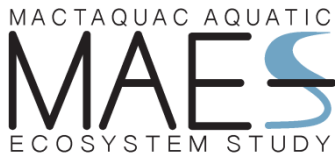


**Mactaquac Aquatic Ecosystem Study
Report Series 2016-047**



**EVALUATION OF TWO
ALTERNATIVE BY-PASS STRATEGIES
FOR PRE-SMOLT ATLANTIC SALMON
(*SALMO SALAR*) IN THE TOBIQUE-
NARROWS DAM TO MAXIMIZE
SURVIVAL AT THE MOUTH OF SAINT
JOHN RIVER – A PRELIMINARY
REPORT**

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4 November 2016



**Canadian
Rivers Institute**



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EXECUTIVE SUMMARY

This report provides a progress update on pre-smolt migration study comparing two alternative strategies available for the downstream migrating juvenile Atlantic salmon (*Salmo salar*). One strategy allows smolts to migrate freely from Tobique River to the mouth of Saint John River, however, these fish will be subject to migrating through three hydropower reservoirs and their associated hydropower generating stations. The other strategy will utilize a possibility to collect (“trap”) the downstream migrating juveniles in the uppermost hydropower dam (Tobique-Narrows) and subsequently, move them downstream using a tank truck (i.e. trap-and-truck strategy).

100 pre-smolt Atlantic salmon have been tagged to date with Vemco V7 transmitters and subsequently monitored using 57 VR2W receivers. These 100 fish were divided to two tagging groups with N=50 released downstream of Tobique-Narrows Generating Station (TNGS), and N=50 released downstream of Mactaquac generating Station (MGS). Additionally, 50 pre-smolt Atlantic salmon have been tagged with V7 dummy-tags to control for tagging-related losses and 50 untagged pre-smolts have been used to monitor natural overwinter mortality. Basic characteristics related to tagging are reported.

Preliminary data from receiver retrieved to-date suggests:

For TNGS Group:

- Relatively high proportion of tagged smolts for which no detections have been observed
- High success rate of headpond migration from Nackawic to MGS in the smolts that were observed active in the MGS reservoir in spring 2016
- High proportion of fish entering Longs Creek Arm
- High migration success from downstream vicinity to at least Grand Bay Ferry area, however, a low proportion of fish existing the SJR (either low probability of detection, or high mortality in this area)

For MGS Group:

- High proportion of fish detected
- High proportion of fish lost in the McKinley area potentially highlighting an area of high predation

1 INTRODUCTION

The Saint John River (SJR) historically supported large numbers of Atlantic salmon (*Salmo salar*) production, primarily from the Tobique River tributary. The Tobique tributary is still the largest producer of juvenile salmon within the Saint John River (SJR) system upstream of the Mactaquac Dam. Approximately 70% of the population initiate their downstream migration in the autumn months (pre-smolts) with movements into the main stem of the SJR where the migrating juvenile salmon overwinter. In the spring, the fish resume their long-distance migration as smolts to the Bay of Fundy and the Atlantic Ocean.

The Tobique River, the downstream migrating juvenile salmon must pass three reservoirs and their dams (the Tobique-Narrows, Beechwood, and Mactaquac Generating Stations) before reaching the mouth of the SJR. A new downstream fish bypass facility is being constructed at the Tobique-Narrows Generating Station (TNGS) and when finalized, it will allow an opportunity to either pass the downstream migrating juvenile salmon to the tailrace of the dam, or alternatively, collect the migrants for a subsequent transfer downstream of Mactaquac Generating Station (MGS) using trap-and-truck strategy. These two strategies both have potential advantages and disadvantages, and a further study was determined necessary to evaluate the merits of each strategy.

As part of ongoing Mactaquac Aquatic Ecosystem Study (MAES) carried out by Canadian Rivers Institute at University of New Brunswick, NB Power initiated a study to determine whether juvenile fish should be eventually allowed to voluntarily pass through the new bypass at TNGS, or be captured at this facility for further in the Tobique headpond for trap-and-truck below the Mactaquac Generating Station (MGS).

The objective of this study is to establish the best bypass strategy that secures maximum survival to the Saint John River mouth and arrival downstream of all barriers for Atlantic salmon pre-smolts from the Tobique River.

This report is an interim deliverable to NB Power to update on progress, and to report on preliminary data collected up to October 2016. It is to be noted that the dataset is not complete and analysis shown in this report is preliminary with subject to changes as the dataset is analysed as a whole.

2 METHODS

Wild Atlantic salmon pre-smolts were acoustically tagged (Table 1) and tracked (Figures 1 – 3) to determine downstream movement rates and success. Fish were sourced from Rotary Smolt Traps (RSTs) operated by the Department of Fisheries and Oceans (DFO) in partnership with Tobique First Nations (TFN) at Three Brooks (46.86914 -67.42933) on the Tobique River. Fish were transported for 20 minutes to a tagging site (46.76366 - 67.55565), and placed to a large circular tank and observed for 24 h before tagging. Acoustic (69 kHz) V7 tags (Vemco, Bedford N.S.) were 7 mm in diameter and 20 mm in length, weighing 1.6 g in air and 0.75 g in water. They were programmed to remain active for the first month after tagging, then turned off until re-activation in late April 2016 to save battery power for the spring migration. The tag/body weight ratio was kept under 5% (average 3.9%) to avoid tagging effects on swimming performance and survival. Tagging was performed by placing fish into a solution of anaesthetic (40 ppm clove oil), with surgery lasting 194 ± 31 s.

Overall, 200 fish were used in the experiment between two experimental groups, a dummy-tagged control group and a non-tagged control group. The first experimental group was a release (N=50) just below the TNGS (46.77849 -67.69599) representing (i.e. simulating) a group that would have successfully migrated through a bypass. Second experimental group was a release (N=50) just below the MGS (45.95923 -66.82638) representing trap-and-truck mitigation strategy. Similar groups of pre-smolts were also dummy-tagged (N=50) or kept untagged (control; N=50) and held overwinter at the Mactaquac Biodiversity Facility (MBF; 45.95885 -66.84392) to quantify mortality due to surgery and transport, overwinter tag loss and overwinter mortality.

The tagged fish recovered for 24 h in a floating live-well within a large circular tank with gravity-fed flow-through from a nearby brook. They were then transported in a large aerated transport tank for approximately 30 min to the TNGS, or approximately 2 h to the MGS or MBF. The control group was anaesthetized at MBF so that lengths and weight could be measured, and held overwinter.

Acoustically tagged smolts were passively tracked downstream through the upper SJR (Figure 1), Mactaquac headpond (Figure 2), and lower SJR (Figure 3) using 57 VR2W receivers. These receivers were deployed for 2015-2016 (Table 2).

Table 1. Sample size (N), tagging dates, weight, length, and condition of acoustically tagged Atlantic salmon pre-smolts. Values shown are mean \pm standard deviation.

Group	N	Tagging Date (2015)	Weight (g)	Fork length (cm)	Condition
Tobique	50	28 Oct – 25 Nov	40.4 \pm 6.4	16.2 \pm 0.7	0.95 \pm 0.67
Mactaquac	50	28 Oct – 25 Nov	40.7 \pm 5.9	16.1 \pm 0.7	0.96 \pm 0.08
Dummy- tagged	50	27 Oct – 9 Dec	44.6 \pm 8.4	16.3 \pm 0.8	1.02 \pm 0.12
Control	50	9 Dec – 10 Dec	42.8 \pm 10.4	16.2 \pm 1.2	0.99 \pm 0.13

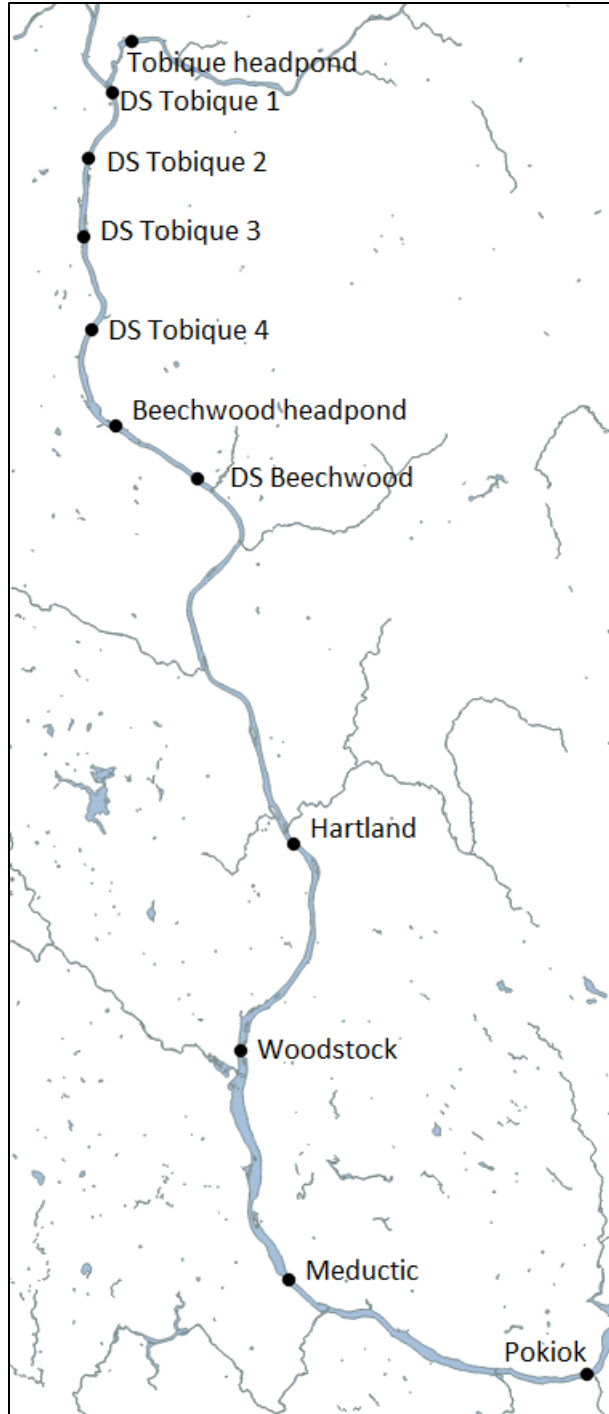


Figure 1. Locations of VR2W receivers in the Saint John River upstream of Mactaquac Headpond proper for 2015-2016. The coordinates of the receivers are shown in Appendix 1.

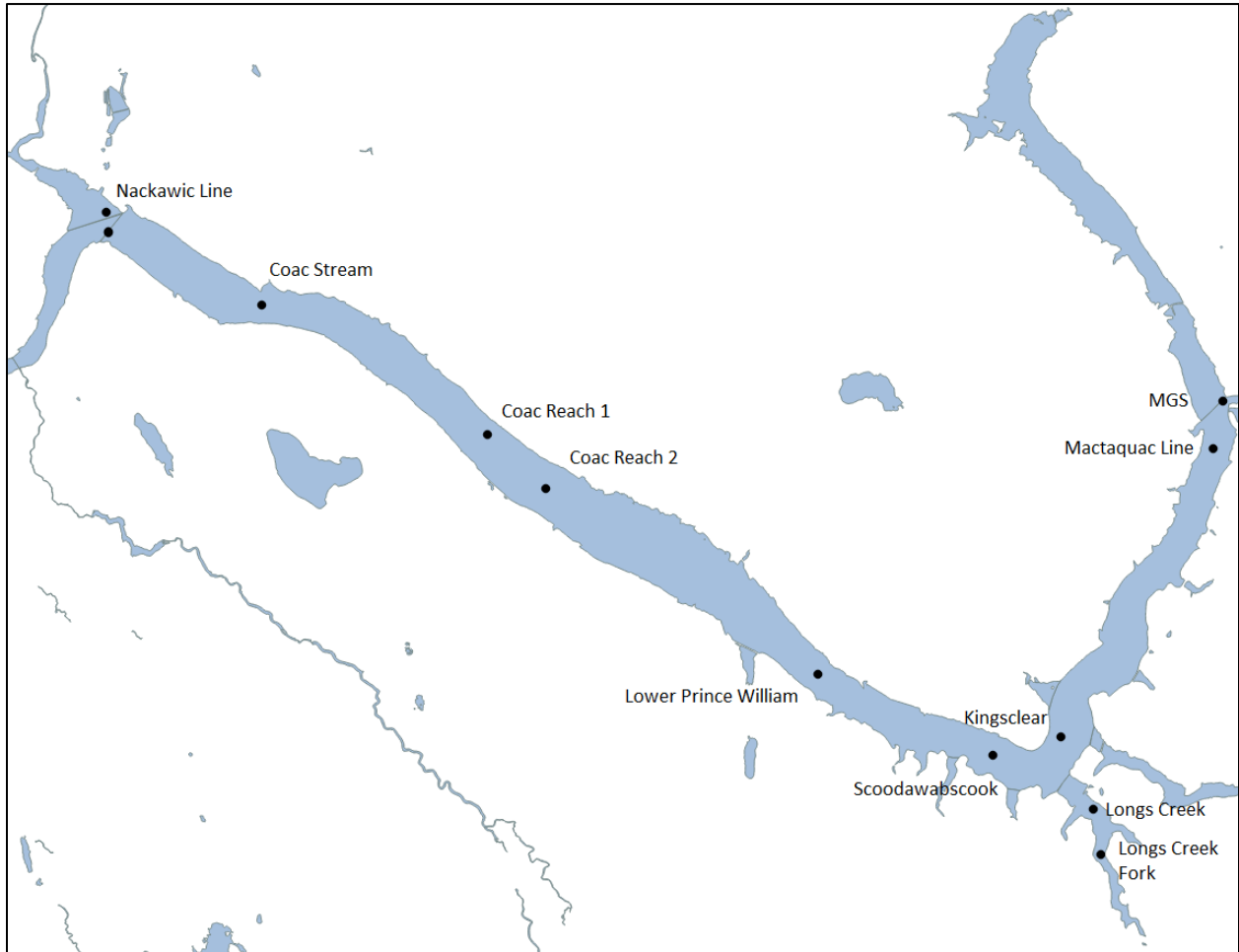


Figure 2. Mactaquac reservoir locations of VR2W receivers for 2015-2016. The coordinates of the receivers are shown in Appendix 1.

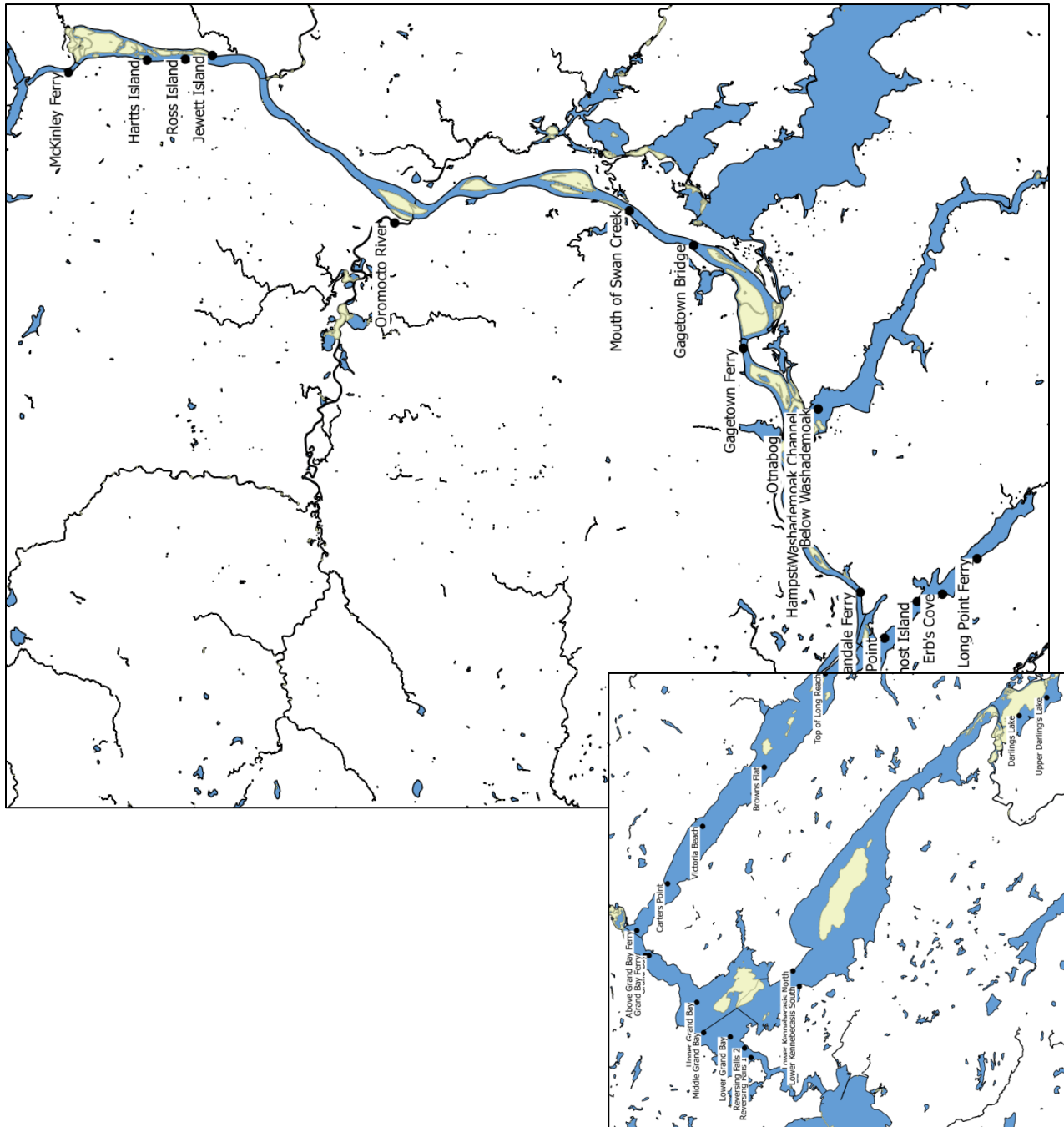


Figure 3. Locations of VR2W receivers downstream of the Mactaquac Generating Station for 2015-2016. The coordinates of the receivers are shown in Appendix 1.

Table 2. VR2W receiver deployment and retrieval schedule for 2015-2016. [Additional receiver retrieval effort is ongoing and additional data will be received]

VR2W Station	Deployment Date	Retrieval Date
Tobique headpond	20 Oct 2015	17 Oct 2016
DS Tobique 1	20 Oct 2015	Not recovered
DS Tobique 2	20 Oct 2015	17 Oct 2016
DS Tobique 3	21 Oct 2015	17 Oct 2016
DS Tobique 4	20 Oct 2015	17 Oct 2016
Beechwood headpond	20 Oct 2015	Not recovered
DS Beechwood	30 Oct 2014	Not recovered
Hartland	17 Nov 2015	Not recovered
Woodstock	30 Oct 2014	17 Oct 2016
Meductic	21 May 2014	Not recovered
Pokiok	22 Oct 2015	3 Oct 2016
Nackawic Line Left	22 Oct 2015	3 Oct 2016
Nackawic Line Right	22 Oct 2015	Not recovered
Coac Stream	4 Nov 2015	20 Apr 2016
Coac Reach	23 Oct 2015	20 Apr 2016
Lower Prince William	8 May 2015	20 Oct 2016
Scodawabscook	23 Oct 2015	27 Apr 2016
Longs Creek	22 Oct 2015	6 May 2016
Longs Creek Fork	22 Oct 2015	6 May 2016
Kingsclear	23 Oct 2015	21 Apr 2016
Mactaquac Line	4 Nov 2015	21 Apr 2016
MGS	4 Nov 2015	13 May 2016
McKinley Ferry	8 Oct 2015	13 Oct 2016
Hartts Island	8 Oct 2015	13 Oct 2016
Ross Island	8 Oct 2015	13 Oct 2016
Jewett Island	8 Oct 2015	13 Oct 2016
Oromocto River	2 Nov 2015	9 Oct 2016
Mouth of Swan Creek	19 Oct 2015	20 Sep 2016
Gagetown Bridge	2 Nov 2015	16 Oct 2016
Gagetown Ferry	2 Nov 2015	9 Oct 2016
Otnabog	14 Oct 2015	9 Oct 2016
Washademoak	2 Nov 2015	14 Oct 2016
Washademoak Channel	2 Nov 2015	14 Oct 2016
Below Washademoak	2 Nov 2015	14 Oct 2016
Hampstead	28 Sep 2015	14 Oct 2016
Evandale Ferry	3 Nov 2015	14 Oct 2016
Long Point Ferry	13 Oct 2015	3 May 2016
Erb's Cove	13 Oct 2015	3 May 2016
Ghost Island	13 Oct 2015	3 May 2016
Lower Belleisle Point	13 Oct 2015	3 May 2016
Top of Long Reach	3 Nov 2015	14 Oct 2016
Browns Flat	26 Sep 2015	21 Oct 2016
Victoria Beach	26 Sep 2015	21 Oct 2016

Table 2 (continued). VR2W receiver deployment and retrieval schedule for 2015-2016.

VR2W Station	Deployment Date	Retrieval Date
Carter's Point	26 Sep 2015	21 Oct 2016
Above Grand Bay Ferry	26 Sep 2015	20 Sep 2016
Grand Bay Ferry	11 Dec 2015	20 Sep 2016
Grand Bay	26 Sep 2015	20 Sep 2016
Upper Grand Bay	4 Nov 2016	25 Sep 2016
Middle Grand Bay	4 Nov 2015	25 Sep 2016
Lower Grand Bay	4 Nov 2015	25 Sep 2016
Upper Darling's Lake	28 Oct 2015	3 May 2016
Darling's Lake	28 Oct 2015	3 May 2016
Lower Kennebecasis North	4 Nov 2015	25 Sep 2016
Lower Kennebecasis South	4 Nov 2015	25 Sep 2016
Reversing Falls 1	11 Aug 2015	25 Sep 2016
Reversing Falls 2	11 Dec 2015	21 Oct 2016

3 PRELIMINARY RESULTS

3.1 FATE OF TOBIQUE-NARROWS RELEASE GROUP

From the data downloaded to date (as of 21 October, not all receivers have yet been retrieved, or downloaded for the second time), 28 of the 50 (56 %) pre-smolts released below the TNGS were observed in spring of 2016 in at least one of the VR2W receivers downstream of Pokiok (Appendix 2).

Of the 28 smolts detected in spring of 2016, three were detected for the first time in areas downstream of MGS (Appendix 2), which may indicate that they moved downstream of the MGS as part of their pre-smolt migration during the time period in winter when the acoustic tags were inactive. Of the 25 smolts actively migrating in the Mactaquac headpond in the spring of 2016, 22 (88%) were observed in the Pokiok/Nackawic area indicating they overwintered in areas upstream of the Nackawic and entered into the headpond mainly in the first two weeks of May (full range between 25 April and 30 May 2016; Appendix 2). Three smolts (of 25, i.e. 12 %) were first observed in the headpond proper, which indicated their overwintering in this area. Ten of the smolts entered Longs Creek which delays their migration.

Of the 25 tagged smolts actively migrating in the Mactaquac headpond, all (100%) must have approached the Mactaquac vicinity (either Mactaquac Line or MGS; Figure 2), but some were missed by these receivers (but later detected by other downstream receivers; Note that more receivers from Mactaquac line are currently being retrieved). The detections at-hand indicate a

wide arrival timeframe to vicinity of MGS between 28 April and 1 June 2016. It appears that three smolts (12 % of those observed actively migrating in the headpond) were unable to negotiate the Mactaquac Dam, as the last detections are either at Mactaquac Line or at MGS (Appendix 2), or these fish died without reaching the first receiver downstream of MGS. It is also noted that there is a potential migration delay while passing through a dam. This was investigated by comparing the first detection in the forebay and the first detection downstream of the MGS. Seven fish experienced minimal delays (0-6 min), whereas four fish were delayed for up to 9 days.

Of the 25 acoustically tagged smolts actively migrating downstream of MGS, five acoustically tagged smolts were last detected at the Kingsclear - McKinley Ferry site(s), which could be due to direct mortality from dam passage or predation. The rest of the tagged smolts (N=20) were all (100%) observed at least at the Grand Bay Ferry receiver, but only six were observed at the Reversing Falls (between 15 – 19 May). This can either indicate relatively high loss of smolts between Grand Bay Ferry and Reversing Falls, or poor detection efficiency at Reversing Falls.

3.2 FATE OF MACTAQUAC GENERATING STATION RELEASE GROUP

Of the 50 pre-smolts released below the MGS, 45 (90 %) were detected (Appendix 2). However, 36 (72 % of initially tagged; 80 % of those detected at least once) acoustically tagged smolts were not detected downstream of McKinley Ferry, located within one kilometer downstream of the release site (Table 3). This suggests extremely high mortality, likely due to predation, in this area. Of all the tagged smolts only seven (14 % of those tagged; 15.5% of those detected at least once) were observed in the Grand Bay Ferry receiver, and only five (10% of those tagged) smolts were detected in Reversing Falls between 12 and 20 May 2016 (Appendix 2).

3.3 MIGRATION RATES

Migration rates were estimated for fish released below the TNGS in four reaches: “Upriver” was defined as the section between TNGS and Nackawic; “Headpond” was considered the area between Nackawic and the MGS; “Dam passage” was defined as passage through the MGS; and “Downriver” was defined as the area between McKinley Ferry and Reversing Falls.

Migration rates were lowest through the “Headpond” reach and highest in the “Downriver” reach which was expected based on reduced water currents in the reservoir environment (Figure 4). Dam passage rates were variable. Migration rates for fish released below the MGS were also estimated for the “Downriver” reach (Figure 4). Since fish overwintered in the downriver reach, estimated migration rates were comparable to the headpond rates of the Tobique release group. Migration rate data will be re-analysed once all data has been retrieved to separate the overwintering periods from the active migration.

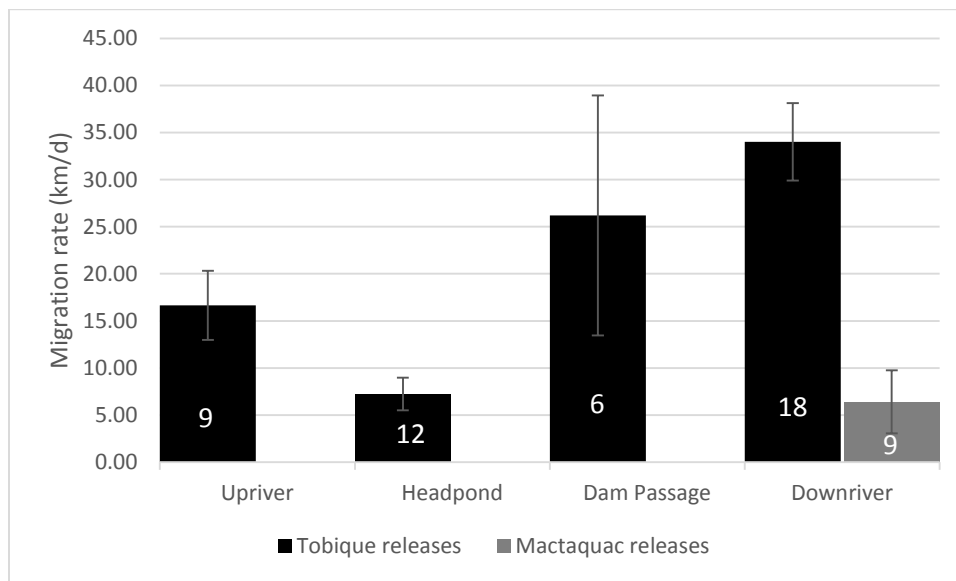


Figure 4. Average \pm standard error migration rate (km/d) of pre-smolts released at the Tobique-Narrows and Mactaquac Generating Stations through the Upriver, MGS Headpond, MGS, and Downriver reaches of Saint John River. Sample sizes are shown.

4 DISCUSSION

As the dataset is currently still being collected and more data is being added, the results at this time consist only of a partial dataset.

Main observations to date include:

For TNGS Group:

- Relatively high proportion of tagged smolts for which no detections have been observed in the TNGS group
- High success rate of headpond migration from Nackawic to MGS in the smolts that were observed active in the MGS reservoir in spring 2016
- High proportion of fish entering Longs Creek Arm
- High migration success from downstream vicinity to at least Grand Bay Ferry area, however, a low proportion of fish existing the SJR (either low probability of detection, or high mortality in this area)

For MGS Group:

- High proportion of fish detected
- High proportion of fish lost in the McKinley area potentially highlighting an area of high predation

The survival analysis will also be refined by correcting for tagging-related mortality based on the survival of the dummy-tagged fish, and natural overwintering mortality can be assessed based on the control group.

5 ACKNOWLEDGEMENTS

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APPENDIX 1:

Coordinates of the Vemco VR2W receivers deployed for 2015-2016 by the Canadian Rivers Institute.

Appendix 1 Table 1: Coordinates of the VR2W receivers shown in Figure 1.

VR2W Station	Latitude	Longitude
Tobique headpond	46.79423	-67.68106
DS Tobique 1	46.76110	-67.69888
DS Tobique 2	46.72047	-67.71918
DS Tobique 3	46.67035	-67.72327
DS Tobique 4	46.61197	-67.71399
Beechwood headpond	46.55194	-67.69169
DS Beechwood	46.51936	-67.61665
Hartland	46.29140	-67.52446
Woodstock	46.16101	-67.56912
Meductic	46.01725	-67.52322
Pokiok	45.95950	-67.25358

Appendix 1 Table 2: Coordinates of the VR2W receivers shown in Figure 2.

VR2W Station	Position	Latitude	Longitude
Nackawic Line	Left	45.99412	-67.22104
	Right	45.98978	-67.22031
Coac Stream		45.97435	-67.17250
Coac Reach	1	45.94670	-67.10208
	2	45.93534	-67.08386
Lower Prince William		45.89519	-66.99879
Scoodawabscook		45.87771	-66.94446
Longs Creek		45.86614	-66.91296
Longs Creek Fork		45.85633	-66.91070
Kingsclear		45.88186	-66.92325
Mactaquac Line		45.94449	-66.87649
MGS		45.95494	-66.87347

Appendix 1 Table 3: Coordinates of the VR2W receivers shown in Figure 3.

VR2W Station	Latitude	Longitude
McKinley Ferry	45.95975	-66.82733
Hartts Island	45.96866	-66.74696
Ross Island	45.96910	-66.70773
Jewett Island	45.97178	-66.68057
Oromocto River	45.85258	-66.49403
Mouth of Swan Creek	45.86121	-66.25397
Gagetown Bridge	45.83628	-66.18856
Gagetown Ferry	45.76225	-66.13842
Otnabog	45.69968	-66.09527
Washademoak	45.69736	-66.06899
Washademoak Channel	45.71647	-66.07434
Below Washademoak	45.71894	-66.06167
Hampstead	45.62251	-66.07583
Evandale Ferry	45.58793	-66.02015
Long Point Ferry	45.61153	-65.90141
Erb's Cove	45.58600	-65.93673
Ghost Island	45.58060	-65.96276
Lower Belleisle Point	45.55505	-65.99551
Top of Long Reach	45.52492	-66.05693
Browns Flat	45.46630	-66.11214
Victoria Beach	45.42929	-66.16737
Carter's Point	45.39329	-66.19896
Above Grand Bay Ferry	45.36400	-66.22659
Grand Bay Ferry	45.34837	-66.21902
Grand Bay	45.34834	-66.21536
Upper Grand Bay	45.31874	-66.17286
Middle Grand Bay	45.29967	-66.16708
Lower Grand Bay	45.29704	-66.14352
Upper Darling's Lake	45.50883	-65.85890
Darling's Lake	45.49763	-65.88375
Lower Kennebecasis North	45.33824	-66.08722
Lower Kennebecasis South	45.32858	-66.08138
Reversing Falls 1	45.28408	-66.12518
Reversing Falls 2	45.29005	-66.13086

APPENDIX 2

First and last detection location and date/time (UTC), and date of arrival in selected key locations for each of the acoustically tagged pre-smolt in the Tobique-Narrows and Mactaquac release groups.

Fish ID	Release Group	First Detection (Location; Date)	Last Detection (Location; Date)	Date of first detection at:					
				Nackawic Line	Mactaquac Line	MGS	McKinley	Evandale	Reversing Falls
39046	Tobique	Pokiok; 8 May 2016	Reversing Falls 2; 20 May 2016	9 May 2016					20 May 2016
39048	Tobique								
39050	Tobique	Mouth of Swan Creek; 10 May 2016	Grand Bay Ferry; 12 May 2016						
39052	Tobique	Nackawic; 5 May 2016	Mactaquac Line; 3 Jun 2016	5 May 2016	29 May 2016	1 Jun 2016			
39054	Tobique	Scoodawabscook; 4 May 2016	Grand Bay Ferry; 16 May 2016					10 May 2016	
39056	Tobique	Pokiok; 7 May 2016	Grand Bay Ferry; 15 May 2016	7 May 2016	11 May 2016				
39058	Tobique	Evandale Ferry; 14 May 2016	Reversing Falls 2; 15 May 2016					14 May 2016	15 May 2016
39060	Tobique	Coac Reach; 17 May 2016	Grand Bay Ferry; 21 May 2016		18 May 2016	18 May 2016	19 May 2016	20 May 2016	
39063	Tobique	Pokiok; 26 Apr 2016	Grand Bay Ferry; 8 May 2016	28 Apr 2016			4 May 2016	6 May 2016	
39064	Tobique	Pokiok; 11 May 2016	Kingsclear; 16 May 2016	11 May 2016					
39066	Tobique								
39068	Tobique	Nackawic; 9 May 2016	Reversing Falls; 19 May 2016	9 May 2016	14 May 2016		16 May 2016	17 May 2016	18 May 2016
39070	Tobique	Grand Bay Ferry; 11 May 2016	Grand Bay Ferry; 11 May 2016						

39071	Tobique								
39072	Tobique	Nackawic; 25 Apr 2016	Reversing Falls; 17 May 2016	25 Apr 2016			28 Apr 2016	16 May 2016	17 May 2016
39073	Tobique	Nackawic; 5 May 2016	Grand Bay Ferry; 19 May 2016	5 May 2016	9 May 2016	16 May 2016		18 May 2016	
39074	Tobique	Pokiok; 11 May 2016	MGS; 17 May 2016	11 May 2016	17 May 2016	17 May 2016			
39080	Tobique	Coac Stream; 11 May 2016	Grand Bay Ferry; 18 May 2016						
39087	Tobique	Pokiok; 8 May 2016	Grand Bay Ferry; 20 May 2016	9 May 2016	17 May 2016				
39088	Tobique	Nackawic; 6 May 2016	Reversing Falls; 22 May 2016	6 May 2016		18 May 2016		20 May 2016	22 May 2016
39089	Tobique								
39090	Tobique	Nackawic; 6 May 2016	Grand Bay Ferry; 18 May 2016	6 May 2016	14 May 2016	16 May 2016		17 May 2016	
39091	Tobique	Pokiok; 5 May 2016	McKinley Ferry; 18 May 2016	15 May 2016	17 May 2016	17 May 2016	18 May 2016		
39092	Tobique	Nackawic; 16 May 2016	McKinley Ferry; 23 Jun 2016	16 May 2016			23 Jun 2016		
39093	Tobique	Pokiok; 11 May 2016	Grand Bay Ferry; 21 May 2016	11 May 2016	17 May 2016	17 May 2016	17 May 2016	19 May 2016	
39270	Tobique								
39271	Tobique								
39272	Tobique	Pokiok; 13 May 2016	Mactaquac Line; 1 Jun 2016	14 May 2016	31 May 2016				
39274	Tobique	Nackawic; 11 May 2016	Kingsclear; 14 May 2016	11 May 2016					
39277	Tobique								
39279	Tobique								

39281	Tobique						
39283	Tobique	Nackawic; 25 Apr 2016	Grand Bay Ferry; 4 May 2016	25 Apr 2016	29 Apr 2016		29 Apr 2016
39285	Tobique						
39287	Tobique						
39289	Tobique						
39291	Tobique						
39293	Tobique						
39295	Tobique						
39297	Tobique	Pokiok; 11 May 2016	Grand Bay Ferry; 19 May 2016				18 May 2016
39299	Tobique	Pokiok; 30 May 2016	McKinley Ferry; 15 Jun 2016	30 May 2016	1 Jun 2016		15 Jun 2016
39301	Tobique	Nackawic; 8 May 2016	Reversing Falls; 25 May 2016	8 May 2016			20 May 2016
39303	Tobique						25 May 2016
39306	Tobique	Pokiok; 9 May 2016	Grand Bay Ferry; 15 May 2016				
39309	Tobique						
39311	Tobique						
39313	Tobique						
39314	Tobique						
39317	Tobique						

39318	Tobique						
39044	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 22 Nov 2015	12 Nov 2015			
39045	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 28 Nov 2015	12 Nov 2015			
39047	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 17 Nov 2015	12 Nov 2015			
39049	Mactaquac	McKinley Ferry; 12 Nov 2015	Reversing Falls; 20 May 2016	12 Nov 2015	19 May 2016	20 May 2016	
39051	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 13 Nov 2015	12 Nov 2015			
39053	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 12 Nov 2015	12 Nov 2015			
39055	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 13 Nov 2015	12 Nov 2015			
39057	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 12 Nov 2015	12 Nov 2015			
39059	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 12 Nov 2015	12 Nov 2015			
39061	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 28 Nov 2015	12 Nov 2015			
39062	Mactaquac	McKinley Ferry; 5 Nov 2015	McKinley Ferry; 4 Dec 2015	5 Nov 2015			
39065	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 12 Nov 2015	12 Nov 2015			
39067	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 18 Nov 2015	12 Nov 2015			
39069	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; 12 Nov 2015	12 Nov 2015			
39075	Mactaquac	McKinley Ferry; 5 Nov 2015	Reversing Falls; 12 May 2016	5 Nov 2015	10 May 2016	12 May 2016	
39076	Mactaquac	McKinley Ferry; 5 Nov 2015	McKinley Ferry; 5 Nov 2015	5 Nov 2015			
39077	Mactaquac	McKinley Ferry; 5 Nov 2015	Mouth of Swan Creek; 5 May 2016	5 Nov 2015			

39078	Mactaquac	McKinley Ferry; 5 Nov 2015	McKinley Ferry; 5 Nov 2015	5 Nov 2015		
39079	Mactaquac	McKinley Ferry; 5 Nov 2015	McKinley Ferry; 5 Nov 2015	5 Nov 2015		
39081	Mactaquac	McKinley Ferry; 29 Oct 2015	Grand Bay Ferry; 5 May 2016	29 Oct 2015	4 May 2016	
39082	Mactaquac	McKinley Ferry; 29 Oct 2015	McKinley Ferry; 29 Oct 2015	29 Oct 2015		
39083	Mactaquac	McKinley Ferry; 29 Oct 2015	McKinley Ferry; 29 Oct 2015	29 Oct 2015		
39084	Mactaquac					
39085	Mactaquac					
39086	Mactaquac	McKinley Ferry; 31 Oct 2015	Reversing Falls; 17 May 2016	31 Oct 2015	10 May 2016	17 May 2016
39269	Mactaquac	Mouth of Swan Creek; 15 May 2016	Reversing Falls; 19 May 2016			18 May 2016
39273	Mactaquac	McKinley Ferry; 12 Nov 2015	McKinley Ferry; Jun 30 2016	12 Nov 2015		
39275	Mactaquac	McKinley Ferry; 12 Nov 2015	Grand Bay Ferry; 12 May 2016	12 Nov 2015		
39276	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 21 Nov 2015	19 Nov 2015		
39278	Mactaquac	McKinley Ferry; 20 Nov 2015	McKinley Ferry; 29 Nov 2015	20 Nov 2015		
39280	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 19 Nov 2015	19 Nov 2015		
39282	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 11 Jun 2016	19 Nov 2015		
39284	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 19 Nov 2015	19 Nov 2015		
39286	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 20 Nov 2015	19 Nov 2015		
39288	Mactaquac					

39290	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 19 Nov 2015	19 Nov 2015		
39292	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 19 Nov 2015	19 Nov 2015		
39294	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 19 Nov 2015	19 Nov 2015		
39296	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 20 Nov 2015	19 Nov 2015		
39298	Mactaquac					
39300	Mactaquac	McKinley Ferry; 19 Nov 2015	McKinley Ferry; 19 Nov 2015	19 Nov 2015		
39302	Mactaquac	McKinley Ferry; 26 Nov 2015	McKinley Ferry; 10 Dec 2015	26 Nov 2015		
39304	Mactaquac	McKinley Ferry; 26 Nov 2015	McKinley Ferry; 27 Nov 2015	26 Nov 2015		
39305	Mactaquac	McKinley Ferry; 29 Nov 2015	McKinley Ferry; 29 Nov 2015	29 Nov 2015		
39307	Mactaquac					
39308	Mactaquac	Mouth of Swan Creek; 11 May 2016	Reversing Falls; 15 May 2016		11 May 2016	14 May 2016
39310	Mactaquac	McKinley Ferry; 26 Nov 2015	McKinley Ferry; 26 Nov 2015	26 Nov 2015		
39312	Mactaquac	McKinley Ferry; 26 Nov 2015	McKinley Ferry; 26 Nov 2015	26 Nov 2015		
39315	Mactaquac	McKinley Ferry; 26 Nov 2015	McKinley Ferry; 27 Nov 2015	26 Nov 2015		
39316	Mactaquac	McKinley Ferry; 26 Nov 2015	Mouth of Swan Creek; 6 Dec 2015	26 Nov 2015		