Bartholomew River Recreational Fishing Management Plan

2018

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1.0 Introduction

In 2017/18 the Miramichi River Environmental Assessment Committee (MREAC) was sponsored through the Atlantic Salmon Conservation Foundation (ASCF) to undertake a two year project on the Bartholomew River to develop a recreational fishing management plan (interim plan in 2017). The second year was supported to implement some key and/or short-term recommendations from 2017. This final plan is based on additional monitoring and reporting on implementation success.

2.0 History of Atlantic Salmon Management on the Bartholomew River

The Bartholomew River is a tributary of the Southwest Miramichi and shares in the fame of the Miramichi region as a world class destination for Atlantic salmon angling. The Village of Blackville is located at the mouth of the Bartholomew. A Highway 8 bridge crossing over the Bartholomew River allows for easy access to this bottom end of the waterway. A network of roads and trails allows for relatively easy access to the bottom third of the river while woods roads provide for the occasional points of access in the headwaters.

The history of Atlantic salmon management on the Bartholomew River turns out to be quite involved and intensive for a period of over 30 years from 1961 to 1993. Prior to this, a dam near the mouth of the river had prohibited the passage of spawning salmon for over a century. Following the removal of the dam near the river's mouth in 1975, the federal Department of Fisheries and Oceans, in response to community concern, established an Atlantic salmon research station 4.5 kms upstream from the village of Blackville. The station was active in Atlantic salmon monitoring and management, engaged in habitat assessment, stock assessments, electrofishing, sample collections, and the stocking of juvenile fish. This activity extended throughout the sub-watershed and resulted in a sizable data set. Copies of much of this data were retained by Mr. Norman Steward of Lockstead Settlement, New Brunswick who graciously loaned this data to MREAC staff for analysis.

3.0 Management Objectives for Atlantic Salmon Fishing on the Bartholomew River

1. To maintain the ecological and recreational fishing values that the Bartholomew River offers to river users.
2. To conserve and protect the existing recreational fisheries stocks and their habitat.
3. To maintain and ensure access to recreational fishing opportunities and experiences.
4. To improve the scientific knowledge base through monitoring and assessment activities of recreational fishes and their habitat conditions.
5. To recruit the cooperation and support of residents, land owners, recreational users and other interested parties to support needed management of the recreational fisheries resources.
6. To promote equity and fairness for all users in the application of management measures for the recreational fisheries.
7. To promote and engage the local interests of various stakeholders to participate in the decision-making process for managing the recreational fisheries resources.
8. To implement a long term strategy to conserve and maintain the wise use of recreational fishes and their habitat.

4.0 River Access

There is a mix of crown and private lands on the Bartholomew River. The lower reaches of the river, for about one half of its meander length, is mostly privately owned (see GeoNB). Above these private lands, the crown lands dominate. The crown lands are managed through lease-hold arrangements with large lumber companies. The woods road network is extensive but still limits convenient access to much of the waterway unless accessed by canoe or off-road vehicles. The Bartholomew Road North provides paved access to a ribbon community of full time residents throughout its length. Several cottages and camps dot the shoreline from the top end of Bartholomew Road North down to the village of Blackville, where the river flows into the Southwest Miramichi. Other convenient access is available about mid-way along the river along a secondary woods road bridge and then again high in the waterway access is possible at crossings of the South Branch and North Branch by another woods road that extends off the

paved road to Hazelton. Other points of access are available to off road vehicles via trails and wood harvesting roads.

5.0 Habitat Conditions

The Bartholomew River watershed is mostly located in the Eastern Lowland Ecoregion of New Brunswick with a headwaters area located in the Valley Lowland Ecoregion (Figure 1). Tracking the main branch and then the North Branch Bartholomew River the waterway has a meander length of 62 kilometers. It illustrates the typical low gradient and relatively wide and shallow character of rivers in this region.

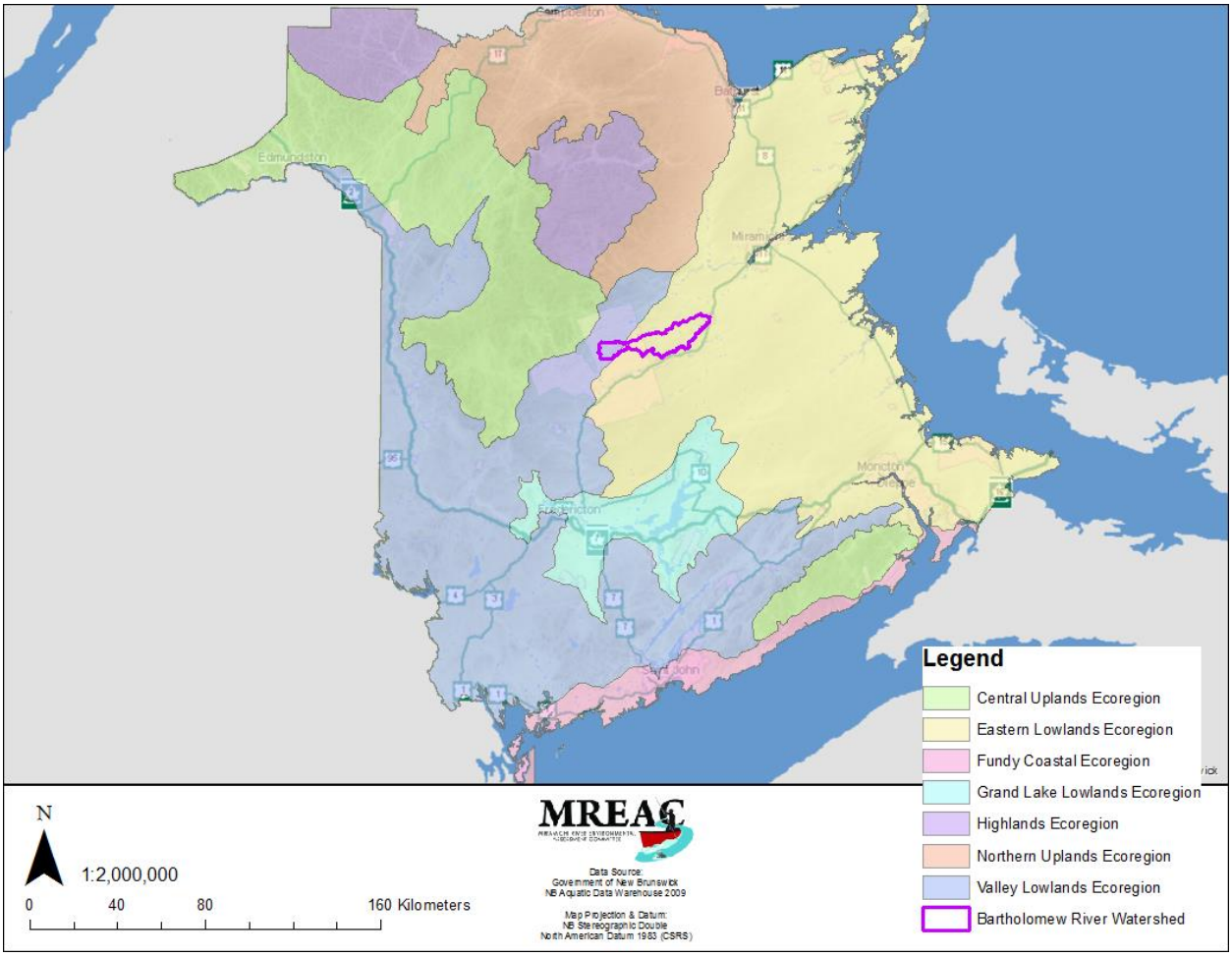
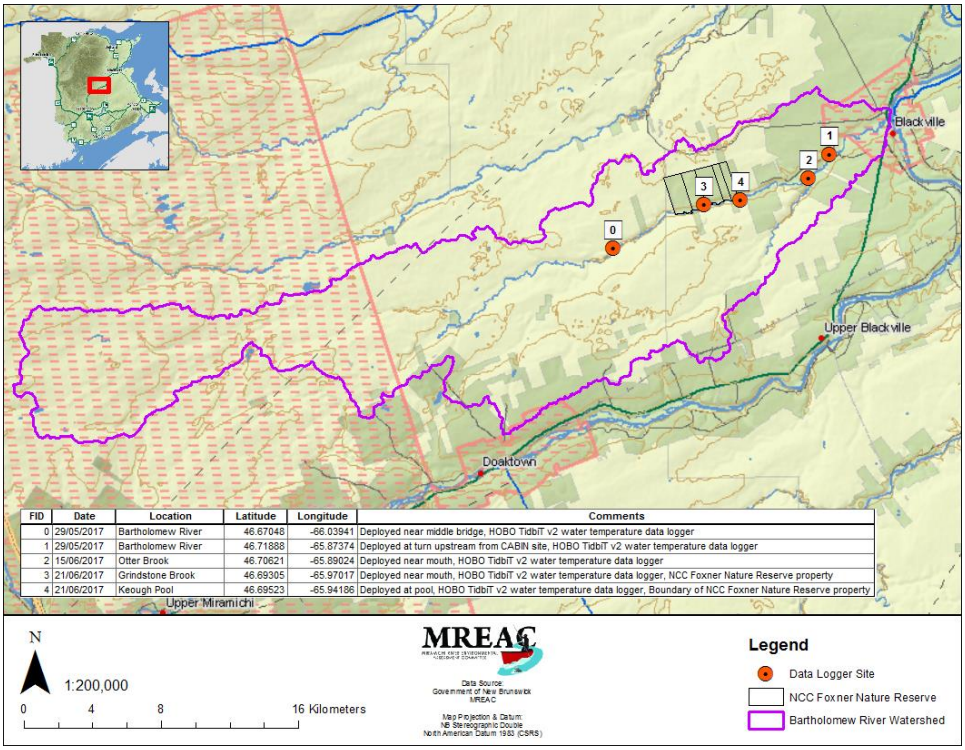


Figure 1: Bartholomew River Drainage Basin within New Brunswick's Ecoregions

5.1 Water Temperatures: In-stream water temperature has become an increasing concern on salmonid bearing streams throughout New Brunswick. Sustained periods of elevated high temperatures, normally mid-summer, can result in significant stress to Atlantic salmon and Brook trout. A "warm water protocol" has been instituted for important salmon pools throughout the larger branches of the Miramichi watershed wherein pool closures will apply when stress levels to fish are such that additional stress due to angling should be avoided. This protocol has a defined temperature regime that would result in temporary pool closures as well as closure of the entire river if warranted. In both 2017 and 2018, conditions were exceptionally hot and dry with low water levels persisting into October. The warm water protocol was implemented twice in 2017 amounting to a 14 day total of restricted fishing. In 2018 the warmer and dryer conditions resulted in restrictions lasting for 48 consecutive days. On the Bartholomew River the closure applies to the Bartholomew River Pool at the mouth of the river from the Hwy 8 Bridge to the river's mouth on the Southwest Miramichi.

Temperature Monitoring: MREAC staff installed five temperature loggers in the open water season of 2017 to assess fish temperature regimes (Figure 2). Two were situated in smaller tributaries to the main branch of the Bartholomew River and three others placed at locations on the main branch. One of the three main branch loggers was positioned at the bottom of the Keough Pool, in hopes of observing significantly cooler temperatures. This difference was not realized as the pool placement did not differ greatly from the other two main branch loggers. One logger placed in the Otter Brook was not recoverable (i.e. missing), another placed in a smaller tributary Grindstone Brook shows significantly cooler conditions than the three others (Figure 3). All were installed for much of the open water season. Comparing one of the Bartholomew River temperature monitors (at the CABIN site) to MREAC's real-time monitoring station at Doaktown, it is noteworthy that the Bartholomew River was consistently lower (~2.5°C) in 2017 (Figure 4). In recent years, river temperature conditions have been somewhat unpredictable but several years have shown conditions of high temperature stress for salmonids and this is the expected trend with the growing impact of climate change.



FID	Date	Location	Latitude	Longitude	Comments
0	29/05/2017	Bartholomew River	46.67048	-66.03941	Deployed near middle bridge, HOBO TidbiT v2 water temperature data logger
1	29/05/2017	Bartholomew River	46.71888	-65.87374	Deployed at turn upstream from CABIN site, HOBO TidbiT v2 water temperature data logger
2	15/06/2017	Otter Brook	46.70621	-65.89024	Deployed near mouth, HOBO TidbiT v2 water temperature data logger
3	21/06/2017	Grindstone Brook	46.69305	-65.97017	Deployed near mouth, HOBO TidbiT v2 water temperature data logger, NCC Foxner Nature Reserve property
4	21/06/2017	Keough Pool	46.69523	-65.94186	Deployed at pool, HOBO TidbiT v2 water temperature data logger, Boundary of NCC Foxner Nature Reserve property

Figure 2: Temperature Data Logger Sites 2017

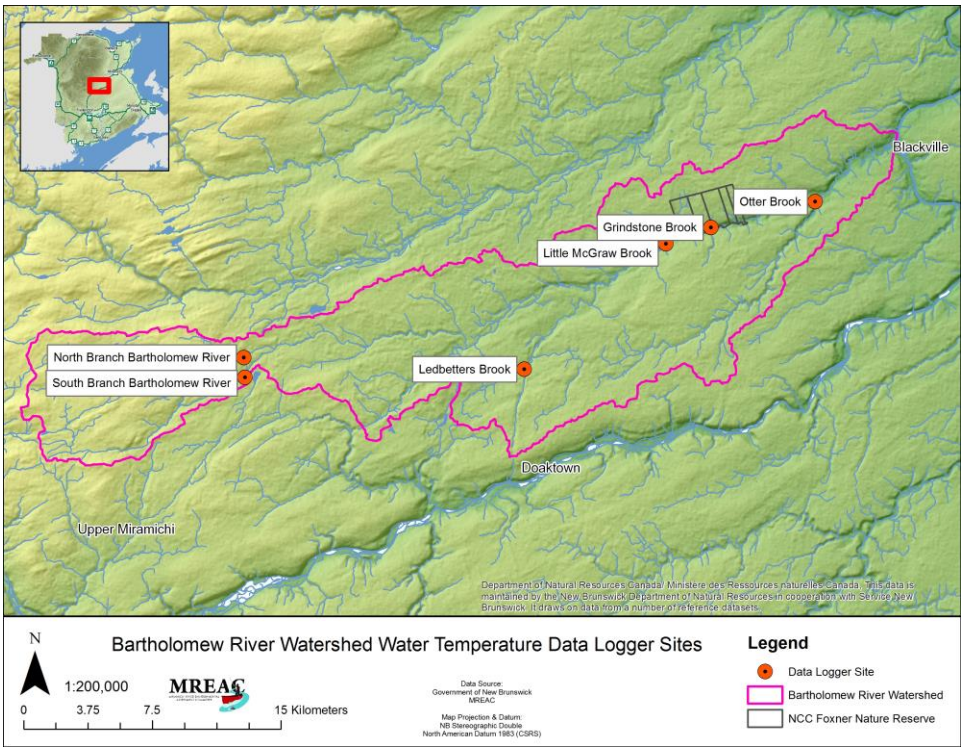


Figure 3: Temperature Data Logger Sites 2018

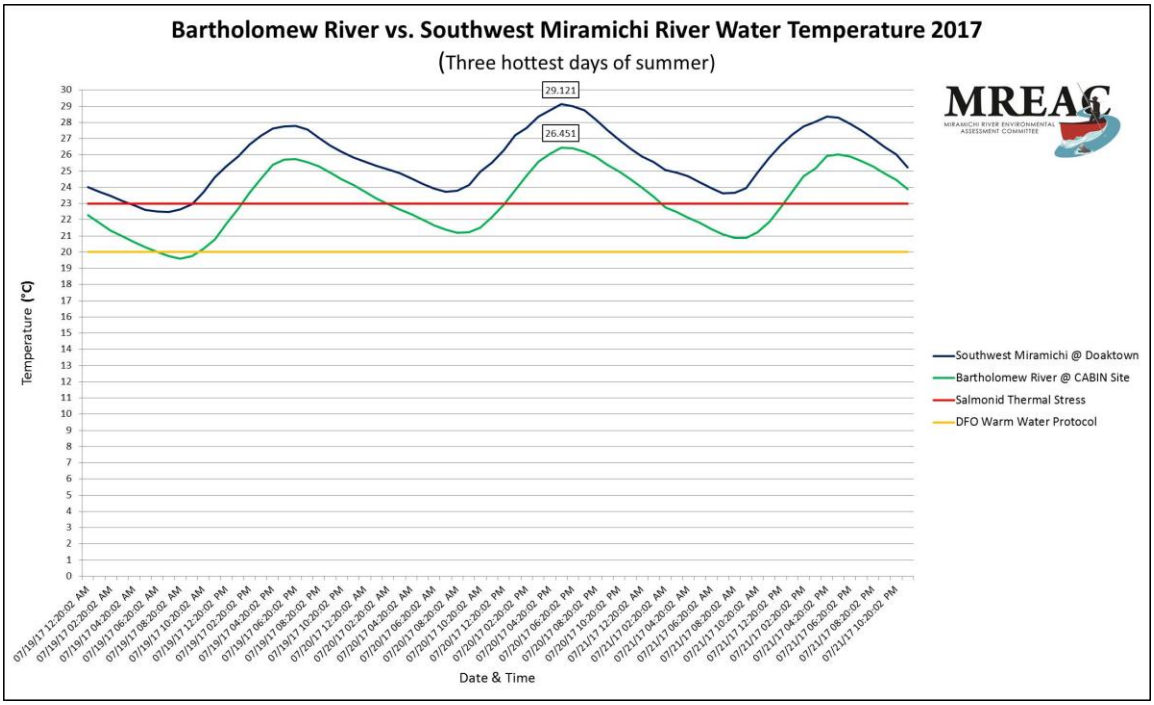


Figure 4: The Bartholomew River Cooler Than the Southwest Miramichi on Hottest Summer Days in 2017

Water quantity is closely related to local or regional weather conditions. The summer of 2017 illustrated this with extended hot weather with virtually no rain throughout July, August and September. Very low water levels were noted throughout the Miramichi watershed, including the Bartholomew River. Low water levels add additional stress in fish habitat as fish are more visible and thus more exposed to predation. Temperature related issues are perhaps the greatest long-term threat to water quality and quantity. However, as related to Atlantic salmon, the Bartholomew leans toward being a "fall run" river, meaning that the main salmon run occurs beyond the critical period of potentially harmful high temperature conditions of mid-summer. Due to the comparatively smaller scale of the Bartholomew, early run fish would be exposed to predation and other threats (including angling and poaching), especially during low water conditions and with more restricted pool sizes. The threat of high temperature conditions also apply to the resident Brook Trout. These will also require management consideration during periods of high temperature stress.

The local impacts of cool water streams are shown to be vital during times of warm water conditions. The cooler waters from these discharges may provide some relief in pools below the stream discharge. The Grindstone Brook, monitored in 2017 and 2018, illustrates this with discharge temperatures at its mouth well over 10°C degrees cooler that those in the main branch (Figure 5), (Figure 6)

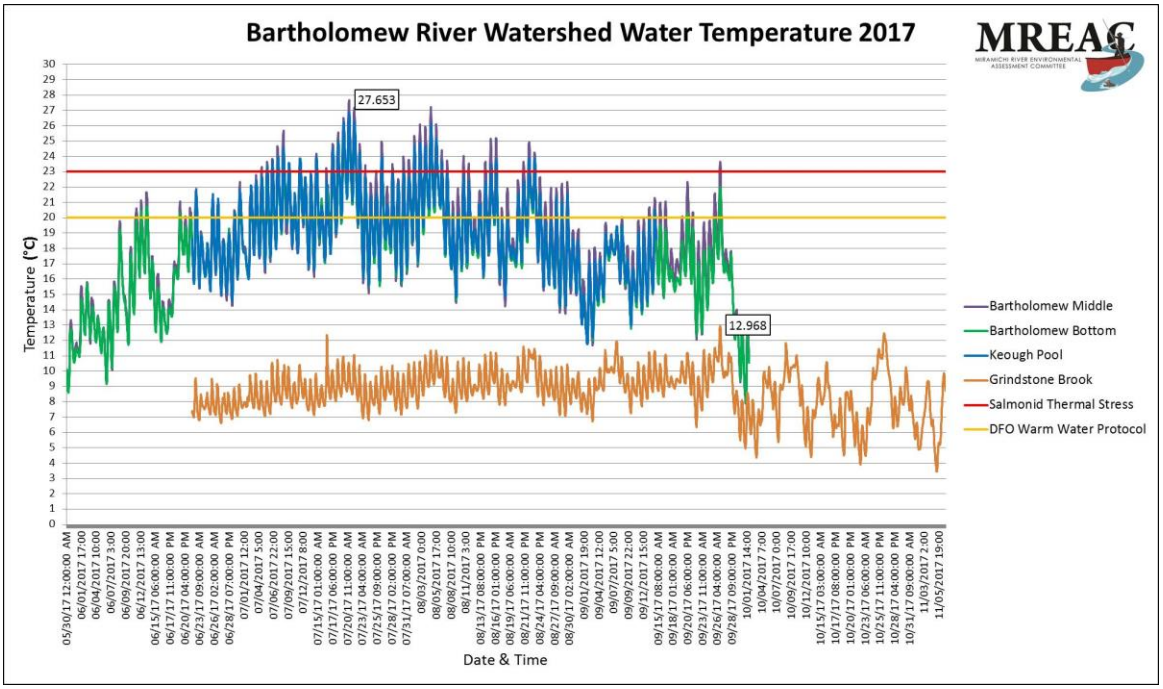


Figure 5: Bartholomew River and Tributaries Water Temperatures 2017

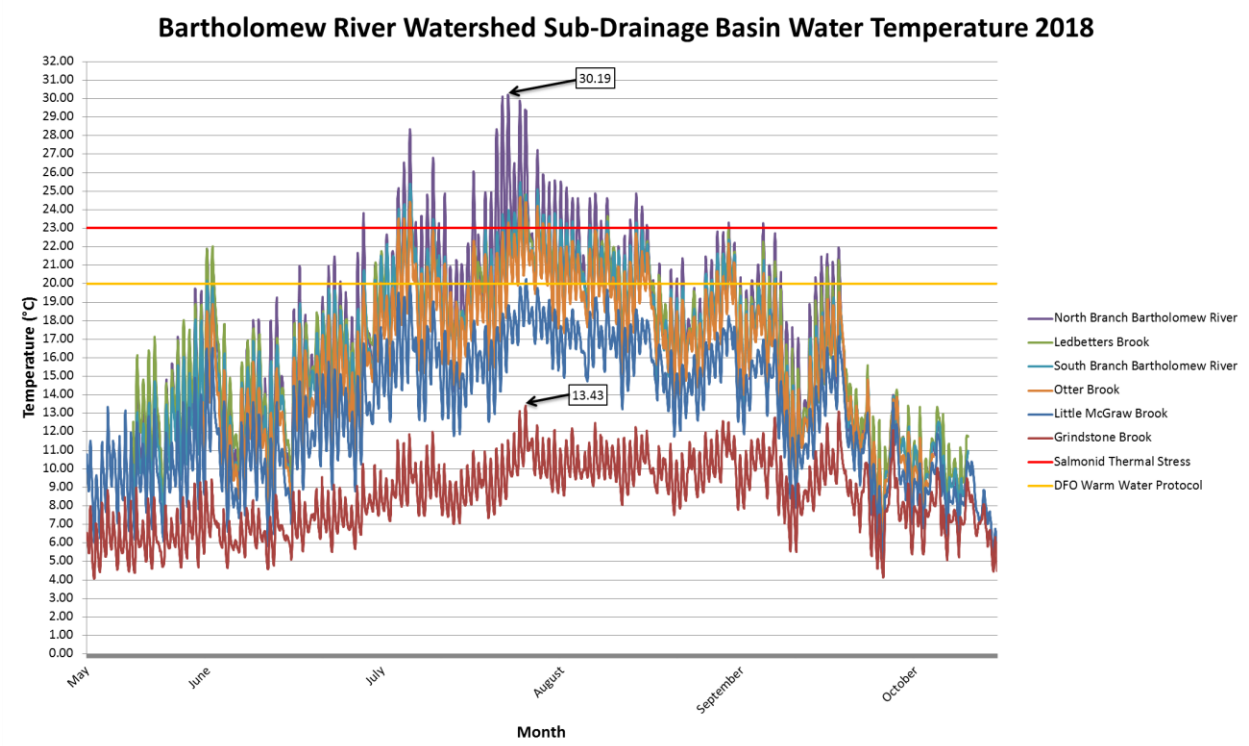


Figure 6: Bartholomew River and Tributaries Water Temperatures 2018

Nine in-stream temperature loggers were deployed in 2018, (Figure 7) one was lost, two others unrecoverable but likely to be recovered in 2019. The data reflects the reality of a hot and dry summer period, often with water temperatures exceeding the 23° C, a threshold known to stress cold water fishes like Atlantic salmon. For just shy of seven consecutive weeks the stress levels were such that the "warm water protocol" was in effect and restricted angling to 26 of the major angling pools distributed throughout the Miramichi watershed. Camp owners observed very little movement of salmon during this period.

Recommendation: Water temperature monitoring with the long-term goal of protecting colder water pools as fish refuges should be instituted on the Bartholomew River.

Figure 7: Installing Temperature Logger North Branch Bartholomew Spring 2018

5.2 Water Quality Monitoring: The remoteness and limited development along the Bartholomew River has been to the benefit to the environmental conditions noted along this waterway. The data collected below shows that the Bartholomew River is in relatively good condition. MREAC staff and volunteers recorded good to excellent water quality conditions throughout their 2017 monitoring initiatives (Table 1), (Table 2), (Figure 5), (Table 3). Field monitoring equipment involved a YSI Pro2030 and an EcoSense pH100A. Conductivity was measured using a desktop YSI EcoSense 9500 Photometer.

Water Quality Monitoring YSI Pro2030 & EcoSense pH100A **May 22, 2017**					
Site	Dissolved Oxygen **(mg/L)**	Specific Conductance **(µS/cm)**	Salinity **(ppt)**	Water Temperature **(°C)**	**pH**
Wildcat Brook @ mouth (~10 meters upstream)	11.53	31.3	0.0	10.5	6.27
Unnamed Brook (before Grindstone Brook traveling down river)	10.15	23.0	0.0	13.2	6.36
Grindstone Brook @ mouth (~10 meters upstream)	12.01	60.7	0.0	7.7	6.82
Unnamed Brook (after Grindstone Brook traveling down river)	10.08	33.6	0.0	15.1	7.05

Table 1: Water Quality Monitoring Bartholomew - May 22, 2017

Water Quality Monitoring YSI Pro2030 & EcoSense pH100A **June 21, 2017**					
Site	Dissolved Oxygen **(mg/L)**	Specific Conductance **(µS/cm)**	Salinity **(ppt)**	Water Temperature **(°C)**	**pH**
Wildcat Brook @ mouth (~10 meters upstream)	8.86	39.5	0.0	17.6	5.98
Grindstone Brook @ mouth (~10 meters upstream)	12.82	64.6	0.0	8.9	6.85

Table 2: Water Quality Monitoring Bartholomew River - June 21, 2017

5.3 Siltation: Issues related to siltation are most commonly related to road construction, especially at river and stream crossings. Industry practices are such that most of these issues are avoided by road building techniques that reduce the impacts of run-off and silt by constructing cross drains, diversion ditches, silt traps and by roadside seeding (personal communication, Tony Vanbuskirk, Fornebu Lumber, 2016). River fording by off-road vehicles may also increase siltation. Established fords were noticed along the watercourse. However, no fording site seemed particularly problematic.

Appropriate sizing for culvert installations and bridge crossings has become a greater challenge with the greater frequency of major rainfall events that may wash out undersized culverts and bridges. No issues were noted on this problem during either the 2017 or 2018 project field season.

Siltation also arises on private lands with wood harvesting and other construction activities. Poor harvesting practices and limited awareness levels of problems associated with siltation are a widespread awareness issue related to private woodlots.

Recommendation: Strategies to promote the use of best management practices among private woodlot owners should continue to be promoted.

5.4 Dissolved oxygen (DO): DO levels for salmonids has not been an issue in any sampling data available or taken by the authors of this report. There do not appear to be any future threats to this parameter based on current and expected land use pressures.

5.5 pH: The pH measures taken on the Bartholomew are generally within an acceptable range for salmonids. In the spring of 2018 MREAC staff was able to collect several pH samples from the mouth of the river (Figure 8). Two late April samples were suppressed and below the Canadian Water Quality Guidelines for the Protection of Aquatic Life.

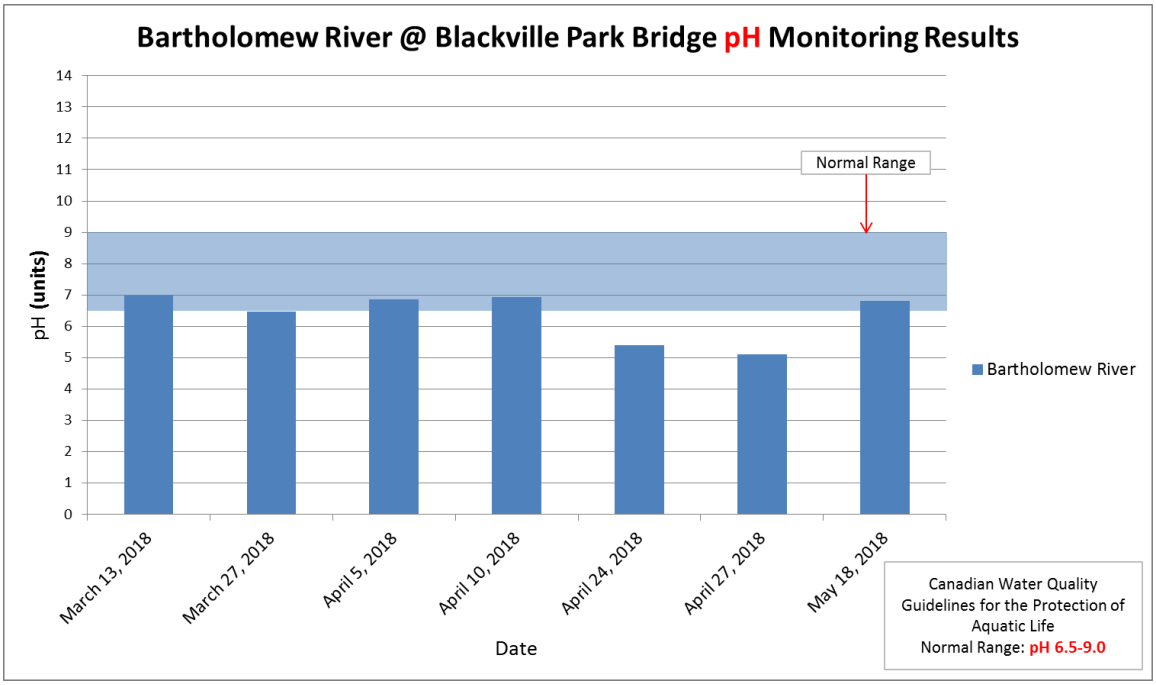


Figure 8: Bartholomew River @ Blackville Bridge pH Monitoring Results

Recommendation: It is recommended that the Bartholomew Rive site continue to be monitored for pH levels in late winter and spring.

5.6 Alkalinity: Alkalinity samples were collected at locations 0-6 in 2017 for the Nature Conservancy of Canada (NCC) (Figure 9). The NCC was interested in these levels from brooks on the newly acquired Foxner Reserve property to get a feel for the buffering capacity of these waterways. MREAC staff extended this sampling to include sites downstream of the NCC reserve.

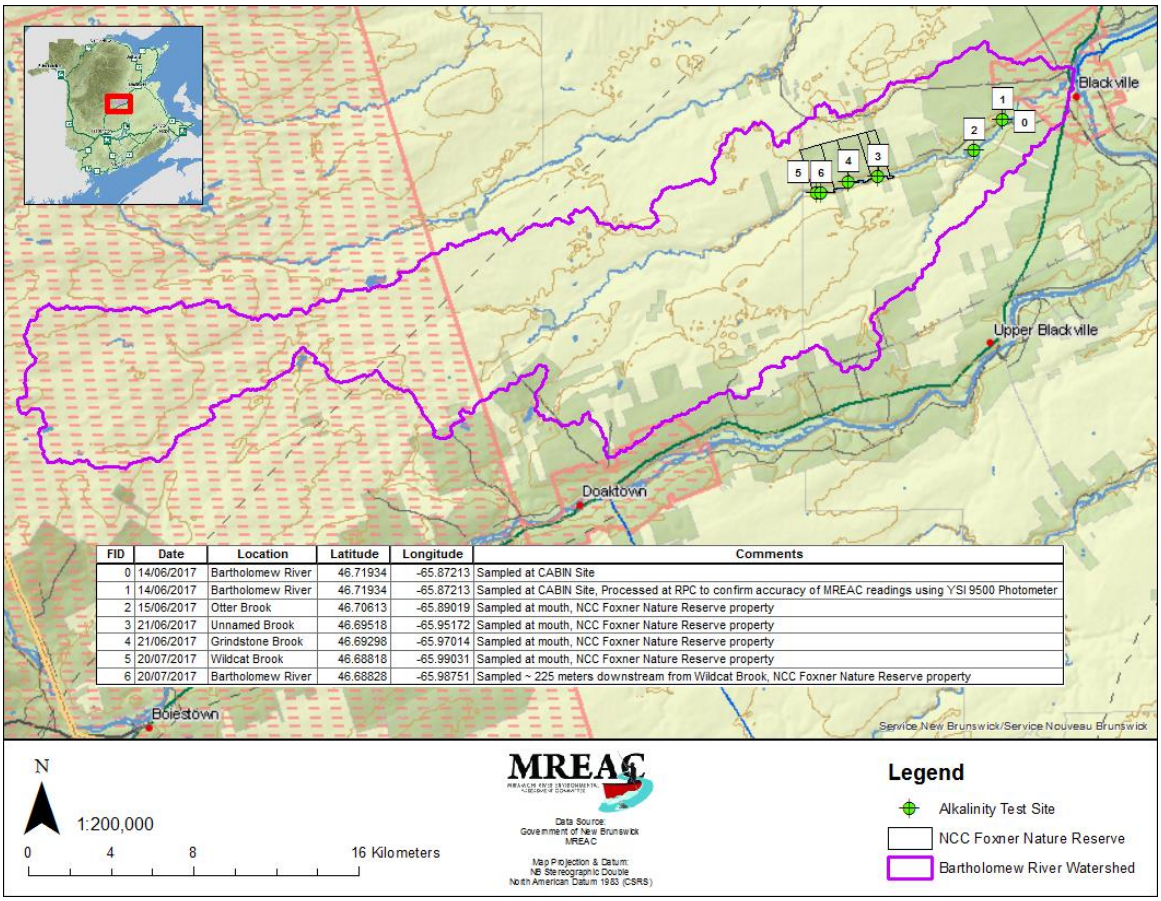


Figure 9: Alkalinity (as $CaCO_3$) Sampling Sites

Water Quality Sampling & Analysis Alkalinity (as $CaCO_3$) YSI EcoSense 9500 Photometer					
FID	Date	Location	Latitude	Longitude	Alkalinity (as $CaCO_3$) **(mg/L)**
0	June 14, 2017	Bartholomew River	46.71934	-65.87213	20
1	June 14, 2017	Bartholomew River	46.71934	-65.87213	20
2	June 15, 2017	Otter Brook	46.70613	-65.89019	20
3	June 21, 2017	Unnamed Brook	46.69518	-65.95172	20
4	June 21, 2017	Grindstone Brook	46.69298	-65.97014	100
5	July 20, 2017	Wildcat Brook	46.68818	-65.99031	25
6	July 20, 2017	Bartholomew River	46.68828	-65.98751	25

Table 3: Alkalinity (as $CaCO_3$) Sampling Results

This current reflection on the environmental condition of the Bartholomew River environmental status is, in part, based on the land use. Other monitoring on the Miramichi River watershed by MREAC and other partners may also apply as the

Bartholomew can generally be considered as typical, especially of the Eastern Lowland ecoregion. The Southwest Miramichi River, Cains River, and Dungarvon River are other major tributaries that like the Bartholomew have most of their meander lengths throughout the Eastern Lowland. Other Bartholomew specific monitoring includes monitoring prompted by this project or other MREAC sponsored projects, the data from which is referenced in this plan.

5.7 General Chemistry – This analysis provided a wide suite of chemical parameters and a snapshot of chemical conditions in the watercourse. Results from 2014 samples did not give rise to any concern about the water chemistry of the river. Results from 2017 sampling are not available at time writing.

6.0 CABIN Protocol Assessment

MREAC staff, in cooperation with Environment Canada staff, has an established Canadian Aquatic Biomonitoring Network (CABIN) site off the Bartholomew Road North (2015) where the highway comes very close to watercourse. The CABIN protocol was repeated in 2017 to supplement this plan with current data. Results of this comprehensive ecological protocol were surprising. A key metric of implementing the CABIN protocol is an assessment of the macro-invertebrate community on the stream bottom. The relative abundance and diversity of this community says much about the health of the watercourse under consideration.

The Canadian Aquatic Biomonitoring Network (CABIN) protocol, as developed by Environment and Climate Change Canada (ECCC), is now a nationally applied technique for assessing the biological condition of freshwater systems. The Miramichi River Environmental Assessment Committee (MREAC) has been engaged in this protocol since 2004. The Miramichi watershed now has 24 established reference and test sites that are found on major tributaries within the drainage basin.

The CABIN protocol was implemented on the Bartholomew River (BTM-DS) on October 21, 2015 and October 12, 2017 (Figure 10). The data, previously entered, was retrieved from the

ECCC CABIN database in October of 2018 in order to assess the conditions present on this river at the time of sampling.

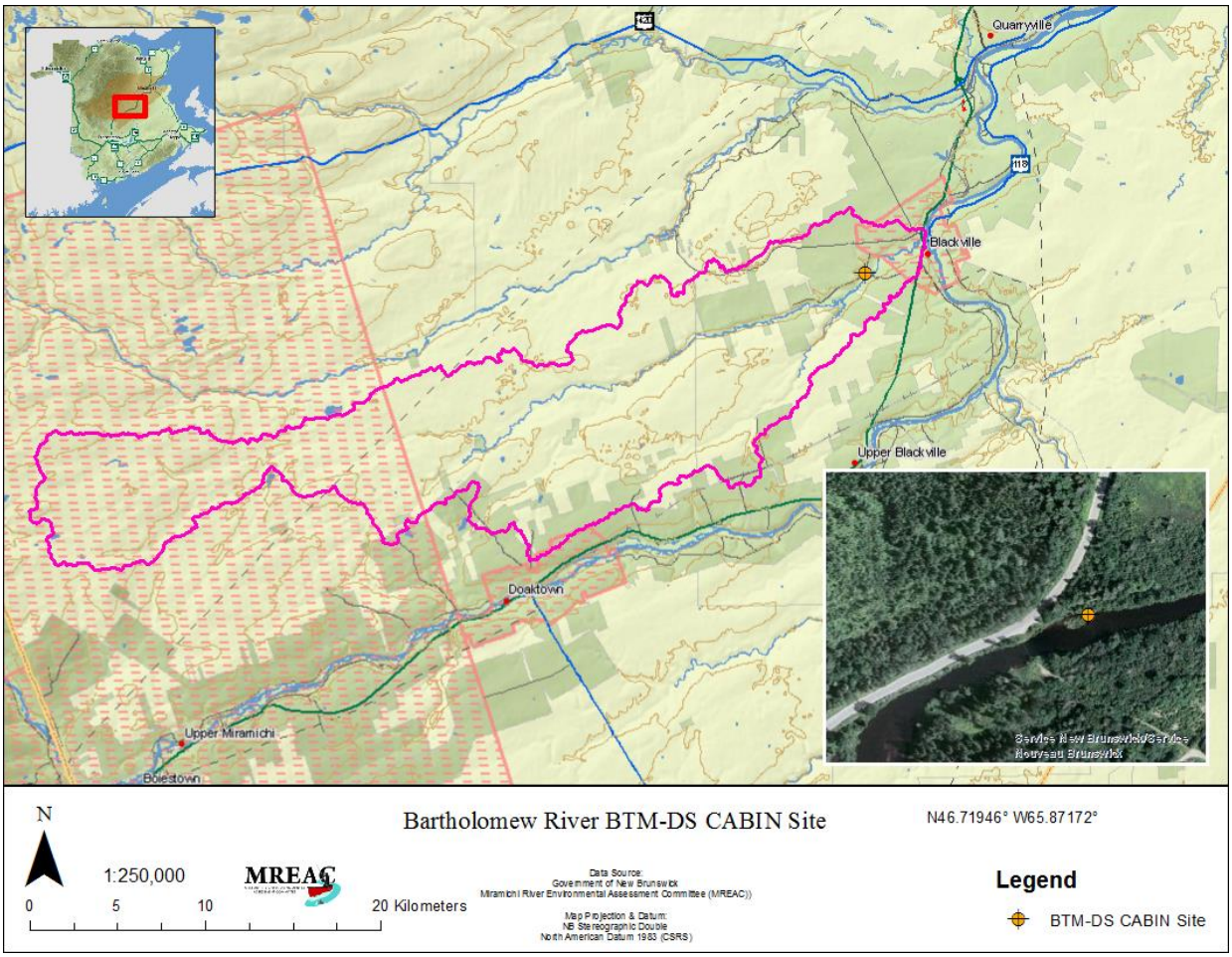


Figure 10: BTM-DS CABIN Site Location

6.1 CABIN Results

The Reference Condition Approach (RCA) assessment and running of the Atlantic Reference Model (ARM) allowed for a comparison of the "Observed vs. Expected" benthic macroinvertebrate community at the BTM-DS CABIN site. Composition of the taxonomic community was also juxtaposed for the two years to reveal changes that might have occurred during that time.

The following Reference Condition Approach (RCA) assessment results for the years 2015 and 2017 illustrate the findings for Observed vs. Expected (O/E) Richness at the BTM-DS CABIN site (Figure 11).

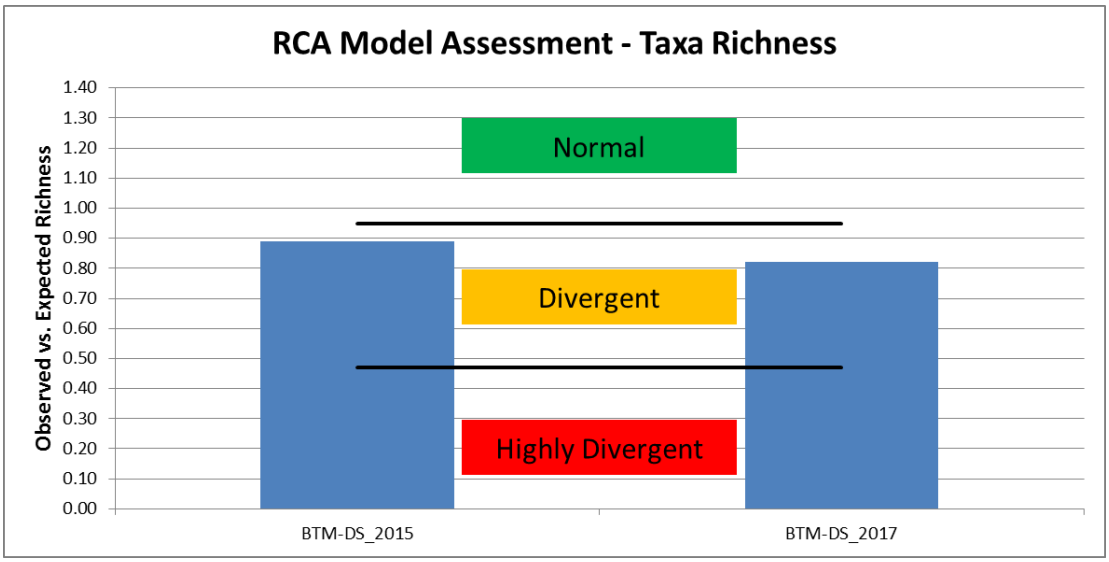


Figure 11: BTM-DS RCA Model Assessment of Taxa O/E Richness 2015 vs. 2017

The ARM model results also show other RCA assessment outputs such as the O/E Berger-Parker Dominance, the O/E Shannon-Wienner Diversity Index, and the O/E Simpson Diversity Index (Table 4).

site_ids	O/E Richness	**O/E Berger_Parker**	**O/E Shannon**	**O/E Simpson**	O/E Pielou
BTM-DS_2015	0.89	1.21	1.16	1.15	1.20
BTM-DS_2017	0.82	1.01	1.01	1.03	0.97

Table 4: Other BTM-DS RCA Model Assessment Outputs 2015 vs. 2017

The BTM-DS CABIN site richness and abundance were also calculated directly from the taxonomic data/counts. The results were compared to the "Normal Range", as determined from the 25th to 75th percentiles (Figure 12), (Figure 13).

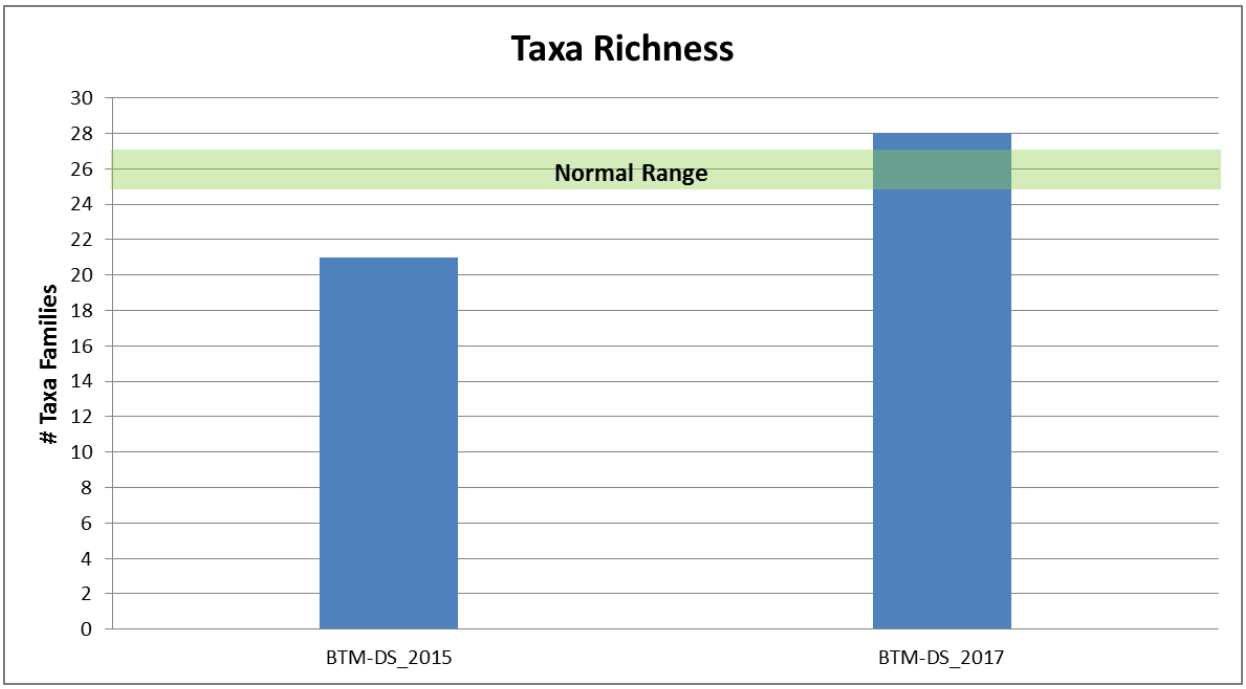


Figure 12: BTM-DS Richness Assessment 2015 vs. 2017

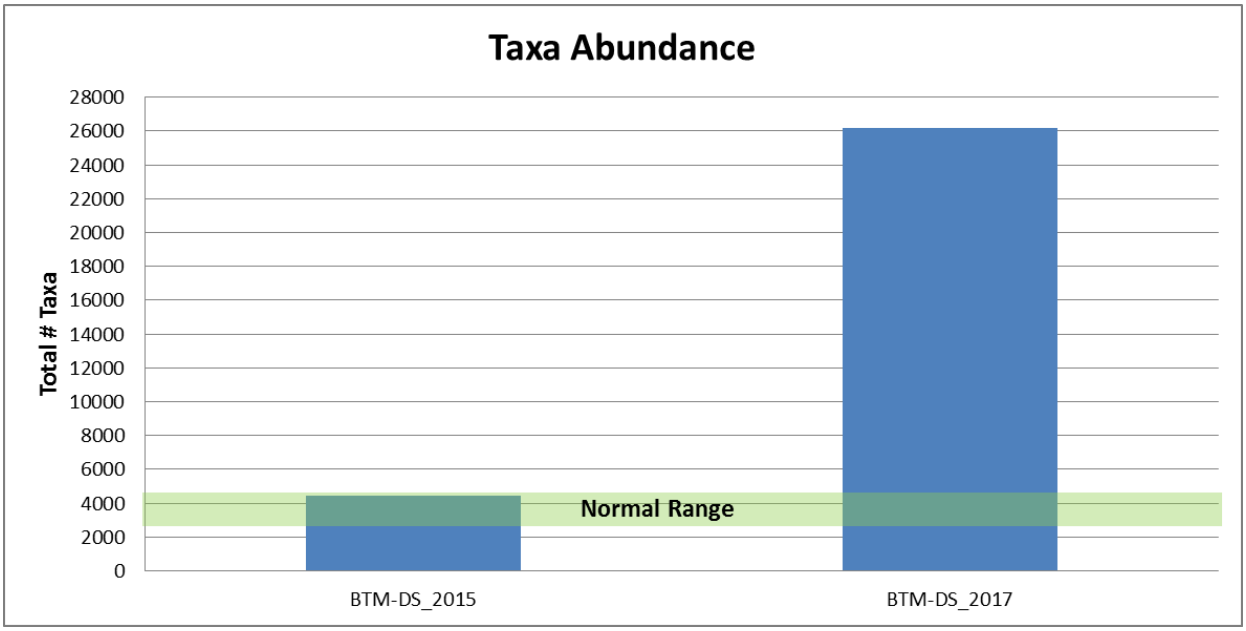


Figure 13: BTM-DS Abundance Assessment 2015 vs. 2017

The following figure illustrates the taxonomic composition of the benthic macroinvertebrate community at the BTM-DS CABIN site for the years 2015 and 2017 (Figure 14).

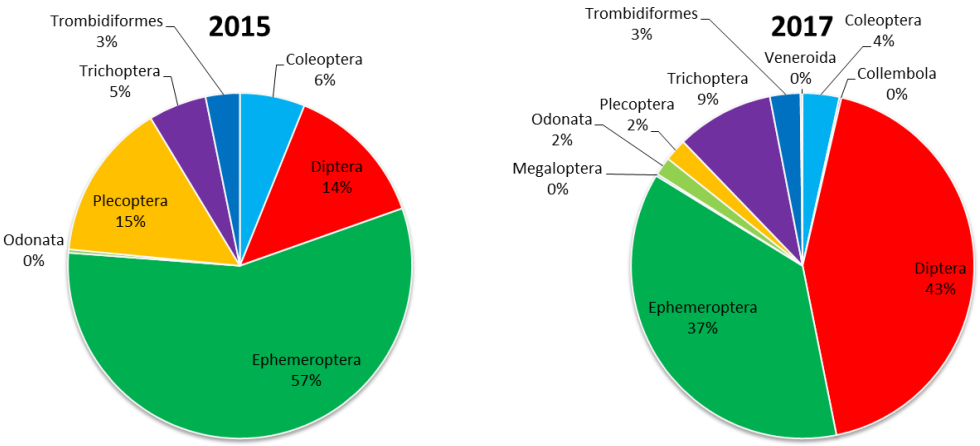


Figure 14: BTM-DS Taxa Composition 2015 vs. 2017

The following figure illustrates the proportion of non-tolerant to pollution taxa [Ephemeroptera, Plecoptera, and Trichoptera (EPT)] to tolerant to pollution taxa (Chironomidae), (Figure 15).

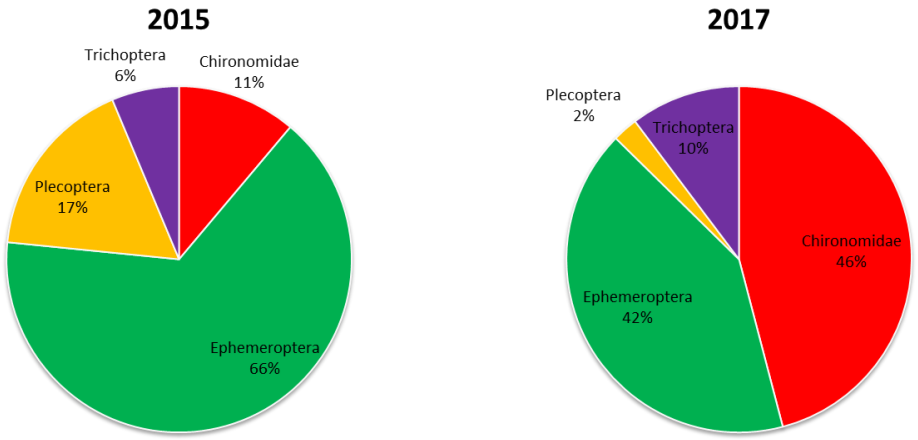


Figure 15: BTM-DS EPT/Chironomidae Ratio 2015 vs. 2017

The substrate composition for the year 2015 versus the year 2017 is illustrated in following figure (Figure 16). For reference, there is a breakdown of the substrate size class and category (Table 5).

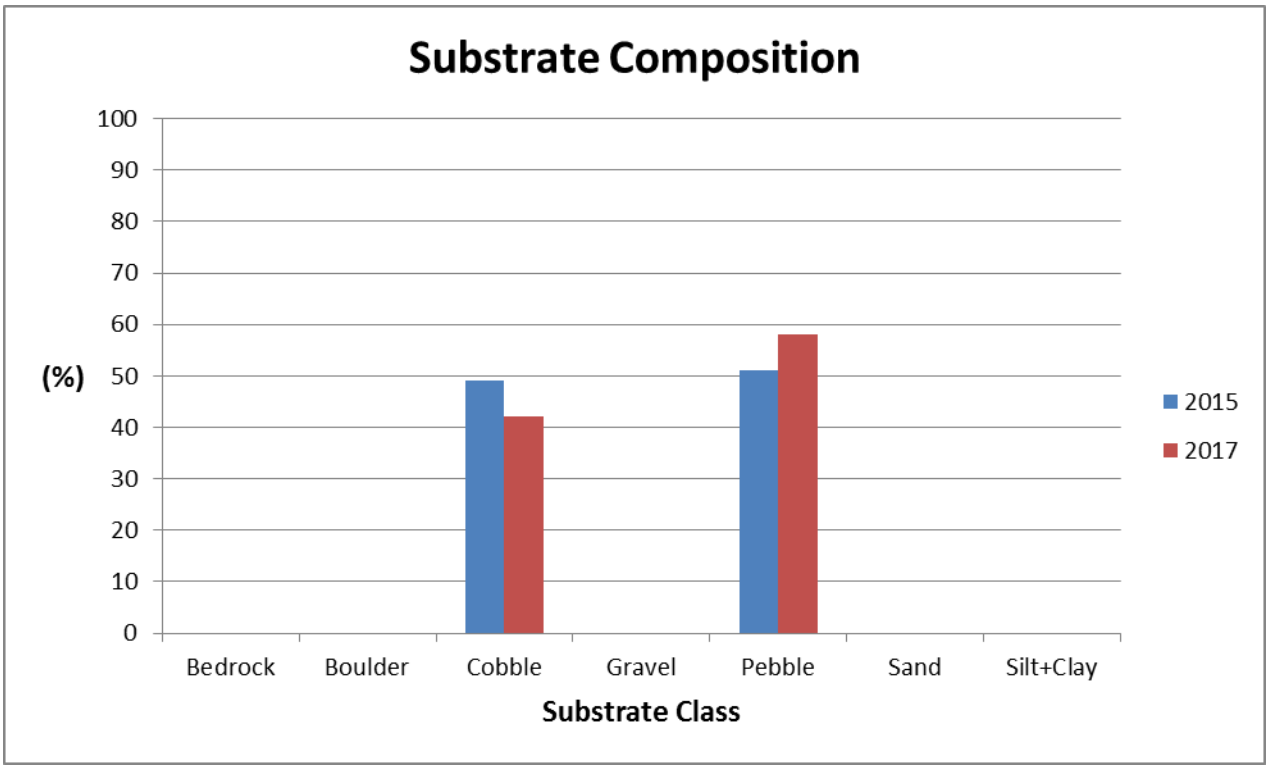


Figure 16: BTM-DS Substrate Composition 2015 vs. 2017

Category	Substrate Size Class
0	Organic Cover
1	< 0.1 cm (fine sand, silt or clay)
2	0.1-0.2 cm (coarse sand)
3	0.2-1.6 cm (gravel)
4	1.6-3.2 cm (small pebble)
5	3.2-6.4 cm (large pebble)
6	6.4-12.8 cm (small cobble)
7	12.8-25.6 cm (cobble)
8	> 25.6 cm (boulder)
9	Bedrock

Table 5: CABIN Category Value and Corresponding Substrate Size Class

Given the importance of the interstitial spaces in the substrate, the following table shows the embeddedness values for the years 2015 and 2017 (Table 6). These values can be cross-referenced with Table 7 showing the CABIN category and corresponding percent embeddedness, substrate deposition.

Type	Variable	Value 2015	Value 2017	Units
Substrate Data	2nd Dominant Substrate	5	6	Category(0-9)
Substrate Data	Dominant Substrate	6	5	Category(0-9)
Substrate Data	Embeddedness	5	4	Category(1-5)
Substrate Data	Geometric Mean Particle Size	6.2	6	cm
Substrate Data	Median Particle Size	6	6	cm
Substrate Data	Periphyton Coverage	2	2	Category(1-5)
Substrate Data	Surrounding Material	3	3	Category(0-9)

Table 6: BTM-DS Embeddedness 2015 vs. 2017

CABIN Category	Embeddedness
1	Completely embedded
2	75% embedded
3	50% embedded
4	25% embedded
5	Unembedded

Table 7: CABIN Embeddedness Category Value and % Embedded

The following table represents the chemistry at the BTM-DS CABIN site for the year 2015 versus the year 2017 (Table 8).

Type	Variable	Value 2015	Value 2017	Units
Water Chemistry	Air Temperature	4	12	Degrees Celsius
Water Chemistry	Alkalinity	16	n/d	mg/L
Water Chemistry	Ammonia	0.025	n/d	mg/L
Water Chemistry	Bottom Dissolved Oxygen	12.75	10.82	mg/L
Water Chemistry	Conductivity	43	n/d	µS/cm
Water Chemistry	Dissolved Chloride	1.5	n/d	mg/L
Water Chemistry	Hardness	18	n/d	mg/L
Water Chemistry	Nitrate/Nitrite	0.025	n/d	mg/L
Water Chemistry	Ortho Phosphorus	0.005	n/d	mg/L
Water Chemistry	pH	7.4	7.3	pH
Water Chemistry	Specific Conductance	42.8	56.3	µS/cm
Water Chemistry	Sulphate	3	n/d	mg/L
Water Chemistry	Temperature	3.9	8.85	Degrees Celsius
Water Chemistry	Total Organic Carbon	6.6	n/d	mg/L
Water Chemistry	Turbidity	0.7	21.5	NTU

Table 8: BTM-DS Chemistry 2015 vs. 2017

6.2 CABIN Discussion

The Reference Condition Approach (RCA) model assessment of taxa observed (what is there) vs. expected (what should be there) richness, number of taxa at family level, for the Bartholomew River BTM-DS CABIN site indicates a slight divergence from normal in 2015 and a further drop in 2017 (Figure 11). This is further substantiated by looking at the taxonomic community numbers manually and calculating the richness directly from the data/counts. The year 2015 was below the normal range of the number of taxa families expected to be found at the site. The year 2017 was above the normal range of the number of taxa families expected to be found at the site and indicated that both years are divergent from normal (Figure 12).

The total number of taxa, taxa abundance, as illustrated in Figure 13 shows an impressive increase for 2017. The number of total taxa jumped from 4443 in 2015 to 26150 in 2017 indicating an elevated level of productivity in the river. Increased biomass of invertebrates can occur from nutrient loading. The water quality results for nitrate/nitrite (Table 8) in 2015 fall within the Canadian Council of Ministers of the Environment (CCME) freshwater Water Quality Guidelines for the Protection of Aquatic Life (no CCME data for phosphorus, and sulphate). Unfortunately, there is no nitrate/nitrite, phosphorus, and sulphate water chemistry data for 2017.

The BTM-DS taxa composition 2015 vs. 2017 (Figure 14) illustrates the breakdown of the benthic macroinvertebrate community. It is evident from this figure that the increased biomass in 2017 comes primarily from the Diptera taxa while there was a decrease in the more sensitive to pollution taxa, Ephemeroptera (Mayflies) and Plecoptera (Stoneflies).

The Ephemeroptera, Plecoptera, and Trichoptera (EPT) and Chironomidae ratio for 2015 vs. 2017 (Figure 15) looks at the total number of non-tolerant to pollution taxa (EPT) versus the tolerant to pollution taxa (Chironomidae). In 2015 there was 86% EPT and 11% Chironomidae while in 2017 there was a decrease in the non-tolerant to pollution taxa, down to 54% EPT, and an increase to 46% Chironomidae, an increase of 35% of the more tolerant to pollution taxa.

The interstitial spaces between the substrate is where macroinvertebrates live. These spaces can become embedded resulting in a loss of habitat for benthic macroinvertebrates. The substrate composition (Figure 16) shows a small decrease in the larger cobble substrate class while there was a small increase in the smaller pebble substrate class in 2017. There was also an increase in the deposited sediment, embeddedness (Table 6), from unembedded (CABIN category 5) to 25% embedded (CABIN category 4).

6.3 CABIN Conclusion

Based on all the data presented in this assessment it can be concluded that the increase in both smaller pebble substrate class and embeddedness may have resulted in a loss of favourable habitat for the Ephemeroptera and Plecoptera taxa; an increase in favourable habitat for the Diptera taxa. It cannot be concluded that nutrient loading was a factor in the increase in biomass of invertebrates since there was no chemistry data for nitrate/nitrite, phosphorus, and sulphate for 2017. Given the small dataset of only two years, further water quality sampling and collection of benthic macroinvertebrates is recommended for a more accurate picture of the Bartholomew River (BTM-DS) CABIN site.

Recommendation: The CABIN protocol should be repeated at the Bartholomew River site as opportunity allows providing for a more complete sample set to assess this waterway.

7.0 Land Use

The Bartholomew River watershed has two large scale forestry operators within its boundary. JDI Ltd. and Fornebu Lumber both manage crown forest lands within their respective timber leases with JDI having the larger share of leasehold property on the Bartholomew watershed. Both also have freehold lands and manage these properties for the same forestry purposes. Figure 17 and Figure 18 illustrates the dominance of forested lands and limited other developments and uses found on the Bartholomew River watershed.

Recreational fishing is one of these other uses on the Bartholomew. There is no accurate tracking of the level of recreational fishing activity. The Bartholomew Pool near the mouth is popular and well fished. Other pools receive little attention according to Blackville resident and longtime fishing enthusiasts Mr. Ian Fortune (personal communication, December 2017).

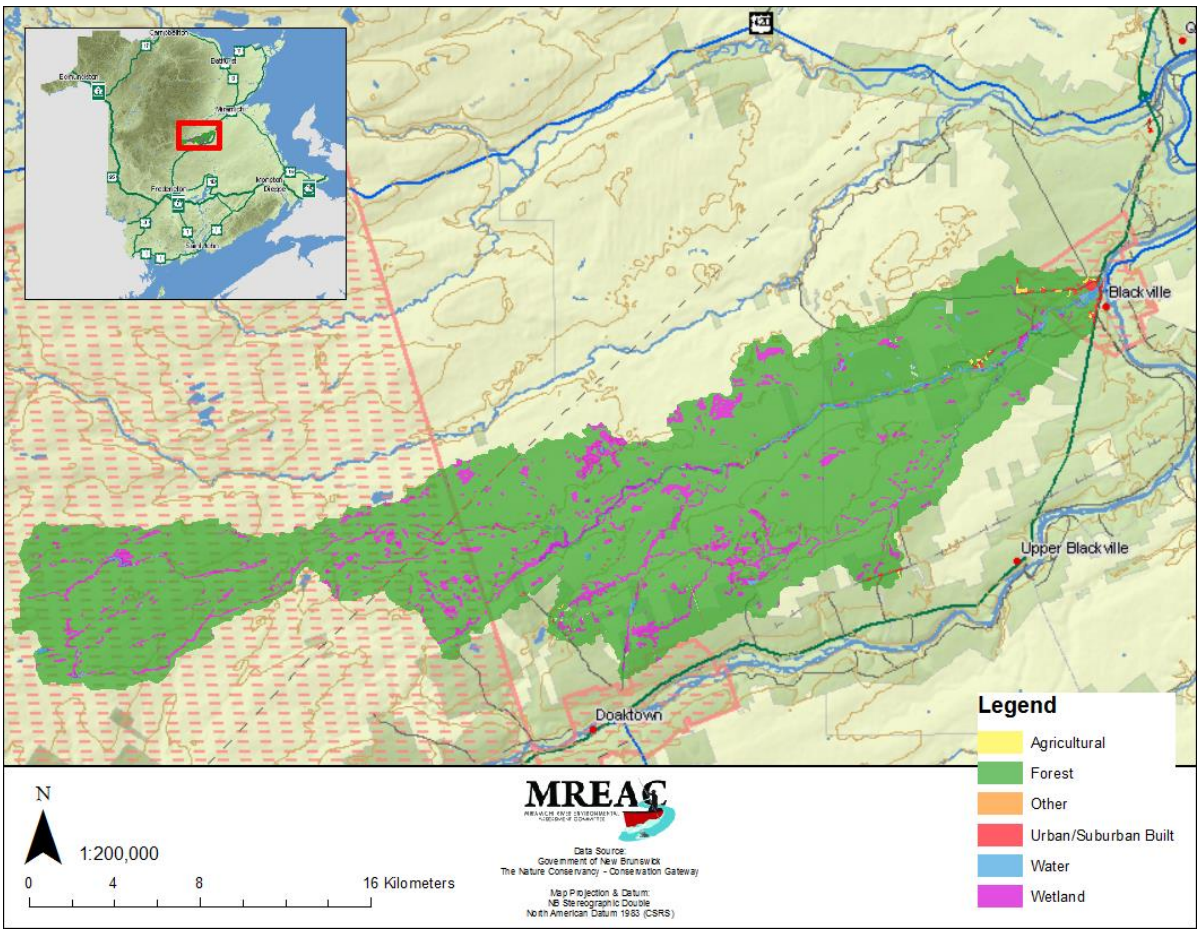


Figure 17: Bartholomew River Watershed Land Use

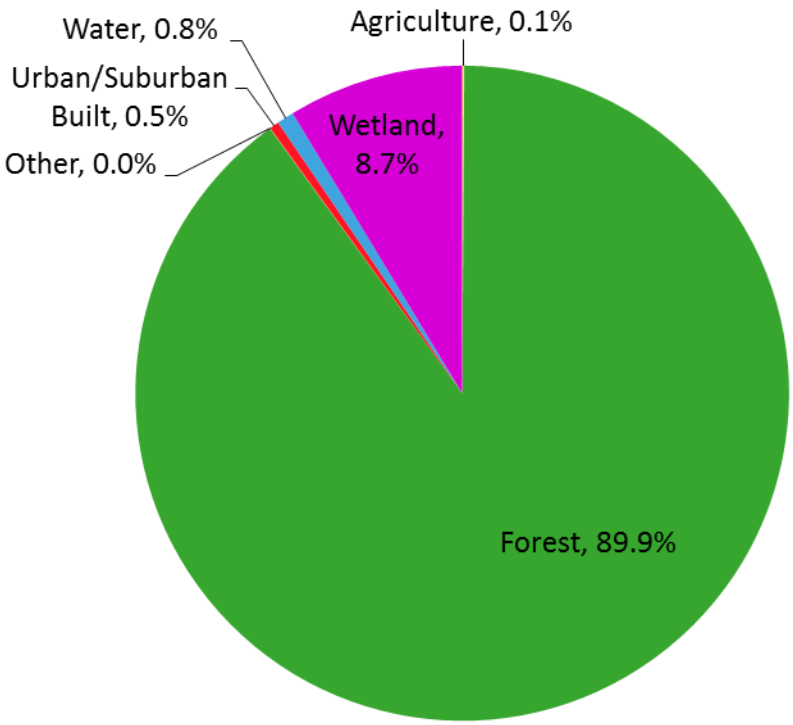


Figure 18: Relative Land Use

Apart from the village of Blackville at the river's mouth, and the ribbon community found along the Bartholomew Road North, there are relatively few full time residents living within the watershed. Other users have camps or cottages on the river and these are concentrated on the lower 10 km reach. The headwaters of the Bartholomew River are virtually without building infrastructure but some access is available through a network of woods roads constructed by the forestry sector. Existing non-managed trails are available for use by all-terrain vehicles and snowmobiles. Stream fording by ATVs is of ongoing concern when the fording results in siltation. Multiple river and stream crossings, including bridges and culverts are found throughout the Bartholomew River developed principally to support movement of timber by the forestry sector.

8.0 Beaver Dams

Much of the headwaters on the Bartholomew River are accessible to spawning Atlantic salmon and Brook Trout. The river is without impoundments apart from beaver dams. Beaver dams occur on the smaller brooks and in the narrower headwater channels. It has become an acceptable practice to remove old, unused (by beaver) dams to promote greater spawning success. It is also a practice to notch existing active dams during the peak of spawning to allow headwater access of spawning fish. It is realized that this work on active dams will be quickly undone by the resident beaver with rapid repair being their natural response. However the appropriate timing for such work allows for significant numbers of spawning fish to move further into the headwaters. In 2017 MREAC staff notched beaver dams on the headwaters on Ledbetter Brook, North Branch Bartholomew River and South Branch Bartholomew River (Figure 19), (Figure 20). In 2018 MREAC staff, with the support of student and staff volunteers from the NBCC Miramichi Environmental Technologies program assisted in notching dams on Ledbetters Brook and the South Branch Bartholomew River (Figure 21).

Recommendation : *An annual program of breaching old beaver dams and notching active beaver days be instituted by watershed groups and other volunteers as available at critical spawning times in the late fall.*

It was noteworthy that in summer of 2018 the water levels were so low that the Beavers attempted to dam the entire main branch of the Bartholomew about mid-way along this watercourse (Figure 22). Higher water levels in the fall were effectively removing this impoundment.

Figure 19: Beaver Dam Notching – Ledbetter Brook 2017 (Before)

Figure 20: Beaver Dam Notching – Ledbetter Brook 2017 (After)

Figure 21: NBCC Miramichi Students Dam Notching South Branch Bartholomew River

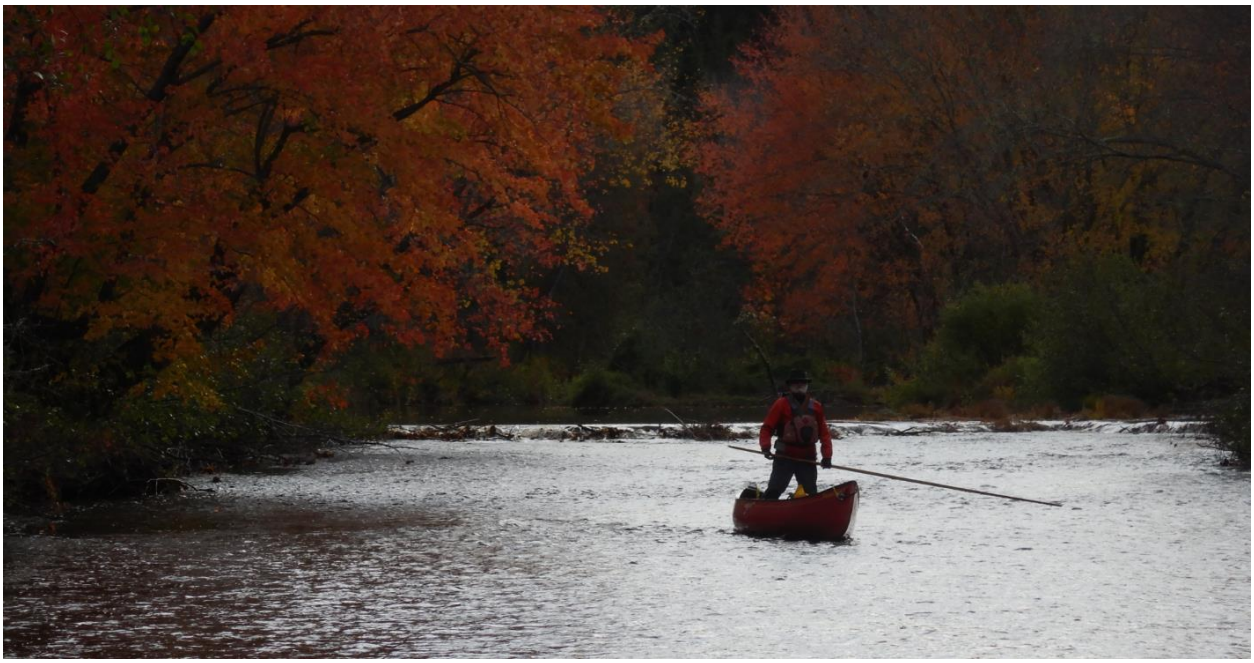
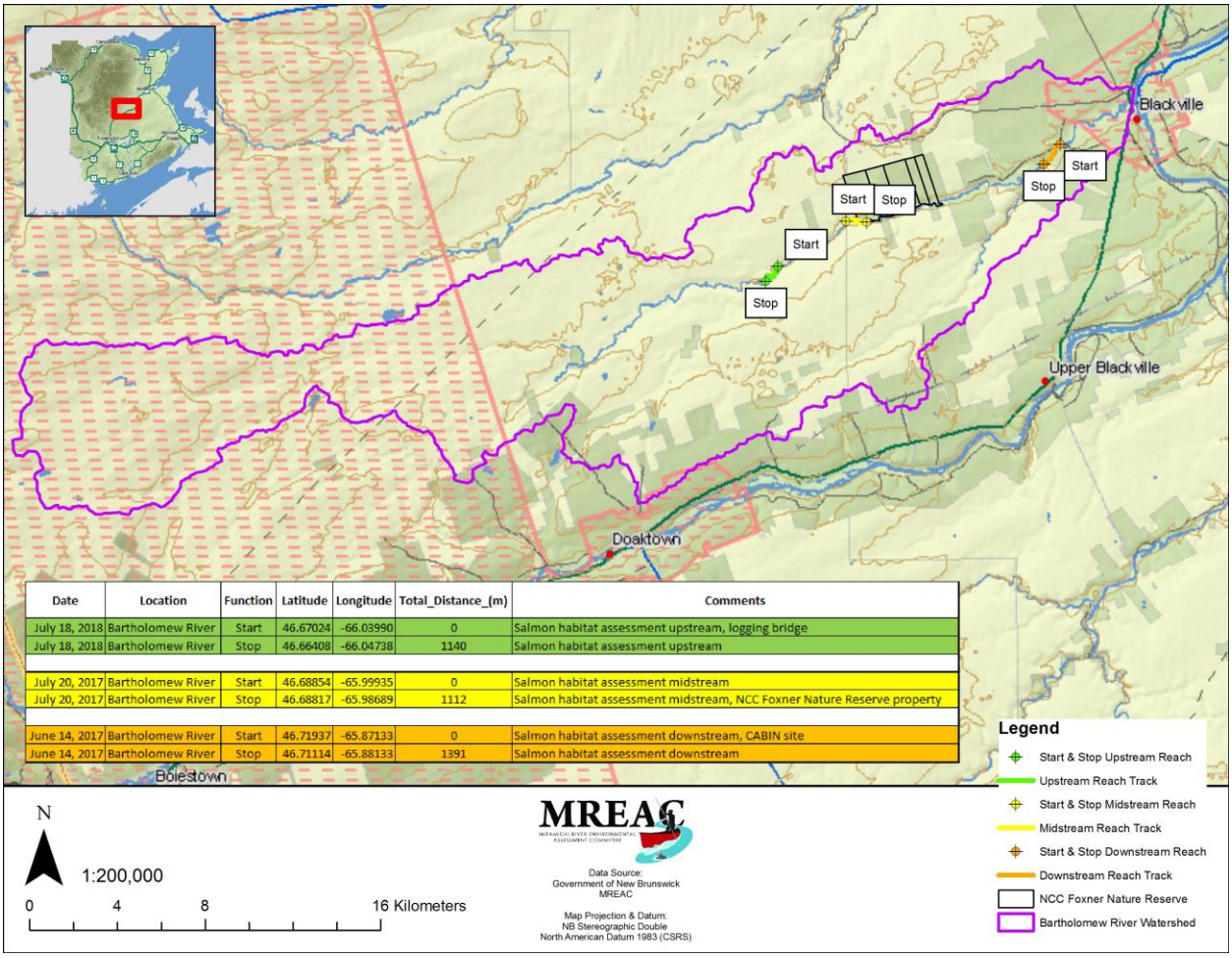


Figure 22: Beaver Dam in Background on Main Branch Bartholomew River (Oct 2018)

9.0 Fish Habitat Assessments

Figure 23 locates the two one kilometer reaches that were assessed for fish habitat quality in 2017 and 2018. MREAC staff used the joint assessment methodology used in New Brunswick by both the province, Fisheries and Oceans staff and others (i.e. DNR&E/DFO New Brunswick – Stream Habitat Inventory). These reaches represent a lower section of the river and middle reaches as indicated. The completed field forms are available at the MREAC office.

These assessments indicate that good habitat conditions existed for fish during these mid-June to mid-July outings, except from the elevated temperatures and low water levels. However, it is noted within the reaches selected that there are relatively few deep holding pools that offer refuge during the stress conditions of high temperatures and low water. Few fish were noticed during these assessments. Many other pools however offer excellent depth and cover as noted during the various other field outings in 2017 and 2018.



Date	Location	Function	Latitude	Longitude	Total_Distance_(m)	Comments
July 18, 2018	Bartholomew River	Start	46.67024	-66.03990	0	Salmon habitat assessment upstream, logging bridge
July 18, 2018	Bartholomew River	Stop	46.66408	-66.04738	1140	Salmon habitat assessment upstream
July 20, 2017	Bartholomew River	Start	46.68854	-65.99935	0	Salmon habitat assessment midstream
July 20, 2017	Bartholomew River	Stop	46.68817	-65.98689	1112	Salmon habitat assessment midstream, NCC Foxner Nature Reserve property
June 14, 2017	Bartholomew River	Start	46.71937	-65.87133	0	Salmon habitat assessment downstream, CABIN site
June 14, 2017	Bartholomew River	Stop	46.71114	-65.88133	1391	Salmon habitat assessment downstream

Figure 23: Fish Habitat Assessment Reaches

10.0 Bartholomew Research Station

Results from the Bartholomew Research Station over the years 1961 to 1993 were compiled by station staff and much of this data provided to MREAC, courtesy of Mr. Norman Stewart. The data is sporadic but that is in part due to sporadic timing of the centre for the early and late years of the station operation. The most comparable years are from 1976 to 1990 where the operating season is more comparable. A banner year for salmon was found in 1988 when 352 wild Atlantic salmon were counted with an additional 83 adipose fin-clipped (hatchery reared) salmon recorded for a total of 435 adult spawners. Similarly the grilse count in 1988 was remarkable with 1240 wild fish counted and 402 fin-clipped for a total of 1642. By comparison the low year in 1976 resulted in only 12 wild and 6 fin-clipped adult salmon and 186 wild grilse and 36 fin-clipped grilse for a total of 222 grilse and total of spawning salmon at 242. Data from ten years

of continuous smolt counts was also provided and again showed wide ranging numbers from a low of 2366 in 1974 to 20,452 in 1978. Other species were recorded at the stations counting fence, the most prominent being suckers that generally exceeded the total salmon count with a high of 4512 in 1977. The sucker counts were also wide ranging throughout the research station years. These data are clearly now dated and may be a poor reflection of the state of the current spawning counts of Atlantic salmon on the Bartholomew River. The data set is available at the MREAC office.

The Miramichi Watershed Management Committee currently operate the Miramichi Salmon Conservation Centre (formerly South Esk Fish Hatchery), taking over from Fisheries and Oceans Canada in 1997. This hatchery is the oldest hatchery operation in Canada starting in 1873 and becoming a federal facility in 1957. The rearing and stocking of salmon fry has been a principle part of the hatchery operation for most of its operating history and the stocking of Miramichi River tributaries the focus of the stocking effort. Stocking of the Bartholomew River has been a common practice since 1976 with the input of 83,070 salmon fry. More modest stocking efforts are the current norm and in 2016 a total of 2600 fry were released, distributed between three different stocking sites.

MREAC was again benefited by Mr. Norman Stewart who had retained years of data (2000 to 2016) from his own electrofishing activity on the Bartholomew River (Figure 24). Sixteen electrofishing sites that constitute 11 on the main stem and 5 tributaries were accessed for this purpose. Considerable variation is noted throughout the years and some of this reflecting beaver dam activity that often limits fish passage in the higher reaches of the watershed. The wide range of data suggest that under good conditions there is an abundance of habitat capacity for juvenile Atlantic salmon, Often conditions are not conducive to high levels of productivity.

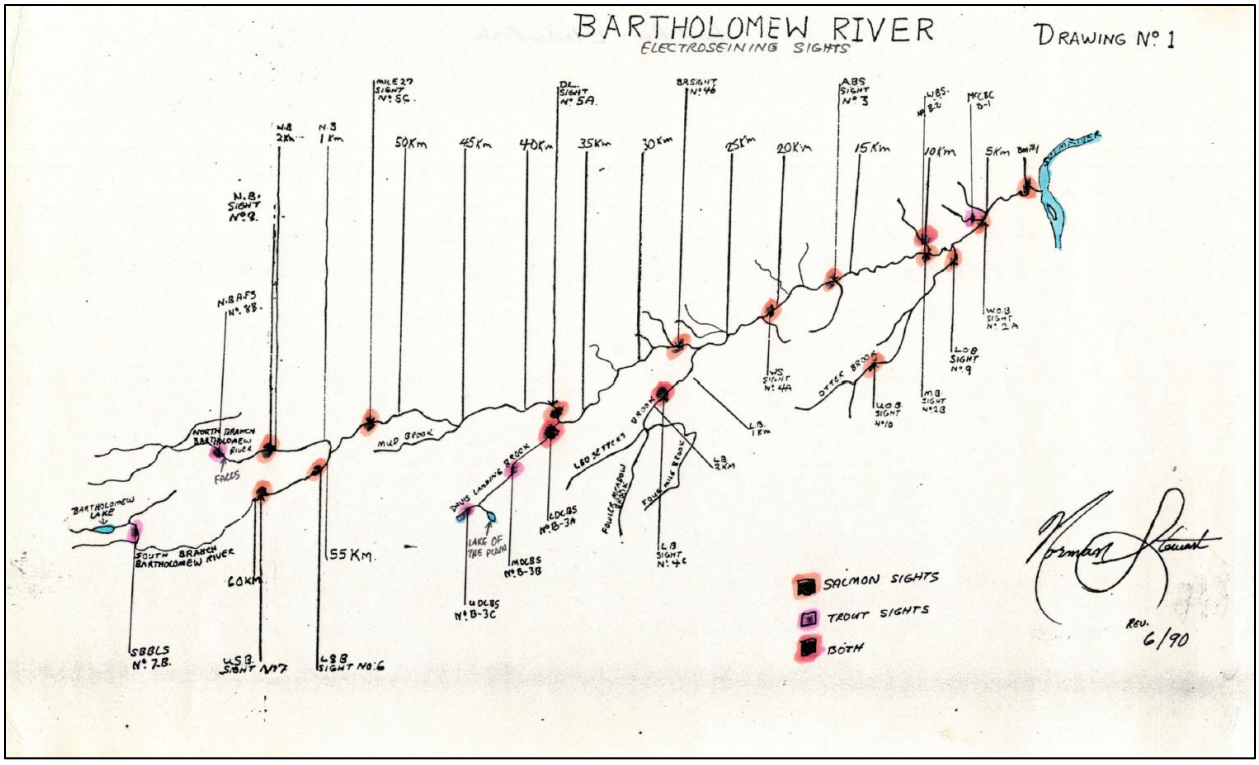


Figure 24: Electrofishing Sites – Bartholomew River

11.0 Private Woodlot Owners

A review of private land holdings that are adjacent to the Bartholomew River (GeoNB) identify over 60 sizable freehold properties that exceed 25 acres. MREAC approached this group of land owners in 2018 to promote best management practices with support from the Northumberland Woodlot Owners Association.

12.0 Conclusion

The Bartholomew River is an intact, high quality watercourse protected in part from its relatively low profile and remoteness in the Miramichi River watershed. It has a significant history in, and made an important contribution to, Atlantic salmon science and management, especially during the year of the Atlantic Salmon Research Centre. Workers and operators from that station have become key players in Atlantic salmon management on the Miramichi watershed, "cutting their teeth" on the Bartholomew.

The Bartholomew River and her tributaries streams thus remain a valued but relatively little used recreational fishing river with an intact population of Atlantic salmon. The lower reach of the river, despite good road access and including many private residences and camps, receives limited attention from recreational fishers. The threat of poaching is likewise a minor issue. No invasive fish species are known to have been taken on the Bartholomew to date.

The NCC Foxner Reserve is a high value property adding over 2100 acres to protected areas in New Brunswick and protecting 5.2 km of shoreline along the Bartholomew River. The NCC now becomes an important partner in the protecting of Atlantic salmon habitat on this waterway.

Water temperatures on the Bartholomew River track cooler than the main branches of the Miramichi but remain a concern due to the cold water preferences of Atlantic salmon. The fall run salmon will continue to have a better time of it due to lessened heat stress and higher water. A major pool at the mouth of the Bartholomew is included in the "Warm Water Protocol" when put into effect. Climate change impacts, as they continue to increase, will be increasingly problematic on this waterway.

Industrial forestry, as the major industrial user continues to be blamed for the "flashy" nature of quickly raising and quickly falling water levels, with negative impacts on salmon habitat conditions. The dozens of private woodlot owners in the lower reaches of the river are a target audience for promoting good woodlot management practices. Waterfront dwellers in camps, cottages and full time residents are likewise candidates for an awareness program to promote shoreline stewardship.

13.0 Summary of Recommendations

Recommendation: Water temperature monitoring with the long-term goal of protecting colder water pools as fish refuges should be instituted on the Bartholomew River.

*Recommendation**:** It is recommended that the Bartholomew Rive site continue to be monitored for pH levels in late winter and spring*.

Recommendation: Strategies to promote the use of best management practices among private woodlot owners should continue to be promoted.

Recommendation: The CABIN protocol should be repeated at the Bartholomew River site as opportunity allows providing for a more complete sample set to assess this waterway.

Recommendation : *An annual program of breaching old beaver dams and notching active beaver days be instituted by watershed groups and other volunteers as available at critical spawning times in the late fall.*

References:

Fisheries and Oceans Canada, Government of Canada, 2018

http://www.inter.dfo-mpo.gc.ca/Gulf/FAM/Recreational-Fisheries/Temporary- closure-salmon-pools

GeoNB, Province of New Brunswick, geonb.snb.ca