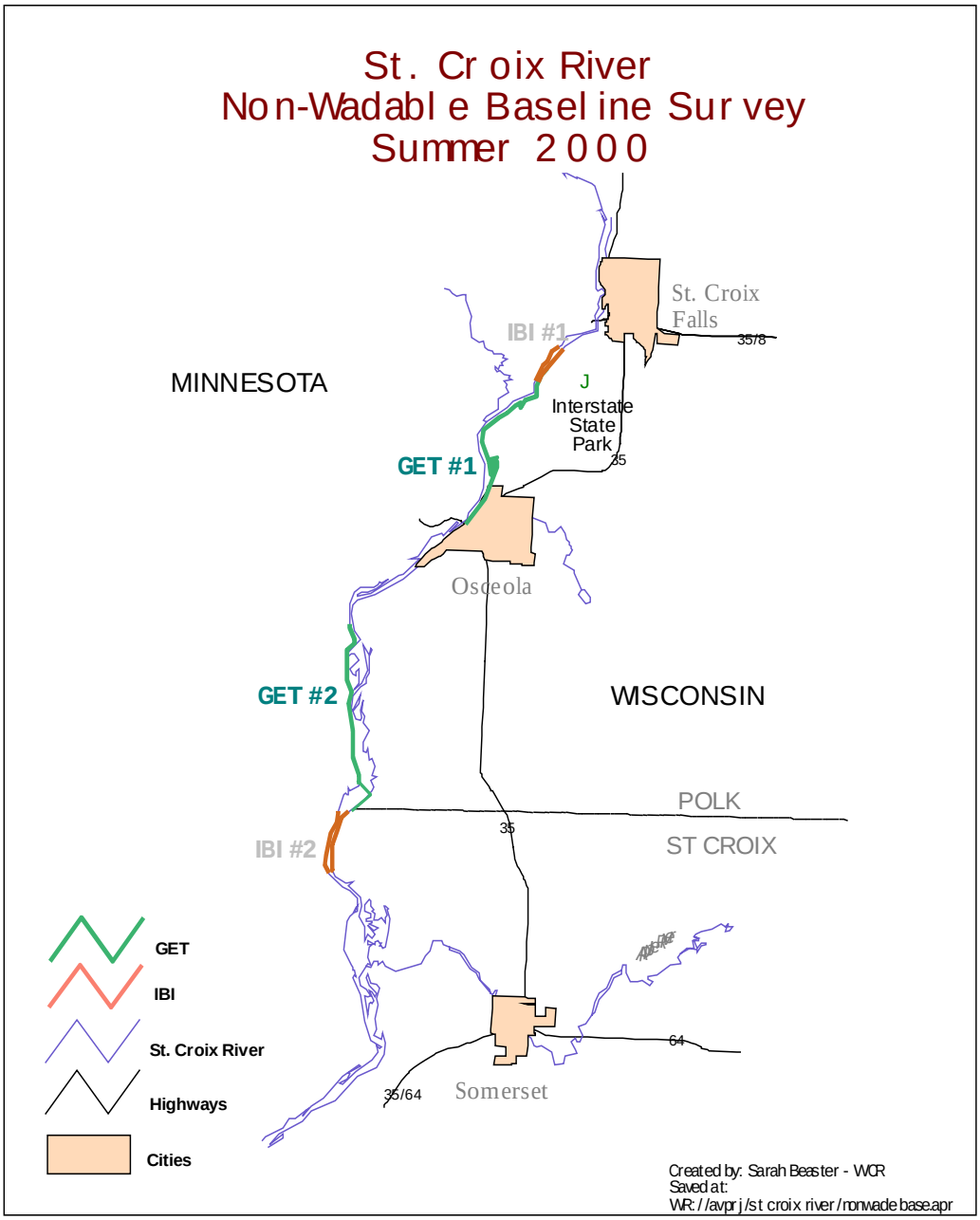
Although species diversity and biomass is high we did document several problems in the fish community. Shorthead redhorse relative weight measures were poorer when compared to the lower Red Cedar River in western Wisconsin. Smallmouth bass growth rates and relative weight measures are also poorer when compared to the lower Red Cedar River. Blue sucker relative abundance is also much lower when compared to the lower Red Cedar River. In addition we collected no crystal darter in the lower St. Croix River whereas it has been collected in other large rivers in western Wisconsin. Walleye mortality rates were also very high and future research should be conducted to determine what factors may be attributing to this.

Overall, the lower St. Croix River fish community is in good condition. This can be attributed to the fact that dams have not fragmented the lower St. Croix River and that near shore habitat degradation has been minimized and that water quality conditions are very good. Fish access from the larger Mississippi River system is not impeded, thereby providing a large free-flowing riverine system with suitable habitat in which the large river fish community in the lower St. Croix River needs to survive.

Future management efforts should target efforts, which avoid and minimize habitat losses associated from various sources. Habitat losses can range from such impacts as water level fluctuations from hydropower operations, fish passage obstruction from dams, fragmentation and destruction of riverine shoreline habitat from landuse changes, near shore habitat losses from development pressures and deterioration of water quality conditions in the watershed. In an effort to maintain the biological integrity of the lower St. Croix River, all these factors must be taken

into consideration and be of equitable importance if the preservation of this river and its associated biological community are to be preserved for future generations.

Figure 1: Sampling sites and stations on the lower St. Croix River



Sampling Dates: **July 26, 27 - 1999**
Sept 22, 23 - 1999
May 1, 2 - 2000

Field Crew: **Marty Engel, Brian Spangler, Dean Johnson, Heath Benike, Ron Benjamin, Brian Brecka, Angela Parkhurst, Sarah Beaster, John Paddock, Ken Schreiber, Tom Aartila, Scott Peavy, Patty Asher and Mike Sorge.**

Data Management: **Heath Benike, Amanda Rabuck and BJ Michalek**

INTRODUCTION

As part of the baseline monitoring strategy for non-wadeable rivers in Wisconsin, the lower Chippewa Basin water staff and Mississippi River fisheries work unit sampled the lower St. Croix River during the 1999 and 2000 field seasons. The purpose of this survey was to develop a baseline inventory of the existing fisheries resources in the lower St. Croix River and to make recommendations for future fisheries management activities. In addition, the work that was conducted will be used to develop standardized methods and procedures for monitoring non-wadeable rivers in the West Central Region and throughout the state of Wisconsin.

PHYSICAL DESCRIPTION

The lower St. Croix River starts below the St. Croix Falls hydropower facility which is unlicensed and currently owned by NSP-W (d.b.a Xcel Energy) at approximately river mile 52.0 and is free flowing for approximately 27 miles where it becomes semi-impounded at Lake St. Croix at approximately river mile 25.0. The focus of this survey was in the free flowing section between St. Croix Falls to Marine on the St. Croix between river mile 52.0 and 34.0. The hydropower facility effects current flow conditions on the lower St. Croix River. The current voluntary minimum flow discharged from the dam is 800 cubic feet per second (cfs) in the winter months and 1600 cfs during the summer recreational period. Mean annual discharge at St. Croix Falls is estimated at 4379 cfs (USGS, 1999). The riparian corridor consists of wooded bluffs intermixed within floodplain forests, islands and backwater complexes. Development pressure is present near Marine on the St. Croix especially on the Minnesota side of the river. The Wisconsin side has less development pressure and is mostly wild land.

METHODS

Two stations were established on the lower St. Croix River (Figure 1). Each station was divided into two sampling reaches. Each sampling station consisted of a one-mile index of biotic integrity run (IBI) and a longer gamefish and endangered and threatened resources run (GET). Sampling was conducted in late-July, late-September and early-May, when water temperatures were above 59 degrees F.

Within the one-mile (IBI) station the following sampling techniques were used:

A. **Large Rivers IBI**: Fish were collected using two pulsed-DC mini-boomshockers during daylight hours. Shocking proceeded downstream with one boat per shoreline operating at approximately 400 volts and 10 amps (80/20 duty/pulse). The catch and effort (minutes) was kept separately for each individual boat. Boat operators were instructed to follow the shoreline for a distance of one mile. Dipnetters were instructed to collect fish greater than two inches in length. Species were identified and

individual, length and weight information was recorded for all fish captured within the one-mile IBI run. Due to the large biomass of fish collected (mainly non-game fish), several processing stops were made within the IBI run. Any fish that was not identifiable in the field was preserved in a 10% formalin solution for identification purposes.

B. Small Fish Assemblage *(SFA)*

1. **Mini Stream Shocker**: Fish were collected using a DC-mini streamshocker equipped with three electrodes operating at approximately 250 volts and 2.5 amps. Shocking proceeded upstream for approximately 3300-5280 feet from the end of the one-mile IBI station. Accessibility and depth were the determining factors to which side of the river was sampled, however an effort was made to sample diverse habitat sites. Effort was recorded in minutes. All fish collected were identified by species and counted. Any fish that was not identifiable in the field was preserved in a 10% formalin solution for identification purposes.

2. **Shoreline Seining:** Three fifty foot seine hauls were sampled at three sites within the one-mile IBI station. Seine haul sites were selected according to various habitat features within the one-mile IBI station. Catch per individual seine haul was kept separate. All individual fish were identified, counted and recorded. Any fish that was not identifiable in the field was preserved in a 10% formalin solution for identification purposes.

C. **Gamefish, Endangered and Threatened Species Run (GET):** Fish were collected using two pulsed-DC mini-boomshockers operating at approximately 400 volts and 10 amps (80/20 duty/pulse). Stations started at the end of the IBI station and continued downstream to the next available landing. Shocking proceeded downstream with one boat covering each shoreline. The catch and effort (minutes) for each boat was kept separately. Boat operators were instructed to follow the shoreline for entire GET run, but they could "work" cover where appropriate. Dipnetters were instructed to collect all gamefish, endangered and threatened species.

RESULTS / DISCUSSION

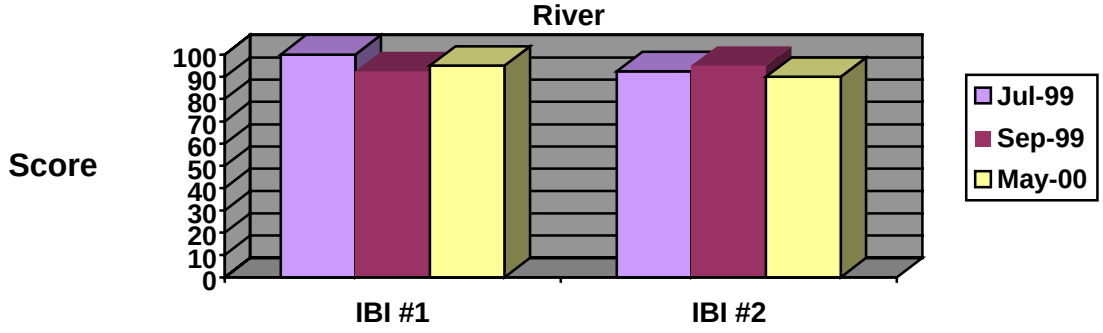
LARGE RIVERS IBI

An index of biotic integrity (IBI) for Wisconsin's large river systems was recently developed by the Wisconsin Department of Natural Resources (Lyons, etal 2001). The large river IBI has two primary uses. The first use is as a rapid assessment tool to characterize ecosystem quality at a broad scale and the second use is to evaluate specific management activities to restore river ecosystems (Lyons, etal 2001).

Mean large rivers IBI scores were calculated for all stations on the lower St. Croix River during the three seasonal sampling bouts (Figure 2). Mean scores ranged between 90-100, which indicates that the overall condition of the lower St. Croix River fish community is in excellent condition. This can be expected, due to the diverse and unique fish community in the lower St. Croix River. The lower St. Croix River as well as, other large rivers in western Wisconsin represent some of the last, large free-flowing riverine

systems in the upper Mississippi River drainage (Benike, 2001). A major reason for the diverse fish fauna is likely due to the fact that dams have not fragmented, flooded or eliminated fish access to this very important large river system and its associated habitats. Studies have shown that dam construction can negatively impact the native fish communities (Winston and Taylor,1991) (DeJalon, Sanchez and Camargo, 1994) (Bonner and Wilde, 2000). If dams were to be constructed or if any barriers to fish migration were provided it is very likely that the health of the native lower St. Croix River fish community would be in serious jeopardy. Another primary reason for the diverse fish community is that near shore habitat development and fragmentation has been minimized along the riparian corridor. Most of the riparian corridor is primarily wooded and essentially wildland which consists of a mixture of floodplain forest, upland hardwoods and large bluffs. If the existing land use changes along the riparian corridor and near shore habitat becomes fragmented and degraded, it is very likely that the health of the lower St. Croix River fish community could be adversely impacted. Water quality conditions on the lower St. Croix are also in good condition, but increasing non-point source pollution, especially concerning phosphorus (Sorge, personal communication) is a concern by resource management agencies. If water quality conditions on the lower St. Croix River were to become further degraded it is likely that the condition of the overall fish community could be impacted.

Figure #2: Mean Large Rivers IBI Scores for the Lower St. Croix River



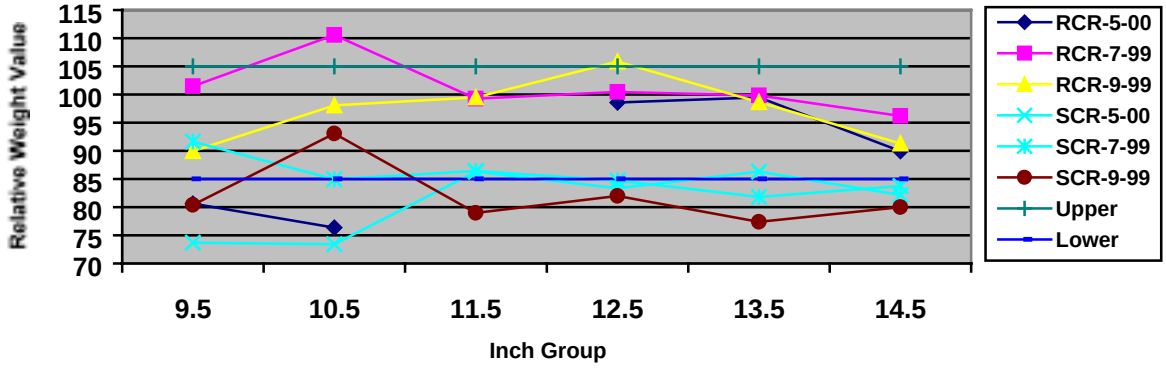
The most abundant fish captured during the IBI sampling runs was golden redhorse and the most abundant gamefish collected was smallmouth bass. A total species list that was collected during the IBI runs is provided in Appendix A.

Relative Weight Measure

Relative weight is one of several condition indices used to assess the general health of fishes. Proposed relative weight equations and standard lengths were proposed for large river fishes (Bister etal, 2000). Relative weight metrics values were calculated for shorthead redhorse on the lower St. Croix River (Figure 3) for all three seasonal sampling periods. Relative weight values were below the normal range for shorthead redhorse for most inch groups. We also compared shorthead redhorse relative weight values from the lower Red Cedar River in western Wisconsin to the lower St. Croix River. Relative weight values for shorthead redhorse on the lower Red Cedar River are higher when compared to the lower St. Croix River. This information suggests that the general

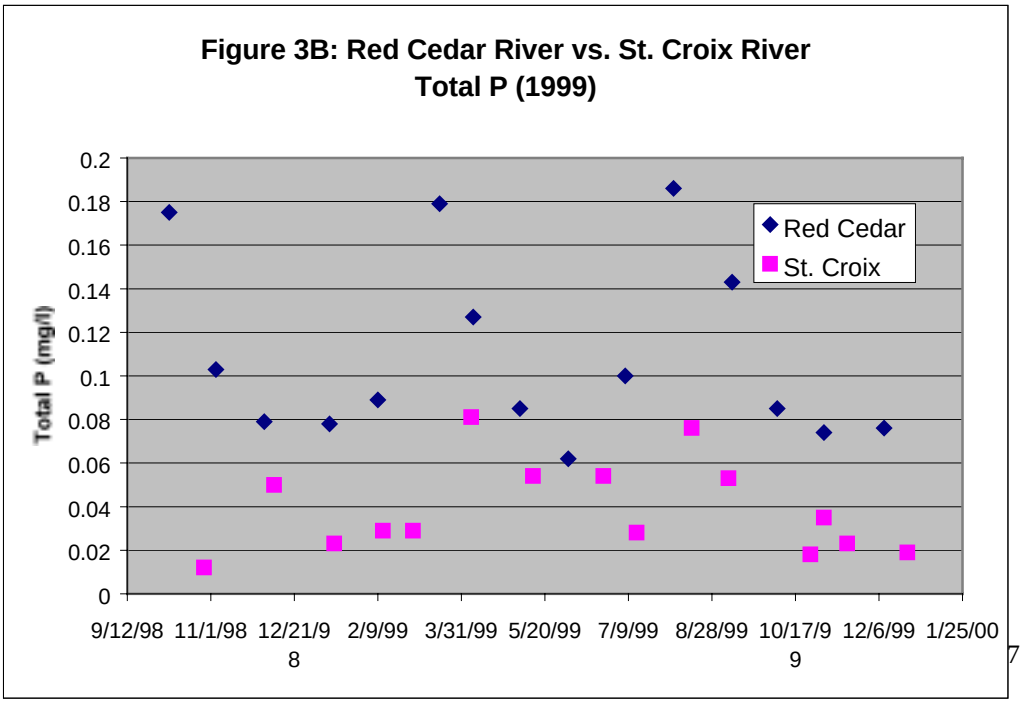
condition of shorthead redhorse are in poorer condition on the lower St. Croix River. Possible explanations for this difference could be related to hydropower operations and river productivity. Hydropower operations are present on both the lower St. Croix and

Figure 3A: Shorthead Redhorse Relative Weight, Lower St. Croix River vs Lower Red Cedar River



lower Red Cedar Rivers. An instream flow study (IFIM) was conducted by the Minnesota Department of Natural Resources on the lower St. Croix River (Johnson 1995). This report documented that the current flow conditions from hydropower operations on the lower St. Croix are impacting aquatic habitat conditions for shorthead redhorse. Mitigative measures which would improve habitat conditions on the lower St. Croix include increasing minimum flows, decreasing maximum discharges, reducing the range between minimum and maximum discharges or a year round run-of-river operation. Another important factor to consider is river productivity. The lower Red Cedar River is listed as a 303d impaired water for pH violations and eutrophication, whereas the lower St. Croix River currently meets state water quality standards. Total phosphorus values are shown in (Figure 3B). It is plausible that the excessive productivity on the lower Red Cedar may be one factor which would account for the higher relative weight values when compared to the lower St. Croix River, this would have to researched in more detailed to determine its merit.

Figure 3B: Red Cedar River vs. St. Croix River Total P (1999)

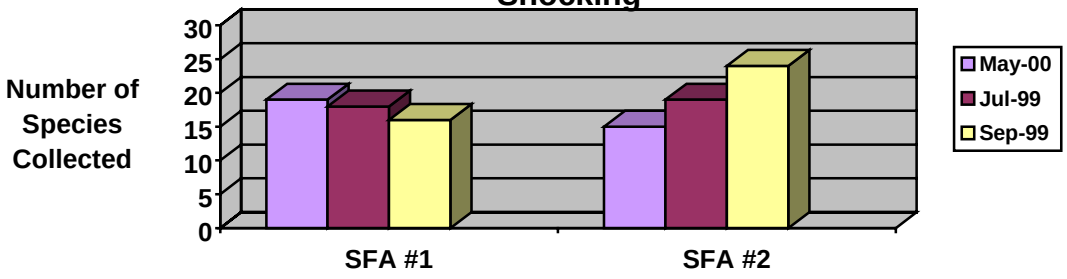


Small Fish Assemblage (SFA)

Shoreline Stream Shocking

Species diversity was highest during the May sampling period at SFA #1 and lowest during the September sampling period. Species diversity at SFA #2; was the highest during the September sampling and the lowest during the May sampling (Figure 3). A list of the total species catch is provided in Appendix A.

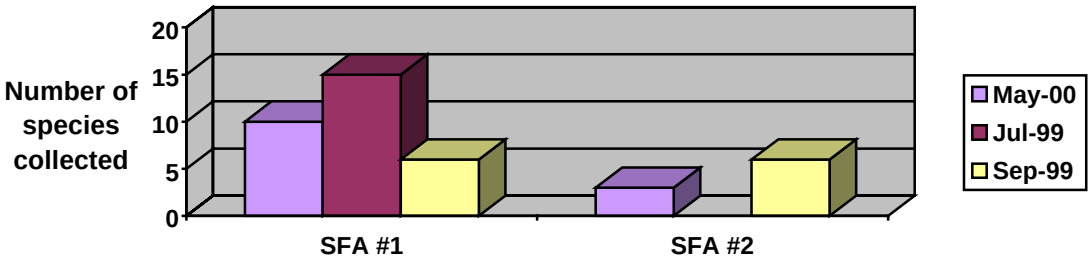
Figure #3: Species Diversity-St. Croix River, Stream Shocking



Shoreline Seining

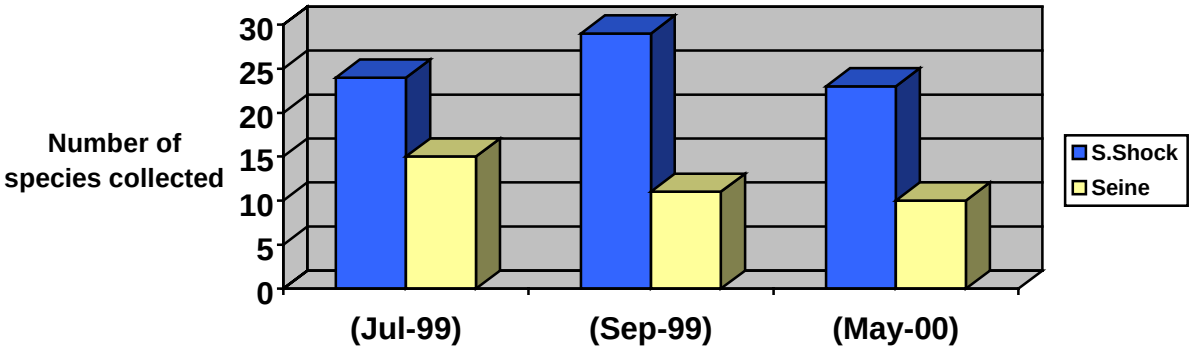
Shoreline seining was conducted during the three sampling periods (Figure 4). Seining was not conducted in July at station #2 due to poor weather conditions. All of the species caught seining were common fish community members except for one; the western sand darter. A total list of species captured can be found in Appendix A.

Figure 4: Species Diversity, Shoreline Seining, lower St. Croix River



When comparing shoreline stream shocking with shoreline seining, species diversity is substantially higher using the shoreline shocking method (Figure 5). This data also suggests that shoreline shocking is a more effect technique for measuring species presence and absence as well as providing a more representative sample on the small fish community assemblage.

Figure 5: Species Diversity Shoreline Shocking vs Seining lower St. Croix River

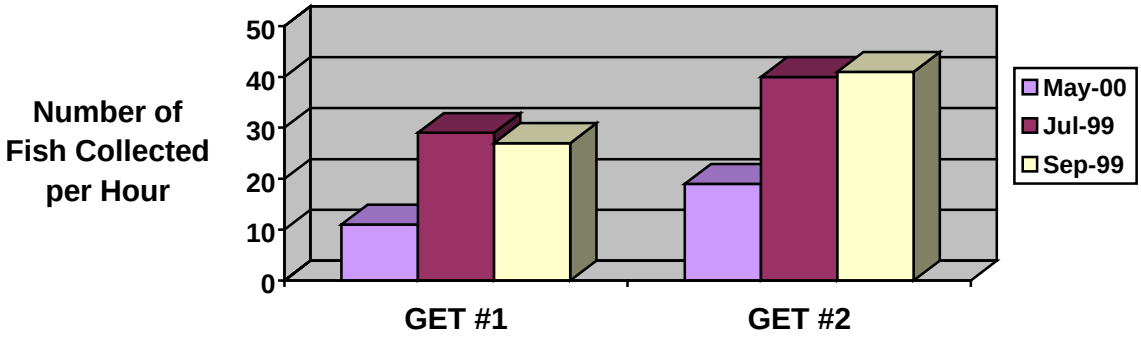


GET (Gamefish and Endangered and Threatened Species Runs)

SMALLMOUTH BASS

Smallmouth bass was the most abundant gamefish collected in the lower St. Croix River. Overall, catch per hour was lowest during the May sampling period (Figure 6) at all stations. The highest catch rate for smallmouth bass was 40.4 fish per hour in September at GET station #2. The data also shows that catch rates did not change appreciably between the September and July sampling period, but the May sampling period was much lower.

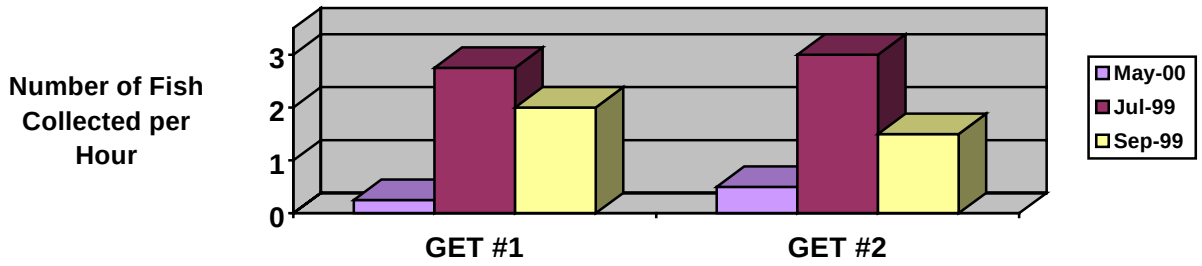
Figure 6: Smallmouth Bass (CPUE/HR) All Sizes



When comparing legal sized smallmouth bass (> 14 inches), catch rates were lowest at all sampling stations during May sampling period and highest during the July sampling

period (Figure 7). One possible reason for the low number of smallmouth bass (>14 inches) in the May sample may be related to migratory patterns. On the Embarrass River and Wolf Rivers in northeastern Wisconsin as well as, the upper St. Croix River, smallmouth bass were shown to move large distances to overwintering habitat (Langhurst and Schonecke, 1990) (Dammen 1996). In addition, smallmouth bass on the Black River have been shown to move into the larger Mississippi River system seeking overwintering habitat (Endris, personal comm.). The May data that was collected in the St. Croix River suggests that adult smallmouth bass were likely still at overwintering habitat in Lake St. Croix or the Mississippi River or fish could have been residing in the "Dalles" section which is located immediately upstream of GET #1. The "Dalles" is a narrow, deep gorge which was not sampled due to navagialbilty and depth concerns.

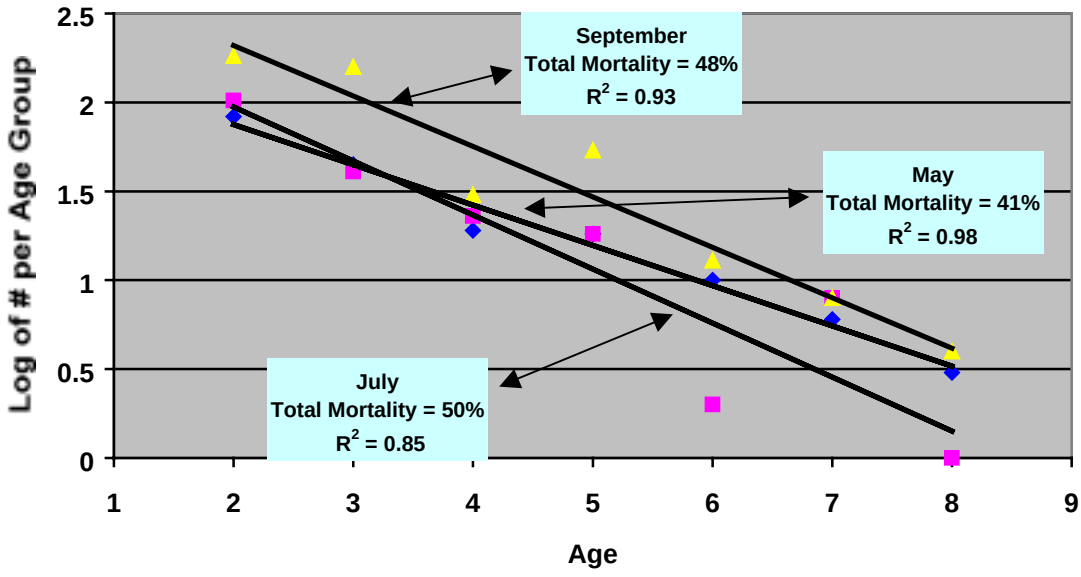
Figure 7: Smallmouth Bass CPUE/HR > 14 inches



Mortality Estimates

Catch curves were developed for smallmouth bass on the lower St. Croix River (Figure 8 and Table #1). Total annual mortality rates for the months of July, September, and May are as follows: July was estimated at 49%, (R^2 =0.88), for ages 1 to 8. September was estimated at 48%, (R^2=0.93), for ages 2-8. May was estimated at 41%, (R^2=0.98), for ages 2-8. (Fig. 9). The rationale for comparing age 1 to age 8 fish with age 2 to 9 fish is

Figure 8: Catch Curve: Smallmouth Bass-May, July, & September Samples, lower St. Croix River, Ages 2-8



because during the July sample all fish were backcalculated to the beginning of the growth year, whereas the September sample of smallmouth bass were considered to be done growing for that year. More specifically, they are the same year classes of smallmouth bass, but they were aged differently due to seasonal sampling problems.

Table 1. Lower St. Croix River-Estimated Annual Mortality Rates-Smallmouth Bass

Month	Year	Age Range	Annual Mortality	R-Squared	Month	Year	Age Range	Annual Mortality	R-Squared
July	1999	1-8	49%	0.88	May	2000	2-8	41%	0.98
		2-8	50%	0.85			3-8	40%	0.97
		3-8	50%	0.77			4-8	38%	0.95
		4-8	51%	0.67			5-8	44%	100 (0.9965)
		5-8	52%	0.52			6-8	45%	0.99
Sept.	1999	2-8	48%	0.93					
		3-8	49%	0.90					
		4-8	45%	0.82					
		5-8	56%	0.95					
		6-8	45%	0.99					

Growth Rates

Growth rates were calculated for smallmouth bass on the lower St. Croix River during all sampling events. Fish were back calculated to the beginning of the 1999 growing season using standard a values (Carlander, 1982) during the July sample. Fish that were captured during the September sampling period were considered to be done growing for the 1999 season and fish collected during the May sample were collected before growth occurred during the 2000. Figure 9 shows that smallmouth bass growth rates were slower for all age classes during the September and May sampling periods and equal to or below the statewide average during the July sampling period (WDNR, FMRB).

Figure 9: Mean Length at Age. Smallmouth Bass, lower St. Croix River

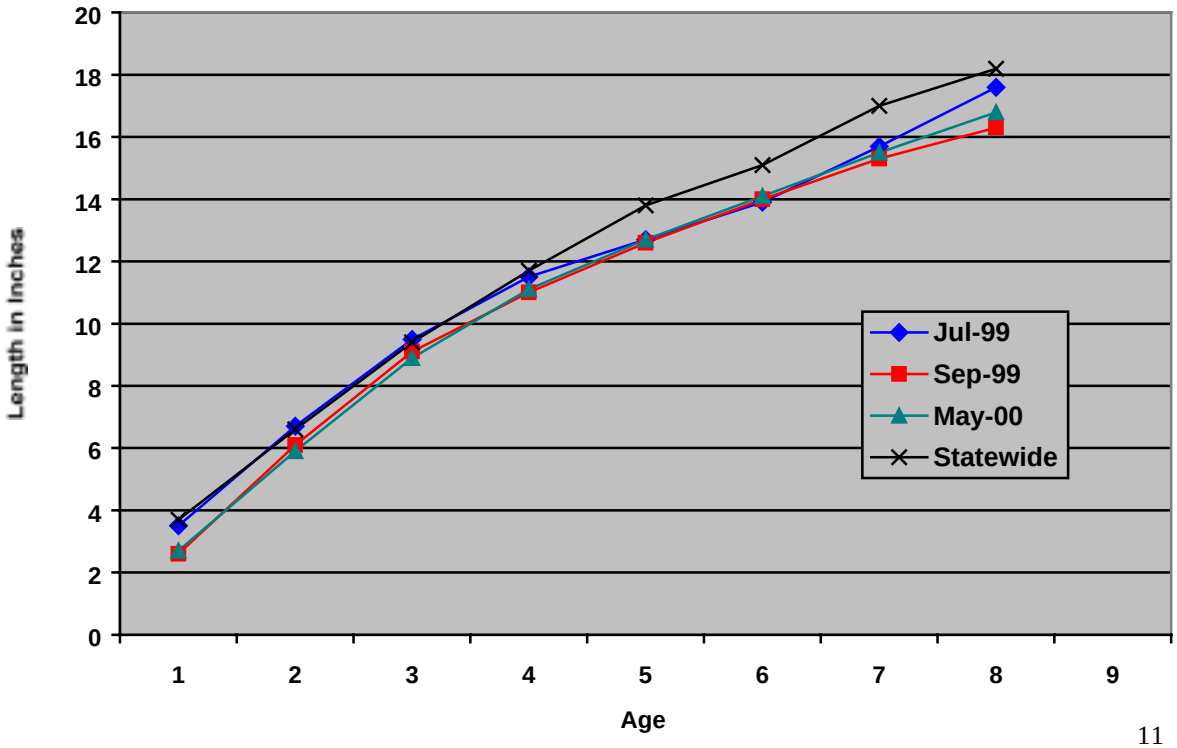


Table 2: Seasonal Mean Length at Age smallmouth bass, lower St. Croix River

Mean Length at Age; July 1999

Year Class	Age	# Aged	SD	Mean Length
1998	1	132	.73	3.5
1997	2	103	.86	6.7
1996	3	41	.80	9.5
1995	4	23	.63	11.5
1994	5	18	.59	12.7
1993	6	2	.78	14.0
1992	7	8	1.04	15.7
1991	8	1	0	17.6
1990	9	1	0	18.2

Mean Length at Age; September 1999

Year Class	Age	# Aged	SD	Mean Length
1999	1	2	.14	2.6
1998	2	181	.73	6.1
1997	3	158	.79	9.1
1996	4	30	.27	11.0
1995	5	54	.60	12.6
1994	6	13	.23	14.0
1993	7	8	.36	15.3
1992	8	4	.15	16.3
1991	9	0	---	---
1990	10	4	.15	18.7

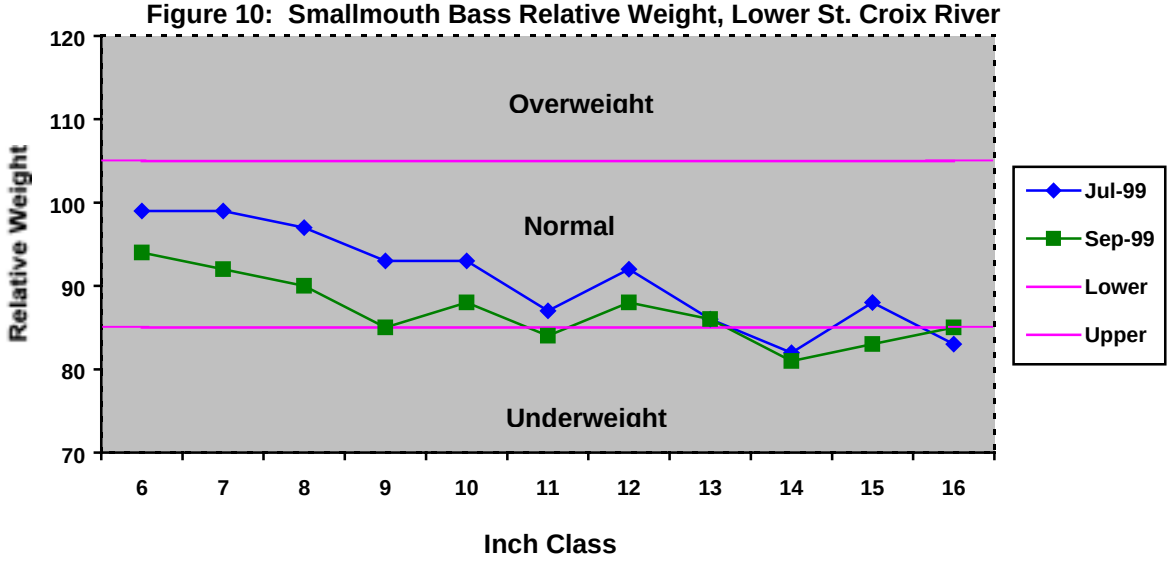
Mean Length at Age; May 2000

Year Class	Age	# Aged	SD	Mean Length
1999	1	2	1.77	2.7
1998	2	84	.78	5.9
1997	3	45	.81	8.9
1996	4	19	.57	11.1
1995	5	18	.07	12.7
1994	6	10	.33	14.1
1993	7	6	.33	15.5
1992	8	3	.12	16.8
1991	9	2	.21	18.0
1990	10	2	.14	18.6

Relative Weight

Relative weight metrics were calculated for the July and September sampling periods for fish between 6 and 16 inches (Figure 10). Relative weights for smallmouth bass were calculated by using the formula devised by (Kolander, Willis, & Murphy 1993). Relative weight values were higher during the July sampling period compared to the September sampling period. Smallmouth bass between 6-15 inches appear to be in poorer condition in September. It would be logical for smallmouth bass to be at optimal fitness before the long winter months of relative inactivity, but this was not the case. Seasonal forage availability could likely influence this anomaly Overall, smallmouth bass were within the normal range during the July sample and within or below the normal range in the September sample. This data also shows as smallmouth bass are reaching larger size ranges, their relative weight values are getting poorer.

Figure 10: Smallmouth Bass Relative Weight, Lower St. Croix River



Comparison of smallmouth bass to the lower Red Cedar River in western Wisconsin.

The Wisconsin DNR sampled the lower Red Cedar River (Benike 2001) concurrently with the lower St. Croix River during the 1999 and 2000 field seasons. Information gathered can be used to make comparisons in the gamefish communities within the two river systems.

Relative Abundance

When comparing catch rates between the lower St. Croix River with the lower Red Cedar River in western Wisconsin, the relative abundance of smallmouth bass is higher on the lower St. Croix River (Figure 11A). The higher abundance can be attributed to higher recruitment levels in the lower St. Croix River when compared to the lower Red Cedar River (Figure 11B).

Figure 11A: Smallmouth Bass (CPUE): lower St. Croix vs lower Red Cedar River

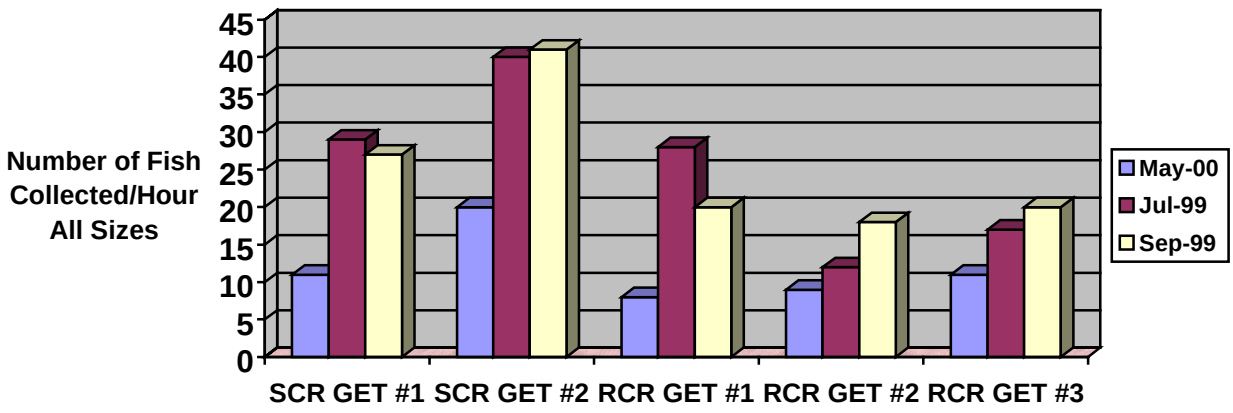
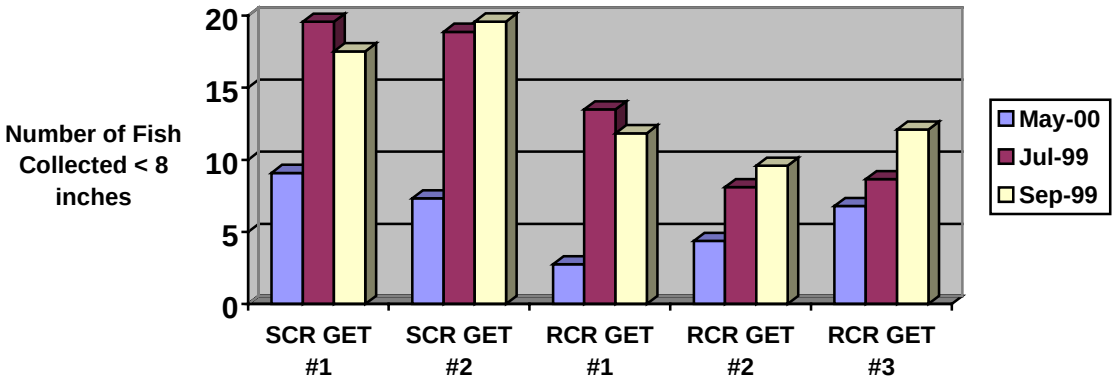


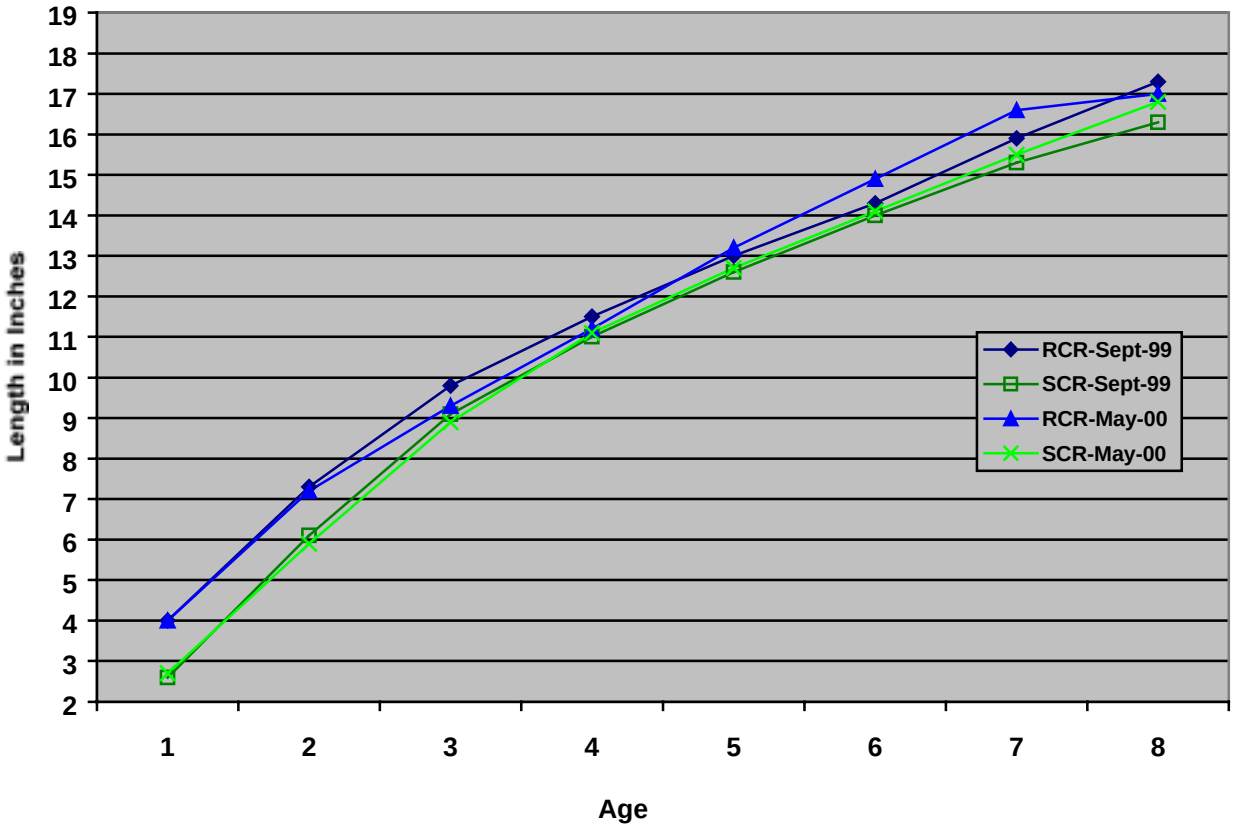
Figure 11B: Smallmouth Bass (CPUE/HR) < 8 inches



Growth Rates

The growth rates between the lower St. Croix River and the lower Red Cedar River in western Wisconsin during the fall and spring sampling bouts appear to be lower on the lower St. Croix River when compared to the lower Red Cedar River. (Figure 12).

Figure 12: Mean Age and Growth Comparison, lower St. Croix vs lower Red Cedar River



Relative Weights

When comparing relative weight values between the lower St. Croix River and the lower Red Cedar Rivers it appears that smallmouth bass are in poorer condition in the lower St. Croix River when compared to the lower Red Cedar River (Figure 13). In addition this data also shows that relative weight values were lower on both rivers during the September sampling period.

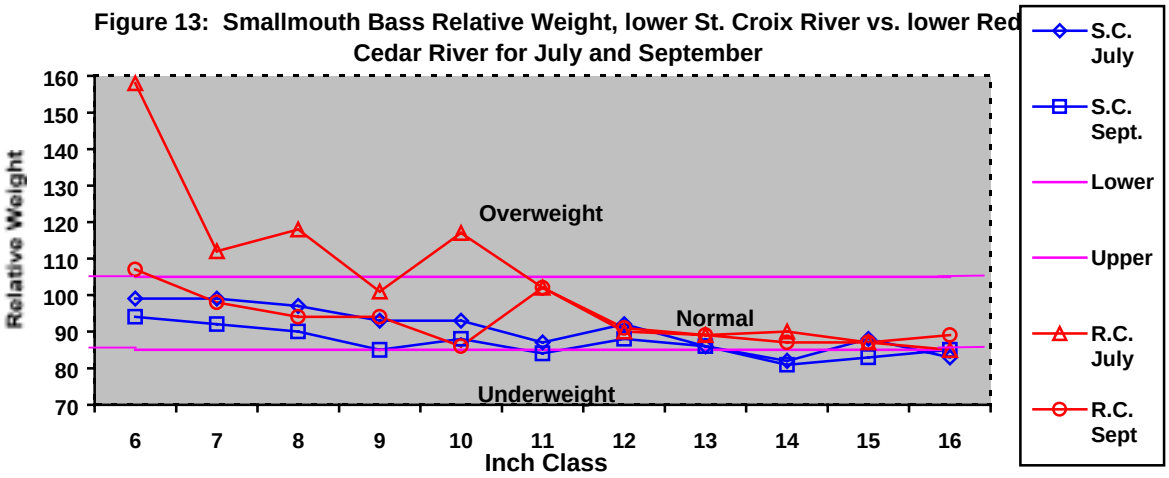


Figure 13: Smallmouth Bass Relative Weight, lower St. Croix River vs. lower Red Cedar River for July and September

Smallmouth Bass Overall

When comparing smallmouth bass population characteristics this information confirms that smallmouth bass recruitment is higher, mortality estimates are comparable but, growth rates are slower and relative weight measures are poorer on the lower St. Croix River when compared to the lower Red Cedar River in western Wisconsin.

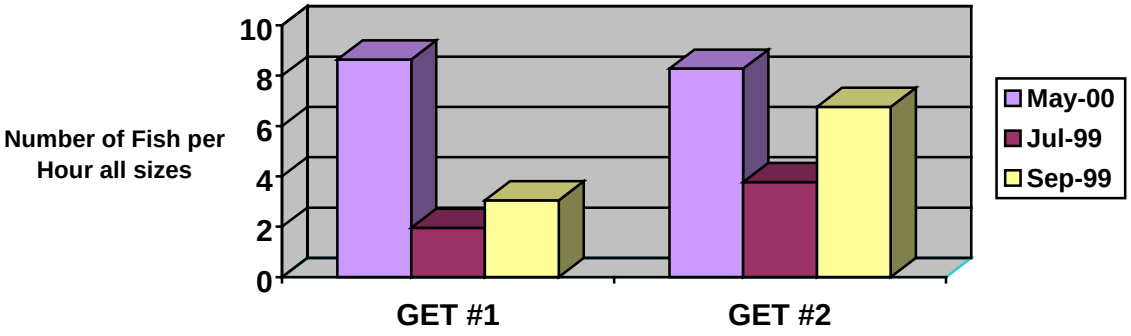
Factors that could possibly be influencing these differences could be attributed to riverine habitat, hydropower operations and higher smallmouth bass abundance. Studies by (Cushman, 1985, Moog 1993, Travenichek, 1995) describe in detail effects from hydropower operations on riverine habitat and biological resources. The lower St. Croix and lower Red Cedar Rivers experience peaking operations from hydropower activities. The lower St. Croix River is much broader and has numerous secondary habitat features such as, backwater bays, sidechannels and cutoff sloughs when compared to the lower Red Cedar River which is confined to a much narrower river channel with few of these secondary habitat features. It is possible that smallmouth bass young are less affected by hydro operations on the lower St. Croix River due to the fact the they could likely seek refuge in these secondary habitats more freely when compared to the lower Red Cedar River. Although smallmouth bass recruitment is higher on the lower St. Croix River, growth rates are slower and relative weight measures are poorer when compared to the lower Red Cedar River. A recent instream flow study conducted by (Johnson, 1995) documented that habitat conditions for smallmouth bass are impacted by current hydropower operations on the lower St. Croix River. Changes in hydropower operations would improve habitat conditions on the lower St. Croix River and could possibly improve growth rates as well as relative weight values for smallmouth bass. Another likely reason why smallmouth bass growth rates and relative weight values are lower on the lower St. Croix is that smallmouth bass abundance is higher when compared to the

lower Red Cedar River. Higher smallmouth bass abundance on the lower St. Croix River likely increases competition for the available forage base within the river.

WALLEYE

Walleye catch per unit of effort ranged from a high of 8.6 fish per hour at GET station # 1 in May to a low of 2.0 fish per hour at GET station #1 in July. Overall, catch rates were higher at GET station #2 (Figure 14). It also appears that there is seasonal movement of walleye on the lower St. Croix River. Both stations had the highest catch rates in May, presumably an upstream migration during the spring spawning season, remain in the river during the summer season and return to the Lake St. Croix during the fall to overwinter. Similar movement of walleye populations have been documented on the upper Red Cedar River in western Wisconsin (Swim, Peavy and Engel 2000).

Figure 14: Lower St. Croix River Walleye CPUE/HR



Mortality Estimates

Catch curves were developed from walleye on the lower St. Croix River from the May sample because of a larger sample size. The total annual mortality rate for various age groups are presented in (Table 3). In addition we compared mortality estimates from the lower Red Cedar which was sampled concurrently with the lower St. Croix River to make comparisons on mortality estimates on the lower St. Croix River. Mortality estimates on the lower St. Croix River are considered to be high and future management efforts should determine what factors may be attributing to this problem.

Table 3. Lower St. Croix River and lower Red Cedar River-Estimated Annual Mortality Rates-Walleye

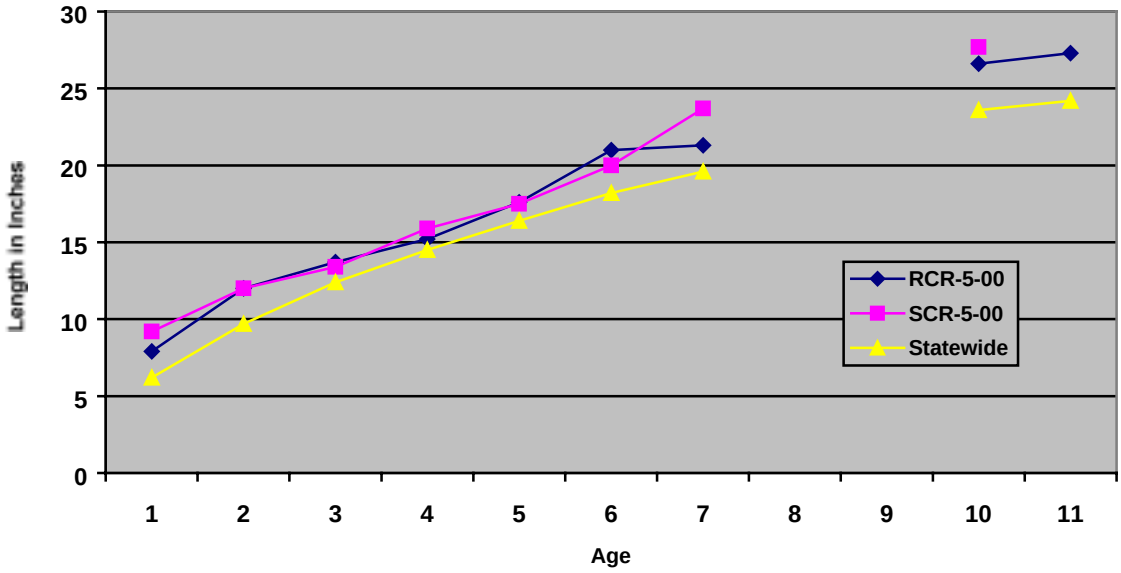
Lower St. Croix River

Month	Year	Age Range	Annual Mortality	R-Squared
May	2000	2-7	53%	0.64
		3-7	66%	0.79
		4-7	77%	0.86
		5-7	79%	0.75

Lower Red Cedar River

Month	Year	Age Range	Annual Mortality	R-Squared
May	2000	2-7	41%	0.79
		3-7	34%	0.63
		4-7	40%	0.57

Figure 15: Mean Length at Age Walleye, lower St. Croix and lower Red Cedar River



Age and Growth

Walleye were aged from the May sampling period. Walleye growth rates on the lower St. Croix River are higher than the statewide average (WDNR, FMRB, 1990) for all age classes. In addition, it appears that walleye are reaching the minimum size limit of 15 inches near the end of the third and during the fourth year of growth (Figure 15, Table 4).

Comparison of walleye growth rates between the lower St. Croix and lower Red Cedar Rivers.

We compared May 2000 aging data collected from the lower St. Croix and lower Red Cedar River located in western Wisconsin (Figure 15). From this information it appears that walleye growth rates for ages 1 through 5 are comparable to the lower Red Cedar in western Wisconsin and both rivers are also above the statewide average. Walleye growth rates for fish between ages 5 and 8 should be used carefully due to a small sample size for both the St. Croix and the Red Cedar River.

It should also be noted for both river systems, male walleye were the predominate sex aged during the May sample. During our sampling events males were still actively expelling milt. We were unable to sex any female walleye during the May sample. Female walleye likely spawned during mid-April and therefore were not unidentifiable during our sampling period.

Table 4. Mean Length at Age walleye, lower St. Croix River.

Year Class	Age	# Aged	SD	Mean Length
1999	1	2	2.05	9.2
1998	2	21	.98	12.0
1997	3	32	1.33	13.4
1996	4	45	1.20	15.9
1995	5	23	1.16	17.5
1994	6	1	0	20.0
1993	7	1	0	23.7
1992	8	0	-----	-----
1991	9	0	-----	-----
1990	10	1	0	27.7

Walleye Overall

Growth rates for walleye on the lower St. Croix River are above the statewide average and comparable to the lower Red Cedar River in western Wisconsin. Mortality estimates were higher when compared to the lower Red Cedar River. Angling pressure and possible seasonal movement of walleye downstream into Lake St. Croix could contribute to the higher mortality rates on the lower St. Croix River. If walleye do make seasonal movements into Lake St. Croix which the data suggest they may, and other studies on the upper Red Cedar River in Wisconsin suggest they do (Swim, Peavy and Engel 2000) angling pressure on Lake St. Croix should be taken into consideration for future management activities on walleye in the riverine section upstream of Marine on the St. Croix. Another factor that should be taken into consideration is that the sample size used to make the mortality estimates was small. It is possible that more species specific work on walleye on the lower St. Croix River could provide more insight into what factors may be influencing walleye mortality rates.

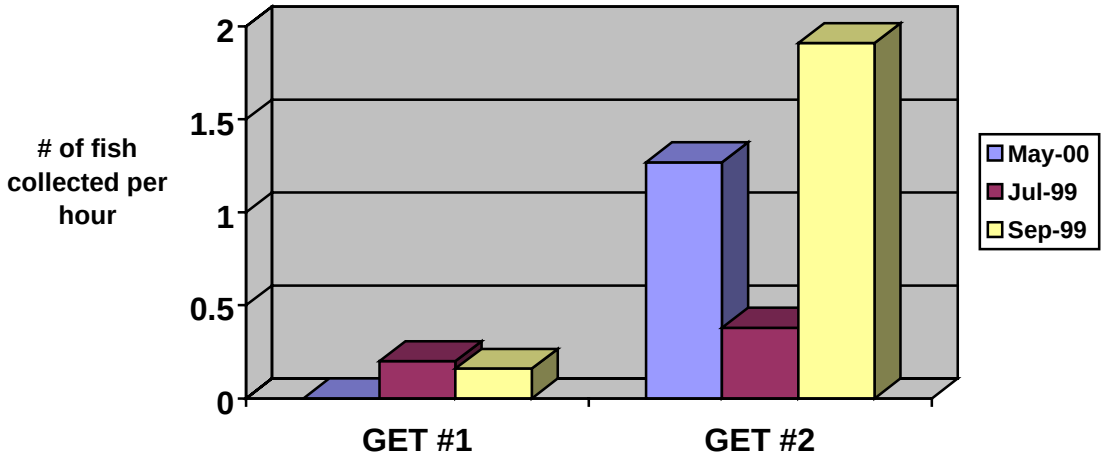
SAUGER

Eight sauger were collected during the May 2000 sampling period. No sauger were collected during the July and September sampling periods. Their presence is considered low on this section of the lower St. Croix River. Since sauger were only captured in May, it provides more evidence of an upstream migration of percids during the spring spawning period.

CHANNEL AND FLATHEAD CATFISH

Channel catfish catch rates were highest during all sampling events at GET station #2 (Figure 16). Only two flathead catfish were captured during all sampling events. Overall catfish were a very minor part of the overall GET catch. Our sampling methods likely underestimate the relative abundance of catfish in the lower St. Croix River.

Figure 16: Lower St. Croix River Channel Catfish (CPUE)



STURGEON

Lake Sturgeon

One lake sturgeon was collected in the September 1999 sampling bout at GET station #2 approximately 3.0 miles upstream from Marine on the St. Croix. The fish was 43.6 inches in length and weighed 14 pounds 4 ounces No other lake sturgeon were collected during our sampling events. Our sampling techniques likely under-represent lake sturgeon relative abundance.

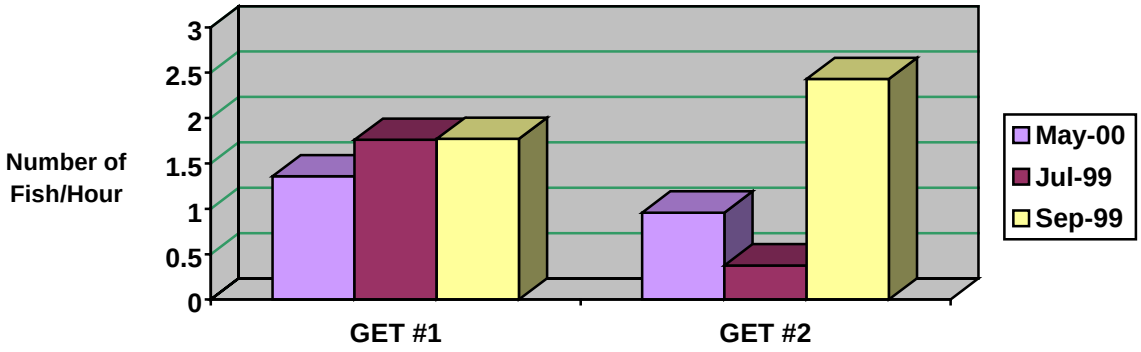
Shovelnose Sturgeon

Sampling of the lower St. Croix River during the three sampling bouts yielded no shovelnose sturgeon. Shovelnose sturgeon were also not found in the lower St. Croix River during the Wisconsin Fish Distribution Survey, but it appears that habitat conditions are suitable and similar to other large rivers in Wisconsin were shovelnose populations are known to exist. Wisconsin Department of Natural Resources staff observed shovelnose sturgeon near Interstate Park during the 1999 field season when conducting mussels surveys using diving gear (Benjamin, personal communication). Further sampling efforts and research should be conducted to determine the status of the shovelnose sturgeon fishery on the lower St. Croix River.

NORTHERN PIKE

Catch per unit of effort for northern pike were highest during the September sampling period at both stations (Figure 17). Northern pike catch rates were more variable at GET station #2 when compared to GET station #1. It should be noted that electrofishing for northern pike is not the preferred sampling method and is highly gear biased.

Figure 17: Northern Pike Catch Rates-Lower St. Croix River



MUSKELLUNGE

The Minnesota DNR has been stocking muskellunge in the lower St. Croix River for the past decade. Our sampling efforts documented three adult muskellunge in the July sample. Most fish were collected near the mouths of small coldwater tributary streams that drain into the lower St. Croix River. These fish are likely seeking thermal refuge in the hot summer months in these locations. Muskellunge stocking could continue at a low rate to provide a low density quality sized river muskellunge fishery, which will provide the angling community additional quality recreational experiences.

ENDANGERED AND THREATENDED SPECIES

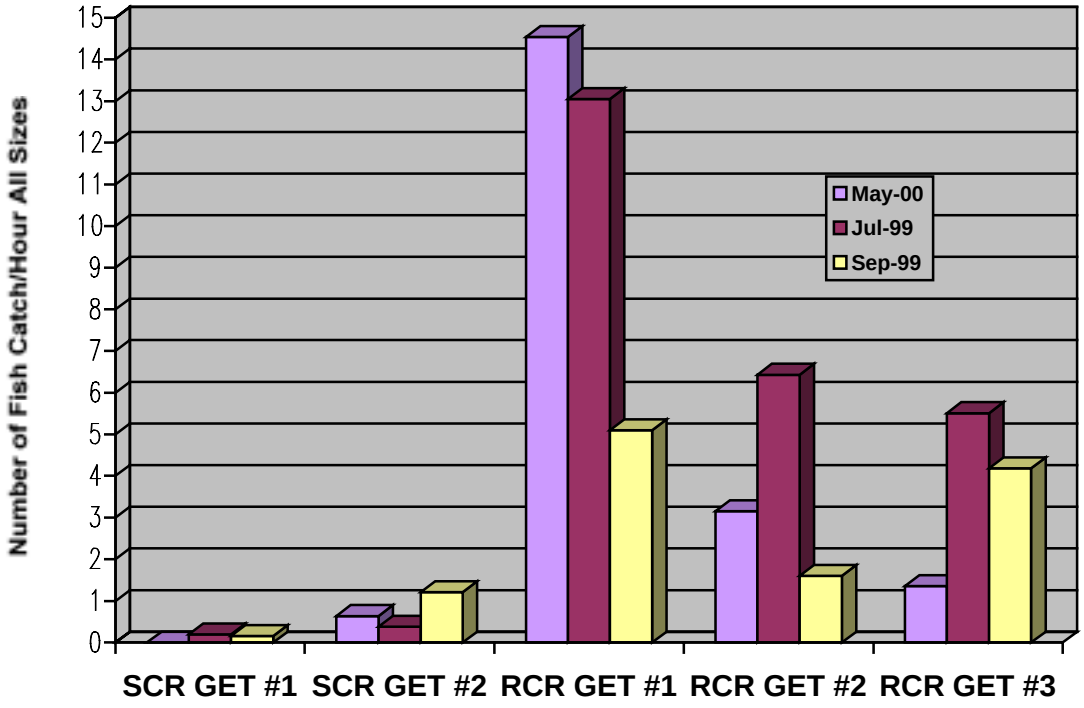
Blue Sucker

Blue sucker were the second most abundant species collected that is listed as threatened or endangered under Wisconsin state law in the lower St. Croix River. Our sampling efforts yielded fourteen blue sucker. Blue sucker were typically captured in deep-fast type habitat usually on the outside bend of the river in the thalweg and usually associated with some form of woody-debris cover in 3-6 feet of water.

Catch rates for blue sucker also varied considerably by site and also on a seasonal basis. Catch rates at GET station #1 were lowest during all three seasonal sampling periods. The highest catch rate was observed in September at GET station #2 (Figure 18). Although we captured fourteen blue sucker in the lower St. Croix River, when compared to the lower Red Cedar River in western Wisconsin, blue sucker relative abundance is substantially lower (Figure 18).

.

Figure 18: Blue Sucker Catch Rates, Lower St. Croix River vs lower Red Cedar River, Wisconsin.



Greater and River Redhorse

Greater and river redhorse are listed as threatened species under Wisconsin law. Greater and river redhorse were collected during all sampling bouts on the lower St. Croix River. Catch rates were combined because of potential identification errors during gamefish runs. Since identification errors were likely during the GET runs, catch per hour information from the gamefish runs will not be reported in this report. It is our opinion that the majority of redhorse captured were river redhorse, but both species were captured on the lower St. Croix River.

Black Buffalo

Black buffalo is listed as a threatened species under Wisconsin law. Our sampling efforts recorded one black buffalo during the May sampling period. It was collected approximately 1.5 miles upstream of the Osceola bridge on the Minnesota side of the river. This is the first recorded specimen from the lower St. Croix River. Wisconsin DNR staff also captured a black buffalo on the lower Red Cedar River during May of 2000 (Benike, 2001) which may indicate that there may be a spring spawning run out of the larger Mississippi River into major tributary streams such as the lower St. Croix River.

Gilt Darter

The gilt darter is listed as a threatened species under Wisconsin law. There was only one gilt darter documented throughout the entire survey. It was collected, just downstream from the boat landing at interstate state park (at SFA #1) in a large gravel/cobble run on the Wisconsin side of the river in one foot of water during the May sampling period.

Crystal Darter

No crystal darter were captured during our sampling events. Histroically crytsal darter have been documented in lower St. Croix River (Fago 1984). Wisconsin Department of Natural Resources divers have witnessed crystal darter during a 1998 mussel survey near the boat landing at interstate state park (Endris, personal communication). We sampled this area but were unsuccessful in collecting any crystal darters. It is likely that they are still present, but in very low numbers.

Endangered and Threatened Species Overall

From the survey information that was collected river redhorse occurrence is common; greater redhorse and blue sucker abundance is considered low; gilt darter and black buffalo are considered to be rare

Future management of all endangered and threatened species should be considered a high priority for the Department. There are few places in the upper midwest, where fish species diversity is higher. Many of the species found here represent some of the last remaining strong holds for large river fishes in the upper midwest. Protection, maintenance and restoration of aquatic habitat and water quality conditions on the lower St. Croix River is of utmost importance.

Comparison between sampling periods

We collected 64 species of fish using all sampling techniques on the lower St. Croix River. The Wisconsin Fish Distribution Survey (Fago, 1984) reported 56 species of fish downstream of the St. Croix Falls dam. Of the 64 species collected during our sampling efforts, we documented fourteen new species that had not been previously recorded on the lower St. Croix River from the Wisconsin Fish Distribution Survey. Those fish documented for the first time on the lower St. Croix River are the american eel, mud darter, silver chub, gizzard shad, river carpsucker, black buffalo, smallmouth buffalo, blacknose dace, slenderhead darter, burbot, blue sucker, flathead catfish, weed shiner and brook trout. Six species that were captured on the lower St. Croix River during the Wisconsin Fish distribution survey were not captured during our sampling events they are the pugnose minnow, speckled chub, golden shiner, spottail shiner, white crappie and crystal darter. There presence is still likely, their absence is likely due to the fact that we did not sample backwater habitats or that their abundance in the river is extremely low.

Management Recommendations

1. **Habitat Protection**: Protecting and maintaining aquatic habitat conditions should be a high priority for the Department within the lower St. Croix River corridor. Protection should consist of fee-title acquisition or easement acquisition of riparian lands along the lower St. Croix River. Protection of this corridor would protect critical near shore-habitat, minimize bank disturbance and development and add to the scenic beauty of the lower St. Croix River.

2. **Habitat Restoration:** Aquatic habitat conditions should be restored by making operational changes at the St. Croix Falls hydroelectric facility. The instream flow study that was conducted by the Minnesota Department of Natural Resources documented that the current operational regime on the lower St. Croix River is providing sub-optimal habitat conditions for many members of the lower St. Croix River fish community.

3. **Trends Monitoring**: The Department should continue long-term trend monitoring on the lower St. Croix fish community. Trend information will allow local management staff to determine if the native fish community is stable, improving or decreasing through time following the nonwadeable baseline monitoring protocol.

4. **Life History Information:** The Department should develop species specific management projects in an effort to collect life history information on important fisheries resources in the lower St. Croix River. Acquisition of movement information, spawning requirements etc. for select endangered and threatened species as well as, select gamefish and non-gamefish communities is needed. More specifically the Department should determine what factors might be influencing walleye mortality on the lower St. Croix River.

4. **Warmwater Habitat Restoration:** Fisheries staff should consider developing warmwater habitat improvement projects and/or restoration projects on the lower St. Croix River. Such projects could consist of spot-treatment bank stabilization, boulder clusters, woody-debris/snag incorporation, connection of backwater oxbows, or restoration of native shoreline plant communities.

5. **Fish Passage Opportunities:** The Department should consider whether fish passage opportunities would be justified at the St. Croix Falls Dam.

6. **Dam Construction/Removal:** The Department should not allow any new dams to be constructed on the lower St. Croix River. This free-flowing, large riverine habitat represents some of the rarest fish communities in the Upper Midwest and if additional dams were to be constructed on the lower St. Croix River, those native fish communities would likely be lost. In addition, at some future point, if hydropower production at the St. Croix Falls Dam is abandoned or becomes uneconomical due to alternative energy sources in the future, the Department should consider whether removal of this structure is warranted.

7. **Future Fish Stocking Practices:** The Department should not stock or permit any stocking of gamefish species on the lower St. Croix River with one exception. The river is stocked with a low number of muskellunge fingerlings by the Minnesota

DNR which provides a low density but a quality sized river muskie fishery. In certain circumstances, recovery stocking for species may be needed at some point if deemed appropriate.

Literature Citations

Benike, H.M. 2001. Lower Red Cedar River Baseline Monitoring-Fisheries Inventory. Wisconsin Department of Natural Resources, West Central Region.

Benjamin, Ron 2001. Mississippi/Lower St. Croix Fisheries Supervisor. Wisconsin Department of Natural Resources. Personal Communication.

Bister etal, 2000. Proposed Standard Weight Equations and Standard Length Categories for 18 Warmwwater Nongame and Riverine Fish Species. North American Journal of Fisheries Management 20:570-574.

Bonner and Wilde 2000. Changes in the Canadian River Fish Assemblage Associated with Reservoir Construction. Journal of Freshwater Ecology. Volume 15, Number 2.

Bowen Z.H. 1998. Evaluation of Generalized Habitat Criteria for Assessing Impacts of Altered Flow Regimes on Warmwater Fishes. Transaction of the American Fisheries Society, 127: 455-468.

Carlander, K. D. 1982. Standard Intercepts for Calculating Lengths from Scale Measurements for Some Centrachid and Percid Fishes. Transactions of the American Fisheries Society. 111: 332-336.

Cushman, R M. 1985. Review of Ecological Effects of Rapidly Varying Flows Downstream from Hydroelectric Facilities. North American Journal of Fisheries Management. 5:330-339.

Dammen, L. 1996. Upper St. Croix Boundary Waters Smallmouth Bass Management. Wisconsin Department of Natural Resources, internal memo.

Endris, M.B. WDNR. West Central Region-Fisheries Expert. Personal Communication.

Fago, D. 1986. Distribution and Relative Abundance of Fishes in Wisconsin. VII. St. Croix River Basin. Technical Bulletin No. 143. WDNR.

Johnson, Shawn L. 1995. Instream flow requirements of Quadrula fragosa and the aquatic community in the lower St. Croix River downstream of the Northern States Power Hydroelectric Dam at St. Croix Falls, Wisconsin. MDNR, Ecological Services.

Kolander, T.D., D.W.Willis and B.R. Murphy. 1993. Proposed revision of the standard weight (W_s) equation smallmouth bass. N. Amer. J. Fish. Mgmt. 13:398-400.

Langhurst and Schoenike 1990. Seasonal Movement of Smallmouth Bass in the Embarrass and Wolf Rivers, Wisconsin. North American Journal of Fisheries Management 10: 224-227.

Lyons, Piette and Niermeyer 2001. Development, Validation and Application of a Fish-Based Index of Biotic Integrity for Wisconsins Large Warmwater Rivers. Transactions of the American Fisheries Society. 130: 1077-1094, 2001.

Moog 1993. Quantification of Daily Peak Hydropower Effects on Aquatic Fauna and Management to Minimize Environmental Impacts. Regulated Rivers. Vol. 8, 5-14.

Sorge, Patrick. Lakes Specialist, Wisconsin Department of Natural Resources, Personal Communication.

Swim, Engel and Peavy. 2000 Comprehensive Lake Survey-Tainter Lake. Wisconsin Department of Natural Resources. Lower Chippewa River Basin.

Travenichek etal. 1995. Recovery of a Warmwater Fish Assemblage after the Initiation of a Minimum Flow Release Downstream from a Hydroelectric Dam. Transactions of the American Fisheries Society. 124: 836-844.

USGS 1999. Water Resources Data Wisconsin Year 1999. Water Data Report WI-99-1.

WDNR. 1990. Fish Management Reference Book. Wisconsin Department of Natural Resources internal publication, Madison, WI.

Appendix A:

A. Species comparisons 1999-2000 sampling vs 1984 WDNR Fish Distribution Survey
B. CPUE Data from GET Runs
C. Seasonal Catch by Gear Type
D. Length Distribution for Gamefish and Select Threatened Species