Mactaquac Aquatic Ecosystem Study
Report Series 2019-072

METHODS PAPER: River Transect Sampling of Physical Attributes Downstream of the Mactaquac Generating Station, 2018 Sampling Season

Caitlin Tarr, Rebecca Dolson-Edge, Mark Gautreau, and Allen Curry

29 March 2019

Canadian Rivers Institute

UNB

Correct citation for this publication:

Tarr, C., R. Dolson-Edge, M. Gautreau, and A. Curry. 2019. METHODS PAPER: River Transect Sampling of Physical Attributes Downstream of the Mactaquac Generating Station, 2018 Sampling Season. Mactaquac Aquatic Ecosystem Study Report Series 2019-072. Canadian Rivers Institute, University of New Brunswick. 9 p.

DISCLAIMER

Intended use and technical limitations of the report, "River Transect Sampling of Physical Attributes Downstream of the Mactaquac Generating Station". This interim report describes the 2018 field season of the Saint John River's physical environment downstream of the Mactaquac Generating Station. This programme is continuously evolving as sites are tested, added, and excluded, and the following report is a summary of the 2018 sampling methods. The CRI does not assume liability for any use of the included data and analyses outside the stated scope.

Introduction

Spatial and temporal variations in river flow, temperature, and chemistry are important for informing validation models, sampling designs, and baselines for future analyses. From 2014 to 2018 (excluding 2017; see Gautreau et al. 2015 and Dolson-Edge et al. 2018), we measured vertical profiles of velocity, temperature, dissolved oxygen, Secchi disk depth, pH, and conductivity at defined transects along the Saint John River (SJR), downstream of the Mactaquac Generating Station (MGS) to the city of Fredericton. Transects were placed intervals (500 m- 1.5 km) along the river based on previously collected bathymetry data (Wallace et al. 2015). Vertical profiles were collected across the main river channel as well as island channels and side channel. The information collected in 2018 and previous years (2014, 2015, and 2016) will be used to inform habitat maps and contribute to baseline data collection in support of MAES project themes Healthy River Ecosystem and Metrics and Monitoring. This document provides a summary of the methods employed during the 2018 physical river transect surveys (see Gautreau et al. 2015 for a summary of methods used between 2014 and 2016).

Methods

In 2018, two sampling events occurred, one in June and one in August, with the same 48 transects sampled both times (Table 1). The 48 transects selected in 2018 represent a subset of the total river transects defined in 2014 (Gautreau et al. 2015). In 2018, odd numbered transects from the main channel (R-DS-#), Keswick River channel (R-DS-Kes-#) and the cross channels (R-DS-CH-#) were planned for sampling. A few additional even numbered transects (based on original transect numbering in 2014) were also surveyed (Table 1). Sampling occurred from June 22 to June 27 and from August 24 to August 28, 2018. Sampling at two different times of the year allows for the evaluation of seasonal changes in temperature, dissolved oxygen, and Secchi disk depth at sites along each transect. In previous years the sampling periods were closer together (e.g., early and late June or early July; Gautreau et al. 2015) and therefore less likely to demonstrate quantifiable variation in environmental conditions.

Sampling was divided over the course of a week with 8-10 transects sampled each day starting close to the MGS and traveling downstream (Figure 1). Sampling 8-10 transects daily in sequential order allowed for all sites to be reached and sampled within 5 days. In previous years, attempts to sample transects along the entire stretch of the study area in a single day proved difficult. The sampling strategy employed in 2018 allowed for sampling to mostly occur between rainfall or other significant weather events. When total rainfall exceeded 5mm between sampling days, sampling was postponed for 24 hours to allow water levels in the river to stabilize.

The same parameters were measured and recorded at each transect. Some changes were made to the original 2014 sampling method (Gautreau et al., 2015) and are outlined

below. The field sheets (Appendix 1) were also modified to include a column for turbidity measurements and only the dominant substrate size (>50%) was recorded. Low water levels during some of the sampling days kept entire transects from being sampled (Table 1).

At each transect, data was collected from three point samples along the transect: river right, center, and river left (determined looking downstream). The center sample was taken at the mid-channel. The right and left samples were taken approximately midway between the center and the corresponding shore.

The sampling crew boated to each point sample along the transect using the coordinates stored in the GPS and set the anchor. Once anchored, a new coordinate was taken, saving it as a waypoint number in the GPS and recording it on the field sheets.

The following parameters were observed or measured and recorded at each point sample:

- Crew members present, weather conditions, and time of day.
- Water depth, measured by a Speedtech portable depth sounder and recorded to 0.1 meters.
- Water velocity was not recorded in 2018 due to more accurate estimates available with ADCP data collected in previous years.
- Substrate size was estimated using a modified Wentworth scale (Appendix 1) and one of three different methods depending on site conditions. Substrate was estimated visually when water clarity and or depth would permit. When the substrate was not visible, a 4m long extendable pole was used to "feel" the bottom, and if the water was too deep for the pole, a Ponar grab sampler was used to pull up a sample for observation. For 2018, only the dominant (>50%) substrate class was recorded. The substrate sampling method (visual, pole, Ponar) was also documented.
- Water chemistry was measured using an YSI 6600 Sonde equipped with dissolved oxygen (mg/L and % saturation), temperature, conductivity, turbidity, and pH probes. The meter was calibrated in the lab prior to departure to the field and checked in field before each sample. At point sample locations less than 3m deep, the sample was taken at the mid water column depth. At point samples deeper than 3m, two samples were taken: one meter from the bottom and one meter under the surface.
- The Secchi depth was measured by lowering the device to the point it was not visible and then recording that depth in meters. Care was taken to always measure from the shadowed side of the boat for consistency.
- Aquatic vegetation was recorded at each site as present or absent, and by type (submergent or surface).

- Wetted width was measured using a Bushnell Sport 850 laser rangefinder. This was done by leaving one person on shore with a white bucket or the Secchi disc, while another goes to the opposite shore. The rangefinder is pointed at the bucket or disc until a distance, in yards, appears on the screen. In some instances where the river width was wide, or the shore was difficult to reach, the boat was anchored at the center site and the measurement from center to each shore was determined and added together.

Figure 1. Locations of the river transects sampled downstream of the Mactaquac Generating Station in summer 2018. Coloured groupings display different sampling days.

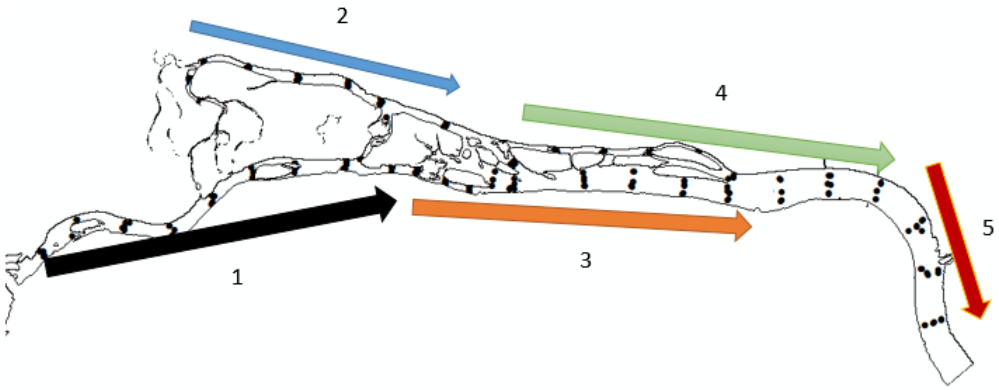

Table 1: 2018 Transect IDs and GPS locations (center transect location) showing point sample locations during each sample period (X = full transect sampled).

Site	Latitude	Longitude	June sampling	August Sampling
R-DS-1	45.96233	-66.8618	X	X
R-DS-3	45.96233	-66.8529	Only left/right	Only left/right
R-DS-5	45.96104	-66.8408	X	X
R-DS-7	45.96131	-66.8283	X	X
R-DS-9	45.96677	-66.8165	X	X
R-DS-11	45.97131	-66.8062	X	X
R-DS-13	45.97015	-66.8009	X	X
R-DS-15	45.97218	-66.7952	X	Only left/right
R-DS-17	45.97334	-66.7816	X	X
R-DS-19	45.97225	-66.7698	X	X
R-DS-21	45.97184	-66.7628	X	X
R-DS-23	45.96974	-66.7557	X	X
R-DS-25	45.96832	-66.7493	X	X
R-DS-27	45.97013	-66.7432	X	X
R-DS-29	45.96934	-66.7374	X	X
R-DS-31	45.97047	-66.7189	X	X
R-DS-33	45.97154	-66.706	X	X
R-DS-35	45.96912	-66.6926	X	X
R-DS-37	45.96768	-66.6806	X	X
R-DS-39	45.96809	-66.6699	X	X
R-DS-41	45.96944	-66.6546	X	X
R-DS-43	45.96818	-66.6416	X	X
R-DS-45	45.96167	-66.6313	X	X
R-DS-47	45.95272	-66.6282	X	X
R-DS-49	45.94386	-66.6268	X	X
R-DS-KES-1	45.99169	-66.8193	X	X
R-DS-KES-3	45.99102	-66.8073	X	X
R-DS-KES-5	45.98857	-66.7941	X	X
R-DS-KES-7	45.98774	-66.7815	X	X
R-DS-KES-9	45.98428	-66.7723	X	X
R-DS-KES-11	45.97984	-66.7555	X	X
R-DS-KES-13	45.97699	-66.7403	X	X
R-DS-KES-15	45.97572	-66.7265	X	X
R-DS-KES-17	45.9753	-66.7136	X	X
R-DS-KES-19	45.97527	-66.7016	X	X
R-DS-KES-21	45.97536	-66.6886	X	X
R-DS-KES-23	45.97051	-66.67970	X	X
R-DS-CH-1	45.97021	-66.8217	Inaccessible	Inaccessible
R-DS-CH-3	45.97701	-66.819	X	Inaccessible
R-DS-CH-4	45.97965	-66.8158	Only center	Inaccessible
R-DS-CH-5	45.97703	-66.8129	Inaccessible	Inaccessible
R-DS-CH-6	45.98408	-66.81349	Inaccessible	Inaccessible
R-DS-CH-7	45.98319	-66.8076	Only center	Inaccessible
R-DS-CH-9	45.98441	-66.8199	Only center/right	Only center
R-DS-CH-10	45.98845	-66.8227	X	Only center/left
R-DS-CH-11	45.97376	-66.77793	X	Only center/left
R-DS-CH-13	45.97974	-66.7708	X	Only center
R-DS-CH-15	45.97304	-66.7371	X	X

References

Dolson-Edge, R., Tarr, C., Nguyen, H., Q., and Curry, R., A. 2018. Baseline water quality conditions in the Saint John River. Mactaquac Aquatic Ecosystem Study Report Series 2018-054. Canadian Rivers Institute, University of New Brunswick, 34 p.

Gautreau, M., Wallace, B., and Linnansaari, T. 2015. METHODS PAPER: River Transect Sampling of Physical Attributes Downstream of the Mactaquac Generating Station. Mactaquac Aquatic Ecosystem Study Report Series 2015-014. Canadian Rivers Institute, University of New Brunswick. 14 p.

Wallace, B., Ogilvie, J., and Monk, W. 2015. METHODS PAPER: Downstream Bathymetry and BioBase Analyses of Substrate and Macrophytes. Mactaquac Aquatic Ecosystem Study Report Series 2015-006. Canadian Rivers Institute, University of New Brunswick, 5p.

APPENDIX 1. Data Sheet - Physical Parameters of the River.

Transect Number: _____ **Weather:**

Date: _____ **Personnel:**

River Center

Time _____ **Latitude** _____

Waypoint # _____ **Longitude** _____

	Lower	Upper
Temperature (°C)		
DO (%)		
DO (mg/L)		
pH		
Conductivity (µS/cm)		
Velocity (m/s)		
Turbidity (NTU)		

Depth (m)	
Secchi Depth (m)	
Dominant Substrate Size (>50%)	
Substrate Est Method	
Macrophytes (Y/N)	

Notes:

Wetted Width _____

River Left

Time _____ **Latitude** _____

Waypoint # _____ **Longitude** _____

	Lower	Upper
Temperature (°C)		
DO (%)		
DO (mg/L)		
pH		
Conductivity (µS/cm)		
Velocity (m/s)		
Turbidity (NTU)		

Depth (m)	
Secchi Depth (m)	
Dominant Substrate Size (>50%)	
Substrate Est Method	
Macrophytes (Y/N)	

Notes:

_____

_____

River Right

Time _____

Waypoint # _____ **Latitude** _____

Longitude _____

	Lower	Upper
Temperature (°C)		
DO (%)		
DO (mg/L)		
pH		
Conductivity (µS/cm)		
Velocity (m/s)		
Turbidity (NTU)		

Depth (m)	
Secchi Depth (m)	
Dominant Substrate Size (>50%)	
Substrate Est Method	
Macrophytes (Y/N)	

Notes:

Comments:

Class	Size	Name	Lay term
1	n/a	fine organic	
2	n/a	coarse organic	
3	n/a	clay	clay
4	1-2mm	sand	sand
5	2mm-2cm	gravel	fine gravel
6	2-3cm	small pebble	"raisins"
7	3-6cm	pebble	grape -- egg
8	6-12cm	small cobble	fist size
9	12-25cm	cobble	grapefruit-
10	25-38cm	large cobble	head size
11	38-52cm	boulder	beach ball caliber
12	>52	l. boulder	
13	n/a	bedrock	

*Substrate Est Method is method used to estimate substrate size: visual, with pole, with ponar grab