

ECHYDR12

Annual Progress Report

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PROJECT BACKGROUND

In 2010, the Aurora Research Institute (ARI) partnered with Environment Canada (EC) on their long-term Water Quality and Aquatic Ecosystems Health project. This agreement enables staff at the Western Arctic Research Centre (WARC; a division of Aurora Research Institute) to provide scientific/technical support to EC researchers working on this project in the western Canadian Arctic, while using WARC as their operational base.

EC researchers are assessing the effects of climate change and resource development on the hydrology, geochemistry and ecology of freshwater systems in the western Canadian Arctic. Information gathered by this research program will be used to obtain baseline information in support of regional environmental and cumulative effects assessment processes.

In 2010, a fully-automated instrumented buoy and subsurface mooring system was put into Noell Lake, to monitor the physical, geochemical, and biological conditions of the lake. The overall objective of this system is to improve knowledge on lake ice and its effects on food webs and productivity in small Arctic lake systems. The buoy system measures lake ice (initiation; growth over winter; breakup in spring; and ice characteristics), water quality, and productivity, logs data year-round, and transmits project data to project partners via satellite. The buoy and mooring system is composed of two parts; (1) a lake buoy with instruments on top, to measure weather conditions (net radiation, wind speed, wind direction, air temperature, relative humidity, and air pressure), and (2) a subsurface mooring system, which includes a tethered array of sensors, measuring light penetration, water quality (chemistry, dissolved oxygen, and temperature), and productivity (chlorophyll concentration), at a variety of depths down to the lake bottom. The subsurface mooring system also includes an ice profiler sensor, to measure the development, growth, and decay of lake ice cover through the cold season.

The buoy was designed and developed by AXYS Technologies Inc. and the Water & Climate Impacts Research Centre (W-CIRC), at the University of Victoria and Environment Canada. It is currently owned and operated by WCIRC. WARC staff, from ARI, provides technical support, routine maintenance, budgeting and project management. The following report details the water sampling done by WARC staff, during the 2012/2013 fiscal year, to complement and supplement the data collected by the buoy installation, the work done to maintain and service the buoy, and an outline of the community outreach initiatives carried out by WCIRC, with the assistance of WARC staff.

PROJECT ACTIVITES

Ice Surveys

On May 8 and 9, 2012, ARI technician (William Hurst) and ARI intern (Jolene Lennie) completed the annual ice depth survey at Noell Lake. William and Jolene used an auger to make 36 holes, through the ice on Noell Lake, at set GPS coordinates (**Figure 1**). At each hole, snow depth, white and black ice thickness, and hydrostatic pressure (i.e., the water surface in relation to the ice surface) were measured (**Figure 2**).

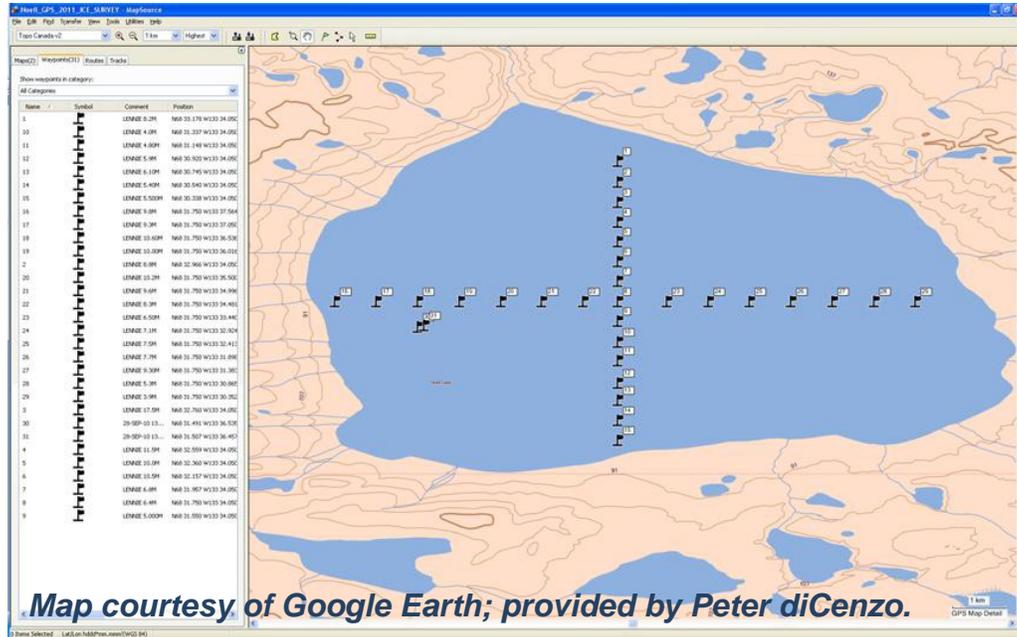


Figure 1: Map locations for the annual ice survey of Noell Lake



Figure 2: ARI technician (William Hurst) taking a measurement of ice thickness (left). ARI intern (Jolene Lennie) taking a hydrostatic measurement (right).

Community Outreach

In the afternoon of May 10, William Hurst and Jolene Lennie assisted four ECHYDR researchers, who were working in collaboration with Youth and Family Support, Inuvik, with aspects of their community outreach workshop, entitled *Arctic Freshwater Systems: Hydrology and Ecology*. The first part of the workshop took place at Samuel Hearne Secondary School (SHSS). Nine students from SHSS were given a brief presentation, by the researchers, outlining the basic theories behind the hydrology and ecology of freshwater systems in the Arctic. Following the presentation, William and Jolene helped the researchers instruct the students in how to use various pieces of sampling equipment (i.e., snow corer, scale to measure snow water equivalence, zooplankton nets, Hach water chemistry kit, van doorn sampler, and YSI hydrosonde). This part of the workshop provided crucial information for the students, in order for them to successfully participate in the second part of the workshop.

On the following morning, William and Jolene helped to escort the nine students from SHSS to Airport Lake. At Airport Lake, the students were given practical experience in sampling various hydrological, geochemical, and biological parameters (i.e., snow water equivalence, ice thickness, hydrostatic pressure, water chemistry, zooplankton, and phytoplankton) (**Figure 3**). In the afternoon, the students used the lab facilities at WARC to: weigh and calculate the density of their snow samples; analyze the chemistry of the snow, ice, and lake water they collected; filter a sample of lake water for chlorophyll; and identify the different types of zooplankton present within the water column, using the dissecting microscope (**Figure 4**).



Figure 3: ARI intern (Jolene Lennie) explaining what hydrostatic pressure is and how to measure it, to students from Samuel Hearne Secondary School.



Figure 4: Inuvik elders (Freida and Angus Alunik) helped to facilitate the *Arctic Freshwater Systems: Hydrology and Ecology* workshop. Here, they are using the dissection microscope at WARC to examine the copepods collected from Airport Lake.

Under-Ice Sampling

On May 12 and May 13, 2012, ARI Lab coordinator (Erika Hille) travelled to Noell lake with three ECHYDR researchers. At seven locations around the lake, they sampled, through the ice, for a number of water quality (major ions, nutrients, carbon, dissolved oxygen, pH, and conductivity) and water productivity (zooplankton and chlorophyll) parameters.

Open Water Sampling

During the open water season (following ice-out), a field team of ARI employees traveled to Noell Lake once every two weeks, to repeat the sampling regiment carried out under-ice (see above), to do minor maintenance on the buoy, and to gather information on the location and condition of the buoy and mooring system.

ARI employees were also responsible for processing the samples back at WARC (i.e., filtering a 1L water sample, per site, for chlorophyll; preserving one of the zooplankton samples with formalin; properly storing the chlorophyll and zooplankton samples; and shipping the remaining water samples to the National Lab for Environmental Testing).

Buoy Maintenance

On 5 July, 2012, four ARI employees (Jasmine Brewster, Jolene Lennie, William Hurst and Donald Ross) traveled to Noell Lake by helicopter. Once there, they used a boat and motor (stored at Noell Lake) to locate the buoy following ice-out. As in 2011, the buoy was not in its original location. Once the team found the buoy, they connected it to

the helicopter sling line and transported it back to Inuvik for annual repairs and maintenance (**Figure 5**).

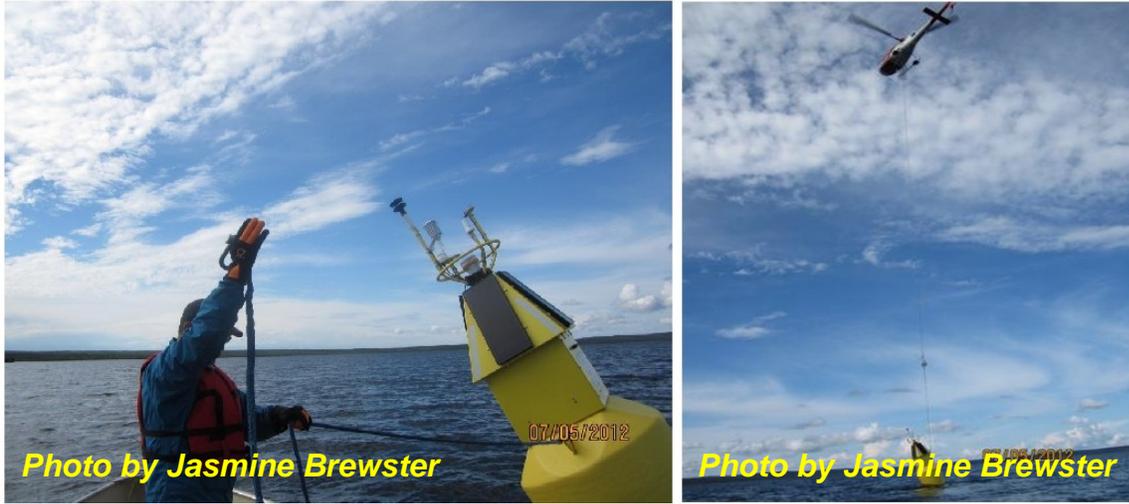


Figure 5: ARI Technician (Don Ross) using a tether to pull in the buoy, in preparation for airlift from Noell Lake to Inuvik (Left). The buoy was transported using a helicopter and sling (Right).

On November 20, 2012, Erika Hille and William Hurst, along with an EC researcher (Peter diCenzo) flew to Noell Lake. Upon their arrival, they sampled, through the ice, for a number of water quality (major ions, nutrients, carbon, dissolved oxygen, pH, and conductivity) and water productivity (zooplankton and chlorophyll) parameters. They also measured white and black ice thickness and water depth at each site.



Figure 6: EC researcher (Peter diCenzo) and ARI technician (William Hurst) using an auger to drill a hole into the ice on Noell Lake, for a new subsurface mooring system.

On November 22, Erika Hille, William Hurst, and Peter diCenzo returned to Noell Lake. Their task was to install a subsurface mooring system, consisting of an array of sensors at various depths, to measure water quality (i.e., temperature, pH, dissolved oxygen, conductivity, and chlorophyll) and an ice profiler, to monitor ice thickness (**Figure 7**).



Figure 7: ARI employee (Erika Hille) cutting a block of ice out on Noell Lake, in order to create an opening large enough to install the subsurface mooring system (left). EC researcher (Peter diCenzo) and ARI employee (William Hurst) preparing to install the subsurface mooring system (right).

CHALLENGES

The challenges we faced were mostly in the winter. The main challenges include the following:

- Limited daylight hours
- Equipment freezing
- Cold working conditions
- Locating the buoy and mooring systems under a thick snowpack and ice
- Overcast or blizzard conditions limited the days that we could travel by helicopter

There were also some challenges in the summer, which are as follows:

- Rough water/boating conditions
- Mosquitos
- Locating and extracting the buoy
- Overcast conditions in August and September made it difficult to predict when we could travel by helicopter

GENERAL CONCLUSIONS

This summarizes the major work done on this project by WARC and Aurora Research Institute staff, in partnership with W-CIRC employees, during the 2012-13 fiscal year.

This was year 4 of the 5 year G&C contribution “Arctic Research and Monitoring” (referred to as “ECHYDRO” by WARC staff). We look forward to further collaboration with the W-CIRC office on this project in the coming year.