

Aquatic Invasive Species Monitoring Project

Year 2020 Report

To the

Fox River Navigational System Authority

By

Patrick Forsythe and Stefan Tucker

Aquatic Ecology and Fisheries Laboratory

University of Wisconsin-Green Bay

Green Bay, WI 54311

February 2021

Executive Summary

The Fox River Navigational System Authority (FRNSA) Aquatic Invasive Species (AIS) monitoring program has been active since 2006. Continuous sampling for the spiny water flea (*Bythotrephes longimanus*) and round goby (*Neogobius melanostomus*) was conducted on the Lower Fox River from June – August of 2006-2020 and Lower Green Bay June- August 2015-2020. Additional sampling for both invasive species was conducted on Lake Winnebago in 2016-2020 near the outflows of Neenah and Menasha. Previous sampling in 2019 confirmed the presence of Round Goby at all sample sites within the Fox River, including three sites above the Rapide Croche lock. This was an expanded distribution from the 2018 sampling where Round Goby was not found at any site above the Rapide Croche lock (De Stasio, 2018). This expanded distribution motivated additional sampling throughout the Fox River and Lake Winnebago targeting round goby. Currently, no Round Goby have been found in Lake Winnebago, but Round Goby was present in all sample locations within the Fox River during 2020. Spiny water flea was sampled for in Green Bay, Fox River, and Lake Winnebago in 2019. Individuals were only found in Green Bay. During 2020, Spiny Water flea were found within Green Bay and none were found within the Fox River, however one tail was observed at the mouth of the Fox River. Invasive Zebra mussels (*Dreissena polymorpha*) were also present in Lake Winnebago and all locations within the Fox River (live specimens or relic shells). No invasive Quagga mussels (*Dreissena bugensis*) were documented. A total of 19 groups of benthic Macro-invertebrates were found throughout the study region within no presence of invasive species.

Objectives

The objective of this study was to monitor the presence of fish and invertebrate aquatic invasive species (AIS) in Lower Green Bay, the Fox River, and Lake Winnebago. Stefan Tucker and Ryne Lehman were employed by University of Wisconsin-Green Bay (UWGB) to complete the monitoring under the supervision of Dr. Patrick Forsythe, Ph.D.

Sampling Design

Monitoring occurred at 11 standardized locations during the summer of 2020 to replicate 2019 sampling areas (Table 1, Figure 1). Each site was sampled four or five times over the course of the summer for spiny water flea, round goby, or both (Table 2). The standardized sampling points served as a general location for sampling efforts to be repeated each sampling event. Specific trap locations are listed in supplemental table 2 at the end of this document. Sampling effort was focused on the most suitable habitat, based on prior knowledge, for each targeted species. Sample sites were sampled in order, going down stream, starting in Lake Winnebago to prevent the spread of AIS. Between each sampling site, all gear and boats were sanitized using a bleach solution consistent with the Wisconsin DNR disinfection practices. <https://dnrx.wisconsin.gov/swims/downloadDocument.do?id=144952597>).

Table 1. Latitude and Longitude coordinates of the approximate location of the areas sampled during the summer of 2020. *WINN-B was added as an exploratory site; see supplemental information at the end of this document

Sampling Site	Latitude	Longitude
WINN 2	-88.364	44.184
WINN1	-88.397	44.154
WINN (Jefferson Park)	-88.427	44.203
WINN-B *	X	X
FR-A (Above Cedar lock)	-88.343	44.277
FR-B (Above Kaukauna Guard lock)	-88.276	44.282
RC-A (Above Rapide Croche lock)	-88.204	44.316
RC-B (Below Rapide Croche lock)	-88.187	44.317
DP-A (Above DePere dam)	-88.066	44.441
DP-B (Below DePere dam)	-88.066	44.455
Bay 1	-87.999	44.551
Bay 2	-87.984	44.576

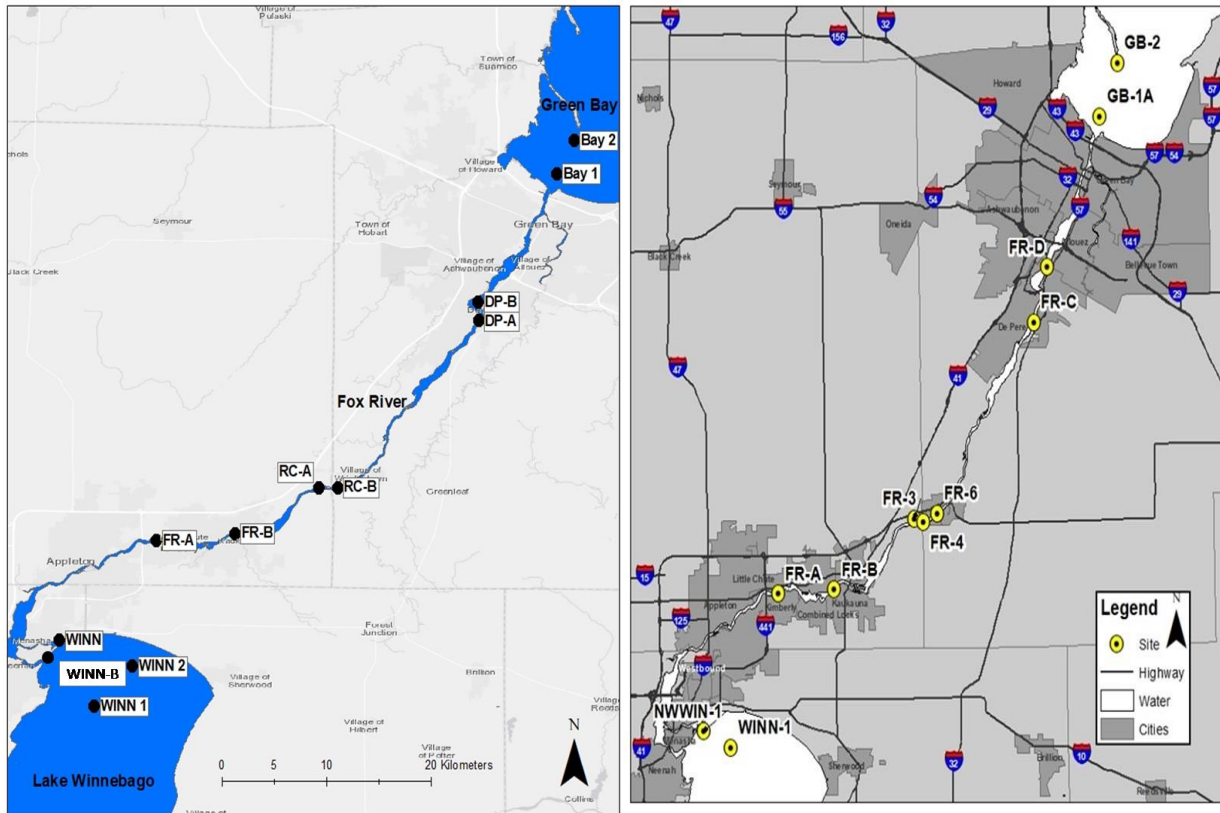


Figure 1. Map of locations sampled for round goby and spiny water flea during the summer of 2020 (left). The map to the right shows historic sampling locations. Note that Lake Winnebago sites were adjusted and site “WINN-B” was added to increase effort in this area.

Table 2. Sampling effort broke down by site and gear type. The “X” indicates that sampling was completed for the targeted species during the summer of 2019. *WINN-B was added as exploratory to expand Round Goby sampling within Lake Winnebago; see supplemental information

Sampling Site	Round Goby	Spiny Water Flea	Benthic Invertebrates
WINN 1		X	
WINN 2		X	
WINN	X		X
WINN-B*	X		
FR-A	X	X	X
FR-B	X	X	X
RC-A	X	X	X
RC-B	X	X	X
DP-A	X	X	
DP-B		X	
Bay 1		X	
Bay 2		X	

Sampling Methods

Round goby: Round goby were sampled four to five times at each site over the course of the summer (Table 2). The primary gear type used was Gee-Feets G-40 (length=40 cm , opening=20 mm , mesh=6 mm) minnow traps baited with cereal dog food (~100g per trap). Eight single minnow traps were set in FR-A, FR-B, RC-A, RC-B, and WINN as conducted in 2019. However, additional sampling occurred in a new site “WINN-B” an increased effort occurred in site DP-A during 2020 and is described in the supplemental information at the end of this document. All traps were baited with dog food and collected after 24 hours. Native fish species were identified, using the Wisconsin Fish ID software (2005), and released. Non-native fish species were counted and transported to UWGB to be frozen and disposed of.



Spiny Water Flea: Zoo plankton tows were taken at each sample site four or five times over the course of the summer (Table 2). The mid-channel location was sampled with a combination of oblique and vertical tows using a Wisconsin-type zoo plankton net (mouth size= 0.13m, mesh size=243 µm). Samples were preserved in the field with 80% ethyl alcohol and transported to UWGB to be sorted under a microscope. Entire samples were examined, and invasive species were removed and stored in 80% ethyl alcohol for long-term preservation.

Benthic invertebrates: Samples were collected, using a large ponar grab sampler (box size=229mm x 229mm), at each sample site (Table 2). Two or three replicate samples were collected at a combination of mid-channel and shoreline locations of each site. Samples were sieved through a tray with a mesh bottom (mesh size=500 µm) and preserved in formalin. Specimens were transported to UWGB, sorted for unique taxa and identified to the family level

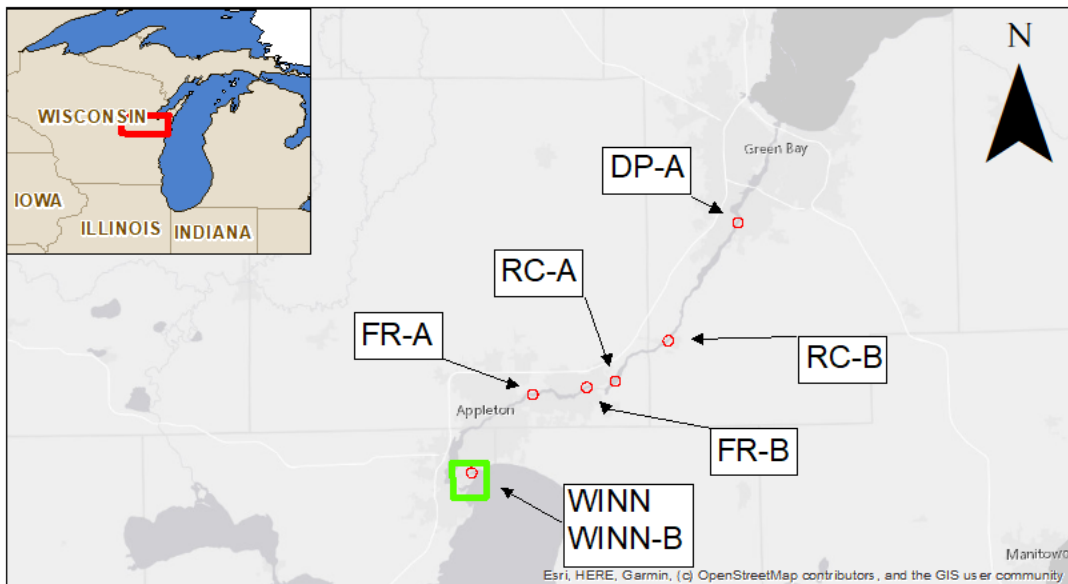
using the reference listed (Bouchard, 2004). A list of regulated species provided on the Wisconsin DNR website (<https://dnr.wi.gov/topic/Invasives/speciesNR40list.asp?filterBy=Category&filterVal=Aquatic%20Invertebrates%20Except%20Crayfish&addFilter=Classification>) was used as a reference to what invasive species are found in Wisconsin. Families and invasive species were noted as either present or absent. Specimens were stored in 80% ethyl alcohol for long-term preservation.

Results

Round goby: Only one invasive fish species, the round goby, was found in 2020. A total of 470 round goby were collected from 416 total minnow trap sets across seven sample areas during the summer of 2020. Round Goby was found at all sample locations except for Lake Winnebago. The distribution of Round Goby is the same as documented in 2019, but total catch has decreased despite a considerable increase in effort (*A total of 679 round goby were collected from 301 total minnow trap sets over six sample sites during the summer of 2019*). Note that site DP-A was utilized to execute a capture efficiency study and therefore resulted in increased effort and catch.

Sampling Site	Round Goby Catch	# Sampling Events	# Traps Deployed	# Hours Fished	CPUE (Goby/hr)
WINN	0	5	90	2160	0
WINN-B*	0	5	90	2160	0
FR-A	1	4	32	768	0.00
FR-B	7	4	32	768	0.01
RC-A	3	4	32	768	0.00
RC-B	40	4	32	768	0.05
DP-A	419*	6*	108*	2592*	0.16*
TOTAL	470	NA	416	9984	NA

*asterisk notes additional sampling effort beyond standardized method. See Supplemental information



Dreissenid Mussel Species:

Zebra mussels were documented at every river reach (FR-A, FR-B, RC-A, RC-B) including Lake Winnebago (WINN). No Quagga mussels were observed at any location. 2-3 replicates were collected at each site and depths of 1, 2 and 3 meters deep. Live zebra mussels were captured at depths ≤ 2 m. Previous report from 2019 stated the presence of Quagga mussels in all river areas except RC-A, however in 2020 we did not observe Quagga mussels and 2019 documentation could be due to misidentification.

Sampling Site	Dreissena Spp. Present	Live Specimen Collected	# Replicates
WINN	Yes- Zebra mussels	Yes	3
FR-A	Yes- Zebra mussels	Yes	3
FR-B	Yes- Zebra mussels	Yes	3
RC-A	Yes- Zebra mussels	No- relic shells	3
RC-B	Yes- Zebra mussels	No- relic shells	2

Benthic Macro-invertebrates:

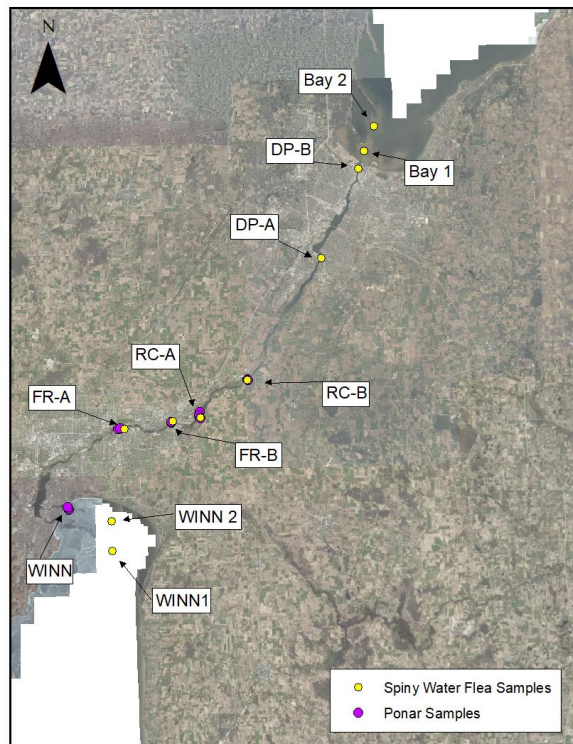
A total of 19 groups of benthic macro-invertebrates were documented. The highest diversity was found in Lake Winnebago. No invasive benthic macro-invertebrates were found.

	WINN	FR-A	FR-B	RC-A	RC-B
Isopoda(O)	X	X			
Baetidae(F)		X			
Ceratopogonidae(F)					X
Chironomidae(F)	X	X	X	X	X
Corixidae(F)		X		X	
Hirudinea(O)	X				
Gomphidae(F)					X
Amphipoda(O)	X		X	X	
Hydrobiidae(F)	X	X			
Hydropsychidae(F)	X	X	X		X
Leptohyphidae(F)		X			
Lymnaeidae(F)	X				
Oligochaeta(O)	X	X	X	X	X
Physidae(F)	X				
Sphaeriidae(F)	X		X		
Planorbidae(F)	X				
Sialidae(F)					X
Turbellaria(O)	X	X			
Valvatidae(F)	X	X			
TOTAL	13	10	5	4	6

Spiny Water Flea:

Only one invasive zooplankton was found during 2020 sampling. Spiny Water flea were only confirmed in the open waters of Green Bay (Bay 1 and Bay 2), however one tail was found at the Fox River mouth which could have been placed here by wind and seiche activity from Green Bay and not from upstream locations. This observation could warrant more extensive sampling in the Fox River proper.

Sampling Site	Spiny Water Flea Present	Live Specimen Collected	# Replicates
WINN 1	No	No	4
WINN 2	No	No	4
FR-A	No	No	4
FR-B	No	No	4
RC-A	No	No	4
RC-B	No	No	4
DP-A	No	No	4
DP-B	Yes- *tail found, no body	*No	4
Bay 1	Yes	Yes	4
Bay 2	Yes	Yes	4



References

- Bouchard, R.W., Ferrington, L.C. and Karius, M.L., 2004. Guide to aquatic invertebrates of the Upper Midwest. University of Minnesota.
- De Stasio, B., 2018. Aquatic Invasive Species Monitoring Project Year 2018 Report to the Fox River Navigational System Authority. Lawrence University, Appleton, WI.
- Smith, B. J., D. G. Simpkins, and T. R. Strakosh 2017. Random versus targeted sampling for monitoring occurrence, community composition, and relative abundance of fishes in near-shore habitats of Lake Michigan. Report #2017-2019, USFWS-Green Bay Fish and Wildlife Conservation Office, New Franken, WI.
- 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/>.

SUPPLEMENTAL INFORMATION

Expanded sampling and experimental trapping assessment: The expanded distribution of Round Goby observed in 2019 motivated an expansion of sampling effort into Lake Winnebago. An exploratory area was added throughout northern Lake Winnebago (generalized as site WINN-B) targeting Round Goby and focused throughout Menasha and Neenah Channels (see map provided below). Exploratory areas within Lake Winnebago consisted of 9-paired minnow traps deployed each sampling event (See supplemental table 1 below for site coordinates). Sampling effort was focused on the most suitable habitat, based on prior knowledge, for each targeted species.

Additionally, sampling within location DP-A was expanded to facilitate a scientific study to examine capture rates of Round Goby using different trap styles and food amounts over six sampling periods. 9 paired minnow traps (box trap and round trap) were deployed with 50 g, 100g ,or 200g of dog food to satisfy the scientific study executed in 2020. Results and summarization of this study are in progress.



Supplemental Table 1: Exploratory trap locations in Lake Winnebago during summer 2020.

Trapping Area	General site location	Longitude	Latitude
WINN B- Exploratory	Riverside Park	44.18242	-88.4497
WINN B- Exploratory	Riverside Park	44.18278	-88.4494
WINN B- Exploratory	Riverside Park	44.18259	-88.4476
WINN B- Exploratory	South tip Doty Isl.	44.18796	-88.4417
WINN B- Exploratory	South tip Doty Isl.	44.18739	-88.4417
WINN B- Exploratory	South tip Doty Isl.	44.18801	-88.4414
WINN B- Exploratory	E. Shore Doty Isl.	44.19429	-88.4409
WINN B- Exploratory	E. Shore Doty Isl.	44.19475	-88.4356
WINN B- Exploratory	E. Shore Doty Isl.	44.19451	-88.433
WINN B- Exploratory	South end of Menasha Channel	44.19804	-88.4286
WINN B- Exploratory	South end of Menasha Channel	44.19882	-88.4269
WINN B- Exploratory	South end of Menasha Channel	44.19935	-88.4266
WINN B- Exploratory	E. Shore Doty Isl.	44.2033	-88.4247
WINN B- Exploratory	Island next to Boat Channel	44.19945	-88.4245
WINN B- Exploratory	E. Shore Doty Isl.	44.20364	-88.4244
WINN B- Exploratory	E. Shore Doty Isl.	44.20282	-88.4244
WINN B- Exploratory	Menasha Channel N. Winnebago	44.20173	-88.4225
WINN B- Exploratory	Menasha Channel N. Winnebago	44.20183	-88.4217

Supplemental Table 2: Standardized Round Goby trapping locations during 2020.

Trapping Location	Site Description	Longitude	Latitude
WINN-Jefferson Park (Menasha)	Menasha Lock	44.19990	-88.44818
WINN-Jefferson Park (Menasha)	Menasha Lock	44.20007	-88.44764
WINN-Jefferson Park (Menasha)	Menasha Lock	44.20006	-88.44734
WINN-Jefferson Park (Menasha)	at road bridge	44.20109	-88.44622
WINN-Jefferson Park (Menasha)	at road bridge	44.20116	-88.44622
WINN-Jefferson Park (Menasha)	at road bridge	44.20127	-88.44610
WINN-Jefferson Park (Menasha)	Lower Jeff. Park	44.20118	-88.44581
WINN-Jefferson Park (Menasha)	Lower Jeff. Park	44.20126	-88.43645
WINN-Jefferson Park (Menasha)	Lower Jeff. Park	44.20141	-88.43563
Kimberely Park FR-A (Kimberely)	441 Bridge (Northside)	44.27746	-88.355035
Kimberely Park FR-A (Kimberely)	441 Bridge (Southside)	44.27587	-88.355065
Kimberely Park FR-A (Kimberely)	artificial rocky shore line(House)	44.27700	-88.35311
Kimberely Park FR-A (Kimberely)	artificial rocky shore line(House)	44.27501	-88.35354
Kimberely Park FR-A (Kimberely)	Tip of Fox Point	44.27647	-88.34998
Kimberely Park FR-A (Kimberely)	artificial rocky shore line(House)	44.27693	-88.34943
Kimberely Park FR-A (Kimberely)	artificial rocky shore line(House)	44.27471	-88.349735
Kimberely Park FR-A (Kimberely)	Blatz Island	44.27595	-88.348553
Riverside Park FR-B (Kaukauna)	artificial rocky shore line(House)	44.28351	-88.27484
Riverside Park FR-B (Kaukauna)	artificial rocky shore line(House)	44.28356	-88.27634
Riverside Park FR-B (Kaukauna)	artificial rocky shore line(Apt.)	44.28149	-88.27600
Riverside Park FR-B (Kaukauna)	artificial rocky shore line(Apt.)	44.28125	-88.27725
Riverside Park FR-B (Kaukauna)	artificial rocky shore line(Apt.)	44.28099	-88.27829
Riverside Park FR-B (Kaukauna)	artificial rocky shore line(Apt.)	44.28078	-88.27876
Riverside Park FR-B (Kaukauna)	Rocks above Boat Launch	44.28199	-88.27953
Riverside Park FR-B (Kaukauna)	Rocks above Boat Launch	44.28182	-88.28029
Plank Road RC-A (Private Launch)	concrete above washed out trees	44.29266	-88.23714
Plank Road RC-A (Private Launch)	concrete rubble downstream of the house	44.29257	-88.23757
Plank Road RC-A (Private Launch)	concrete rubble in front of the house	44.29250	-88.23815
Plank Road RC-A (Private Launch)	concrete rubble above boat launch	44.29224	-88.23941
Plank Road RC-A (Private Launch)	concrete rubble above boat launch	44.29207	-88.23973
Plank Road RC-A (Private Launch)	downstream of the concrete island	44.29032	-88.23768
Plank Road RC-A (Private Launch)	upstream of the concrete island	44.29018	-88.23778
Plank Road RC-A (Private Launch)	artificial rocky shore line (House)	44.28534	-88.23702
Wrightstown RC-B (Wrightstown)	rocky shore line (Above 96 Bridge)	44.32479	-88.16899
Wrightstown RC-B (Wrightstown)	rocky shore line (Above 96 Bridge)	44.32537	-88.16786
Wrightstown RC-B (Wrightstown)	rocky shore line (Above 96 Bridge)	44.32613	-88.16667
Wrightstown RC-B (Wrightstown)	rocky shore line (Below 96 Bridge)	44.32907	-88.16552
Wrightstown RC-B (Wrightstown)	rock rubble against Washington Street	44.32737	-88.16266
Wrightstown RC-B (Wrightstown)	rock rubble under trees	44.3266	-88.44818
Wrightstown RC-B (Wrightstown)	rock rubble next to a large public parking	44.32660	-88.16395
Wrightstown RC-B (Wrightstown)	rock rubble along Wrightstown Park	44.32384	-88.16703