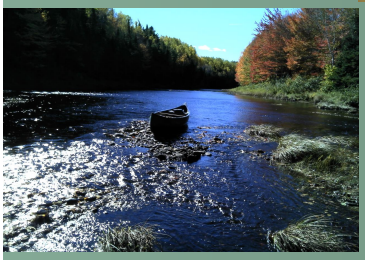
MREAC
MIRAMICHI RIVER ENVIRONMENTAL ASSESSMENT COMMITTEE

Atlantic Salmon Conservation Strategy

Bay du Vin River - 2020



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Atlantic Salmon Conservation Strategy - Bay du Vin River

2020

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Executive Summary

The Miramichi River Environmental Assessment Committee (MREAC) delivered an Atlantic salmon habitat assessment on the Bay du Vin River drainage basin in 2013 with Atlantic Salmon Conservation Foundation (ASCF) support. MREAC followed up in 2020, again with ASCF support, to deliver a conservation strategy on the Bay du Vin. Additional field work and monitoring was conducted in 2020 to determine current year conditions. Available historical data, and interviews with property owners and stakeholders contributed to the strategy.

The Bay du Vin River sub-watershed is a smaller of the Miramichi River tributaries, covering an area of 315 km². It is a known Atlantic salmon bearing river with a fall spawning run. It is not included among the scheduled rivers that limit angling to fly fishing within the annual fishing season (May 15 to Oct 15).

Of the approximate 56-kilometre length of the main branch, 44 kilometres were travelled by canoe. A fish habitat assessment in 2013 was conducted on three river reaches, those being the top, middle, and bottom, having a combined linear distance of 3 kilometers.

Based on available data, visual observations, river monitoring and communication with river stakeholders, the Bay du Vin River does not appear to have habitat characteristics required to sustain significant Atlantic salmon production. Limiting factors will be challenging or impossible to overcome. Future efforts should concentrate on maintaining the existing ecological values that sustain the existing stock of Atlantic salmon and other fish species.

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1.0 Introduction

A Bay du Vin River drainage basin habitat assessment for Atlantic salmon potential was completed in 2013 by MREAC staff and volunteers. In 2020 additional monitoring was completed to supplement the available data set from previous work on this waterway. With this monitoring and research completed on the Bay du Vin River to date, we deliver this Atlantic salmon conservation strategy.

The Miramichi River and her many tributaries remain a critical refuge for Atlantic salmon in New Brunswick, Canada. Among these the Bay du Vin River is an orphan river within the much larger Miramichi drainage basin. Relatively little is known about existing salmon angling and the river's potential of producing Atlantic salmon. This being so, a habitat assessment of the Bay du Vin River in 2013 was a valuable first step in attaining the appropriate overview required to determine this rivers potential of contribution to the sustainability of Atlantic salmon. In 2020, with ASCF support, MREAC undertook the preparation of an Atlantic salmon conservation strategy on the Bay du Vin. Additional temperature monitoring, field surveys, and electro-fishing in 2020 supplemented the 2013 data. This conservation strategy discusses the Bay du Vin River's potential to contribute to Atlantic salmon production and the sustainability of this wildlife resource. More specifically this report discusses the rivers limiting factors on salmon production.

Discussions with camp owners and stakeholders suggest it is considered a trout fishing river rather than known for salmon angling. While known to support Atlantic salmon the Bay du Vin is a "fall run" river (Pers Comm. Rod McEacheron, NBDELG). The limited number of camps and cottages on the Bay du Vin suggest low intensity of recreational salmon angling. The fall run would occur beyond the summertime use of most of these seasonal properties and limit fishing pressure on Atlantic salmon even further.

During field surveys approximately 44 kms of the 56 km length of Bay du Vin, main branch, was covered by canoe. More detailed fish habitat surveys were conducted in 2013 in the headwaters, on a middle reach and on a lower river reach. These surveys covered a totaled over 3 kms of waterway. Additional monitoring results for both 2013 and 2020 are reflected in this strategy.

Figure 1 -Bay du Vin River Scene - October 2020

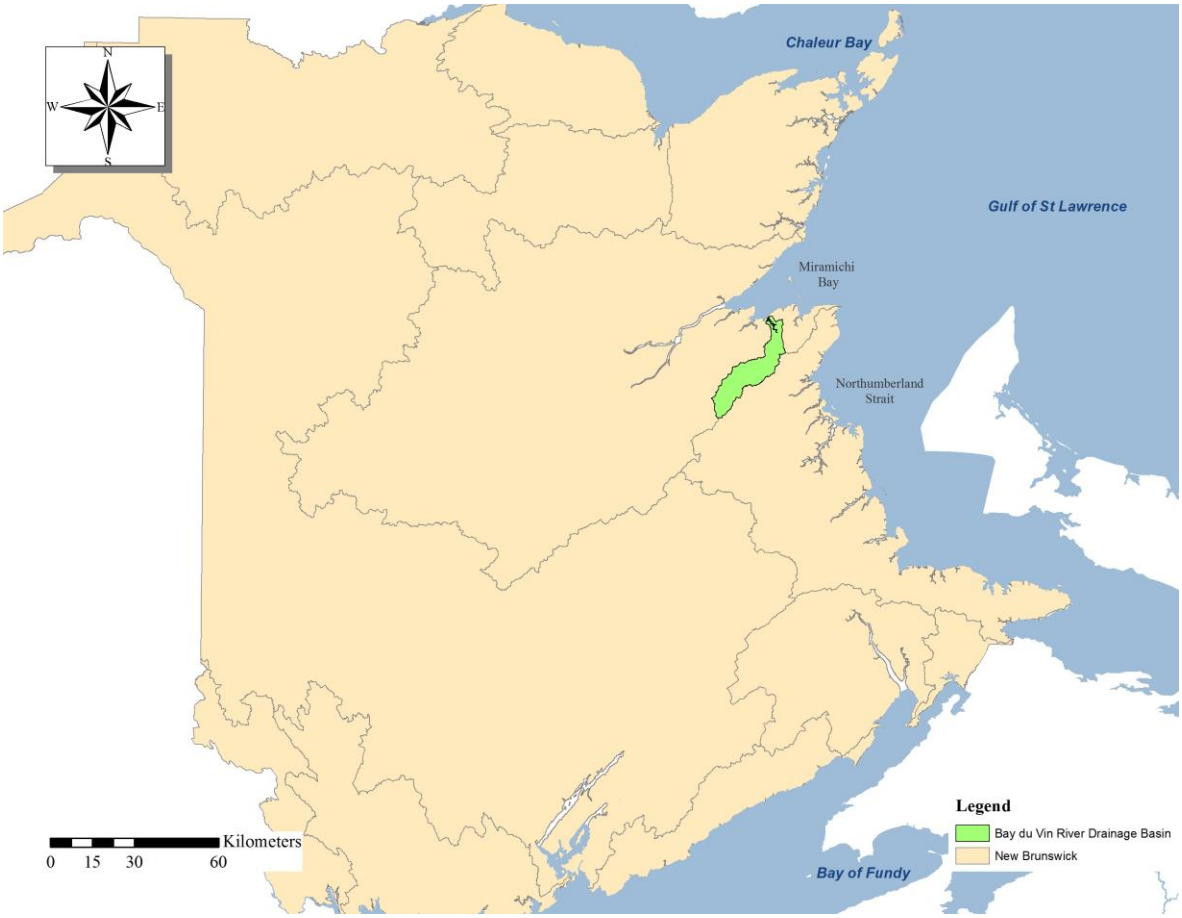

Figure 2 Bay du Vin Watershed in New Brunswick

Figure 3 Bay du Vin River - Estuary - July 2020

2.0 Conservation Strategy Objectives for Atlantic Salmon on the Bay du Vin River

1. To maintain the current ecological and recreational fishing values that the Bay du Vin River currently possesses.
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, landowners, recreational users and other interested parties to support effective 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.

3.0 River Setting and Access

The Bay du Vin River drainage basin lies in Northeastern New Brunswick and encompasses approximately 315 km² (Figure 2). The basin shape is long and linear with the main branch fed by several smaller tributary stream. The basin runs in a southwest to northeast direction and empties into the Miramichi Inner Bay.

There is an uneven mix of crown and private lands on the Bay du Vin River. The lower reach of the river and the headwaters are predominantly under private ownership. Crown land predominates in the mid reach of the river, both east and west of Hwy 11, interspersed with some smaller private land holdings. The freshwater flow of the main branch of the Bay du Vin to tidal waters is approximately 48 kilometers. The Bay du Vin estuary extends for another 8 kilometers before discharging into Miramichi Inner Bay. Along the tidal waters the shoreline is more developed with several year-round residents. Commercial fishing occurs along the estuary with a small harbor near the river mouth that provides mooring for various fishing vessels.
The crown lands on the Bay du Vin are managed through lease-hold arrangements with J. D. Irving. Hwy 440 provides paved access to several points and crossings of the main branch. The camps and cottages along the river are concentrated roughly from the hamlet of Rosaireville, downstream through approximately 10 km of the middle reach of the river.

4.0 Physical Setting and Climate

It is noteworthy that 2020 was a record setting year for sustained high summer temperatures and limited rainfall in most of New Brunswick. The following Climate Normals (1971-2000. Environment Canada) are thus a significant departure from the summer weather experienced in 2020. Climate Normals show a mean July temperature of 19.2°C and a mean January temperature of -10.7°C. The mean annual precipitation is 1,115 mm and the drainage basin receives an annual 1993.4 total hours of sunshine (Environment Canada, 2013).

The past decade has shown that summer temperatures are on the rise and this is in keeping with the expected climate change scenario. The rainfall amounts have been more erratic but have tended to be drier.

The Bay du Vin River drainage basin is part of the Eastern Lowlands ecoregion (Figure 4). This makes the Bay du Vin a low gradient river with an average drop of 1.6 meters per kilometer.

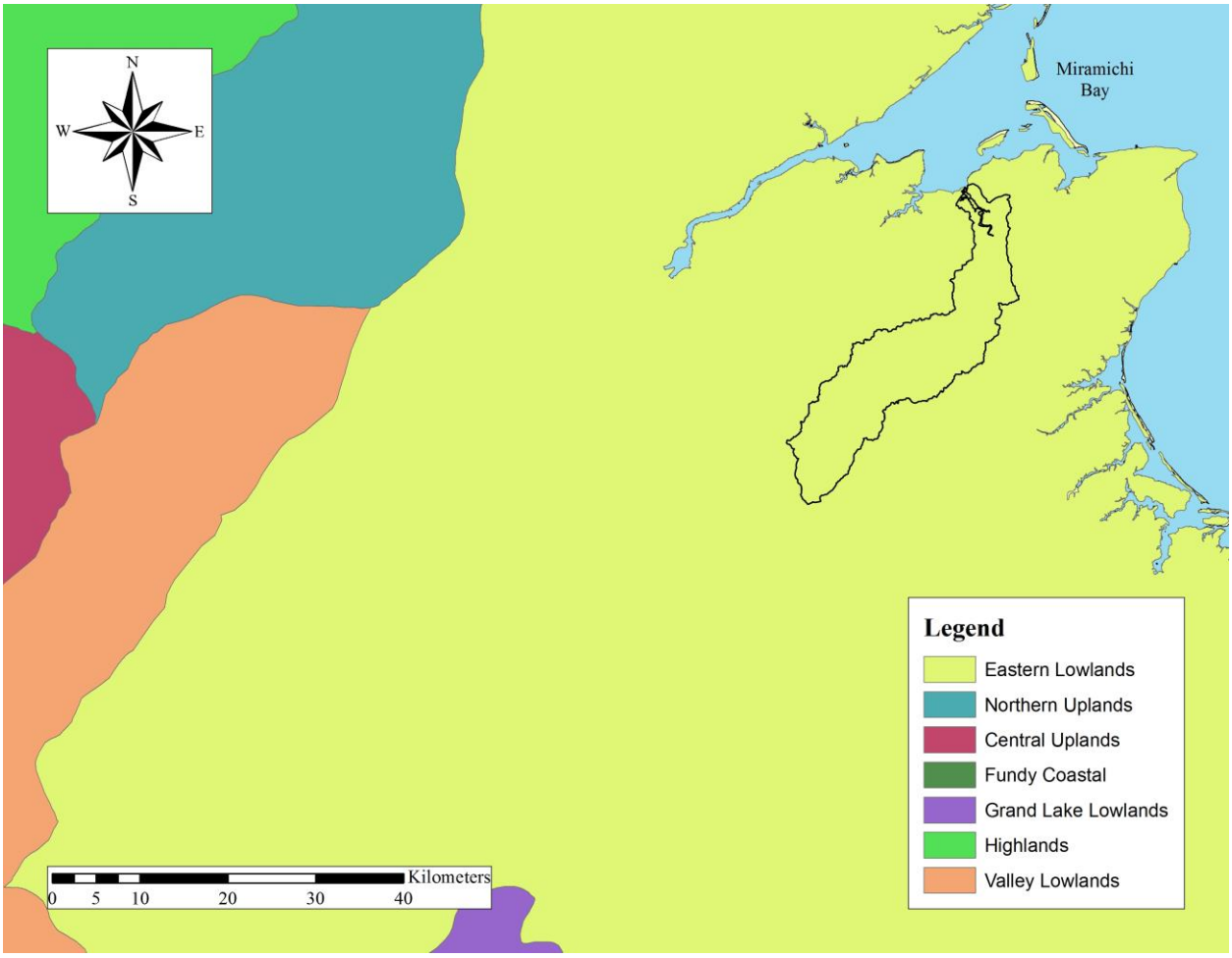

Figure 4 Bay du Vin River within New Brunswick Ecoregions

4.1 Geology

The bedrock geology of the Bay du Vin River drainage basin is typical to that of the eastern lowlands ecoregion which is generally composed of grey sandstone and red mudstone. The stratum is dating to the Carboniferous (Pennsylvanian) geologic era (Figure 6) (NBDNR, 2009). Exposed bedrock is a prominent feature of long stretches of the river bottom with little other surficial material as a cover. The shoreline likewise has much exposed rock defining the bank-full width of the river.

The surficial geology of the Bay du Vin River (Figure 7) drainage basin is primarily composed of silt, sand, gravel, rubble, loamy lodgement till, and minor ablation till. The organic sediments found in bogs or fens are typically 1 to 5 meters thick. One of the large bogs is being harvested for

its peat. This operation, distant from the watercourse, appears to have limited impact on water quality.

Figure 5 Exposed Bedrock on Riverbank and River Bottom

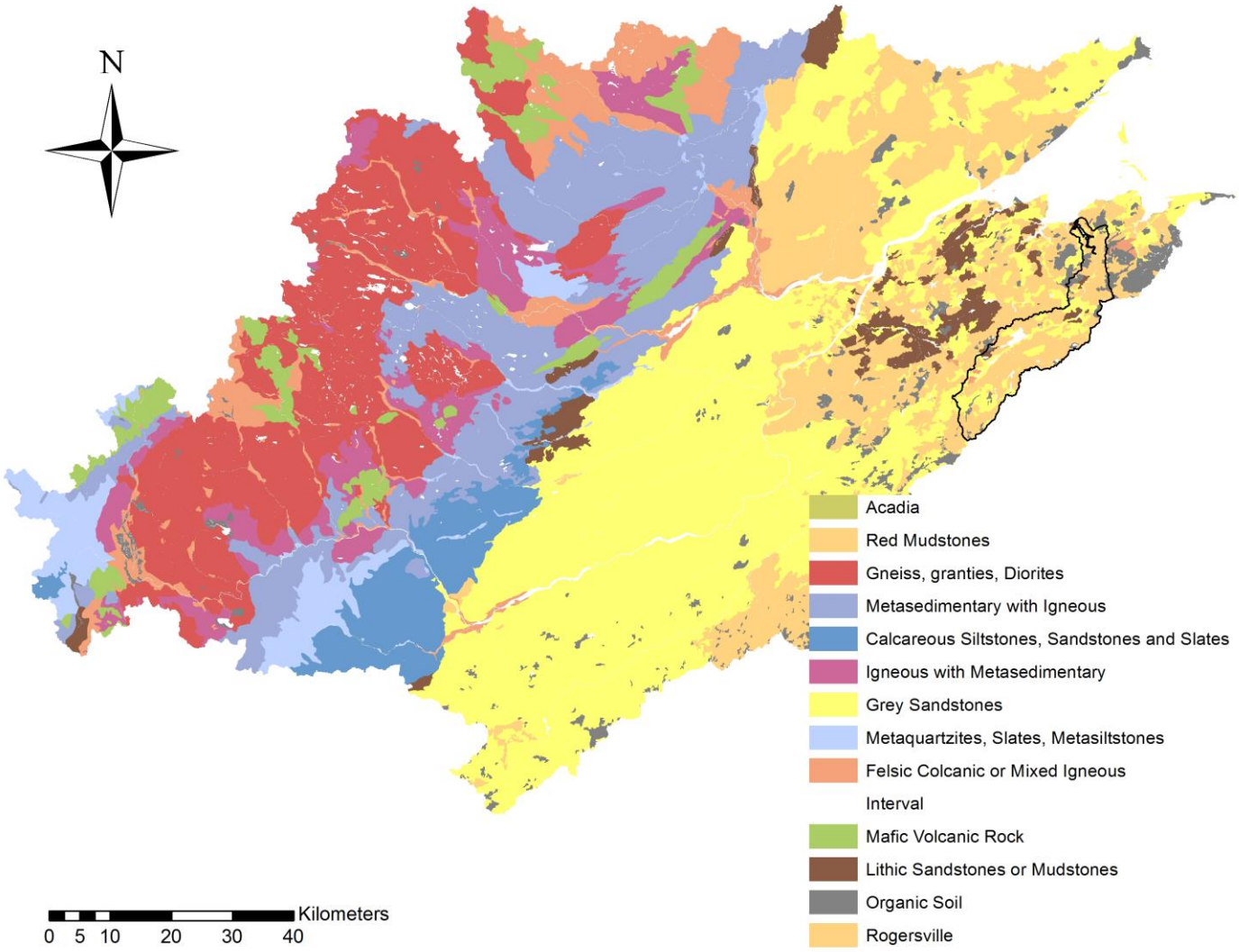

Figure 6 Bay du Vin River Geology within the Miramichi Watershed

Figure 7 Typical Bay du Vin River Substrate

5.0 Land Cover and Land Use

The predominant land cover within the Bay du Vin River drainage basin is forest at ~ 72.96%. Forestry is thus the main economic pursuit on the watershed and has the greatest anthropogenic impact on the watershed. Most of the forest harvesting is industrial scale work by J.D. Irving, lease holder of the crown lands. This is followed by other activities as shown in Figure 8. Next in line, the "other" land use category includes industrial, infrastructure, barren, and recreational uses. and these lands are widespread throughout the watershed. Wetlands at 10.80% (NBDNR, 2009) are concentrated lower in the watershed on low-lying land closer to the coastline. The one peat moss harvesting operation located within the watershed is owned by Scotts Canada Limited. Most of the agricultural lands (at 3.8%) are concentrated in the headwaters with some pastures situated along the tidal waters.

Recreational fishing is one of the “other: uses. There is no accurate tracking of the level of recreational fishing activity. No reports of particularly active anglers on the Bay du Vin were encountered to offer local insights.

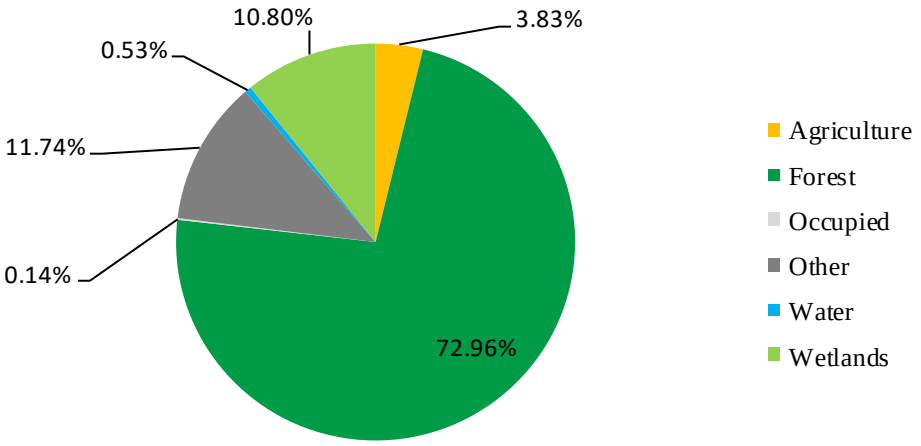

Figure 8 Bay du Vin Watershed - Land Cover and Land Use

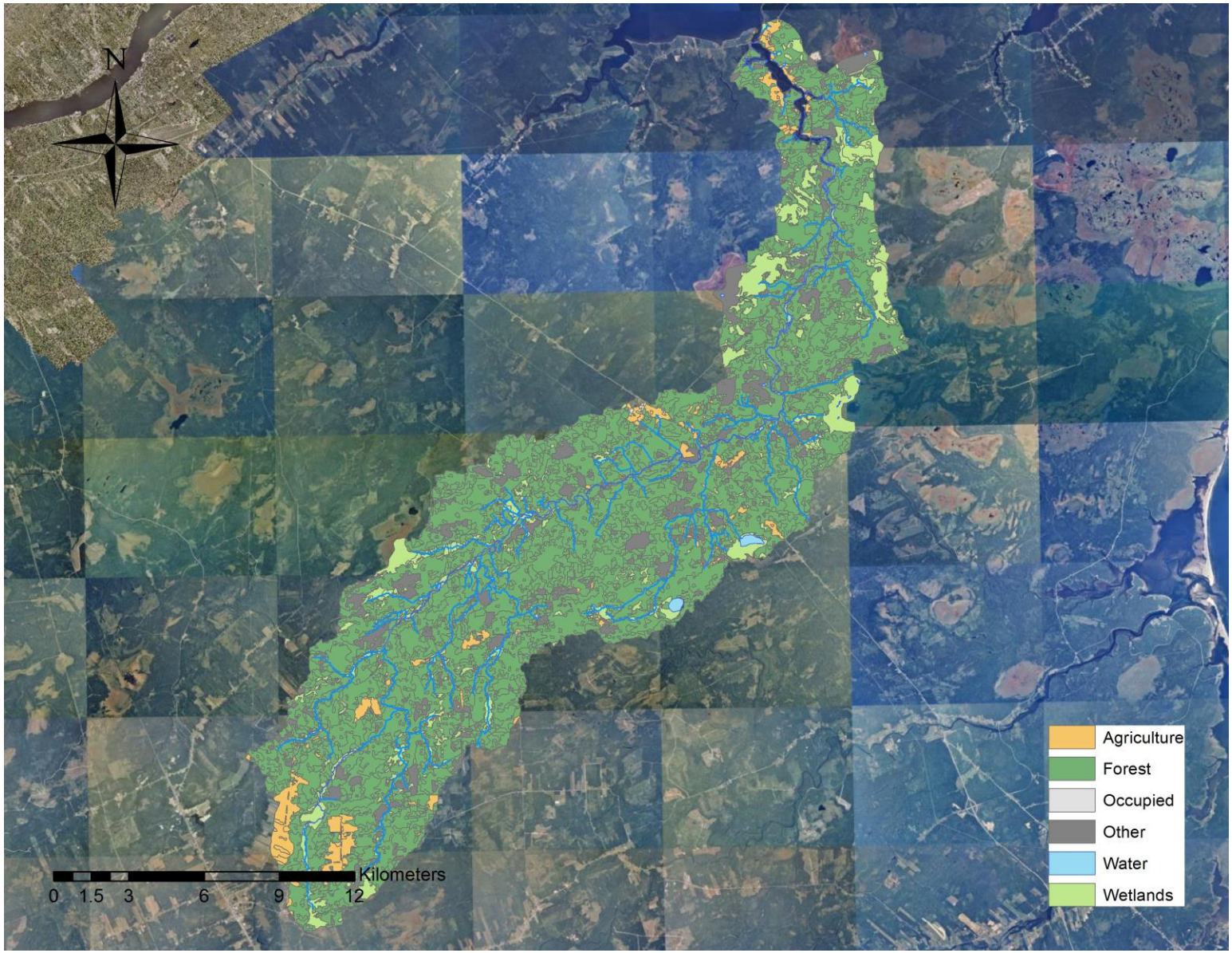

Figure 9 Bay du Vin Watershed Land Cover and Use

Figure 10 Trap-net Fishing on the Bay du Vin Estuary

6.0 Beaver Dams

Much of the headwaters on the Bay du Vin River are accessible to spawning Atlantic salmon and Brook Trout. The river is without impoundments apart from beaver dams. Beaver dams were not a prominent visual feature of the smaller tributaries of the Bay du Vin perhaps more due to lack of accessibility. The exceptionally low water conditions during much of 2020 emboldened this rodent to attempt a series of dams on the main branch of the Bay du Vin. In October when the water levels rose toward normal levels these dams were not an impediment to spawning salmon. No impoundments from abandoned dams or other barriers that would impede were encountered in 2013 or 2020.

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

Figure 11 Bay du Vin - Beaver Dam on Main Branch - October 2020

7.0 Habitat Assessments

Three detailed stream habitat surveys were completed in 2013. The reaches were chosen based on their accessibility, wide distribution in the drainage basin and representativeness of the waterway. Each of the three reaches covered a length of at least one kilometer. The results of the habitat assessments showed issues related to salmon habitat. Much of the river bottom is exposed bedrock and none of the reaches showed a significant number of pools and existing pools are of limited depth (i.e. < 2 meters). The DNR&E / DFO – New Brunswick Stream

Habitat Inventory field form data from the top, middle, and bottom reaches appear to show that the overall characteristics of the Bay du Vin River such as good bank stability, vegetation along banks, canopy coverage in the headwaters, and an abundance of large woody debris show positive habitat conditions for Atlantic salmon habitat. However, given that the surveyed reaches lacked pools and much of the substrate is bedrock, it is speculated that these are limiting factors for the Bay du Vin River as a salmon producing river.

The land cover and use figure (Figure 9) for the Bay du Vin River drainage basin illustrates that a large percentage of the watershed is covered by forest and significant wetland resources. The major economic activities within the watershed are lumber harvesting, one peat production operation and some agriculture production. None of these uses appear to pose any direct threat to fish habitat.

The benthic macroinvertebrate sampled in applying the CABIN protocol over multiple years show that the EPT (bug families) and Total Taxa Richness on the Bay du Vin River do not appear to be impacted. This is based on the benthic community found at the one CABIN collection site.

The water temperature at the top, middle, and bottom reaches for the year 2013 indicated that the temperature exceeded the 23°C salmonid thermal stress threshold twice. The 2020 water temperature data from an upper and lower site (Figure 17) shows a more stressful temperature regime on the Bay du Vin River. Not only has the water temperature exceeded the 23°C thermal stress threshold, but it also exceeded this level for a prolonged period. The Bay du Vin River with a smaller and shallow watercourse will get warmer quicker during the hot days and get colder quicker when the ambient temperature drops. These conditions relegate the Bay du Vin to being a fall run river with little likelihood of that changing in the future.

Figure 12 Fish Habitat Assessment - Bay du Vin River 2013

Two electrofishing sites were identified and then visited in September of 2020 by fish biologist Rod A. Currie. Rod was supported by Kate Currie, MREAC staff and volunteers.
Both sites produced juvenile salmon at the fry and parr stages. Water conditions were very low, typical of the entire summer of 2020. The complete Currie report **"**Results of Fish Population Surveys at Two Locations on Bay du Vin River during September 2020" is found in Appendix 1. The author, Rod Currie makes a significant comment on the status of Atlantic salmon on the Bay du Vin River as follows:

"The currently low numbers of spawning salmon in nearly all Maritime rivers suggests the Bay du Vin River is also experiencing low numbers of spawning salmon. If there are insufficient

spawners to occupy all of the available habitat, then it is not surprising that the numbers of salmon fry, and to a lesser degree parr, are not distributed evenly throughout the stream."

Figure 13 Bay du Vin Electrofishing Team 2020

8.0 Water Quality

Water quality monitoring on the Bay du Vin in 2013 and in 2020 indicated that for most parameters the conditions are fine to support fish populations, including Atlantic salmon. Appendix 2 shows water sample results taken in 2020. Results from 2013 sampling are available in the 2013 report (Collins and Trajkovic) on the Bay du Vin Atlantic salmon habitat assessment.

Water temperature is an obvious exception. As a smaller scale shallow river, water temperatures, especially those in recent years, have resulted in temperatures will above the stress threshold of salmonids. River management on the Miramichi use a sustained threshold above 20°C as a trigger

for the “warm water protocol”. Twenty-eight of the better-known pools were closed to fishing for most of the summer of 2020 due to the hot and dry conditions. Two temperature loggers (a third went missing) on the Bay du Vin (Figure 16) illustrate the elevated temperatures in 2020 (Figure 17). Previous monitoring during 2013 (Figure 18) was more favorable but temperatures still exceeded 20°C and reached 23°C as a stress threshold.

Water quantity is another limiting factor, and between water temperature and water quantity the Salmon run being limited to the fall is understandable.

Dissolved oxygen levels have been acceptable in repeated samples over multiple years of monitoring. These have always been above the 6.5 mg/l threshold, the lowest being 7.04 mg/l.

The river’s pH values are likewise withing an acceptable range. River water, and snow pH values, taken during spring freshet, all exceeded 7.00.

Sedimentation issues appear to be small scale. One river fording site (Figure 14) was noted to contribute sediment under wet weather conditions. As noted, much of the riverbed is bedrock material with exposed bedrock along much of shoreline. There is no delta at the river mouth to suggest the river deposits large amounts of sediment. Additional erosion issues are caused by camp and cottage owners who overzealously clear cut to the riverbank. (Figure 15)

Other evidence of stream alteration is evident on a property where boulders were placed in-stream, presumably with the intent to improve fishing at the site.

A 2013 water chemistry sample process by the N.B. DELG laboratory in 2013 and a 2020 sample from the RPC laboratory in 2020 show all parameters within acceptable levels. These results were compared to the Canadian Council of Ministers of the Environment’s (CCME) Water Quality Guidelines for the Protection of Aquatic Life.

Figure 14 Bay du Vin River Fording Site

Figure 15 Cleared Flood Plain - Bay du Vin River - Cottage Property

Recommendation: Strategies to promote shoreline and river stewardship among private camp and cottage owners should be promoted.

Recommendation: *A Bay du Vin cottage/camp owner's association should be promoted to improve environmental awareness, river stewardship, and to flag issues of habitat degradation and other ecological concerns.*

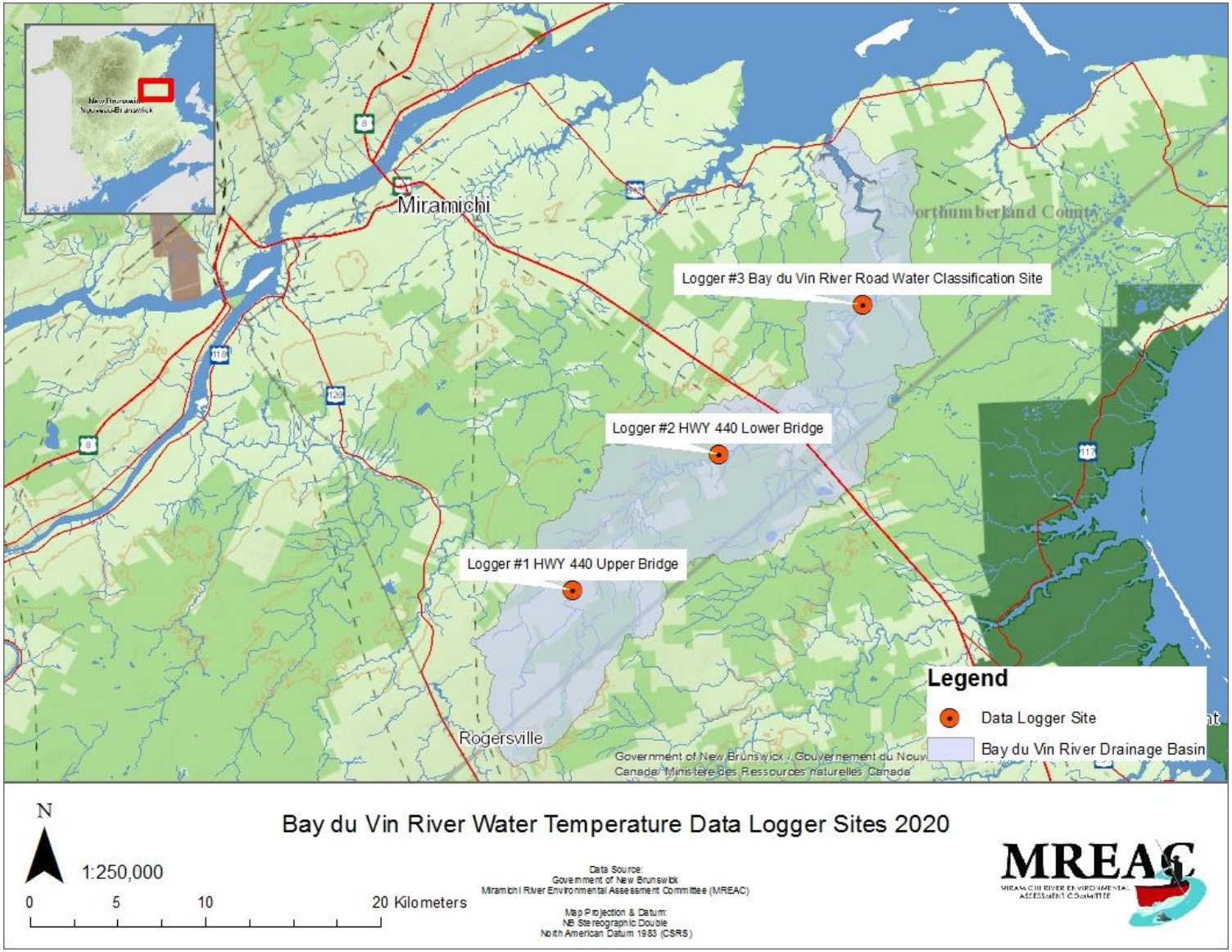

Figure 16 2020 Bay du Vin Data Logger Sites - Water Temperature

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 ecological condition of freshwater systems. This protocol is based on the relative health of the macroinvertebrate population of representative sample sites along selected rivers. MREAC has been engaged in this protocol since 2004.

MREAC staff and ECCC have annually applied the CABIN protocol on the Bay du Vin River at an established site below the Hwy 11 bridge since 2004. This reference condition site has sustained high quality habitat conditions over these years based on species diversity and abundance. Details of the CABIN protocol are presented in MREAC's 2013 habitat assessment report. No significant change has occurred since that time.

Recommendation: Water temperature monitoring with the long-term goal of protecting colder water streams and pools as fish refuges should be instituted by Fisheries and Oceans Canada on the Bay du Vin River

Recommendation: Results from the CABIN protocol reference site on the Bay du Vin River, monitored by ECCC, should be reviewed annually to track the ecological condition of the macroinvertebrate population on this waterway.

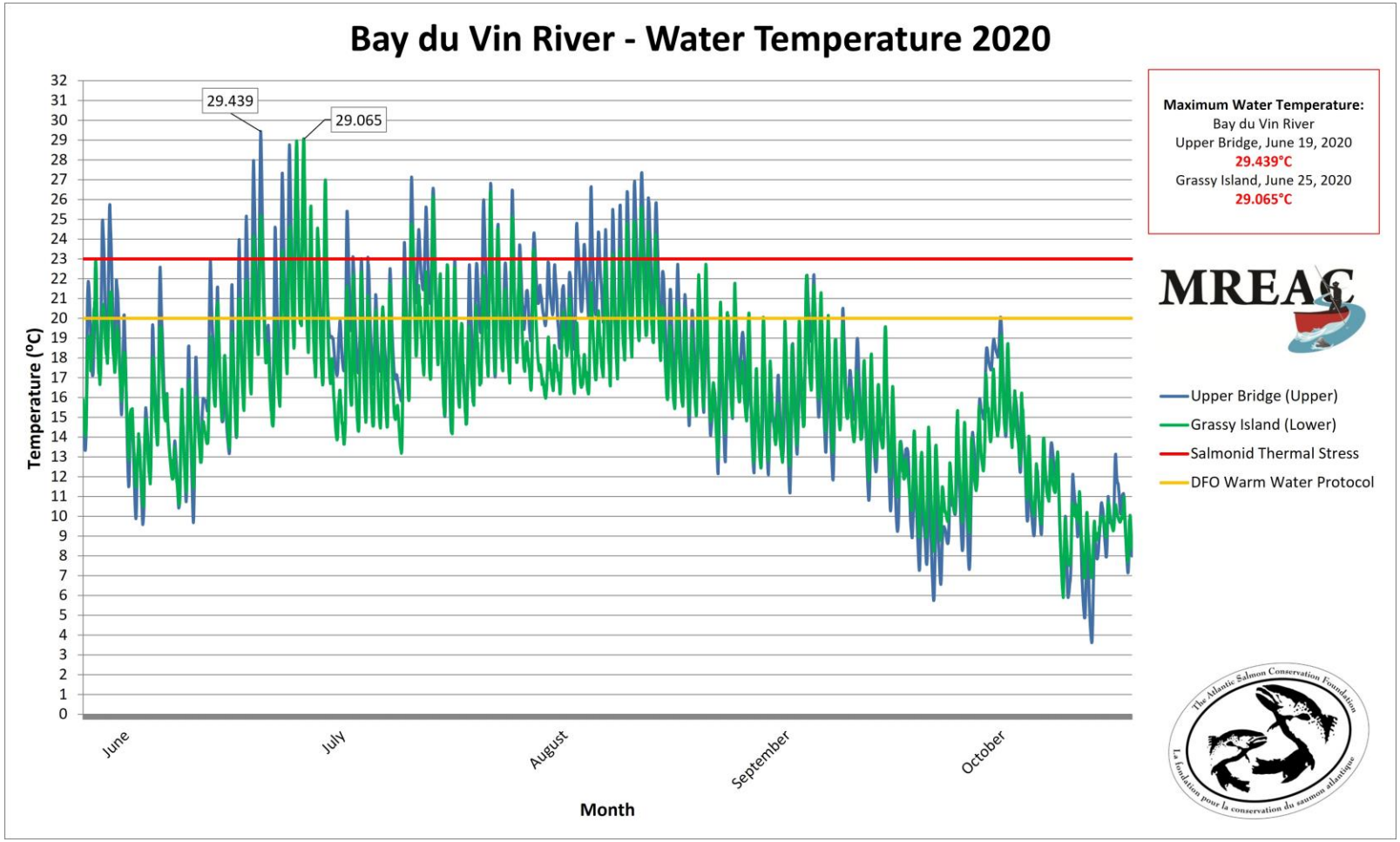

Figure 17 2020 Temperature Logger Results from Upper and Lower Sites

The following figure represents the water temperature at the three Bay du Vin reaches vs. the thermal stress for Salmonids in 2013. The data loggers were deployed from July 25 to October 23, 2013.

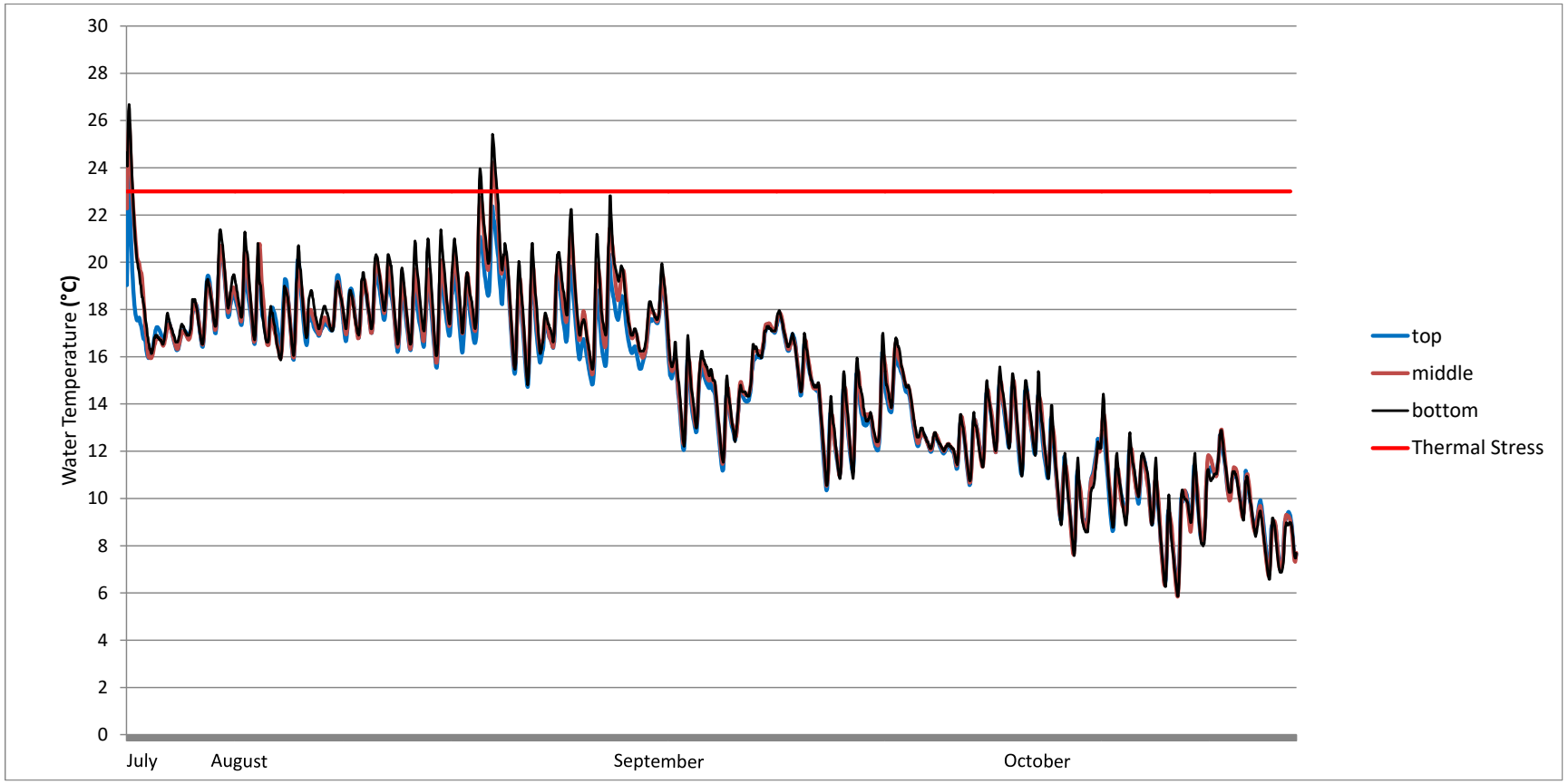

Figure 18 Water Temperature vs. Thermal Stress - Top, Middle, and Bottom Sites - 201

9.0 Land Tenure

A review of private land holdings along the Bay du Vin River (GeoNB) show some sizable freehold properties that exceed 25 acres. These properties are concentrated along the mid reaches and along the tidal waters near the river mouth. Navigating the river reveals no lumbering practices that cause sedimentation or remove canopy cover. The risks remain among these properties for poor management of these woodlots that could lead to siltation and increased heating of the waterway. By working with the Northumberland Woodlot Owners Association best management practices on these properties can be promoted.

> *Recommendation: Strategies to promote the use of best management practices among private woodlot owners should be promoted through the woodlot owner's association.*

10.0 Conclusion

The Bay du Vin is a relatively small, intact waterway with an extant Atlantic salmon population. The watercourse is protected in part by its relatively low profile, small scale, and remoteness amid the higher profile tributaries on the Miramichi. Despite good road access and the private camps and cottages, Atlantic salmon apparently receive limited attention from recreational fishers. The threat of poaching is an unknown. Thus, the limited pressure on this waterway suggest this stock, however large or small, is not in peril.

MREAC monitoring and research on the Bay du Vin River in 2013 and 2020 provide much more ecological information on the Bay du Vin than seems available from other sources.

No invasive fish species are known to have impacted the Bay du Vin to date.

Climate change impacts, as they continue to increase, will be increasingly problematic on this waterway. Already suffering high temperatures during the peak of summer, the habitat for juvenile salmon seems limited at best and will not likely improve in face of warming conditions. Apart from temperature, the other environmental parameters for fish habitat are in good condition.

Industrial forestry, as the major industrial use on the Bay du Vin and all of New Brunswick continues to be blamed for the "flashy" nature of quickly raising and quickly falling water levels, with negative impacts on salmon habitat conditions. Despite this, the largely intact riparian zone and relatively narrow channel on the Bay du Vin allows for good shading.

The waterfront properties including camps, cottages and some full-time residents in the headwaters and at the river mouth are candidates for an awareness program to promote shoreline and river stewardship. Reaching this disparate audience poses some challenge.

Based on the data analyzed, visual observations recorded, and personal communications with landowners and stakeholders, the Bay du Vin River does not appear have significant production of Atlantic salmon. However, the current limited pressure from recreational fishers suggest that the existing salmon stock is currently secure. Increasing impacts from a warming climate suggest the future of a sustainable salmon stock on the Bay du Vin, over the long term, is in question. In the interim, finding ways to implement the recommendations from this conservation strategy will stabilize the Atlantic salmon stock over the shorter term.

All this considered, the future of Atlantic salmon on Miramichi waterways, including the Bay du Vin, seems more likely to be determined more by far reaching global factors than local limiting conditions.

11.0 Summary of Recommendations

Recommendation: Water temperature monitoring with the long-term goal of protecting colder water stream and pools as fish refuges should be instituted by Fisheries and Oceans Canada on the Bay du Vin River.

Recommendation**:** Monitoring of the Bay du Vin River, Hwy 11 site, for pH levels should continue to be done by MREAC in late winter and spring.

Recommendation: Results from the CABIN protocol reference site on the Bay du Vin River, monitored by ECCC, should be reviewed annually to track the ecological condition of the macroinvertebrate population on this waterway.

Recommendation: Strategies to promote shoreline and river stewardship among private camp and cottage owners should be promoted.

Recommendation: A Bay du Vin cottage/camp owner's association should be promoted to improve environmental awareness, river stewardship, and to flag issues of habitat degradation and other ecological concerns.

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

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Appendix 1

Results of Fish Population Surveys at Two Locations on Bay du Vin River during September 2020

In 2020, R. Currie was contracted by the Miramichi River Environmental Assessment Committee (MREAC) to conduct fish population assessments at two locations on the Bay du Vin River in eastern New Brunswick. The following report summarizes the results of theses surveys.

Location:

Fish population assessments were conducted at two locations on the Bay du Vin River. These locations correspond to bridge crossings where the Bay du Vin River is crossed by Route 440 which runs between Rogersville and St. Margarets. The bridge crossings were selected to gain access to the river. The first survey was conducted in riffle habitat downstream of the bridge on Route 440 that is approximately 4 km west of St. Margarets. The second site was located at the bridge on Route 440 that is approximately 11 km further to the west of the first site, near the community of Rosaireville. These locations are shown on the attached map (Figure 1).

Methodology:

The fish sampling methodology followed procedures for the removal method of population estimation for enclosed sites. However, it is important to note that although the sampling methodology closely followed procedures for enclosed sites, due to the extremely low flow conditions it was thought the use of fine mesh barrier nets to enclose the fish communities inhabiting the riffle habitat would not be necessary.

At each site the limits of the sampling area were marked, then fish were collected from within each designated area during 4 consecutive sweeps using a Smith-Root Model LR24 backpack electro-fisher. The format settings on the unit were as follows: for the St. Margarets site, the electro-fisher automatically selected an output current of 300 volts and this power level was maintained for this location. For the Rosaireville site, the electro-fisher selected 360 volts as the optimum power setting and this voltage was maintained for this site. Other settings on the unit were maintained at their default levels: pulse width = 6 milliseconds and frequency = 40 hertz. Electrofishing was conducted by moving back and forth across the stream while gradually moving upstream from the lower boundary towards the upper boundary. Stunned fish were collected by several technicians using dip nets and placed in a pail that was partially filled with water. Periodically the captured fish were transferred to a large holding tub placed in the stream immediately outside of the sampling area. Following each sweep, fish were lightly anesthetized using tricane methanesulfonate (TMS), identified to species, and counted. Additionally, individual brook trout and juvenile Atlantic salmon were measured for fork length,

then assigned an age class based on their respective size class. Processed fish were then transferred to a holding cage placed in the stream until the final sweep was completed. When fish from the final sweep were processed, all of the fish were released unharmed back into the stream. The sampling site was then measured and the area of the site was determined. The midday water temperature for each site was also recorded with a certified pocket thermometer.

Estimates of population density for each species of fish, as well as for each age class of salmon and trout, were generated using the *Microfish 3.0* formula (Van Deventer and Platts, 1989). The density estimates were then adjusted based on the size of each site to achieve a standard unit area of 100 m^2 to permit the direct comparison of fish densities between sites and between years if sites are revisited in the future.

Results and Discussion:

The results of the fish population surveys for two sites in the Bay du Vin River during September, 2020 are presented in Table 1. It is important to note that although the fish population surveys were conducted during a period of extremely low flow levels in the river, the timing of the survey was delayed until September when lower overnight temperatures tended to modify water temperatures. The midday water temperature at the lower site on 01 September measured 16^oC at 11:50 am. The upper site was sampled on 02 September and the midday water temperature at this location measured 14^o at noon.

TABLE 1
Results of Fish Population Surveys at Two Sites in the Bay du Vin River during September, 2020

Species	**Age Class**	**Number of Fish/100 m^2**	
		Upper Site	**Lower Site**
Atlantic salmon	0+	22.3	1.9
	1+	2.1	4.9
	total	24.4	7.1
Brook trout	0+	1.0	
Common shiner		6.9	19.2
Blacknose dace		79.7	99.6
Creek chub		10.0	1.1
White sucker		2.1	0.4
Threespine stickleback		5.2	0.4
Sea lamprey		1.7	0.8
Ninespine stickleback		0.7	
Brook stickleback			0.4

Total Fish		131.7	129.0

A review of the data provided in Table 1 indicates the presence of 9 species of fish inhabiting the sampling site that is further upstream, while 8 fish species were found at the lower site. As can be seen in the table, salmon, common shiner, blacknose dace, creek chub, white sucker, threespine stickleback, and juvenile sea lamprey are common to both sites. Three brook trout fry and 2 ninespine stickleback also were found at the upper site, while a single brook (fivespine) stickleback was found at the downstream site. These slight differences in species representation are based on the presence of only 1-3 individuals and their absence from the alternate site may simply be the result of chance.

In terms of numbers of fish, blacknose dace is the most abundant species at both locations. This is not surprising since this is a very common fish species and they often represent the most abundant species in other streams where they occur.

With respect to Atlantic salmon, two age classes of juvenile salmon were found at each of the sampling sites. With a total density of 24.4, the upper site had the highest total density of salmon. Salmon fry (0+ age class) represented the bulk of this number, while the density of salmon parr (1+ age class) was quite low. For the lower site, the density of salmon parr is higher than that found at the other site, but the density of fry is very low which results in a much lower total density of juvenile salmon. There are several possible reasons for the difference in the salmon community for these sites. The upper site may represent, or be closer to, better spawning habitat and this could account for the higher density of salmon fry at this location. Similarly, the higher abundance of salmon parr at the lower site might suggest this is better parr habitat than fry habitat. The currently low numbers of spawning salmon in nearly all Maritime rivers suggests the Bay du Vin River is also experiencing low numbers of spawning salmon. If there are insufficient spawners to occupy all of the available habitat, then it is not surprising that the numbers of salmon fry, and to a lesser degree parr, are not distributed evenly throughout the stream.

Three brook trout fry were captured at the upper site, while no trout were captured at the lower site. This difference is not considered significant for a couple of reasons. Firstly, the difference in numbers (3 versus 0) is not large. Secondly, it is important to consider the extremely low and warm water conditions that occurred throughout the summer and fall in New Brunswick. Since brook trout are very sensitive to warm waters, it is likely that this species was not distributed evenly throughout the available habitat in the Bay du Vin River. If the water conditions reflected higher/normal levels and cooler temperatures, then this species might be more widespread and appear more evenly distributed.

All of the remaining fish species represent common coarse fish species. Each of these species occur in approximately similar low abundance at each of the sites. The presence of these species indicate the Bay du Vin River supports a diverse fish community.

Appendix 2

General Chemistry Analysis (Water Sample) – RPC Laboratory – Nov. 2020

Attention: Harry Collins
Project #: Not Available
Location: Bay du Vin River

Analysis of Water

RPC Sample ID:			376027-1
Client Sample ID:			Bay du Vin River
Date Sampled:			17-Nov-20
Analytes	**Units**	**RL**	
Sodium	mg/L	0.05	3.77
Potassium	mg/L	0.02	0.50
Calcium	mg/L	0.05	10.2
Magnesium	mg/L	0.01	1.41
Iron	mg/L	0.02	0.28
Manganese	mg/L	0.001	0.030
Copper	mg/L	0.001	0.005
Zinc	mg/L	0.001	0.001
Ammonia (as N)	mg/L	0.05	< 0.05
pH	units	-	7.6
Alkalinity (as $CaCO_3$)	mg/L	2	25
Chloride	mg/L	0.5	4.4
Sulfate	mg/L	1	6
Nitrate + Nitrite (as N)	mg/L	0.05	< 0.05
o-Phosphate (as P)	mg/L	0.01	< 0.01
r-Silica (as SiO_2)	mg/L	0.1	6.5
Carbon - Total Organic	mg/L	0.5	16.0
Turbidity	NTU	0.1	1.0
Conductivity	µS/cm	1	78
Calculated Parameters			
Bicarbonate (as $CaCO_3$)	mg/L	-	24.9
Carbonate (as $CaCO_3$)	mg/L	-	0.093
Hydroxide (as $CaCO_3$)	mg/L	-	0.020
Cation Sum	meq/L	-	0.818
Anion Sum	meq/L	-	0.749
Percent Difference	%	-	4.40
Theoretical Conductivity	µS/cm	-	81
Hardness (as $CaCO_3$)	mg/L	0.2	31.3
Ion Sum	mg/L	-	48
Saturation pH (5°C)	units	-	9.1
Langelier Index (5°C)	-	-	-1.54

This report relates only to the sample(s) and information provided to the laboratory.

RL = Reporting Limit; Organic Carbon and ion chemistries for turbid samples are determined on filtered aliquots.