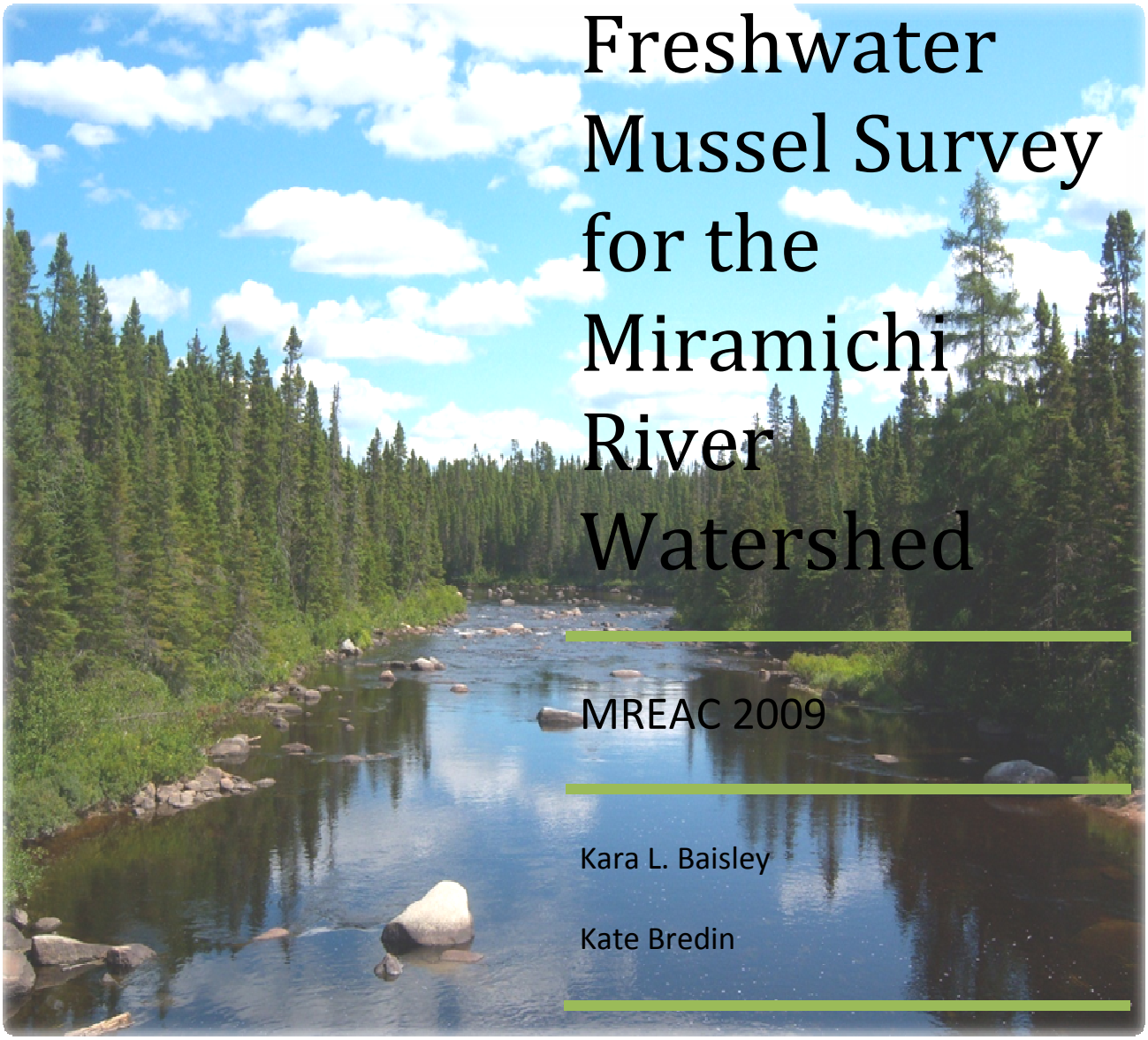

Freshwater Mussel Survey for the Miramichi River Watershed

MREAC 2009

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1.0. Introduction

With funding support from the New Brunswick Wildlife Trust Fund, the Miramichi River Environmental Assessment Committee (MREAC) completed a second year of freshwater mussel surveys in the Miramichi River watershed during the summer months of 2009. After surveying 15 sites in 2008 and finding three different species of freshwater mussels, MREAC proposed to survey another 15 sites in 2009 in order to cover more of the watershed and gain a better understanding of freshwater mussel populations and distribution.

Water quality is generally very good throughout the Miramichi River watershed. Most of the watershed is crown land and private lands have a relatively low population density. However, some forestry, mining, agriculture and other industrial activities are carried out within the watershed and may locally impact water quality on a number of tributaries. As freshwater mussels can be good water quality indicators, further understanding of the abundance and distribution of species throughout the watershed is important to the assessment and monitoring of water quality within the Miramichi River and its many tributaries. The Miramichi River is also world renowned for its Atlantic salmon, which is a host to the parasitic larval stage of some freshwater mussel species, in particular the Eastern Pearlshell.

Prior to 2008 when MREAC began this project, only limited freshwater mussel surveys had been conducted in the Miramichi River watershed, including surveys at a total of 19 sites by freshwater mussel specialist, Kate Bredin, in 2002 and 2006. A significant population of a rare freshwater mussel, the Brook Floater (*Alasmidonta varicosa*), was discovered in the Southwest Miramichi River in 2006. The Brook Floater has been nationally assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as *Special Concern* and has a Provincial General Status Rank of "may be at risk" in New Brunswick. The existence of this rare species in a tributary of the Miramichi River makes freshwater mussel surveys of the watershed doubly important to more fully delineate this species' population and range.

The main objective of this project was to continue conducting freshwater mussel surveys in the Miramichi River watershed, focusing on un-surveyed areas on the Southwest Miramichi and Little Southwest Miramichi River. These rivers were also selected to complement another project MREAC is undertaking, Water Classification. The second objective of the project was to search for additional locations of Brook Floaters to further clarify this species' distribution and abundance within the Miramichi watershed.

2.0. Methodology

In 2009, the Southwest Miramichi River and the Little Southwest Miramichi River were targeted for mussel surveys. The Southwest Miramichi River was targeted to complement the MREAC Water Classification project; freshwater mussel survey information will be combined with Water Classification data to generate a more comprehensive classification of the Miramichi River watershed. The Southwest Miramichi and tributaries were also surveyed because this is the only branch with confirmed populations of Brook Floater, in the middle reach of the Southwest Miramichi near Doaktown. The upper reaches of the Southwest Miramichi were surveyed to further delineate the upstream range of this known Brook Floater population.

In 2008 a Brook Floater shell was found in The Little Southwest Miramichi River by Mr. Nelson Poirier. This tributary was surveyed in 2009 to confirm the existence of a live Brook Floater population. Few surveys had been done on this tributary in the past and therefore little was known about mussel populations in the Little Southwest Miramichi.

The field method used was similar to that described in the report "*Inventaire des moules d'eau donce dans les rivieres Kouchibouquac, Kouchibouguacsis et Black du Parc national Kouchibouguac, Nouveau-Brunswick*" published in December 2002 by Parks Canada (Beaudet, et al., 2002). Field work began in July 2009 once the river water levels dropped to allow for safe sampling conditions, and ended in September 2008 when water temperatures had cooled and mussels were less likely to be visible at the surface. Surveyors consisted of MREAC staff: Kara Baisley, MREAC Biologist; Harry Collins, MREAC Executive Director; and MREAC summer student Melissa Hebert.

Sites were chosen based on 1) their location - either on the Southwest Miramichi or Little Southwest Miramichi, which were the main focus of our study for this year; 2) accessibility; and, 3) public reports of mussel sightings. Site locations and coordinates can be found in Table 1; and Figure 1 maps the survey sites within the Miramichi River watershed. Teams of 2-3 people searched at each site for a cumulative total of four person-hours. Each surveyor used a Glass-bottom viewing bucket and searched different sections of the survey site. Shorelines were also closely inspected for empty shells. Waters deeper than 1.2 meters were not surveyed, preventing coverage of the entire river width for larger, deeper tributaries.

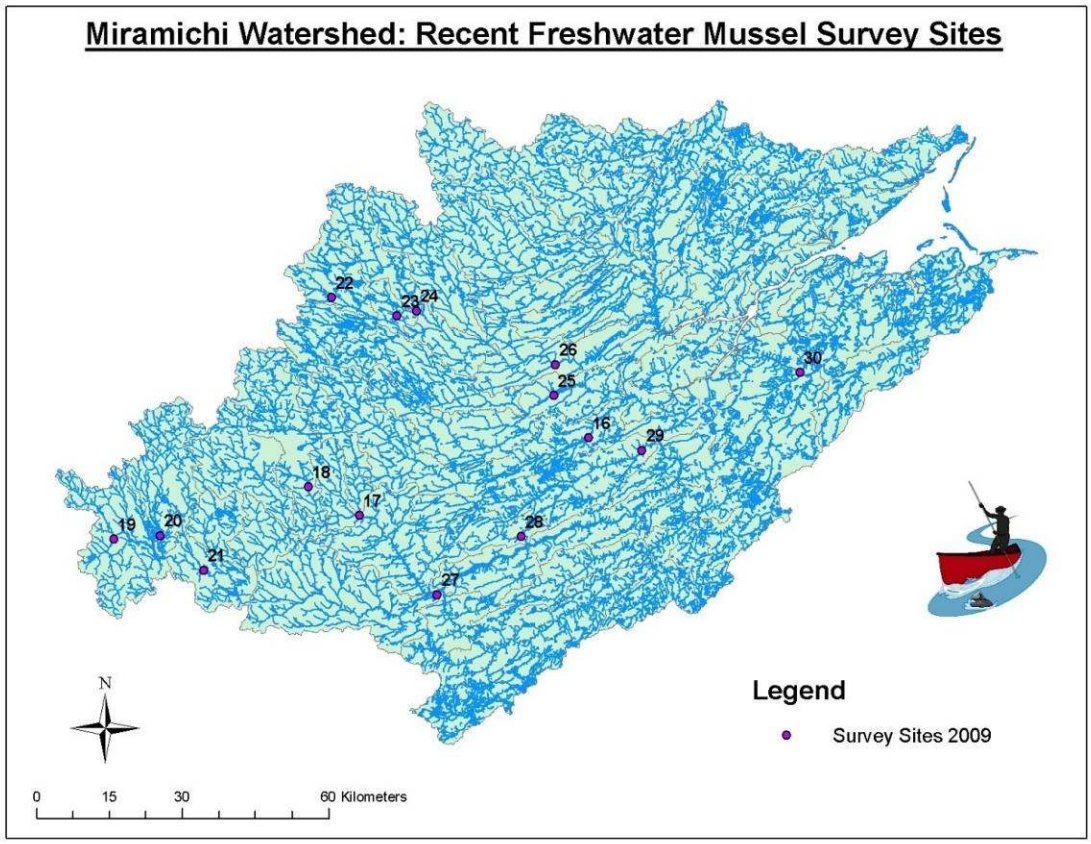
Surveyors normally removed visible mussels from the riverbed for identification and then placed them back. A laminated identification key was created to assist surveyors with on-site identification. A few mussels were kept from each site as a sample collection for later transfer to the New Brunswick Museum. Dead mussels present on shore were also counted and some shells were collected as samples. Sightings of dead mussel shells helped identify key areas of the river where live mussels were likely to be discovered. A tally of dead and live mussels was kept by the surveyor for all species found. When the

survey time period ended, the number of live and dead mussels of each species found was totalled. Water temperate, pH and riverine habitat characteristics were also recorded, and photos of each survey site were taken.

Table 1 – 2009 Freshwater mussel survey site locations, including name, tributary, site number and coordinates. (Site numbering is continued from 2008 survey sites)

Location	Tributary	Site #	Latitude	Longitude
Blackville (Dungarvon)	Dungarvon River, Trib. of SW Miramichi	16	46.74382	-66.01542
Rocky Brook Lodge	SW Miramichi	17	46.60087	-66.63285
Clearwater Brook	Clearwater Brook, Trib. SW Miramichi	18	46.65417	-66.76983
Carleton Adventure Lodge	South Branch of SW Miramichi	19	46.55397	-67.29037
Irving Barrier (tree nursery)	North Branch of SW Miramichi	20	46.56208	-67.16615
Deersdale (Irving mill)	SW Miramichi	21	46.49848	-67.04918
West Branch of the Little SW Miramichi	West Branch of the Little SW Miramichi	22	47.00417	-66.70907
Upper Little SW Miramichi	Little SW Miramichi	23	46.97002	-66.53102
Palisade Camp	North Pole Stream Tri of Little SW Miramichi	24	46.97940	-66.47843
McGraw Brook Camp	Little SW Miramichi	25	46.82245	-66.10895
Catamaran Research Center	Little SW Miramichi	26	46.87927	-66.10447
Taxis Bridge	Taxis River, Trib. of SW Miramichi	27	46.45457	-66.42335
Big Hole Brook	Big Hole Brook, Trib. of SW Miramichi	28	46.56142	-66.19847
Bartholomew Old Bridge Crossing	Bartholomew River, Trib. of SW Miramichi	29	46.71970	-65.87217
Hwy 126 1st Barnaby Bridge	Barnaby River, Trib. of SW Miramichi	30	46.86020	-65.44445

Figure 1 - Map of the Miramichi River watershed showing MREAC freshwater mussel survey site locations for 2009



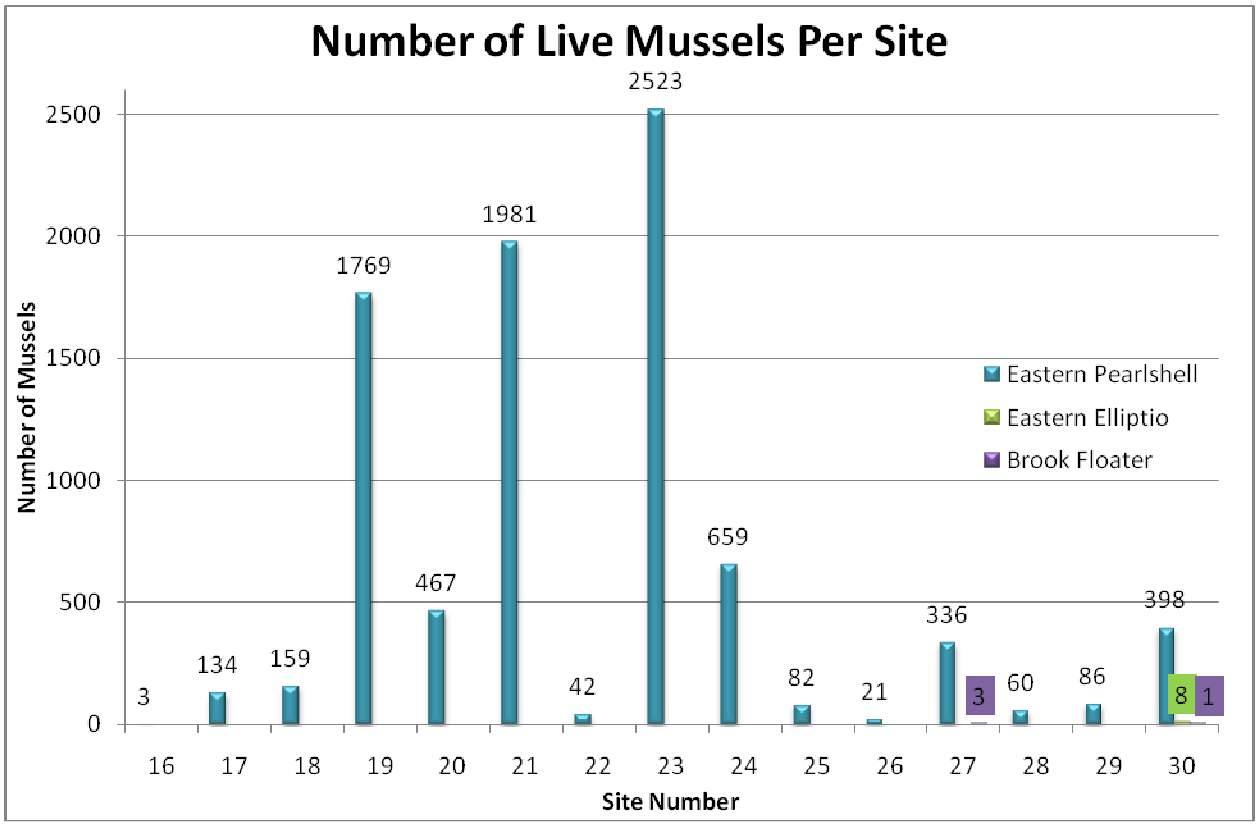
3.0. Results and Observations

During this second year of freshwater mussel sampling, MREAC surveyed an additional 15 sample sites, finding at least one mussel species at every site, and discovering three different species during the project. The total number of freshwater mussels recorded was 8732. Table 2 shows the total number of live mussels recorded at each site and Figure 2 demonstrates these results in a bar graph.

Table 2 - Number of live mussels of each of three species recorded at 2009 survey sites

Location	Site #	Eastern Pearlshell	Eastern Elliptio	Brook Floater
Blackville (Dungarvon)	16	3		
Rocky Brook Lodge	17	134		
Clearwater Brook	18	159		
Carleton Adventure Lodge	19	1769		
Irving Barrier (tree nursery)	20	467		
Deersdale (Irving mill)	21	1981		
West Branch of the Little SW Miramichi	22	42		
Upper Little SW Miramichi	23	2523		
Palisade Camp	24	659		
McGraw Brook Camp	25	82		
Catamaran Research Center	26	21		
Taxis Bridge	27	336		3
Big Hole Brook	28	60		
Bartholomew Old Bridge Crossing	29	86		
Hwy 126 1st Barnaby Bridge	30	398	8	1
Total		**8720**	**8**	**4**

Figure 2 – Bar chart demonstrating the number of live mussels of the three species found at each site (Note: Site 16 does not register as a bar because just 3 individuals were recorded.)



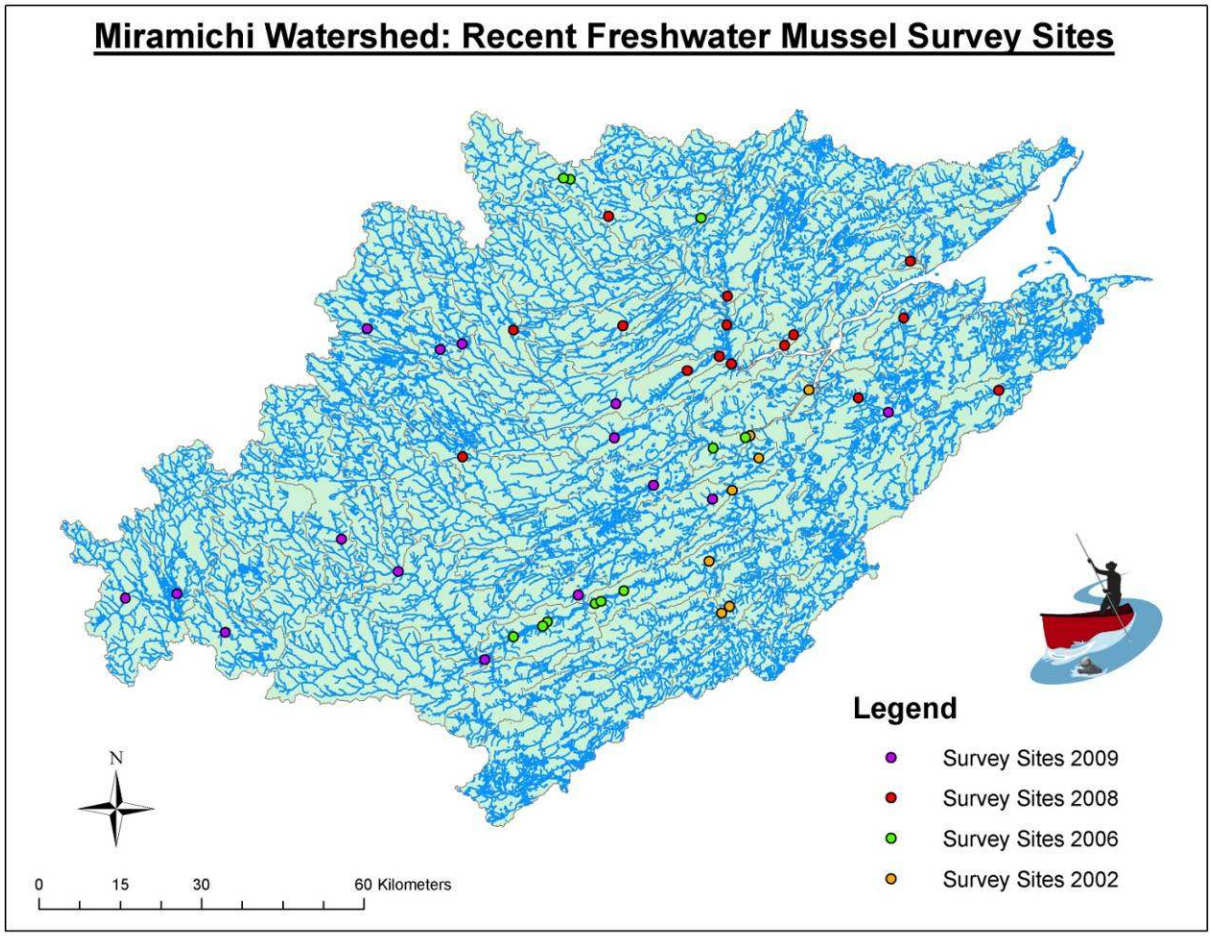
Eastern Pearlshell (*Margaritifera margaritifera*) was the most abundant mussel species found in 2009; it was present at every survey site and a total of 8720 live individuals were recorded. The largest number was at site 23 on the Upper Little Southwest Miramichi River where a total of 2523 individuals were recorded. Eastern Elliptio (*Elliptio complanata*) was the second most numerous mussel found this year, but in considerably smaller numbers than the Eastern Pearlshell; eight individuals were found at one survey site on the Barnaby River. The Brook Floater (*Alasmidonta varicosa*) was found at two sites in two different tributaries although just four individuals were recorded. Water quality information and river habitat observations are presented in Appendix A.

In 2009 two new Brook Floater populations were discovered in two separate tributaries within the Miramichi River watershed. In August 2009 while MREAC staff were conducting water quality monitoring sampling for MREAC's Swim Watch project, a Brook Floater shell was discovered at the 2008 freshwater mussel survey Site number 09 on the Barnaby River. This prompted an additional survey at an upstream site on the Barnaby to determine if Brook Floater were more widely present throughout this tributary. The species was recorded from the second site (# 30), confirming a live population of this

rare species in the Barnaby River. Three live Brook Floater were also found at Site 27 on the Taxis River in 2009.

Figure 3 illustrates the survey site locations for the four major freshwater mussel sampling efforts in the Miramichi River watershed within the last ten years. This includes 30 sites sampled by MREAC over the past two summers, and 19 survey sites by Kate Bredin in 2002 (Bredin, 2002) and in 2006-7 (COSEWIC 2009), for a total of 49 freshwater mussel survey sites in the Miramichi watershed to date.

Figure 3 - Map of the Miramichi River watershed showing site locations of major freshwater mussel surveys completed within the last ten years: by MREAC in 2009 (purple dots) and 2008 (red) and Bredin in 2006-07 (green) and 2002 (orange) (Bredin 2002, COSEWIC 2009)



4.0. Discussion

Progressively greater freshwater mussel survey coverage of the Miramichi River watershed has been achieved with each year of sampling conducted by MREAC. 2009 surveys have been an important addition to the survey coverage, with surveys conducted in new tributaries such as the Little Southwest Miramichi, Barnaby and Taxis that have had little survey coverage to date. In 2009 freshwater mussels were recorded from all 15 sites surveyed, whereas in 2008, freshwater mussels were recorded from 12 of 15 surveys sites (Baisley, K.L. 2008). In addition, a greater number of individual mussels (8732) were counted during 2009 surveys, as compared to 2008, where just 3162 mussels were counted. The higher incidence and number of mussels recorded in 2009 may be due to the survey sites in general being in more remote locations and less disturbed sites than those sampled in 2008.

Freshwater mussel species diversity was low at sites surveyed by MREAC in 2009, similar to the findings in 2008 (REF 2008 MREAC REPORT HERE). Out of the 15 sites sampled in 2009, only two sites had more than one species of freshwater mussels present. The Taxis River, site 27, located west of Boiestown, had two mussel species, Eastern Pearlshell and Brook Floater. The only site with three mussel species was the Barnaby River at site 30 at the Highway 126 Bridge where Eastern Pearlshell, Eastern Elliptio and Brook Floater were recorded . The dominant species throughout the Miramichi River watershed is the Eastern Pearlshell; it was recorded from all 2009 surveys sites and 10 of 15 sites surveyed in 2008.

Many of the 2009 survey sites are in the headwaters of the Southwest Miramichi and the Little Southwest Miramichi Rivers, where forestry represents the most significant form of land-use. Although there is no past freshwater mussel data to compare with, this present survey data will provide valuable background information that can be used to assess the effects of future changes in the intensity or type of land use on water quality. This baseline freshwater mussel information is even more important for the Barnaby River as a new large scale cranberry facility is currently being developed in the Rogersville area. Three freshwater mussel species were recorded from this river, including the “special concern” species, Brook Floater. Having some background freshwater mussel information before this development commences will help MREAC to monitor changes in water quality in the Barnaby River as the cranberry development proceeds.

4.1. Eastern Pearlshell (*Margaritifera margaritifera*)

Eastern Pearlshell are commonly found in clean, cool streams and rivers that support Salmonid species (e.g., trout and salmon), some species of which are used as host fish to carry Eastern Pearlshell glochidia larvae. This mussel species is found in sand, gravel and cobble substrates, with a range of flow conditions. Eastern Pearlshell also have an amazing ability to withstand fast flowing, rocky conditions

due to a thick, durable shell, which is characteristic of few other freshwater mussel species. They are also commonly found in soft water (acidic) with low levels of calcium (Nedeau, 2000).

The Eastern Pearlshell was by far the most common freshwater mussel found during this project, located at all 15 sites, and with the highest total number of live mussels recorded (8720). Site conditions were highly variable, ranging between sand, cobble, rock and boulder substrates, with slow, moderate and fast water flows, all potential habitat conditions for this species. The Southwest Miramichi and Little Southwest Miramichi River are world renowned for their Atlantic salmon fishing, and during the surveys salmon parr and brook trout were spotted at many of the survey sites. With healthy Salmonid populations on these rivers, it was no surprise to find a healthy Eastern Pearlshell population.

The lowest number of Eastern Pearlshell found this year was at site 16 on the Dungarvon River near Blackville with a total of just three live mussels. This site is a common fishing spot and the low numbers at this site could be attributed to the high volume of in-stream foot traffic and disturbance of the river bed by fishermen. As water conditions too high for surveyors to cross the river or go further downstream, the river area that could be surveyed was limited. More mussels may have been detected if water conditions had allowed surveyors to move further downstream where less foot traffic occurs. The highest number of Eastern Pearlshell found was at site 23 with a total of 2523. This site is in the headwaters of the Little Southwest Miramichi on the Upper Branch and is relatively undisturbed by human impacts.

4.2. Eastern Elliptio (*Elliptio complanata*)

The Eastern Elliptio occupies a wide array of habitats, ranging from small streams to large rivers to lakes, and is found in substrates of clay, sand, mud and cobble. These mussels do not favour silty or rocky substrates or water that is too deep. This species also has a high tolerance for disturbed or polluted sites, “suggesting that it has a wide environmental tolerance and a capacity to quickly colonize new habitats” (Nedeau, 2000).

This freshwater mussel species was found at only one site during 2009, on the Barnaby River (site 30), where a total of eight live individuals were recorded. These mussels are similar in appearance to the Eastern Pearlshell and can be difficult to identify. However, they have a thinner shell and are less elongated, and are not commonly found in fast flowing, rocky rivers preferred by the Eastern Pearlshell (Nedeau, 2000). Many of the 2009 survey sites were located in headwaters of tributaries, with dense cobble substrate and fast water flow, habitats where Eastern Elliptio was less likely to be found. 2009 surveys confirmed that the Eastern Elliptio continues to be the second most abundant mussel species from MREAC surveys of the Miramichi River system.

4.3. Brook Floater (*Alasmidonta varicosa*)

The Brook Floater is usually considered to be a habitat specialist that requires running water environments such as shallow rivers or streams with moderate to high water flows" (COSEWIC, 2009). They usually prefer sand or fine gravel but can be found in pockets of sand within cobble and rocky substrates. They are threatened by aquatic habitat degradation from silt, nutrients and sewage, poor agriculture and land management practices. They are medium in size with a swollen, kidney shaped shell and a noticeable cantaloupe coloured foot. Their known host fish species are Ninespine Stickleback, Blacknose Dace, Yellow Perch and Golden Shiner (COSEWIC, 2009).

Two new populations of Brook Floater were discovered during 2009 surveys – in the Taxis (site 27) and Barnaby Rivers (site 30), which have had little survey effort until this project. Both of these sites had rocky substrate with sandy pockets, with medium to fast water flows, ideal conditions for this species of freshwater mussel. This raises the total number of known Brook Floater populations in Canada from 15 to 17 (COSEWIC, 2009). Ten of the 17 known Canadian Brook Floater populations occur in New Brunswick, and three of these are in the Miramichi watershed, indicating the relative importance of the Miramichi to this rare species. Because just three live individual Brook Floaters were found in the Taxis River, and one live individual in the Barnaby, more intensive surveys of these two tributaries are warranted to further delineate the abundance and river range of these newly discovered populations.

The species global distribution is highly fragmented within the Eastern United States, New Brunswick and Nova Scotia. Because Brook Floater populations are steadily declining in the US due to ongoing habitat degradation, the Canadian population is an important stronghold for the species' survival, especially as new populations continue to be discovered. With federal laws such as the Fisheries Act, and provincial laws such as the Clean Water Act in New Brunswick, the Brook Floater does have some protection in Canada (COSEWIC, 2009).

5.0. Conclusion

MREAC conducted a freshwater mussel survey during the summer of 2009, surveying 15 sites with a total of 8732 mussels of three different species recorded. Mussels were found at all 15 survey sites in 2009. Brook Floaters were discovered in two new rivers in 2009 at site 27 on the Taxis River and at site 30 on the Barnaby River, demonstrating the importance of the Miramichi watershed to this rare species.

The total number of sites surveyed by MREAC in the Miramichi River watershed now stands at 30 locations. The cumulative number of locations within the Miramichi watershed that have been sampled for freshwater mussels within the past 10 years , including MREAC's two projects and Bredin's 2002 – 2007 work, now total 49 sites. As the Miramichi River watershed encompasses an area greater than 13,400km^2, continued surveys are necessary to generate more accurate and comprehensive information on freshwater mussel diversity, distribution and abundance. In particular more intensive surveys are required for Brook Floater, in order to better estimate population sizes within the Barnaby and Taxis Rivers

6.0. References

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Appendix A

Date	Location	Site #	Dist. (m)	Substrate	Water Flow	DO (mg/L)	pH	Temp (°C)	Notes
23-Jul-09	Blackville (Dungarvon)	16	150	cobble with sand	swift center	8.84	7.35	18.6	common fishing area, water too high to cross and work further downstream
20-Aug-09	Rocky Brook Lodge	17	300	rocky, boulders w/ sandy pockets	swift & riffles	8.72	7.82	22.3	common fishing spot, big river, only sampled one side, mussels scattered
20-Aug-09	Clearwater Brook	18	400	rocky, cobble w/ sandy pockets	swift w/ riffles and pools	8.96	7.36	20.6	common fishing spot
21-Aug-09	Carleton Adventure Lodge	19	200	rocky, shall, cobble	med to slow	7.98	7.42	18.3	*overcast day, scum on rocks, collected crayfish
21-Aug-09	Irving Barrier (tree nursery)	20	200	rocky, cobble w/ sandy pockets	slow	8.95	7.56	18.4	*overcast day, deep & dark area, a lot of fish. Sampled below fish barrier
21-Aug-09	Deersdale (Irving mill)	21	350	rocky, cobble w/ sandy bars	slow	8.70	7.42	19.6	*overcast day, river wide & deeper towards other side, sampled part of river
25-Aug-09	West Branch of the Little SW Miramichi	22	250	boulders, rocky w/ sandy pockets	slow	8.64	7.64	18.9	margis lighter, shells found in middons, random lives ones amoung rocks
25-Aug-09	Upper Little SW Miramichi	23	200	boulders, rocky w/ pockets of sand/cobble	slow on edges, med in middle	8.67	7.88	20.1	*sunny w/ cloudy periods
25-Aug-09	Palisade Camp	24	200	lots boulders, rock, pockets sand/cobble	riffles fast, swift water w/ slow pool	9.24	7.70	18.4	very boulder and rock, mussels found scattered around
26-Aug-09	McGraw Brook Camp	25	300	rocky & cobble	med, swift on riffles	8.90	7.84	19.9	common fishing spot
26-Aug-09	Catamaran Research Center	26	250	rocky w/ boulders & cobble pockets	med to swift	8.64	7.84	21.8	big river, only sampled part of one side above catamaran brook, mussels found amoung boulders in pockets
01-Sep-09	Taxis Bridge	27	250	shall, very rocky w/ some sandy spots	med to swift	11.62	7.35	15.1	only sampled part of river, dark side, mussels beginning to burrow, BF found near other side amoung rock
01-Sep-09	Big Hole Brook	28	400	rock, shall w/ cobble pockets & sandy shore	slow to med	12.53	8.00	14.1	water beginning to cool, mussels beginning to burrow
02-Sep-09	Bartholomew Old Bridge Crossing	29	300	rock, cobble & sand	slow	11.82	7.68	13.9	cold water, skipped section of river as too deep, was once a bridge crossing
03-Sep-09	Hwy 126 1st Barnaby Bridge	30	550	shall, rock with sandy pockets	slow, med on riffles	11.02	7.92	18.1	BF found in center on raised rock