Aquatic Invasive Species Monitoring Project

Year End Report

To the

Fox River Navigational System Authority

By

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January 24, 2007

Objectives

As stated in the Aquatic Invasive Species (AIS) Control and Monitoring Plan of the Fox River Navigational System Authority (FRNSA, April 2006 version, Appendix B), the objective of the Rapid Croche AIS Monitoring Plan is to "monitor the presence and map the distribution of fish and invertebrate AIS in the Fox River two pools immediately up and downstream of Rapide Croche Lock."

Following consultation with the AIS Committee, the plan was amended to include sampling of three pools immediately upstream and downstream of the Rapide Croche Lock. The project was conducted under the supervision of Dr. Bart De Stasio, Ph.D., of the Department of Biology, Lawrence University, Appleton, WI. Two students were employed for the summer on the project, one funded by the FRNSA and the other through a grant from the Excellence in Science Fund, Lawrence University.

Sampling Design

Monitoring occurred at six sites along the lower Fox River, WI during the summer of 2006. Three sites were located above the Rapide Croche Lock and Dam (FR1, FR2, FR3; Figure 1 and Table 1). Each sampling site designated a general area for sampling efforts, and was further separated into mid-channel versus near-shore sampling locations, depending on the type of sampling performed. Monitoring took place on 14 days during the summer of 2006 (Table 2). Separate boats provided by

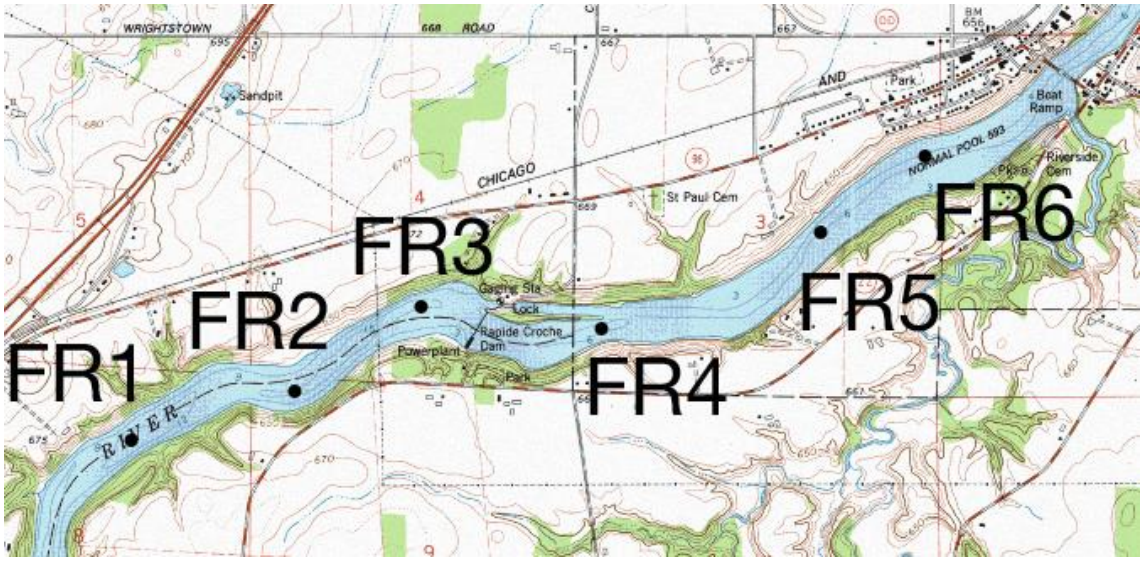

Figure 1. Map of sampling locations along the lower Fox River, WI during summer 2006.

the FRNSA were employed above and below the dam on each date. Upstream and downstream locations were sampled on different days, and all nets and equipment were washed thoroughly and dried prior to the next sampling.

Table 1. Latitude and Longitude coordinates of the six sampling sites along the lower Fox River, WI during summer 2006.

Location	Latitude	Longitude
Upstream of Rapide Croche		
FR1	N 44º 18.887	W 88º 12.691
FR2	N 44º 18.889	W 88º 12.576
FR3	N 44º 19.077	W 88º 11.962
Downstream of Rapide Croche		
FR4	N 44º 18.947	W 88º 11.413
FR5	N 44º 18.952	W 88º 11.022
FR6	N 44º 19.238	W 88º 10.531

Table 2. Sampling effort above and below the Rapide Croche Dam on the lower Fox River, WI during summer 2006. Dates on which sampling was performed are indicated for each type of sampling effort. Totals indicate the total number of samples collected, and for fish trapping, the total number of hours of effort in trapping.

Date	Plankton Tows	Benthic Grabs	Seine Netting	Dip Nets	Fish Trapping
6/19	X	X	X	X	
6/29					X
7/6	X	X			X
7/12					X
7/13 - 7/14			X	X	
7/20 - 7/21	X	X	X	X	X
7/25	X	X	X	X	
7/27	X	X	X	X	
8/3 - 8/4	X	X			X
8/7			X	X	
8/9	X	X	X	X	
Totals:					
- above	12	24	43	120	12 (288 hrs)
- below	9	18	75	150	12 (456 hrs)

Sampling Methods

Plankton: Duplicate oblique tows were performed at the mid-channel location of each site using a Wisconsin-type plankton net with retaining collar (mouth diameter=0.13m, mesh size=63 um). Additional samples collected with a net with 153-um mesh were also obtained initially, but were found to be redundant with the 63-um mesh samples. All subsequent sampling employed 63-um mesh nets. Samples were preserved in Formalin (4% buffered sucrose-formaldehyde solution) and examined in the laboratory using 10X to 400X magnification. All zooplankton in the samples were identified to the species level, when possible, using Edmonson (1965), Balcer et al. (1984), Pennak (1989),

Hopkins (1990), and Thorp and Covich (1991). Abundances in samples were not enumerated, but entire samples were examined to determine presence of each species.

Benthic invertebrates: Mid-channel areas were sampled using a standard Ekman grab sampler (0.15m X 0.15m box size). Duplicate grab samples were collected at each site and filtered through a wash bucket with mesh bottom (mesh size=500um). Both shoreline areas at each site were sampled with a combination of dip netting and beach seining techniques. Animals captured were washed into sorting trays and transferred with forceps to bottles with sugared Formalin. Specimens were identified in the laboratory to the species level, where possible, using the references listed above for plankton identifications and Hilsenhoff (1995).

Invertebrates that attach to solid substrates from a planktonic phase (i.e. zebra and quagga mussel veligers, *Dreissena polymorpha* and *D. bugensis*) were sampled using floating periphyton samplers. Each sampler contained 16 glass slides suspended in the water, onto which organisms settled. Samplers were anchored at each of the sites above and below the dam for two consecutive two-week sampling periods (above dam: 7/14/06 - 7/27/06 and 7/27/06 - 8/9/06; below dam: 7/12/06 -7/25/06 and 7/25/06-8/7/06). Glass slides were removed at the end of each two-week period and preserved in sugared Formalin. Specimens on the slides were identified to the species level, when possible, using the references listed previously.

Fish: Fish were sampled at each of the sites using a combination of trapping and seining techniques. Two sizes of cod-end type traps were employed; standard "minnow" traps (length=0.42m, opening=22mm, mesh=6.4mm) and larger hand-made traps of the same design (length=2m, opening=125mm, mesh= 12.5mm). Traps were deployed for a maximum of 24 hours, emptied, and redeployed during five different periods of the summer (see Table 2). Traps were set with and without bait (cheese, bread, frozen fish) on different dates to optimize the potential catch. Trapping included mid-channel as well as shoreline locations at each site. If possible, specimens were identified in the field to the species level and then released. Specimens of new species compared to existing records or specimens difficult to identify in the field were preserved in Formalin. Upon return to the laboratory specimens were transferred to ethyl alcohol (70%) for long-term preservation. Specimens were identified to the species level when possible, using Hubbs and Lagler (2004), Lyons et al. (2000), and the Wisconsin Fish ID software (2005).

Results

Fish:

A total of 17 species of fish were collected from the six sites during the summer of 2006 (Table 3). The majority of these species were sampled downstream of the Rapide Croche Lock and Dam (15 out of 17), while only 9 out of the 17 species were found upstream of Rapide Croche Dam. None of the species documented are considered "invasive" currently, but the common carp is a well-established non-native species to the Fox River. No sea lamprey (*Petromyzon marinus*) were collected at any sites during 2006.

Table 3. Fish species documented above and below the Rapide Croche Dam, WI during summer 2006.

Above	Below
	Blacknose shiner *Notropis heterolepis*
Emerald shiner	Emerald shiner *Notropis atherinoides*
	Mimic shiner *Notropis volucellus*
Spottail shiner	Spottail shiner *Notropis hudsonius*
Johnny darter	Johnny darter *Etheostoma nigrum*
Smallmouth bass	Smallmouth bass *Micropterus dolomieu*
Common carp	Common carp *Cyprinus carpio*
	Fathead minnow *Pimephales promelas*
Green sunfish	Green sunfish *Lepomis cyanellus*
Bluegill	Bluegill *Lepomis macrochirus*
	Bluntnose minnow *Pimephales notatus*
	Bigmouth buffalo *Ictiobus cyprinellus*
	Yellow perch *Perca flavescens*
	Trout-perch *Percopsis omiscomaycus*
	Rock bass *Ambloplites rupestris*
Logperch *Percina caprodes*	
Channel catfish *Ictalorus punctatus*	

Benthic Invertebrates:

There were more groups of benthic invertebrates found below the Rapide Croche Dam than above the dam (Table 4). Of the 13 groups documented below the dam, two are considered aquatic invasive species. These are the zebra mussel and the Rusty crayfish. Both of these species were also collected from the sites above the dam. Zebra mussels were especially thick in many areas, and the Rusty crayfish was very abundant in most shoreline areas.

Table 4. Benthic invertebrate taxa documented above and below the Rapide Croche Dam during summer 2006. Highlighted groups are considered "invasive" species.

Above	Below
Dreisenna polymorpha (zebra mussel)	*Dreisenna polymorpha* (zebra mussel)
Orconectes rusticus (Rusty crayfish)	*Orconectes rusticus* (Rusty crayfish)
Chironomus sp. (midge fly)	*Chironomus sp.* (midge fly)
Coenagrion sp. (damsel fly)	*Coenagrion sp.* (damsel fly)
Buenoa sp. (water boatman)	*Buenoa sp.* (water boatman)
Dineutus sp. (whirligig beetle)	*Dineutus sp.* (whirligig beetle)
Caddisfly larvae (on periphyton samplers)	Caddisfly larvae (on periphyton samplers)
Lymnaea sp. (freshwater snail)	
Progomphus sp. (dragonfly)	*Progomphus sp.* (dragonfly)
	Libellulidae sp. (dragonfly)
	Dromogomphus sp. (dragonfly)
	Peltedytes sp. (beetle)
	Hexagenia sp. (mayfly)
	Caenidae sp. (mayfly)

Plankton:

The composition of the zooplankton communities were more similar above and below the dam than was the case for either fish or benthic invertebrates (Table 5). A total of 22 species of zooplankton were recorded, with the majority of them occurring in both locations. Nineteen groups occurred upstream while 17 species were found at sites below the dam. None of the groups identified are considered aquatic invasive species at this time.

Table 5. Zooplankton documented from sites above and below the Rapide Croche Dam during Summer 2006. None of the groups observed are considered "invasive" species.

Above	Below
Acanthocyclops vernalis	*Acanthocyclops vernalis*
Alona sp.	
Bosmina sp.	*Bosmina sp.*
Chydorus sp.	
Cyclopoid copepodite	
Daphnia galeata mendotae	*Daphnia galeata mendotae*
Daphnia longiremis	*Daphnia longiremis*
Daphnia pulicaria	
Daphnia retrocurva	*Daphnia retrocurva*
Daphnia schodleri	*Daphnia schodleri*
Diacyclops thomasi	*Diacyclops thomasi*
Diaphanosoma sp.	*Diaphanosoma sp.*
Eubosmina sp.	*Eubosmina sp.*
Leptodiaptomus ashlandi	*Leptodiaptomus ashlandi*
Leptodiaptomus sicilis	*Leptodiaptomus sicilis*
Leptodiaptomus siciloides	*Leptodiaptomus siciloides*
Mesocyclops edax	*Mesocyclops edax*
Skistodiaptomus oregonensis	*Skistodiaptomus oregonensis*
Leptodora kindti	
	Harpacticoid copepod
	Eucyclops agilis
	Chaoborus sp.

Education and Outreach

Website:

We have created a website that is specific for the Aquatic Invasive Species Monitoring Program (http://www.lawrence.edu/dept/biology/FRNSA). The site will contain descriptions of our sampling design and procedures, past and current data on presence and absence of species, and links to related web pages and resources. We envision this website being the primary location for dissemination of our findings for the public with an interest in the Fox River Locks project.

Fox River Academy Collaboration:

We have established a close collaboration with the Fox River Academy, the Environmental Charter School of the Appleton Area School District (http://www.aasd.k12.wi.us/FoxRiverAcademy/). This grade 3-8 school-within-a-school uses topics related to the Fox River watershed as a focus for an integrated curriculum. My students and I have worked with the teachers and students this past year on sampling and the ecology of the Fox River, and highlighted the topic of invasive species and the restoration of the lock system. Students in grades 7 and 8 are required to complete projects related to the Fox River, and we will work with some of these students on topics related to the FRNSA activities. Some projects may include public education on FRNSA activities in addition to other aspects. We envision this collaboration as a way to further educate the public about FRNSA activities in addition to highlighting the importance of the Fox River in our communities.

Suggested Modifications

Our methodology for sampling plankton and benthic invertebrates appear to be giving us good assessment of the taxa present in each of the sites. The fish sampling during 2006 provided important baseline information for the majority of species present. Other species that have been shown in the past to be resident in the lower Fox River below the Rapide Croche Dam were not observed (Cochran 1994, Cochran and Hesse 1994, ThermoRetec 2001). These would include species such as sea lamprey (*Petromyzon marinus*) and white perch (*Morone Americana*), both of which occur in Green Bay and the lower Fox River. We did not expect to catch sea lamprey in 2006 because our sampling program started after the typical time period of the spring spawning run (i.e. May). Our intention is to deploy lamprey traps upstrteam and downstream of the Rapide Croche Dam this coming spring to determine whether lamprey occur above and below the dam. Our sampling techniques should be catching white perch if they are present, but we are currently discussing with University of Wisconsin-Madison the feasibility of performing one or more electroshocking surveys above and below the Rapide Croche Dam to augment our sampling methods. This might produce more complete results for the fish surveys.

Another change to the present arrangement would be to allocate funds to hire two students on this project each year instead of a single student. I was able to secure a grant from Lawrence University this past year to hire a second student for the project, but this will not likely be possible each year. I will again apply for such a grant, but this is not a certainty this year. Once trained, my students are fully capable of conducting all the sampling on their own, but it is important to have at least two individuals in the boat while sampling, both for logistical as well as safety reasons. I am not being paid for my time on this project, and training the students in the field, supervising their work in the laboratory and checking identifications is about the limit of my available time. Therefore, having two students hired on the project is really necessary. This number of workers is also good for dividing the duties for processing samples and identification of the various types of organisms.

Conclusions

The initial year of sampling for aquatic invasive species in the lower Fox River demonstrated that some invasive species are already present both above and below the Rapide Croche Dam. Both zebra mussels and Rusty crayfish were present at all sites examined above and below the dam in 2006. The data did not show the presence of other invasive species that have been observed below the dam previously (e.g. sea lamprey, white perch). Our sampling methods planned for the coming year should detect the presence of these species, as well as others that are likely to arrive soon, such as the round goby (*Neogobius melanostomus*). In addition, the collaboration with the Fox River Academy and the website we created this year should facilitate continued educational efforts related to the restoration of the Fox River lock system.

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