

Aquatic Invasive Species Monitoring Project

Year 2016 Report

To the

Fox River Navigational System Authority

By

Bart De Stasio, Ph.D.

**Department of Biology
Lawrence University
Appleton, WI 54911**

September 29, 2016

Objectives

The Aquatic Invasive Species (AIS) Control and Monitoring Plan of the Fox River Navigational System Authority (FRNSA, 2009 update) has the stated objective to “Monitor the presence and map the distribution of fish and invertebrate AIS in the Fox River three navigation pools immediately up and downstream of the Rapide Croche Lock.” Under the supervision of Dr. Bart De Stasio, Ph.D., Lawrence University, three students (Cherise John, Jori Warwick and Rachel Wilson) were employed during the summer of 2016 to carry out the investigations. Cherise John was supported by an Advanced Opportunities Small Grant from the Wisconsin Louis Stokes Alliance for Minority Participation (WiscAMP) program funded through the National Science Foundation.

Sampling Design

Monitoring occurred at six sites along the lower Fox River, WI during the summer of 2016 (Table 1, Figure 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. We conducted 25 different sampling trips on 17 days during the summer (Table 2). Sites were sampled three to five times over the course of the summer. Separate boats were employed upstream and downstream of the Rapide Croche dam site on each date, and all nets and equipment were sanitized thoroughly using bleach prior to the next sampling event according to the protocols established by the WI DNR to prevent the spread of AIS (http://dnr.wi.gov/topic/fishing/documents/vhs/disinfection_protocols.pdf).

Table 1. Latitude and Longitude coordinates of the sites sampled along the lower Fox River, WI during summers 2008-2016.

Location	Latitude	Longitude
Upstream of Rapide Croche		
FR-A (above Cedar lock)	N 44° 16.562	W 88° 20.541
FR-B (above Kaukauna Guard lock)	N 44° 16.665	W 88° 17.042
FR-3 (above Rapid Croche lock)	N 44° 19.077	W 88° 11.962
Downstream of Rapide Croche		
FR-4 (below Rapid Croche lock)	N 44° 18.947	W 88° 11.413
FR-C (above DePere dam)	N 44° 25.813	W 88° 04.273
FR-D (below DePere dam)	N 44° 27.742	W 88° 03.354

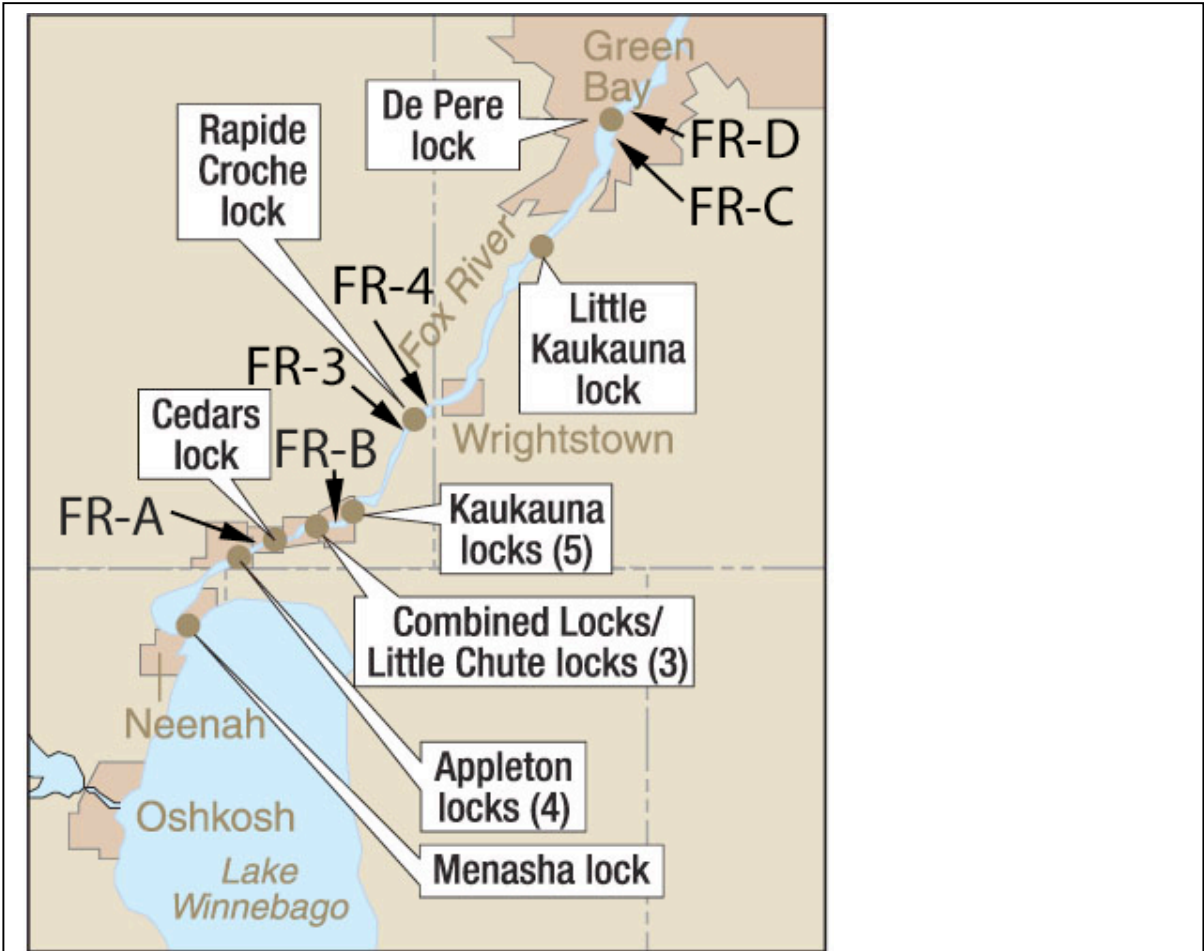


Figure 1. Map of sampling locations along the lower Fox River, WI.

Table 2. Sampling effort upstream and downstream of the Rapide Croche dam on the lower Fox River, WI during summer 2016. Dates on which sampling was performed at each site are indicated for each type of sampling effort.

Site & Date	Dip Net	Plankton Tow	Benthic Grab	Seine Netting	Fish Trap
FR-A 6/21/16	X	X	X	X	
FR-B 6/21/16	X	X	X	X	
FR-3 6/24/16	X	X	X	X	
FR-C 6/28/16	X	X	X		
FR-D 6/28/16	X			X	
FR-4 6/29/16	X	X	X	X	
FR-A 6/30/16					X
FR-A 7/5/16	X	X	X	X	X
FR-B 7/5/16	X	X		X	
FR-3 7/6/16	X	X	X	X	
FR-C 7/12/16	X	X	X		
FR-D 7/12/16	X	X	X	X	X
FR-4 7/14/16	X	X			X
FR-A 7/19/16	X	X	X	X	
FR-B 7/19/16	X	X	X	X	X
FR-B 7/26/16					X
FR-D 7/26/16					X
FR-C 7/28/16					X
FR-3 7/28/16	X	X	X	X	X
FR-A 8/2/16	X	X	X	X	
FR-B 8/2/16	X	X	X	X	
FR-D 8/4/16	X	X	X	X	X
FR-C 8/9/16	X	X	X		X
FR-4 8/9/16	X	X	X	X	X
FR-3 8/10/16					X

Sampling Activities

Fish: Fish were sampled at each site using a combination of trapping, netting and seining techniques. Three sizes of cod-end type traps were employed; standard “minnow” traps (length=0.42m, opening=22mm, mesh=6.4mm), elongated eel traps (length=0.78m, opening=40mm, mesh=6.4mm), and larger hand-made traps of the same design (length=2m, opening=125mm, mesh= 12.5mm). Traps were deployed without bait for a maximum of 24 hours, emptied, and redeployed during July and August at each site (see Table 2). Netting included mid-channel as well as shoreline locations at each site using standard hoop nets (2ft diameter, 10ft length, 1in square mesh) either unbaited or using frozen cod as bait. We also conducted at least three (and up to five) beach seine hauls at each shoreline location on each sampling day (1/4 inch mesh, 4 foot height, 20 foot

length). If possible, fish were identified in the field to the species level and then released. Specimens of new species compared to existing records, non-native species, or specimens difficult to identify in the field were saved live for later identification in the laboratory. Specimens were transported to Lawrence University in accordance with WI Administrative Code NR 40 and all applicable permitting requirements under a WI Scientific Collector's permit (SCP-NER-148). Upon return to the laboratory specimens were frozen for disposal or 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).

Benthic invertebrates: Mid-channel areas were sampled using a standard Ekman grab sampler (0.15m X 0.15m box size). Replicate grab samples were collected at each site and filtered through a wash bucket with mesh bottom (mesh size=500um). Shoreline areas at each site were sampled with a combination of dip netting and beach seining techniques (generally until no new taxa were obtained). Animals captured were washed into sorting trays, picked into sealed containers and later preserved with 80% ethyl alcohol. Specimens were identified in the laboratory to the genus or species level, when possible, using the references listed above for plankton identifications as well as Pecharsky *et al.* (1990), Merritt *et al.* (2008) and Hilsenhoff (1995).

Plankton: On each sampling date 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). Samples were preserved in 80% ethyl alcohol 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.

Results

Fish:

A total of 17 species of fish were collected from the six sites during the summer of 2016 (Table 3). Nine species of fish were observed downstream of the Rapide Croche barrier, while 13 of the total 17 species were found upstream of Rapide Croche. As in the previous year, only one invasive fish species, the round goby (*Neogobius melanostomus*), was documented during the summer. Round goby was found at all sites below Rapide Croche, and was not observed at any of the sites above the barrier (which extends upstream to the pool above the Cedar Lock).

Table 3. Fish species presence documented in the lower Fox River, WI upstream and downstream of the Rapide Croche dam during summer 2016. A value of one indicates presence. Sites FR-A, -B and -3 are upstream, with FR-4, -6, -C and -D downstream of Rapide Croche dam. The round goby (highlighted) was the only invasive fish species observed.

Fish	FR-A	FR-B	FR-3	FR-4	FR-C	FR-D
<i>Ambloplites rupestris</i> (Rock Bass)	1	1	1		1	1
<i>Alosa pseudoharengus</i> (Alewife)						1
<i>Cyprinus carpio</i> (common carp)	1					
<i>Etheostoma nigrum</i> (Johnny darter)		1	1			
<i>Lepisosteus osseus</i> (Longnose Gar)		1	1			
<i>Lepomis cyanellus</i> (green sunfish)	1					
<i>Lepomis gulosus</i> (Warmouth)						1
<i>Lepomis macrochirus</i> (Bluegill)		1	1			
<i>Micropterus dolomieu</i> (Smallmouth bass)	1					1
<i>Micropterus salmoides</i> (Largemouth bass)	1	1	1			
<i>Neogobius melanostomus</i> (Round goby)				1	1	1
<i>Notropis atherinoides</i> (Emerald Shiner)	1		1			1
<i>Notropis heterolepis</i> (Blacknose Shiner)			1			
<i>Notropis hudsonius</i> (Spottail Shiner)	1	1	1	1		
<i>Luxilus cornutus</i> (Common Shiner)				1		
<i>Perca flavescens</i> (Yellow Perch)	1	1	1		1	1
<i>Pomoxis nigromaculatus</i> (Black Crappie)		1				
TOTALS	8	8	9	3	3	7

Benthic Invertebrates:

There were 55 groups of benthic invertebrates observed during the summer of 2016, with 50 occurring upstream and 16 downstream of the Rapide Croche barrier (Table 4). Zebra mussels were observed at all sites both above and below Rapide Croche. Rusty crayfish were found at one site above the Rapide Croche) and one below the barrier. One invasive amphipod species (“side-swimmer”) was observed just above the Rapide Croche dam.

Table 4. Benthic invertebrate taxa documented upstream and downstream of the Rapide Croche dam during summer 2016 (value of 1 indicates presence). Highlighted groups are considered “invasive” species.

Macroinvertebrates	FR-A	FR-B	FR-3	FR-4	FR-C	FR-D
(alderfly) <i>Sialidae</i> family	1					
(amphipod) <i>Gammarus</i> sp.		1	1			
(amphipod) <i>Gammarus fasciatus</i>			1			
(amphipod) <i>Hyaella azteca</i>	1	1	1			
(whirligig beetle) <i>Gyrinidae dineutus</i>			1			
(aquatic beetle) <i>Helophorus</i>			1			
(aquatic snail) <i>Amnicola</i> genus		1				
(aquatic snail, disc-shaped) <i>Gyraulus</i> sp.		1	1			
(aquatic snail, left handed) <i>Physella</i> sp.	1	1	1			
(aquatic snail, right handed) <i>Pleurocera</i> sp.	1	1		1		
(aquatic snail) <i>Helisoma</i> sp.			1			
(aquatic snail) <i>Fossaria</i>	1		1	1		
(bloodworm larvae) <i>Chironomidae</i> sp.		1	1	1		1
(caddisfly) <i>Hydropsychidae</i> sp.			1	1		
(caddisfly) <i>Trichoptera</i> order	1	1	1			1
(caddisfly larvae)		1	1		1	1
(damselfly) <i>Calopterygidae</i>		1	1			
(damselfly) <i>Enallagma</i> sp.	1					
(damselfly) <i>Ischnura hastata</i>			1			
(damselfly) <i>Zygoptera</i> suborder						1
(decollate snail) <i>Bulimus</i> genus	1		1			
(dobsonfly) <i>Corydalinae</i> subfamily			1			
dragonfly larvae		1				
(fly) <i>Tabanidae</i> sp.						

Table 4 (continued)

Macroinvertebrates	FR-A	FR-B	FR-3	FR-4	FR-C	FR-D
(giant water bug) <i>Belostoma sp.</i>			1			
(isopod) <i>Asellidae sp.</i>		1				
(isopod) <i>Caecidotea sp.</i>		1				
(mayfly) <i>Baetis hiemalis</i>	1	1				
(mayfly) <i>Caenis sp.</i>	1		1			1
(mayfly) <i>Cloeon sp.</i>			1			
(mayfly) <i>Ephemerellidae sp.</i>	1	1				
(mayfly) <i>Ephemeroptera order</i>	1	1				
(mayfly) <i>Ephemeroptera metretopodidae</i>	1					1
(mayfly) <i>Metretopus sp.</i>			1			
(mayfly) <i>Siphonurus sp.</i>			1			
(mayfly larvae)		1	1			
(stonefly larvae)		1				
(midge, biting) <i>Ceratopogonidae sp.</i>						
(midge) <i>Chironomidae family</i>		1	1			1
(predaceous diving beetle) <i>Dytiscidae family</i>		1	1			
(devil crayfish) <i>Cambarus diogenes</i>		1				
(riffle beetle) <i>Elmidae family</i>		1				
(rusty crayfish) <i>Orconectes rusticus</i>			1			1
(crayfish) <i>Orconectes limosus</i>			1			
(water mite) <i>Hydrachnidiae family</i>	1		1			1
(water scorpion) <i>Ranatra sp.</i>		1		1		
(water bug nymph) <i>Belostomatidae</i>			1			
(waterboatman) <i>Corixidae</i>			1			
(waterboatman) <i>Palmarcorixa sp.</i>						
(waterboatman) <i>Sigara sp.</i>		1		1		
(waterboatman) <i>Trichocorixica sp.</i>	1	1	1			
(worm) <i>Naididae/Tubificidae</i>	1		1			
(worm) <i>Tubifex</i>						1
(zebra mussel) <i>Dreissena polymorpha</i>	1	1	1	1	1	1
TOTAL	18	26	33	7	2	11

Plankton:

A total of 19 taxa of zooplankton were recorded in 2016, with 17 occurring upstream of the barrier and 10 below (Table 5). The invasive spiny water flea, *Bythotrephes longimanus*, was collected on July 19, 2016 at FR-B (a total of three individuals were found in the samples). More extensive sampling on August 2, 2016 with a larger net (0.5m diam, 250um mesh) did not show any spiny water fleas at this site. Examination of additional Ekman grab samples on Aug. 2 did not result in any tail spines or individuals. Based on these data it appears that the spiny water flea had not established a reproducing population at this site. The presence of spiny water fleas in the samples on July 19 may be due to local contamination near the public boat ramp at Riverside Park near FR-B.

Table 5. Zooplankton documented from sites upstream and downstream of the Rapide Croche dam during Summer 2016. A value of one indicates presence. The spiny water flea *Bythotrephes longimanus* (highlighted) was the only invasive species observed.

Zooplankton	FR-A	FR-B	FR-3	FR-4	FR-C	FR-D
<i>Acanthocyclops vernalis</i>	1	1	1	1		1
<i>Alona sp.</i>				1		
<i>Bosmina longirostris</i>	1		1	1		
<i>Bythotrephes longimanus</i> (spiny water flea)		1				
<i>Calanoid juvenile</i>	1	1	1	1		1
<i>Chydorus sp.</i>			1			
Cyclopoid order	1	1	1	1		1
<i>Daphnia</i> genus		1	1	1		1
<i>Daphnia mendotae</i>	1	1				
<i>Daphnia pulicaria</i>	1	1			1	1
<i>Daphnia retrocurva</i>		1				
<i>Diaphanosoma birgei</i>	1	1	1	1		1
<i>Leptodiaptomus</i> genus		1				
<i>Leptodiaptomus ashlandi</i>			1			
<i>Leptodiaptomus siciloides</i>	1	1	1	1	1	1
<i>Leptodora kindti</i>	1	1				
<i>Limnocalanus macrurus</i>	1					
<i>Mesocyclops edax</i>	1	1	1	1	1	1
<i>Skistodiaptomus oregonesis</i>	1	1	1			
TOTAL	12	14	11	9	3	8

References Cited

- Balcer, M.D., N.L. Korda, and S.I. Dodson. 1984. Zooplankton of the Great Lakes: A Guide to the Identification and Ecology of the Common Crustacean Species. The University of Wisconsin Press, Madison, WI.
- Edmonson, W.T. (ed.) 1965. Fresh-water Biology, 2nd edit. John Wiley and Sons, Inc. New York, NY.
- Fox River Navigational System Authority. 2009. AIS Control and Monitoring Plan for the Rapide Croche Boat Transfer Station, Appendix B: Aquatic Invasive Species Control and Monitoring Plan. (June 2009).
- Hilsenhoff, W.L. 1995. Aquatic Insects of Wisconsin. Natural History Museums Council, University of Wisconsin Press, Madison, WI.
- Hopkins, G.J. 1990. The Zebra Mussel, *Dreissena polymorpha*: A Photographic Guide to the Identification of Microscopic Veligers. Queen's Printer for Ontario, Canada.
- Hubbs, C.L. and K.F. Lagler. 2004. Fishes of the Great Lakes Region, Revised Edition (Revised by G.R. Smith). University of Michigan Press, Ann Arbor, MI.
- Lyons, J., P.A. Cochran, and D. Fago. 2000. Wisconsin Fishes 2000: Status and Distribution, University of Wisconsin Press, Sea Grant Institute, Madison, WI.
- Merritt, R.W., K.W. Cummins, and M.B. Berg. 2008. An Introduction to the Aquatic Insects of North America, 4th edit. Kendall/Hunt Publishing, Iowa.
- Pecharsky, B.L., P.R. Fraissinet, M.A. Penton and D.J. Conklin 1990. Freshwater macroinvertebrates of northeastern North America. Cornell University Press, Ithaca.
- Pennak, R.W. 1989. Fresh-water Invertebrates of the United States: Protozoa to Mollusca, 3rd edit. John Wiley and Sons, Inc. New York, NY.
- Thorp, J.H. and A.P. Covich (eds.) 1991. Ecology and Classification of North American Freshwater Invertebrates. Academic Press, Inc. San Diego, CA.
- Wisconsin Fish ID Software. 2005. Software for Identifying Fishes of Wisconsin. University of Wisconsin Center for Limnology, Sea Grant Institute, and Wisconsin Department of Natural Resources. <http://www.wiscfish.org/fishid/>.