

Current Research and Monitoring Programs in Great Bear Lake and the Great Bear Lake Watershed

(Draft May 26, 2014)

1. Water

Using Remote Sensing to Support Cumulative Impact Monitoring of Water Resources in the Northwest Territories (Hatfield Consultants Partnership): The project is intended to determine and record lakes where ice has frozen to the bottom and areas where floating ice is present for the winter survey; and to observe broad wetland types and the extent and presence of submerged aquatic vegetation for the summer survey. Collectively, this information will be used to calibrate satellite observations and validate the derived map products.

Environment Canada Northern Water Quality Monitoring Network (Environment Canada): The Water Quality Monitoring and Surveillance Division of Environment Canada conducts water quality sampling at 8 locations in the NWT. Water samples are collected 3 to 6 times per year depending on the location, as part of the Northern Water Quality Monitoring Network. This monitoring program contributes to the collection of baseline data and reference conditions for northern rivers to help determine spatial and temporal trends, determine compliance with established guidelines, detect emerging issues, and measure response to remedial measures and regulatory decisions.

Water quality is measured at the outlet of the Great Bear River at Great Bear Lake (65.1283, 123.5508; 3 times/yr). Parameters include total and dissolved metals (no mercury), major ions, physical parameters, nutrients and organics.

Long-term Monitoring of Great Bear Lake Fisheries and the Aquatic Ecosystem: Monitoring and research related to fish and fish management and the collection of standardized ecosystem level information, such as up-to-date water quality information to detect changes in water chemistry due to climate change and development, is being undertaken in Great Bear Lake. These sources of information can be combined to examine the relationships between fish abundance and various environmental drivers. Water quality parameters will be recorded for each sampling event/location and more frequent water quality information (together with zooplankton) will be collected annually near Déline by local monitors. The five arms of Great Bear Lake will be monitored for water-related physical parameters including nutrients and total dissolved solids; fish health; zooplankton and benthic invertebrates.

Community-Based Water Monitoring: Community-based water monitoring began in 2012 and continued in 2013. Water quality monitoring equipment was deployed near 17 communities along the Slave, Hay, Mackenzie, Great Bear, Little Bear, Peel, Liard and Yellowknife rivers; Franks Channel; Slater and Bogg creeks; and Kakisa, Trout, and Great Slave lakes. Monitoring stations were visited monthly during the ice free season to change equipment and take surface water grab samples. Sampling was conducted in partnership with community members.

Surface grab samples are analyzed for physical parameters, nutrients, ions, and total and dissolved metals. Ultralow total and dissolved mercury was introduced in 2013. The YSI sonde 6600 measures temperature, conductivity, pH, oxidation/reduction potential, dissolved oxygen, turbidity, and chlorophyll. These measurements are taken every 2 hours. The polyethylene membrane devices measure dissolved polycyclic aromatic hydrocarbons and the diffusive gradients in thin-films measure dissolved metals, methyl mercury and vanadium every 3-5 days or every 30 days. The Great Bear River, Little Bear River, Slater Creek, Bogg Creek and Mackay Creek (all just upstream of Mackenzie River and Great Bear River confluence) have been sampled.

Arctic Wastewater Research (Environment Canada): The objective of this research was to assess the performance of lagoons and wetlands in the treatment of municipal wastewater in Canada's Arctic as part of the Canada-wide Strategy for the Management of Municipal Wastewater Effluent which includes national performance standards for the release of total suspended solids, carbonaceous biochemical oxygen demand and total residual chlorine in municipal wastewater effluent.

Samples were taken from the influent (raw sewage) and effluent (treated wastewater) during the period of discharge at the wastewater system. A single sample has been taken at most NWT communities (including Déline); for lagoons that discharge continuously over the summer, samples were taken at least twice.

Raw sewage and treated wastewater quality analyses include physical parameters, nutrients, major ions, total and dissolved metals, hydrocarbons, bacteriological, residual chlorine, carbonaceous biochemical oxygen demand, total suspended solids, and chlorophyll (2011 only).

2. Fish

The road to ecosystem redemption: Comparative study of degraded and pristine giant lakes of North America using Ecopath (Fisheries and Oceans Canada): This project is focused on comparison of ecosystem health of pristine and degraded giant lakes of Canada. Ecosystem health is comparatively a new approach in environmental management and refers to the condition and functioning of an ecosystem in comparison to the normal conditions and functions. The project also supports one of the objectives in the Great Bear Lake Management Plan to develop an ecosystem model of the lake. This research is developing simple and robust ecosystem models that managers can use to explore the whole system management strategies for fisheries and to determine the risk of degradation of ecosystem health. The project also incorporates traditional knowledge to deepen the understanding of cumulative impacts caused by the present and foreseeable future fishing and other anthropogenic activities and climate change.

Under this project, a workshop was held in 2012 at Déline and traditional knowledge regarding temporal change in fish community, subsistence fisheries, climate change and community approach towards a healthy ecosystem was gathered through interviews and discussions. As hypothesized, the pristine GBL ecosystem looks more developed, stable and in better health as compared to few other great lakes of Canada.

Lake Trout and Cisco in Great Bear Lake (Fisheries and Oceans Canada): Research on lake trout in Great Bear Lake has been conducted on an annual basis since 2000.

The emphasis has been on sampling lake trout among the different arms of the lake to better understand their size and age structure, growth, maturity and relative abundance for the purpose of assessing the status of harvested stocks. An additional component of the lake trout project has involved examining the presence of different forms of lake trout present in the lake and how they contribute to the biodiversity and functioning of the Great Bear Lake aquatic ecosystem. This is being accomplished through ongoing research that includes measuring different attributes of the shape of the trout from pictures taken in the field, gathering Traditional Ecological Knowledge of lake trout types through interviews with Dǎlǎnǎ community members, examining the diet and looking at the chemical properties of muscle tissue that provide us with an idea on long-term feeding habits, and looking at movements through archival tagging.

The lake trout project was expanded in 2008 to include more comprehensive annual sampling for cisco in different depths. Similar to the trout, the body shape of the cisco captured from shallow and deep habitats is being examined to determine if there are different forms of cisco as seen in many other deep north American lakes left behind after the last glaciation. The data collected so far has yielded a valuable time-series of information on the biology of lake trout in the lake and has confirmed the presence of multiple forms of lake trout and cisco that appear to have different ecological characteristics and roles in the Great Bear Lake food web.

In 2012 a multi-year ecosystem study was initiated which maintains the lake trout and cisco assessment research, but has greater spatial coverage of different habitats, and includes the whole fish community together with water quality, primary productivity and invertebrate production which are essential for supporting fish populations. This expansion of the research will improve understanding of the lake and how fish productivity is maintained. The large lake monitoring protocols developed and the baseline data collected through this study will form an important basis for tracking and understanding the cumulative effects of climate change, fishing and other anthropogenic (human induced) drivers on the Great Bear Lake ecosystem and its fisheries.

Monitoring of mercury, flame retardants and other chemicals in lake trout and cisco from Great Bear Lake (Environment Canada): The project is designed to find out whether contaminant levels are changing in fish (lake trout and cisco) in Great Bear Lake. The research team require a batch of spring-caught fish and a batch of summer/fall-caught fish for this study. Twenty whole lake trout and 20 whole cisco of a range of sizes are required from each collection period. The fish will be frozen immediately after capture and sent south for analyses.

3. Caribou

Caribou genetics (Sahtu Renewable Resources Board, University of Manitoba, ENR): The main goal of the caribou research project is to develop a comprehensive understanding of the identities and relationships among caribou populations and Dene people in the Sahtú region in order to inform and prioritize management efforts. The caribou genetics study has developed collaborations with the ʔehdzo Got'ǎnǎ Gots'ǎ Nákedı and the ʔehdzo Got'ǎnǎ of Fort Good Hope, Norman Wells, Tulít'a, Dǎlǎnǎ, and Colville Lake to research and monitor caribou populations. The project brings together traditional knowledge and non-invasive population genetics to organize and understand

the biological diversity of caribou and to develop an approach to caribou research that balances and accommodates aboriginal and scientific ways of knowing.

Community-based monitoring (harvesters) to determine spatial structure of caribou in the Sahtu region (Environment and Natural Resources): The project involves caribou condition assessment, genetics and diversity; and multi-species monitoring using winter track surveys. The main goal of the caribou research project is to develop a comprehensive understanding of the identities and relationships among caribou populations and Dene people in the Sahtú region in order to inform and prioritize management efforts. The project will bring together traditional knowledge and non-invasive population genetics to organize and understand the biological diversity of caribou and to develop an approach to caribou research that balances and accommodates aboriginal and scientific ways of knowing.

4. Archaeology

Sahtu Spatial State of Knowledge (Aurora Research Institute): The overall project goal is to identify and make accessible all the mapping work completed in the Sahtu region for community use as appropriate. One product will be a literature review/ article related to the Sahtu Dene understanding of place, space, knowledge and experience.

Ground-truthing NAD83 coordinates for all recorded NWT archaeological sites (Prince of Wales Northern Heritage Centre): The project will include ground-truthing coordinates for archaeological sites in the Sahtu.

5. Social Sciences

Re/mediating Indigenous Environmental Justice: Resource Extraction, Divergent Risk Perception, and Economic Equality in the North (Queen's University): The project is part of a dissertation, which examines how the Deline Dene's assessments of the risks of uranium mining on Great Bear Lake proliferated from the geographical and political margins to the center, prompting public and official responses. As the source of these environmental risk assessments is the oral histories of the Deline Dene, it is important to collect and record these oral histories. While interviews which perform some of the work of recording oral histories were conducted by documentary filmmakers and journalists in the late 1990s and early 2000s, the objective in pursuing this field research is to gain a sense of the Deline community's current views on the risks posed by ongoing uranium mining on Great Bear Lake.

Dene Mapping Project Repatriation and Analysis: Understanding valued places at the intersection of caribou ecology and harvesting (Sahtu Renewable Resources Board): This project includes work with the maps and computer files from the Dene Mapping Project, undertaken by the Dene Nation across the NWT in the 1970s and 1980s. There is a trails map from this work which is being updated to modern computer standards, and other hunter/trapper wildlife observations on the maps which have remained hidden for decades will be brought to light and made available. The old maps will be preserved by a specialist known as a conservator, and scanned for use in decision-making and research. Once the information is updated and available, the

SRRB will be working with the communities in meetings and workshops to understand how and when to use this information properly.

Wildlife, Habitat and Harvesting: Responses to Exploration and Development in the Central Mackenzie Valley (CMV): State of Spatial Knowledge Component: This project is focussed on aboriginal harvester responses to oil and gas exploration and development from traditional knowledge and scientific perspectives. For the spatial state of knowledge component, the project's goals are to identify and make accessible all the maps – computer and paper – that people have recorded information on and make sure that they remain confidential but useful for communities as appropriate.

The Sahtú Settlement Harvest Study (Sahtu Renewable Resources Board): A survey of harvesters took place in the Sahtú Settlement Area between 1998 and 2005 as a requirement of the Sahtú Dene and Métis Comprehensive Land Claim Agreement (1993). The objective was to estimate total harvests of animals, birds, and fish for all Sahtú Dene and Métis hunters, trappers, and fishers over a five year period. The results of the study were intended for two main uses: to provide information on harvesting for fish and wildlife management Sahtú by the SRRB and government; and, to determine the Sahtú Basic Needs Level of Dene and Métis so that harvesting traditions could be protected.

The data resulting from the study have been available for resource management and land use planning in a raw form since 2005. In 2012-2013 the ʔehdzo Goʔıne ʔots'ę Nákedı hired consultants to review the study and assess the status of the information. A report was produced that included a critique of the Sahtú Harvest Study in comparison to other studies in the Canadian north; an assessment of the information that was collected; and recommendations to complete the initial study, as well as consider possibilities for future harvest study work in the region.

It is now a priority of the SRRB to finalize the information from the harvest study to determine how representative, accurate, and reliable the numbers are. In 2013-2014, with the help of statisticians, calculations will be done that can provide total estimated harvests for the region, and a measure of how much error is associated with the numbers. A series of workshops will then be held in each community to ask harvesters, people that worked on the harvest study, and community members for their feedback on the study and the data. The workshops will be an important way of adding to the work done by the statisticians, by providing a local context for the information.

Déıne Language and Stories of the Land program (Déline in partnership with University of Toronto and University of Cologne): (need description)

6. Contaminants

Radiological Characterization & Delineation Study - Historical Waste Contaminated Great Bear River Sites (Atomic Energy of Canada Limited): The project will delineate the horizontal and vertical extent of uranium contaminated soil at sites located along the Great Bear River portion of the northern transportation route (NTR). The soil quality and quantity information gathered during this assessment is required to assist in the development of future remediation plans for this segment of the NTR.

Sources

<http://nwtwaterstewardship.ca>

<http://data.nwtresearch.com>

www.srrb.nt.ca/