BaySys - Team 5

Sediment Coring and Water Quality Fieldwork Summary
March 1-6 and April 2-5

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Contents

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2 Fieldwork Goals

To investigate the nature of sediment, organic matter, and mercury contributions over time to lakes in the Nelson River system, the goal of this field program was to collect sediment cores and water samples from 2 sites within the pre- and post-impoundment waterbody extents at 5 lakes in the Nelson River watershed:

On-system

- Stephens Lake
- Threepoint Lake
- Split Lake

Off-system

- Leftrook Lake
- Assean Lake

3 Flight Summary

Lakes in this study were accessed by Otter on wheel-skis provided by Wings Over Kississing, flown from the airport in Thompson, Manitoba. A detailed flight summary is provided in the table below. Flight duty days began at 7:30 am, therefore any delay in departure time was a result of unsuitable weather conditions. Flight days were cancelled from March 4-8th due to a province-wide winter storm, and on April 3rd due to freezing rain conditions in Thompson. Transport by skidoo to the coring site on April 3rd was provided by a local guide from Split Lake, Manitoba.

Date	Lake	Depart YTH	Arrive Lake	Depart Lake	Arrive YTH	Miles	Flight Time
Mar 2	Threepoint Lake	12:50	13:10	18:15	18:35	82	40 min
Mar 3	Leftrook Lake	11:00	11:20	15:30	15:50	70	40 min
Apr 4	Stephens Lake	9:40	10:40	14:00	-	190	90 min
Apr 4	Split Lake	-	14:30	15:45	16:15	69	30 min

4 Sediment Coring

At on-system lakes, deep sites within the pre-flooding extent and shallow sites within the post-flooding extent were selected using waterbody boundary, bathymetry, and bottom substrate ArcGIS shapefiles generated as part of the Regional Cumulative Effects Assessment undertaken by Manitoba Hydro. At off-system lakes, deep and shallow sites were selected in areas likely to yield successful core recovery by reviewing bathymetry and bottom substrate maps provided by Manitoba Hydro.

4.1 Methods

At each lake, sediment coring was executed using two, water depth-specific coring systems deployed through a 10 inch hole drilled through the ice using a motorized ice auger.

At deep sites, sediment cores were collected using a KB-style gravity corer supported by line strung though a block pulley mounted to quadrapod. Once settled in bottom sediment, the core was secured by tripping a closure lid on the gravity corer by release of a messenger. Cores were retrieved by hand-hauling the gravity corer up through a 10 inch hole in the ice. Water atop each core was siphoned off to preserve the sediment surface during transport. Core samples were split at 1 cm intervals, stored in whirlpack bags, and refrigerated.

At shallow sites, pairs of sediment cores were collected using a manually operated, wetland push-style corer. Due to the nature of this coring equipment, it could only be deployed in less than 2 m water depth. Two cores were collected through separate holes to secure enough material, which was subsequently combined and homogenized during the core splitting process. Water atop each core was siphoned off to preserve the sediment surface during transport. Core samples were split at 1 cm intervals, stored in whirlpack bags, and refrigerated.

Sectioned core samples will be processed and prepared for various analytical methods at the Centre for Earth Observation Science at the University of Manitoba.

4.2 Sampling Summary

Sediment cores were successfully retrieved from both sites at all lakes but Stephens Lake, where the bottom substrate at the deep site would not allow for penetration of the gravity corer. The shallow site at Stephens Lake also proved difficult for core recovery due to the gravely nature of the sediment, but a core was collected after several attempts.

At Threepoint Lake, the substrate at both deep and shallow sites was difficult to penetrate; cores at these sites were shorter than anticipated (8 cm and 7 cm respectively) and comprised sandier sediment than cores collected from off-system lakes.

At Split Lake (SpL-17-01-C), a 12 cm core was collected following several failed attempts; this site exhibited a faster water current than other sites on Split Lake, which inhibited the gravity corer's ability to effectively penetrate bottom sediments.

4.3 Sample Inventory

Sediment cores collected during March and April 2017 field work are listed in the table below. Sample IDs ending in "01" indicate a core collected using the KB-style gravity corer, whereas those ending in "02" indicate a core collected using the wetland corer.

Date	Lake	Sample ID	Water Depth	Core Length	UTM Zone	Easting	Northing
Mar 2	Threepoint Lake	TL-17-01	6.7 m	8 cm	14U	508097	6169531
Mar 2	Threepoint Lake	TL-17-02	1.4 m	7 cm	14U	507759	6170806
Mar 3	Leftrook Lake	LL-17-01	10.0 m	53 cm	14V	517586	6213052
Mar 3	Leftrook Lake	LL-17-02	1.0 m	24 cm	14V	516690	6213538
Mar 4	Assean Lake	AL-17-01	8.3 m	54 cm	14V	662680	6236546
Mar 5	Assean Lake	AL-17-02	1.0 m	20 cm	14V	663010	6236226
Apr 3	Split Lake	SpL-17-01-A	5.7 m	40 cm	14V	678487	6236828
Apr 3	Split Lake	SpL-17-01-B	5.7 m	42 cm	14V	678488	6236825

Date	Lake	Sample ID	Water Depth	Core Length	UTM Zone	Easting	Northing
Apr 4	Split Lake	SpL-17-01-C	9.0 m	12 cm	14V	673290	6225306
Apr 4	Stephens Lake	StL-17-02	1.8 m	20 cm	15V	392760	6251882

5 Water Sampling

5.1 Methods

At all stations, water samples were collected for dissolved organic carbon (DOC), sulphide and mercury. Water for all samples was collected through a 10 inch augered hole in the ice using a GO-FLO bottle on a weighted rope. Sulphide samples were collected into glass vials (containing 6M HCl, $FeCl_3$, N,N-dimethyl-p-phenylenediamine and purged with nitrogen) using syringes. When the water is added to the vile, any sulphide in the water should form a blue complex with the reagents. This complex is stable when stored in an oxygen free environment and can be analyzed by a UV-visible spectrometer in Winnipeg. DOC samples were filtered through a 0.45 µm filter and collected in a 2 mL vial. They were then preserved with 100 µL of 1M HCl. Mercury samples were collected using the clean hands-dirty hands technique. Both filtered and unfiltered samples were collected for total mercury and methyl mercury in glass amber pre-washed and spot-tested bottles. Filtering was done through 0.45 µm filters in the hotel bathroom and samples were preserved with 0.5% HCl. Blanks were taken for mercury, sulphide and DOC at all sites. In addition, mercury blanks were taken in the hotel bathroom. Water samples were stored in coolers with ice until we returned to Winnipeg. Analysis on samples is ongoing.

5.2 Sampling Summary

Water samples were successfully retrieved from two sites on all lakes except for Split Lake in which water was only collected from one site in the interest of time. Water samples were collected at deep sites from 2-3 depths. At shallow sites, water was collected at one depth in duplicate.