

St. Croix River Winged Mapleleaf Conservation Project – 2010 Final Report

By Mark Hove, Daniel Hornbach, Elise Griffin, Karen Jackson, Kelly MacGregor, Derek Ochi, Brandon Sansom, and Carl Skarbek
Macalester College, 1600 Grand Ave., St. Paul, MN 55015

1.0 Executive Summary

We completed four objectives to improve winged mapleleaf conservation efforts in the St. Croix River during 2010. Over the past century the winged mapleleaf has experienced reductions in range and abundance and the federal government responded by listing it as endangered in 1991. The Winged Mapleleaf Mussel Recovery Plan lists, among other activities, re-establishing winged mapleleaf populations and identifying the current range of the species as tasks that will contribute to its delisting. We undertook four projects to assist with conservation efforts: (1) aggregate winged mapleleaf in the St. Croix River at Interstate State Park for use in propagating juveniles, (2) collect brooding winged mapleleaf for use in propagating juveniles at Genoa National Fish Hatchery, (3) survey the lower St. Croix River for unknown populations of winged mapleleaf, and (4) assess survivorship of pustulous mussels marked in 2009 at two locations in the upper St. Croix River under consideration as winged mapleleaf re-establishment sites. We followed standard methods to conduct these studies. SCUBA was used to aggregate and collect winged mapleleaf at Interstate State Park that were used in the 2010 juvenile winged mapleleaf propagation program at Genoa National Fish Hatchery. SCUBA surveys of 15 locations in the lower St. Croix River revealed a previously unknown population of winged mapleleaf at William O'Brien State Park, which expanded the known range of *Q. fragosa* in the St. Croix River by 30%. We observed mixed results in our efforts to recapture pustulous mussels marked in 2009. We recaptured 38 marked mussels at the Nevers Dam site where one individual had died, yielding an estimated 3% annual mortality of marked mussels. In contrast, we did not find any of the marked mussels at the Sunrise River site. We believe we either mis-recorded the location of the Sunrise River mussels in 2009 or perhaps the mussels were covered with sediment. Completion of these objectives helped move forward efforts to conserve winged mapleleaf.

2.0 Introduction

Winged mapleleaf (*Quadrula fragosa*), a native mussel once found throughout much of the upper Mississippi River, has become extirpated throughout most of its historic range and is in need of conservation efforts. Listed as federally endangered in 1991 (USFWS 1991) and the Winged Mapleleaf Recovery Plan lists several activities needed to delist the species including describing the species' current range, re-establishing and strengthening winged mapleleaf populations (e.g., using propagated juveniles), and identifying locations where winged mapleleaf can be re-established (USFWS 1997). This project addressed these conservation needs through the following objectives: (1) aggregate winged mapleleaf in the St. Croix River at Interstate State Park for use in juvenile propagation efforts, (2) collect brooding winged mapleleaf from the St. Croix River for the production of juvenile winged mapleleaf at Genoa National Fish Hatchery, (3) survey the lower St. Croix River for unknown populations of winged mapleleaf, and (4) assess survivorship of marked pustulous mussels aggregated in 2009 at two locations in the upper St. Croix River being considered for re-establishing winged mapleleaf populations.

3.0 Methods

3.1 Winged mapleleaf aggregation

We worked with employees of the US Fish and Wildlife Service (USFWS), National Park Service (NPS), and Minnesota Department of Natural Resources (MN DNR) to aggregate winged mapleleaf in the St. Croix River at Interstate State Park for use in juvenile mussel propagation at Genoa National Fish Hatchery, Genoa, WI. We used SCUBA and snorkeling equipment in July 2010 to collect winged mapleleaf and relocate some of them to pre-established USFWS aggregations located just downstream of the Folsom Island wing dam. Winged mapleleaf we did not relocate were given to the USFWS for marking and placement in aggregations.

3.2 Winged mapleleaf retrieval

Working with USFWS, NPS, and MN DNR employees we retrieved winged mapleleaf from aggregation sites at Interstate State Park, as well as finding new winged mapleleaf

not in the aggregations, for use in juvenile mussel propagation. We assisted with winged mapleleaf collection dives weekly between August-September 2010 in the St. Croix River and also helped with transporting brooding winged mapleleaf to Genoa National Fish Hatchery.

3.3 Winged mapleleaf distribution

During 2010 we surveyed sites between Otisville, MN and Prescott, WI in the St. Croix River using SCUBA in an effort to find unknown populations of winged mapleleaf. Two to four divers spent 5-60 min searching for mussels at each of 15 sites. At most sites two searches were undertaken. The first was a timed search where divers collected all living mussels and empty valves until collection bags were full (5-15 min) for use in comparing relative abundance and diversity of the mussel community among sites. The remainder of the time spent at the site was used to search for additional mussel species (live and dead) in order to better describe the species composition of the local mussel community. During all aspects of the survey emphasis was placed on finding living or dead winged mapleleaf. Living and dead mussels collected at each site and a qualitative description of the substrate was recorded.

3.4 Mussel recapture

We revisited two locations where we had marked 100 pustulous mussels during 2009 in order to recapture them or their valves and assess annual survivorship. We used SCUBA to search for marked mussels at Nevers Dam (521322E 504224N) and upstream of the Sunrise River boat launch (510175E 504944N). We spent a day searching at each of the two sites. All living and dead marked animals were counted and returned to the collection site.

4.0 Results

4.1 Winged mapleleaf aggregation

Working with the USFWS, NPS, and MN DNR we collected and relocated winged mapleleaf to aggregations downstream of the wing dam at Folsom Island, Interstate State

Park, St. Croix River. We spent four days assisting with this effort. The USFWS, Twin Cities Field Office kept a tally of winged mapleleaf that were collected and relocated.

4.2 Winged mapleleaf retrieval

We checked winged mapleleaf aggregations regularly during the fall of 2010 and obtained four gravid individuals that were used for juvenile propagation efforts. Agencies and organizations that planned to participate in this effort planned to aggregate winged mapleleaf between Aug 23-Oct 1. Mark Hove was scheduled to work between Aug 27-Oct 1 (and worked between Aug 27-Sept 24) but flooding occurred in the St. Croix River between Sept 24-Oct 4 and the search for brooding winged mapleleaf had to be stopped. Four brooding winged mapleleaf were collected during 2010 both in and outside of aggregation areas (Fig. 1). Mark Hove assisted with transportation of gravid animals to Genoa National Fish Hatchery. Additional details about brooding winged mapleleaf used in the 2010 St. Croix River winged mapleleaf propagation effort is available from the USFWS, Twin Cities Field Office.



Figure 1. A brooding winged mapleleaf observed outside of aggregation area downstream of Folsom Island wing dam at Interstate State Park, St. Croix River. (Photographs taken by Nick Rowse, USFWS)

4.3 Winged mapleleaf distribution

We used SCUBA to survey 15 sites in the St. Croix River between July 28-Sept 16, 2010 in an effort to find unknown populations of winged mapleleaf. During this survey we observed 24 live unionid species and 24 species represented by empty valves between Otisville, MN-Prescott, WI (Fig. 2). The only place where we observed winged mapleleaf was at William O'Brien State Park where we collected one live (Fig. 3) and three dead (Fig. 4) animals. Living and dead mussels collected at each site and a qualitative habitat description was recorded (Appendix).

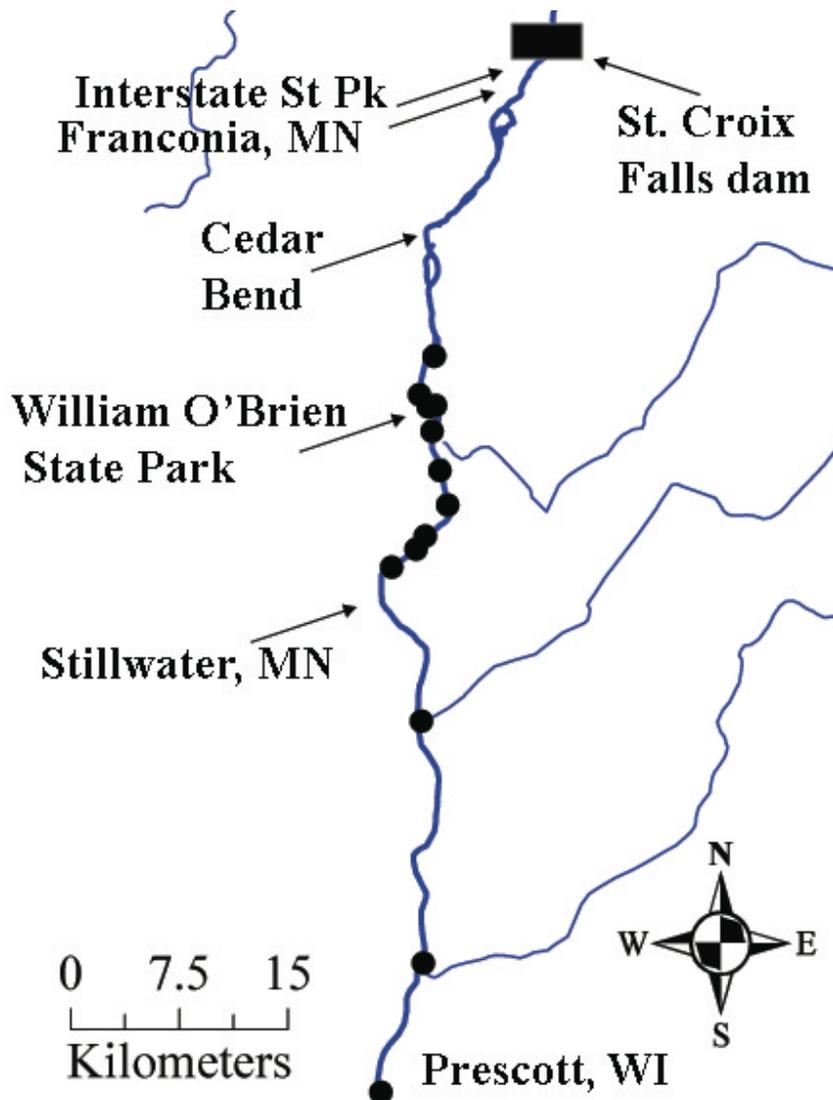


Figure 2. Sites searched during 2010 winged mapleleaf survey.



Figure 3. Live winged mapleleaf observed at William O'Brien State Park, St. Croix River.

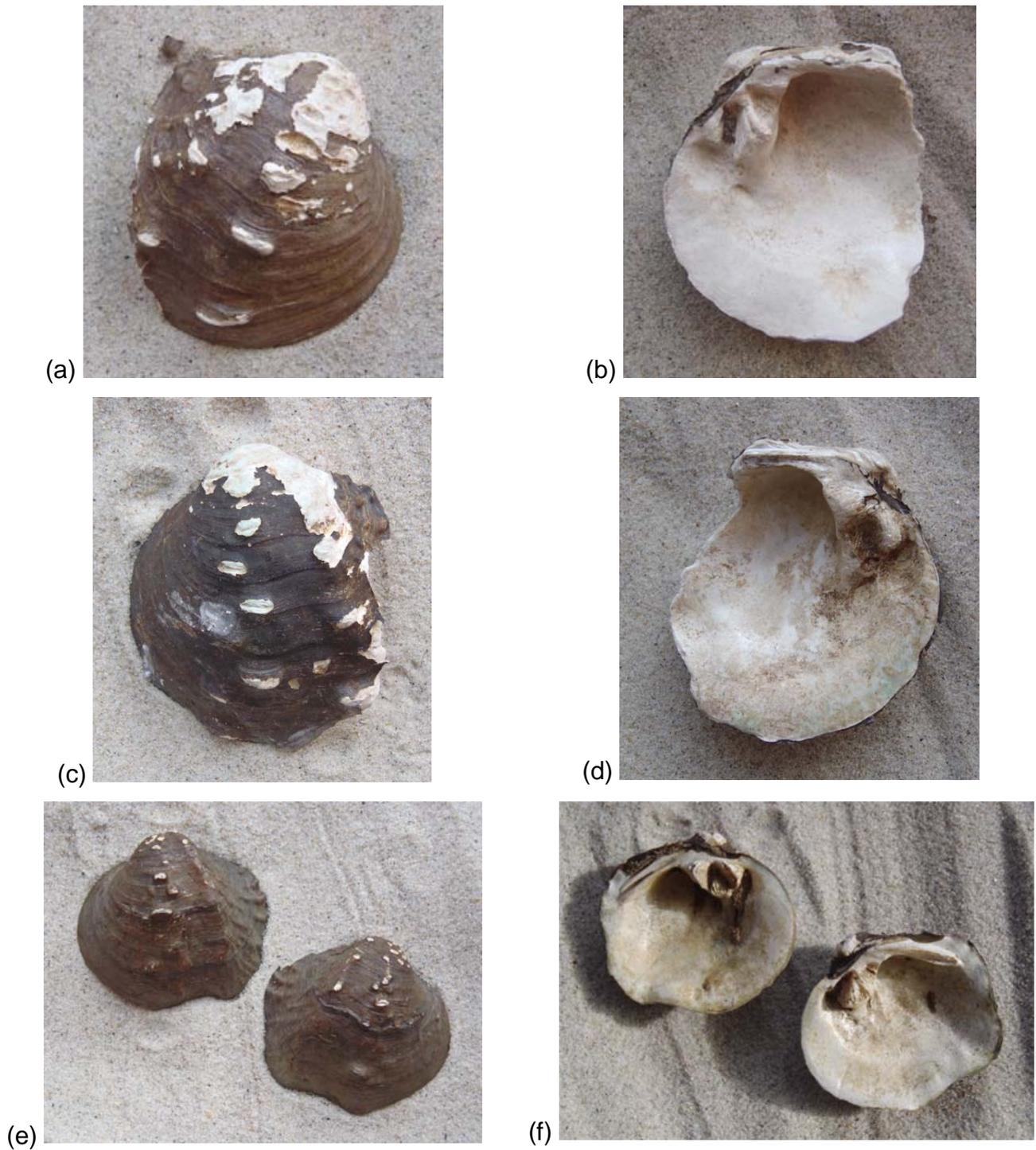


Figure 4. Empty winged mapleleaf valves collected at William O'Brien State Park, St. Croix River: (a) external view of specimen 1, (b) internal view of specimen 1, (c) external view of specimen 2, (d) internal view of specimen 2, (e) external view of specimen 3, (f) internal view of specimen 3.

4.4 Mussel recapture

During July 2010 we searched for pustulous mussels marked in 2009 at the potential winged mapleleaf re-establishment sites at Nevers Dam and Sunrise River in the upper St. Croix River. We found some marked mussels at the Nevers Dam site but none were observed upstream of the Sunrise River boat launch (Fig. 5). A total of 37 of 100 live mussels marked in 2009 and one dead marked mussel was found at the Nevers Dam site (3% annual mortality), but no live or dead marked mussels were observed at the Sunrise River site. Divers observed very few mussels at the Sunrise River site nor did they feel mussels as they searched the substrate.

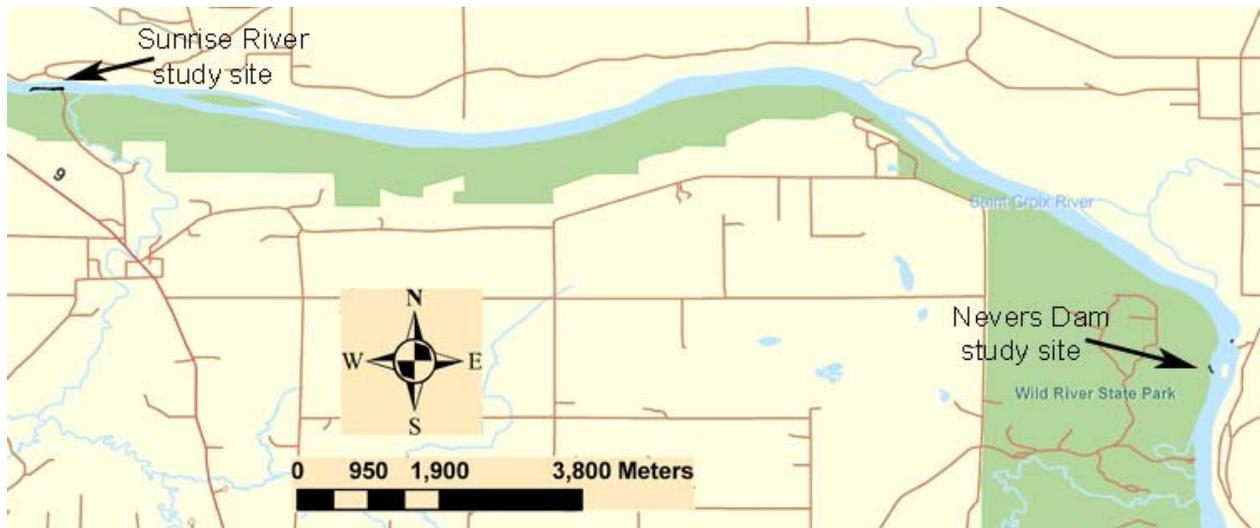


Figure 5. Locations of Sunrise River and Nevers Dam study sites.

5.0 Discussion

Our efforts to find undiscovered winged mapleleaf populations in the lower St. Croix River was successful. We searched several reaches along 62 km of the lower St. Croix River that looked promising for winged mapleleaf. We sought areas similar to where we have found winged mapleleaf at Interstate State Park and Franconia, MN, *i.e.*, reaches downstream of deep pools with coarse, stable substrate. We did not find any deep pools downstream of Cedar Bend but we found that river thalwegs were good locations for finding coarse substrate and mussels. Along a gentle thalweg at William O'Brien State

Park we found a previously unknown group of winged mapleleaf. This site is 9 km downstream of the furthest downstream site previously known for to hold winged mapleleaf at Cedar Bend (Heath 2002), an approximate 30% extension of the known range for the species in the St. Croix River. Although we did not observe any other winged mapleleaf populations the most promising habitats we observed occurred upstream of the High Bridge. Sites in Lake St. Croix appeared rather poor for winged mapleleaf, that is, substrate at most sites was primarily sand with only scattered areas of coarse substrate. It would be useful to know if winged mapleleaf at Cedar Bend and William O'Brien State Park are self-sustaining or if they are maintained by animals upstream.

Efforts to aggregate and find brooding winged mapleleaf during 2010 were successful. Over the last several years we've often collected around 5 brooding winged mapleleaf for use in propagating juvenile mussels. This year we visited winged mapleleaf aggregation areas more frequently to increase the likelihood of collecting more brooding animals. The team searching for brooding winged mapleleaf this year and found four individuals but our collection efforts were compromised by a flood, which made the river inaccessible for the last quarter of the winged mapleleaf brooding period.

Recovery of pustulous mussels marked in 2009 was variable between sites at Nevers Dam and Sunrise River during 2010. At both sites we checked the location of the aggregation using GPS several times through the search, as well as verifying the location visually with markers along on the shore. Additionally, divers searched throughout and 15 m beyond the aggregation area. We recovered 38 (1 dead) of 100 marked mussels at Nevers Dam site, and none at Sunrise River site. Since we found no living or dead marked mussels at Sunrise River site we may have searched the wrong portion of the river due to an error in recording the aggregation location during 2009. Alternatively, the mussels may have moved away from the aggregation site but it would be unusual for the majority of the mussels to move (Cope *et al.*, 2003). There was quite a bit of shifting sand at the Sunrise River site, which may have buried the mussels at the site although divers also felt for mussels in the sand during search efforts. During 2009 we placed marked

mussels in high quality habitat at both Sunrise River and Nevers Dam sites. It is difficult to understand why we did not find the marked mussels at the Sunrise River site. Our observations reinforce the merits of making multiple GPS readings with high quality GPS reader. Additionally, mussel aggregations could be marked with an underwater marker (e.g., 20 m rope staked between two dog screws oriented parallel with river current) although this may draw the attention of the public to the aggregation.

6.0 Acknowledgments

We thank the St. Paul District Army Corps of Engineers for project funding and the National Park Service for administering the funds.

7.0 Literature Cited

- Cope, W. G., M. C. Hove, D. L. Waller, D. J. Hornbach, M. R. Bartsch, L. A. Cunningham, H. L. Dunn and A. R. Kapuscinski. 2003. Evaluation of relocation of unionid mussels to in situ refugia. *Journal of Molluscan Studies* 69: 27-34.
- Heath, D. 2002. Geographic distribution of winged mapleleaf mussel (*Quadrula fragosa* (Conrad, 1835)) in the St. Croix River, Minnesota and Wisconsin. Report for the USFWS, Bloomington, MN. 5 pp.
- U.S. Fish and Wildlife Service. 1991. Determination of endangered status for the winged mapleleaf freshwater mussel. *Federal Register*, **56**: 28345-28349.
- 1997. Winged mapleleaf mussel (*Quadrula fragosa*) recovery plan. Fort Snelling, Minnesota. 69p.

8.0 Appendix

Observations made at sites surveyed for the St. Croix River winged mapleleaf distribution survey. A “√” denotes the presence of a species.

Site: 1

Date: July 28, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, Brandon Sansom*, Karen Jackson* * divers

UTM coordinates (NAD83) 15 0518151E 5003719N

Substrate: sandy on WI side, coarse on MN side Depth: 2-3 m

Timed search: 6 min.

Notes: Searched approx. 10 m

Note: Mussels observed in deeper water down to sand in middle of river.

Species	Timed search	
	Live	Dead
<i>Actinonaias ligamentina</i>	2	5
<i>Amblema plicata</i>	2	10
<i>Elliptio dilatata</i>	1	6
<i>Fusconaia flava</i>	1	9
<i>Lampsilis cardium</i>		3
<i>Leptodea fragilis</i>		5
<i>Pleurobema sintoxia</i>	1	1
<i>Potamilus alatus</i>		7
<i>Pyganodon grandis</i>		1
<i>Quadrula metanevra</i>		3
<i>Quadrula pustulosa</i>		8
<i>Tritogonia verrucosa</i>	1	2
<i>Truncilla truncata</i>		11

Timed search: 15 min.

Notes: Searched approx. 30 m

Note: Mussels observed in shallower water near the shore.

Species	Timed search	
	Live	Dead
<i>Actinonaias ligamentina</i>	5	7
<i>Amblema plicata</i>	2	8
<i>Elliptio dilatata</i>	1	6
<i>Epioblasma triquetra</i>		1
<i>Fusconaia flava</i>	6	23
<i>Lampsilis cardium</i>	2	5
<i>Lasmigona costata</i>	1	
<i>Leptodea fragilis</i>		3
<i>Ligumia recta</i>		6
<i>Pleurobema sintoxia</i>	1	2
<i>Potamilus alatus</i>		4
<i>Quadrula pustulosa</i>	4	3

<i>Strophitus undulatus</i>		1
<i>Tritogonia verrucosa</i>	6	1
<i>Truncilla truncata</i>		17

Species search

Substrate: mostly cobble (broken sedimentary rock), some boulders and sand

Team 1 searched for 13 min along 20 m reach

Team 2 searched for 15 min along 25 m reach

New species observed: live – *Lasmigona complanata*, *Pyganodon grandis*
dead – *Obliquaria reflexa*

Site: 2

Date: July 28, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, Brandon Sansom*, Karen Jackson* * divers

UTM coordinates (NAD83) 15 0518749E 5002859N

Substrate: primarily coarse substrate

Depth: ≈2 m

Timed search: 6 min.

Notes: Searched approx. 10 m

Species	Timed search	
	Live	Dead
<i>Actinonaias ligamentina</i>	5	
<i>Amblema plicata</i>	4	14
<i>Elliptio dilatata</i>	4	5
<i>Fusconaia flava</i>	2	7
<i>Lampsilis cardium</i>	3	
<i>Lasmigona complanata</i>	2	2
<i>Leptodea fragilis</i>	3	9
<i>Ligumia recta</i>		1
<i>Pleurobema sintoxia</i>	2	2
<i>Potamilus alatus</i>	1	6
<i>Quadrula pustulosa</i>	6	1
<i>Tritogonia verrucosa</i>	1	1
<i>Truncilla truncata</i>		2
Unknown adult		6

Timed search: 15 min.

Notes: Searched approx. 50 m

Species	Timed search	
	Live	Dead
<i>Actinonaias ligamentina</i>	1	4
<i>Amblema plicata</i>	4	5
<i>Elliptio dilatata</i>		3
<i>Fusconaia flava</i>	3	4
<i>Lampsilis cardium</i>	5	5
<i>Leptodea fragilis</i>		2
<i>Ligumia recta</i>		1
<i>Potamilus alatus</i>	2	11
<i>Quadrula pustulosa</i>	2	2
<i>Tritogonia verrucosa</i>	2	4
<i>Truncilla truncata</i>		2
Unknown adult		4

Species search

Substrate: mostly cobble (broken sedimentary rock), some boulders and sand

Team 1 searched for 20 min along 60 m reach

Team 2 searched for 15 min along 100 m reach

New species observed: live – *Pleurobema sintoxia*, *Quadrula metanevra*, *Obliquaria reflexa*, *Epioblasma triquetra*, *Pyganodon grandis*, *Ligumia recta*, *Truncilla truncata*
dead – *Potamilus ohiensis*

Site: 3

Date: July 28, 2010

River: St. Croix River

Crew: Mark Hove, Byron Karns, Brandon Sansom, Karen Jackson

UTM coordinates (NAD83) 15 0519203E 5006384N

Valves observed in a muskrat midden

Species	Dead
<i>Amblema plicata</i>	1
<i>Ellipsaria lineolata</i>	2
<i>Fusconaia flava</i>	119
<i>Obliquaria reflexa</i>	3
<i>Obovaria olivaria</i>	2
<i>Pleurobema sintoxia</i>	11
<i>Potamilus alatus</i>	1
<i>Quadrula fragosa</i>	1
<i>Quadrula metanevra</i>	2
<i>Quadrula pustulosa</i>	10
<i>Truncilla truncata</i>	1
Unknown adult	2

Site: 4

Date: September 2, 2010

River: St. Croix River

Crew: Bob Whaley* and NPS dive intern*, * divers

UTM coordinates - near (NAD83) 15 0519203E 5006384N, about half way down

Greenberg Island near the Wisconsin shore

Substrate: (not recorded)

Depth: ≈2 m

Timed search: 6 min.

Notes: Searched approx. 30 m, discharge was high and visibility was low, divers had trouble staying on the river bottom even with creepers

No winged mapleleaf were observed

Site: 5

Date: September 10, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

UTM coordinates (NAD83) 15 0519156E 5006343N

Substrate: quite coarse substrate

Depth: ≈2 m

Timed search: two 30 min. dives

Notes: Searched approx. ≈100 m along WI shore where there is a strip of decent mussel habitat 20-30 m wide. Saw 1 live winged mapleleaf (12 yr) old. Winged mapleleaf observed in an area with more gravel. Photographed and returned to site. Saw many *T. verrucosa* and *A. plicata*. River discharge ≈ high so water Turbid & dark, could only see 18".

Site: 6

Date: September 10, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

UTM coordinates (NAD83) 15 0519024E 5001186N

Substrate: primarily broken sedimentary rock, not much gravel, seems like mediocre mussel habitat. Patches of substrate look kind of like habitat at Interstate State Park.

Timed search: 7 min.

Notes:

Species	Timed search	
	Live	Dead
<i>Actinonaias ligamentina</i>	4	1
<i>Amblema plicata</i>	4	
<i>Elliptio dilatata</i>	2	12
<i>Fusconaia flava</i>	9	14
<i>Lampsilis cardium</i>	2	
<i>Lasmigona complanata</i>		1
<i>Leptodea fragilis</i>		1
<i>Obliquaria reflexa</i>		1
<i>Potamilus alatus</i>	1	1
<i>Quadrula metanevra</i>	1	
<i>Quadrula pustulosa</i>	7	1
<i>Strophitus undulatus</i>		1
<i>Tritogonia verrucosa</i>	6	1
<i>Truncilla truncata</i>	2	17

Species search

Substrate: mostly cobble (broken sedimentary rock), some boulders and sand

Searched for 26 min along approx. ≈ 100 m x 35 m reachNew species observed: live – *Pleurobema sintoxia*, *Ellipsaria lineolata*, *Strophitus undulatus*, *Ligumia recta*dead – *Quadrula fragosa* (2 valves), *Lampsilis siliquoidea*

Site: 7

Date: September 10, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

UTM coordinates (NAD83) 15 0519270E 5002975N

Substrate: broken sedimentary rock Depth: ≈2 m
like Site 6 but more sand, gravel, and boulders.Stones rounded, habitat looks better for
mussels than Site 6 but few mussels.

Areas with gelatinous mud.

Timed search: 5 min.

Notes:

Species	Timed search	
	Live	Dead
<i>Elliptio dilatata</i>		1
<i>Lampsilis cardium</i>	1	
<i>Leptodea fragilis</i>		3
<i>Potamilus alatus</i>	1	1
<i>Pyganodon grandis</i>		1
<i>Strophitus undulatus</i>		2

Site: 8

Date: September 14, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

Latitude: 45° 08.357'

Longitude: 92° 45.078'

Substrate: broken sedimentary rock
 along shore, several springs. Deeper
 there is a lot of rubble, gravel, & broken
 sedimentary rock.

Depth: ≈3.5 m

Timed search: 4.5 min.

Notes:

Species	Timed search	
	Live	Dead
<i>Amblema plicata</i>	1	3
<i>Elliptio dilatata</i>		10
<i>Fusconaia flava</i>		10
<i>Lampsilis cardium</i>	1	
<i>Lasmigona complanata</i>	1	1
<i>Leptodea fragilis</i>		2
<i>Ligumia recta</i>		1
<i>Pleurobema sintoxia</i>		1
<i>Potamilus alatus</i>		10
<i>Pyganodon grandis</i>	1	
<i>Quadrula pustulosa</i>	1	2
<i>Strophitus undulatus</i>		1
<i>Tritogonia verrucosa</i>		2
<i>Truncilla truncata</i>		3

Species search

Searched for 12 min along approx. ≈100 m reach

New species observed: live – *Fusconaia flava*dead – *Quadrula metanevra*

Site: 9

Date: September 14, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

UTM coordinates (NAD83) 15 0520099E 4996067N

Substrate: Primarily shifting sand

Depth: 1-2 m

Timed search: ≈10 min.

Notes: Checked upstream of island and just downstream of 4 m deep pool downstream of NPS zebra mussel check station. Habitat sandy, not promising for mussels. Some valves near some large rocks but this area only ≈20 m long

Species*	Timed search	
	Live	Dead
<i>Amblema plicata</i>		√
<i>Elliptio dilatata</i>		√
<i>Fusconaia flava</i>		√
<i>Lampsilis cardium</i>		√
<i>Lasmigona complanata</i>		√
<i>Lasmigona costata</i>		√
<i>Leptodea fragilis</i>		√
<i>Ligumia recta</i>		√
<i>Obliquaria reflexa</i>		√
<i>Potamilus alatus</i>		√
<i>Quadrula pustulosa</i>		√

(* Individuals not counted, only species checklist)

Site: 10

Date: September 14, 2010

River: St. Croix River (downstream of High Bridge)

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

UTM coordinates (NAD83) 15 518551E 4993890N

Substrate: sand, cobble, sticks

Depth: 3 m

Timed search: ≈5 min.

Notes: Gravel and cobble along shore but deeper it is only sand, cobble and sticks, poor mussel habitat.

Species	Timed search	
	Live	Dead
<i>Fusconaia flava</i>		√
<i>Lampsilis cardium</i>		√
<i>Obliquaria reflexa</i>		√
<i>Potamilus alatus</i>		√
<i>Quadrula pustulosa</i>		√
<i>Tritogonia verrucosa</i>		√
<i>Truncilla truncata</i>		√

(* Individuals not counted, only species checklist of old valves)

Site: 11

Date: September 14, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

UTM coordinates (NAD83) 15 517928E 4992995N

Substrate: sand with rare cobble

Timed search: ≈10 min.

Notes: few mussels

Site: 12

Date: September 14, 2010

River: St. Croix River

Crew: Mark Hove*, Byron Karns*, and NPS intern * divers

UTM coordinates (NAD83) 15 0516222E 4991770N

Substrate: primarily fine sand

Timed search: 3.5 min.

Notes:

Species	Timed search	
	Live	Dead
<i>Amblema plicata</i>	10	17
<i>Elliptio dilatata</i>	2	1
<i>Fusconaia flava</i>	2	
<i>Lasmigona complanata</i>	1	
<i>Obliquaria reflexa</i>	2	1
<i>Potamilus alatus</i>	4	5
<i>Quadrula metanevra</i>		1
<i>Quadrula pustulosa</i>	1	2
<i>Tritogonia verrucosa</i>	2	

Species search

Searched for ≈10 min

New species observed: live – *Pyganodon grandis*, *Toxolasma parvus*, *Truncilla truncata*
dead – *Leptodea fragilis*

Site: 13

Date: September 16, 2010

River: St. Croix River (Hudson, WI)

Crew: Mark Hove*, Bob Whaley*, and NPS employee * divers

Latitude: 44.983

Longitude: -92.768

Substrate: all sand

Depth: 1-2 m

Timed search: 9 min.

Notes: Zebra mussels attached to mussels at this site

Species	Timed search	
	Live	Dead
<i>Amblema plicata</i>	18	3
<i>Arcidens confragosus</i>	1	
<i>Fusconaia flava</i>	2	
<i>Lampsilis cardium</i>		1
<i>Lasmigona complanata</i>	1	
<i>Obliquaria reflexa</i>	3	1
<i>Pyganodon grandis</i>	1	1
<i>Quadrula quadrula</i>	1	1

Species search

Searched for 5 min

New species observed: live – *Elliptio dilatata*, *Dreissena polymorpha***Site: 14**

Date: September 16, 2010

River: St. Croix River (Kinnickinic Narrows)

Crew: Mark Hove*, Bob Whaley*, and NPS employee * divers

UTM coordinates (NAD83) 15 0518432E 4964337N

Substrate: loose sand

Depth: 1-2 m

Timed search: 10 min.

Notes: Zebra mussels attached to mussels at this site

Species	Timed search	
	Live	Dead
<i>Amblema plicata</i>	1	√
<i>Fusconaia flava</i>	4	√

Site: 15

Date: September 16, 2010

River: St. Croix River (Prescott, WI)

Crew: Mark Hove*, Bob Whaley*, and NPS employee * divers

UTM coordinates (NAD83) 15 0515507E 4955388N

Substrate: sand with occasional cobble

Depth: 1-3 m

Timed search: 12.7 min.

Notes: Searched 40 m

No zebra mussels attached to mussels at this site although byssal threads on valves. Bob recalls however that 1 month ago zebra mussel were attached to mussels at this site.

Species	Timed search	
	Live	Dead
<i>Actinonaias ligamentina</i>	1	
<i>Amblema plicata</i>	15	1
<i>Elliptio dilatata</i>	2	1
<i>Fusconaia flava</i>	9	2
<i>Lampsilis cardium</i>		1
<i>Lampsilis higginsii</i>	√	
<i>Lampsilis siliquoidea</i>		3
<i>Leptodea fragilis</i>		√
<i>Obliquaria reflexa</i>	5	3
<i>Pleurobema sintoxia</i>	√	
<i>Pyganodon grandis</i>	2	1
<i>Quadrula pustulosa</i>		1

√ - species observed