Cooperative Freshwater Ecology Unit Annual Report 2012

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Unité Conjointe
D'écologie D'eau Douce

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Awards and Recognition

- Dr. Nathan Basiliko was awarded the Canada Research Chair in Environmental Microbiology and will join the Co-op Unit in June 2013. His wife, Dr. Dana Wilson will also be coming to Laurentian and joining the School of Rural and Northern Health as an Assistant Professor. In the 2012/13 NSERC competition Dr. Basiliko was successful with both his CFI and Discovery grant requests.

- Dr. David Kreutzweiser was the recipient of the Canadian Forest Service Merit Award, Outstanding Achievement. 2013.

- Dr. Norman Yan was inducted as a fellow Royal Society of Canada, Academy of Science, Life Science Division. Dr. Yan served as the 2012 "Watershed Talk" lecturer at the Lake Centre on Nov. 23, 2012 presenting a talk entitled "What's An Applied Ecologist to Do in An Increasingly Complicated World?".

- Dr. Nadia Mykytczuk joined the Living with Lakes Centre Team in 2012 as an Environmental Microbiologist and post-doctoral fellow. Dr. Mykytczuk received a 5-yr NSERC Discovery grant in March 2013 and her recent paper was selected as "Editor's Choice" in the Journal Science (Mykytczuk, N.C.S., et al. 2013. Bacterial growth at -15°C; molecular insights from the permafrost bacterium *Planococcus halocryophilus* Or1. (Published online ahead of print *ISMEJ* February 7, 2013, doi:10.1038/ismej.2013.8.)

- Dr. Heidi Swanson, a new faculty at Waterloo has joined the Co-op Unit as an external member, and brings great expertise to the study of the ecology of arctic fisheries and trace contaminants.

- Dr. Bjorn Rosseland joined the Co-op Unit in 2012 as our 1st international member and was here as a visiting scientist in Feb-May, 2012. Dr. Rosseland's research institute at the University of Life Sciences in Norway, has been designated as a Centre of Excellence in Radiation Research by the Research Council of Norway. Dr. Rosseland will return for his next visit on Aug. 22, 2013.

- Six Co-op Unit Scientists (J. Bailey, D. Campbell, J.Gunn, T. Johnston, W. Keller, D. Pearson) were among the recipients of a $4.4 million NSERC grant (2012-2015) to establish the Canadian Network for Aquatic Ecosystem Services. Dr. J. Gunn was selected to serve on the network science advisory committee. The 1st meeting of the network scientists and graduate students from 11 universities will be held at the Lake Centre on April 29 and 30th, 2013.

- Dr. Daniel Campbell was very prominent in the news in 2012/2013 for his work on remediation of disturbed lands at the DeBeers Victor Mine in the Hudson Bay Lowlands. Dr. Campbell, will retain his association with MIRARCO but is joining the Environmental Studies program at LU as an Assistant Professor. He will be teaching a course in Environmental Impact Assessment at the VLWLC in the fall of 2013.

- Dr. Nadia Mykytczuk and Dr. John Gunn were successful co-applicants in the 5 year $1.65 M SMART-MINE (Scientific Mentoring, Applied Research and Training for sustainable MINEs) program. This NSERC CREATE program is a bilingual Quebec/Ontario graduate training program involving Univ. Montreal, INRS, McMaster, Ottawa and Laurentian Universities, and is designed to develop skills and innovative solutions to mining-related environmental problems.

Student Scholarships, Fellowships, Bursaries

- Shakira Azan, PhD Candidate. E. G. Bauman Fellowship from Queen's University.

- Arran Brown, MSc Candidate. York University Entrance Scholarship for his MSc studies under Dr. N Yan

- Katrina Furlanetto, BSc student, Wes and Dorletta Curran Memorial Award(Queen's)

- Michelle Gillespie. MSc Candidate. February 17, 2012. Fisheries and Oceans Canada Habitat and Restoration Bursary. $3900. On February 17, 2012 she was also awarded the Sudbury Game and Fish Protective Association Scholarship. $1000. (Laurentian)

- Anneli Jokela, PhD student, Queen Elizabeth II Scholarship in Science and Technology (Queen's)

- Brian Kielstra. MSc Candidate. April 2012. Recipient of a CGS-M NSERC scholarship for his next year of studies. $17,500. (Queen's)

- Meagan King, BSc. Honours Student. Award from the Kingston Field Naturalists' Fund for Queen's University Biological Station. (Queen's)

- Tamsen Lahnalampi. MSc Candidate. November 2012. Margaret Atwood, Lake Lovers Student Award. $500 (Laurentian)

- Kim Lemmen, MSc Candidate, Ontario Graduate Scholarship, Northern Student Training Program Award. (Queen's)

- Josef MacLeod. MSc Candidate. March 18, 2012. W. Garfield Weston Foundation Fellowship for Northern Conservation administered by Wildlife Conservation Society of Canada. $20,000. He was also awarded the Richard Leitch Memorial Graduate Student Research Bursary. $2,500 (Laurentian)

- Caroline Sadlier, BSc. Honours Student. 2012 Second place Winner of Ecology Award at Ontario Biology Day, Laurentian University, Sudbury, ON. 16-18 March 2012. On November 2012 she also received a Margaret Atwood, Lake Lovers Student Award. $500 (Laurentian)

- Janel Sauder. BSc. Honours Student. February 14, 2012. ESRI Student Scholarship. $1500 (Laurentian)

- Ashley Stasko. MSc Candidate. Jan., 2012. Department of Fisheries and Oceans Habitat and Restoration Scholarship. $2,200. (Laurentian)

- Celia Symons, MSc Candidate, NSERC CGS-M, W. Garfield Weston Award for Northern Research (Queen's)

- Erik Szkokan-Emilson. PhD Candidate. 2011-2012. Ontario Graduate Scholarship. $15,000 (Laurentian)

- Karrah Watkins, LU BSc. Honours Student. 2013 Winner of Ecology Award at Ontario Biology Day, McMaster University, Hamilton, ON. 16-17 March 2013. (Laurentian)

Community Outreach

- **Dr. Peter Beckett is the Outreach Coordinator with the VLWLC. He served in the following Capacities in 2012:**
  - **VETAC:** Chair
  - **Bioski and Snowshoe Club:** Executive member.
  - **Canadian Land Reclamation Association (National)**: Director
  - **Canadian Land Reclamation Association (Ontario Chapter):** Director
  - **Greenspace Advisory Panel:** Technical member assisting in defining conservation areas in Sudbury.
  - **Junction Creek Stewardship Committee:** Technical advisor
  - **Rainbow Routes:** Environmental Advisor and Board Member
  - **Sudbury Naturalists:** Co-chair

- **City of Lakes Advisory Panel:** John Bailey and Charles Ramcharan served as members of the City of Sudbury Lakes Advisory Panel (LAP).

- **Foundation Hubert Lemire:** Dr. Peter Beckett was in Haiti over reading week 2013 where he was working with the Foundation Hubert Lemire and visiting Haitian Universities and local restoration and agriculture groups in southern Haiti in an effort to apply how the lessons of regreening Sudbury could be applied to re-afforestation and mountain landscape restoration. Drs Graeme Spiers, Kabwe Knongolo and Dan Archambault are also involved in the potential projects.

- **Picture our Lakes Photography Contest:** The Co-op Unit again took a lead role with Artists on Elgin, in a contest to celebrate the more than 330 lakes in the city's boundaries. Over 300 photos were submitted. The awards presentation was held for the first time at the VLWLC. The Co-op Unit continues to work toward its goal of promoting lake stewardship within the general public through this contest related education.

- **Stewardship Committees:** Charles Ramcharan served as a member of both the Long Lake and Ramsey Lake Stewardship Committees. Both of these lakes had blue green algae blooms in 2011 and 2012.

- **Sudbury Water Gathering**: Tom Johnston assisted this event this year by giving a public presentation on Sudbury's fish communities on 26 April 2012.

- **Greater Sudbury Vital Signs**: Dr. John Gunn served as Honorary Chair for the 2012 issue of the Vital Signs Report with a special focus on "Living with Lakes". This excellent publication is produced by the Sudbury Community Foundation and reports on our community's well being.

- **Source Water Protection Program**: Charles Ramcharan has served as an environmental advisor

- **Public Lectures:** Norman Yan was invited to provide lectures to the general public on numerous occasions including:
  - ~ "Unmuzzled: weighing in on the government's environmental policy and the new role of the vocal scientist". Invited presentation at, Ramsay Wright Building, University of Toronto. 24 October 2012.
  - ~ "Effects of calcium decline and invading species on Shield lakes" Halls Lake Cottage Association, Hall's Lake, 18 August, 2012.

Endowments and Community Support

In 2012 we were delighted to receive a gift of $500,000 from the Mansour Family to establish a long-term endowment that will support the visiting scientist program at the Living with Lakes Centre. In recognition of this generous gift the atrium of the Lake Centre was named the Milad Gebrael Mansour Atrium during a special ceremony on October 1, 2012

The Living with Lakes Centre continues to be a much loved community space. Some of the special events that occurred in 2012 included the monthly Lunch by the Lake music concerts, the Margaret Atwood birthday party, the launch of the water poetry book (Our Lakes Shall Set Us Free, Editor: Roger Nash), a photography exhibition featuring photos of the La Cloche area, launch of the Vital Signs report, the Governor General's Leadership Group, and a wide variety of community meetings and gatherings. Dr. Jane Goodall was among the many special visitors in 2012.

Some statistics:

- Approximately **110** groups have held events in our building representing over **5000** users
- **7** fundraising events through the Office of the President or Advancement Department
- **86** external community group users
- **50** other Laurentian University group users

Living with Lakes Centre Design Awards

The building continues to win design awards:

- Consulting Engineers of Ontario's Award of Merit for in the Industry, Energy and Resources category (April 28, 2012),
- The Canadian Consulting Engineers Award of Excellence (Oct 23, 2012)
- The Ontario Woodworks Green Building Wood Design Award (Nov. 7, 2012)

Key Science and Science Engagement Events

- *TĀLER – NSERC CRD meetings* (see below for details)

- *Far North Branch meeting and First Nation consultation May 28-29, 2012*: About 60 people including scientists, policy makers and representatives from many First Nation communities in the Far North of Ontario gathered for a 2 day workshop to discuss land-use planning and other issues related to impending development in this vast region. The results of this meeting have helped to prioritize research and monitoring needs.

- *A Midsummer Night of Research, Aug. 9, 2012*: The newly established Advanced Medical Research Institute of Canada located at Health Sciences North collaborated with us for an evening to showcase some of the innovative research taking place along the Ramsey Lake Road "**science corridor**". The audience comprising health care professionals, researchers, and the general public enjoyed illuminating and eclectic topics from microbial mining to tobacco vaccines.

- *Building Environmental Aboriginal Human Resources (BEAHR) training:* In September, 2012, the Director and two staff from the Matawa Tribal Council's 4 Rivers Environmental Services group came to the Lake Centre with three Aboriginal trainees as part of their training toward becoming Community-based Environmental Monitors. They spent three long and full days in the field, including sampling on Ramsey Lake. It was an important experience for them as well as a step toward build environmental capacity within Aboriginal communities. It has also helped in developing working relationships between our researchers and First Nation community members and 4 Rivers. David Pearson and Kimberley Jorgenson of Four Rivers subsequently collaborated in reviewing and providing invited comments on the Environmental Core and Environmental Monitoring Research and Regulatory specializations in the BEAHR program.

- *International Delegation from Peru and Columbia, Oct 30, 2012*: Daniel Campbell hosted a visit to the VLWLC from The Inter-American Institute for Cooperation on Agriculture. This group was in Sudbury to learn about the mining industry, our environmental challenges, and solutions developed by a variety of stakeholder groups. They also visited a mine tailings reclamation project at Xstrata Nickel and had presentations on the Sudbury story from Laurentian University, MIRARCO, Ontario Federation of Agriculture, the City of Greater Sudbury and the Wahnapitae First Nation.

- *Canadian Aquatic Biomonitoring Network (CABIN) Science Forum Nov 14-15, 2012*: Our state of the art videoconferencing capability provides unlimited collaboration opportunities. This event was attended remotely by C. Sarrazin-Delay, J. Heneberry and S. Greene. The goal of the 2-day forum was to enhance collaboration, share knowledge and improve the tools and use of CABIN. It consisted of presentations and interactive discussions allowing network users to learn about different applications of CABIN in a variety of sectors, successes and challenges, and to learn about the future directions of the program.

- *Science Unmuzzled:* Nearly 100 people attended this event on March 8, 2013 organized by the Biology Society. A panel of scientists, media, and politicians shed light on the current status of science and explored questions like "is there a war on science", and "who owns the information generated by public money and what happens to it."

- *Russian Delegation:* March 10 - 12, 2013. Nine Russian delegates from The National Mineral Resources University - University of Mines, St Petersburg, Russia, hosted by the Goodman School of Mines, visited Laurentian University including the VLWLC to discuss potential collaborations. Their university has the oldest school of mines in the world and can be a great model for our new initiatives. The focus of the Goodman School of Mines on sustainable mining has created a pivotal role for the Living with Lakes Centre sparking new areas of collaboration.

- *Bioremediation workshop (March 27, 2013)***:** The Living with Lakes Centre and the Goodman School of Mines held a workshop on Mar 27 titled "Completing the Mining Cycle: Bioremediation and Reclamation of Mine Waste Areas". Presentations illustrated how lessons learned in Sudbury may be applied to developments in the Ring of Fire area to avoid some of the environmental damage experienced in the previous century. (see below for details)

- *Green Mines Green Energy Conference, April 23, 2012*: Representatives of Xstrata Nickel, Vale, Goldcorp as well as the University of Waterloo, the Ontario Ministry of the Environment and Natural Resources Canada are working with the VLWLC (Daniel Campbell, Peter Beckett) to build a long-term research initiative on the use of organic residuals to reclaim mine tailings and grow biofuel crops, another activity under the bioremediation umbrella.

- *Canadian Network for Aquatic Ecosystems Services (CNAES) April 29-30, 2013: (*see details about the network below) will hold its first Annual Network Meeting. The meeting provides an excellent opportunity for networking and information sharing among Network members from across Canada. Attendees will include researchers from 11 universities, Canadian government scientists, industrial partners and environmental and technology associations, and will feature several national and international keynote speakers. The Meeting will facilitate the exchange of project ideas within and across research themes, promote discussion of the various approaches being considered in different regions, and will aim to enhance collaboration amongst researchers. Highly-Qualified Personnel (HQP) will have the opportunity to present their work to other Network members. In addition, each Theme will be provided the opportunity to meet and discuss their research.

- *Ecotoxicology Course*: One of the many advantages of a Visiting Scientist program is the ability to offer enriched training opportunities to our graduate students. Renowned Ecotoxicologist, Dr. Bjorn Rosseland delivered at 2 day course in May 2012 to about 12 students and technicians.

NSERC CRD Program TĀLER 2010-2015

"Terrestrial Aquatic Linkages for Ecosystem Recovery"

The TĀLER project funded by NSERC, Vale Ltd. and Xstrata Ltd. was designed to address the concerns identified through the Ecological Risk Assessment as part of the Sudbury Soils Study. The ERA concluded that Sudbury's terrestrial ecosystems exhibited persistent problems because of the continuing soil erosion, elevation of metal contaminants and the lack of organic matter. The degraded nature of the land in turn appeared to adversely affect the recovery of diverse communities of invertebrates at the interface of terrestrial and aquatic ecosystems (i.e. littoral zones, riparian areas). The initial research team for this project consisted of J. Gunn and W. Keller (Laurentian), D. Kreutzweiser (Can. For. Serv.) S. Watmough (Trent), N. Yan (York) and J. McGeer (Wilfrid Laurier) and their students and post-docs. In 2011 S. Arnott (Queen's) joined the project to support a M.Sc. project by B. Kielstra. In 2012, A. Yates (Western) and J. Bailey (VLWLC) joined to support a M.Sc. project by N. Novodvorsky

TĀLER addresses the following questions:

1) How does disturbance type (fire, logging, mining) affect benthic invertebrate recovery? (D. Kreutzweiser, J. Gunn, S. Arnott)
2) What controls the quantity and quality of organic matter entering lakes? (S. Watmough, J. Gunn)
3) How do organic matter and base cations interact to influence the toxicity of residual metals? (J. McGeer, N. Yan, M. Celis-Salgado)
4) What habitat characteristics are associated with healthy invertebrate communities? (A. Yates, J. Bailey, W. Keller)

The TĀLER projects make use of study sites and facilities at the:

1) CFS experimental watershed sites in White River, Ontario
2) Catchment sites associated with many key long-term study lakes (e.g. Clearwater, Daisy, Laurentian) in Sudbury
3) FLAMES lab and long-term catchment study sites in Dorset

Extensive data from over 300 sites from the Freshwater Invertebrate Reference Network of Northern Ontario (FIRNNO) located across mining regions of Ontario are also being used.

The TĀLER group held its first workshop at the Copper Cliff Club on Oct. 27, 2010 hosted by Vale Ltd. A special guest at the meeting was Dr. Sandra Clinton, a microbial ecologist from N. Carolina State. Representatives for the City (S. Monet) and the OMOE (P. Welch) also participated. The second TĀLER workshop was held on Aug. 31, 2011 at the Lakes Centre. A unique aspect of the meeting was the participation of 12 OUPFB (Ontario University Program in Field Biology) students from 7 participating universities. The 3rd and 4th TALER meetings we held in 2012 and the agendas were as follows. The 2013 TĀLER meeting will be held on Aug. 29-30, again with OUPFB student participation.

TĀLER Meetings held in 2012

Thursday, April 12-13, 2012

- J. Gunn Welcome and Introduction to TĀLER workshop
- C. Wren The Sudbury Soils Study: Linkages to aquatic systems and terrestrial restoration

TĀLER Progress Reports

- K. Wallace (LU) -Recovery patterns of benthic invertebrate communities in logging disturbed streams
- J. Sauder (LU) -The effects of land cover on Daisy Lake's water quality
- B. Kielstra (Queens/LU) How landscape characteristics may influence the colonization and distribution of a freshwater amphipod (*Hyalella azteca*) in disturbed environments
- E. Szkokan-Emilson (LU/Trent) -Climate change and Canada's boreal lakes: Drought-induced flux of metal contaminants from peatlands in watersheds vulnerable to extreme events
- N. Mykytczuk (LU) - Sequencing technologies for studying microbial communities in disturbed landscapes
- J. Babin-Fenske - Phylogenetic analysis of *Hyalella* colonization in lakes recovering from acidification and metal contamination
- P. Pennington (Trent) Wetland biogeochemistry along a historic pollution gradient in Sudbury, Ontario
- S. Luke (Trent)Microbial biomass and aerobic respiration along a pollution gradient in Sudbury wetlands
- M. Celis-Salgado (York) Daphnid recovery in Sudbury Lakes: are we there yet?
- C. Gibson (York) – Protective Effects of DOM on Daphnia
- K. Livingstone (WL) Understanding source differences among natural organic matters (NOM) in their mitigation of Cu toxicity to *Hyalella azteca*
- K. Chan (WL) Factors influencing Ni toxicity in *Hyalella azteca*

Friday, April 13, 2012

8:00-10:00 Writing Workshop – N. Yan
10:00-12:00 Site Visits

Thursday, November 22, 2012

TĀLER Progress Reports

- D. Kreutzweiser (CFS) - Targets and benchmarks for mining reclamation: Lessons learned from boreal forest watershed recovery
- C. Sadlier (LU) - The role of stream microbial communities in the recovery of aquatic ecosystems from natural and industrial damage
- B. Kielstra (Queens/LU) - Landscape-level effects on a freshwater amphipod at the land-water interface
- E. Szkokan-Emilson (LU/Trent) - Seasonal Changes in DOM Quality in Boreal Peatlands and Implications For Trace Metal Transport and Availability in Lakes
- M. Preston (U of T) - The importance of the microbial community composition in peat decomposition processes
- P. Pennington (Trent) - Temporal and spatial variation in peatland biogeochemistry in the smelter affected area of Sudbury, Ontario

Friday, November 23, 2012

- M. Juckers (Trent) - Impacts of simulated drought on pore water chemistry of peatlands in the Greater Sudbury Area, Ontario
- S. Barrett (Trent) - Impact of Industrial Pollution on the Community and Biochemistry of Wetland Vegetation
- C. Gibson (York) - Understanding protective effects of natural organic matter for Ni toxicity to Daphnia
- K. Livingstone (W. Laurier) - Does ecosystem disturbance influence the toxicity mitigation quality of natural organic matter?
- K. Chan (W. Laurier)- Factors affecting Ni Toxicity in *Hyalella azteca*
- A. Tanentzap (York) - Planktivorous fish are larger in deltas that receive more organic matter from their terrestrial catchments

Aquatic Restoration Group - Sudbury Environmental Study Lakes

In 2012, the Ministry of the Environment at the Cooperative Freshwater Ecology Unit continued sampling lakes for the Sudbury Environmental Study (SES) under 2 main programs which complement each other: SES Extensive and SES Intensive. The SES Extensive program includes a set of 44 lakes, located within a 100 km zone around Sudbury. These lakes were all acidified to below pH 5.5 in the early 80s, but are now in various stages of recovery. They are sampled once annually during the period late June through early August. The data are intended to provide information on regional patterns in water quality and lake recovery in the lakes near Sudbury. During 2012 all 44 lakes in the SES Extensive lake set were sampled once for a set of standard water chemistry parameters. The SES Intensive program is a set of lakes sampled monthly or twice-monthly through the ice-free season for a wide range of physical, biological and chemical parameters (water chemistry, Secchi disc transparency, oxygen/temperature profiles, zooplankton, phytoplankton), therefore giving a larger and more varied amount of data on a smaller group of lakes. In 2012 there were 12 lakes sampled monthly (May - October) and 1 lake sampled twice-monthly (Swan lake) under the SES Intensive program.

In 2012, the SES sampling was expanded to include lakes in the Serpent River watershed that were acidified through the effects of acid mine drainage from Elliot Lake uranium mines and are now recovering. Zooplankton, phytoplankton and standard water chemistry data were collected for comparison to Sudbury-area recovering lakes to compare the rate and nature of their recoveries. *Daphnia pulicaria* and *Daphnia mendotae* bioassays were also conducted at the York University FLAMES laboratory using water from select Serpent River watershed lakes compared to similar bioassays using water from two Sudbury area lakes (Clearwater Lake and Whitepine McLeod)). This component of the programme is expected to provide further insight to the recovery of Sudbury lakes and will be expanded in future years.

Sampling was also expanded to include visits to 4 lakes in the vicinity of the proposed chromite smelter north of Capreol. This additional sampling was undertaken in order that we are better positioned to distinguish any new effects from the construction and operation of the chromite smelter from historical and ongoing effects from the Sudbury smelting operations.

The zooplankton taxonomy lab continued to process samples collected under the SES program, but also processed samples for various partners and collaborators including the Severn Sound Environmental Association, Dorset Environmental Science Centre (DESC) and the Climate Change and Multiple Stressor Research Programme.

Database management during 2012 included updating the several databases that house data produced from our programs. In addition, numerous data requests were addressed from partners and collaborators. Support for other projects, including graduate student projects was also provided (data, expertise and logistics).

These Sudbury area monitoring programs continue to be a very important component of Canadian and international efforts to assess the effects of acid deposition and the responses of lakes to sulphur emission controls. In recent years these studies have also figured prominently in large-scale collaborations investigating the effects of other major environmental stressors including climate change, UV-B irradiation, changes in DOC concentrations and declines in calcium. Results from these sampling programs have been presented and interpreted by ARG partners and numerous collaborators. Most of these publications were prepared for peer reviewed journals for widespread dissemination. A list of recent publications arising from this program can be found within the publication section of this report

Climate Change and Multiple Stressor Aquatic Research Program

Science Advancement and Science Transfer:

To promote and facilitate climate change and multiple stressor research in Ontario, partial funding support has been provided for 12 projects at 8 universities (Queen's, Ottawa, Toronto, Wilfrid Laurier, UQAM, York, Trent, Laurentian). These projects are yielding valuable results that are advancing the scientific understanding of climate change and multiple stressor effects on aquatic ecosystems. Products include B. Sc. and M. Sc. theses, and a number of journal papers

have recently been submitted from these projects; many more will be submitted during the coming year.
Substantial progress has been made in networking and collaborating with northern researchers. A special issue of the journal – Arctic, Antarctic and Alpine Research is in progress which will feature science from the Hudson/James Bay drainage of Ontario as well as studies from Manitoba and Quebec. W. Keller is a guest associate editor for this special issue.

Much progress has been made in establishing relationships with First Nations residents and communities in the Far North in order to work towards increasing future science-related collaborations. W. Keller coordinated work by Albert Chookomolin (Peawanuck resident) and Timothy Miles (Fort Severn resident) for installation of recording thermisters in sea run brook charr rivers to document thermal conditions during spawning runs. W. Keller visited with Chief and Council of Fort Severn (Ontario's most northerly community) to discuss possible future aquatic science work in the area. W. Keller visited with Chief and Council of the community of Fort Hope while completing a regional lake survey (29 lakes) in July 2012.

Field Project Updates:

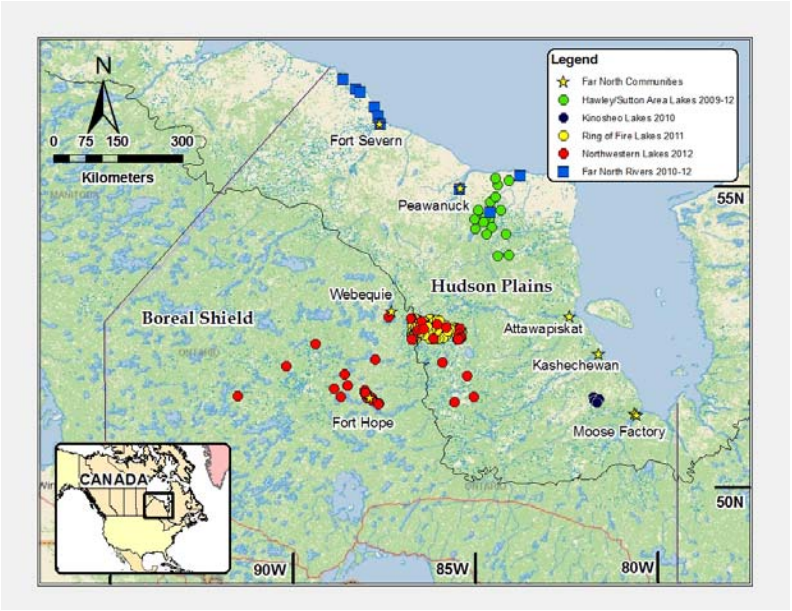
Hawley Lake – Sutton River Area
In August 2012, Laurentian University continued sampling aquatic ecosystems in the Hawley Lake area near the Hudson Bay Coast. This work followed on studies conducted in the summers of 2009 to 2011. These studies involve collaborators from MNR, University of Ottawa, Queen's University, Trent University, University of Toronto, Carleton University and Wilfred Laurier University. During 2012, work focused on collecting water quality and temperature data from Hawley Lake and from various locations along the Sutton River. A status report summarizing all the work done in the Hawley Lake area has been prepared. All information generated from the studies will be made available to stakeholders involved with managing and protecting water resources in Ontario's Far North.

"Ring of Fire" Area Lake Surveys
In August 2011, in collaboration with the Ontario Geological Survey (OGS), 98 lakes were sampled in a block running through the "Ring of Fire" area, near the community of Webequie. Lakes were sampled through the transition between the Hudson Bay Lowlands and the Boreal Shield. During 2012, Geochemical analyses of water samples from that survey were completed by OGS, additional water analyses were conducted by MOE, and paleolimnological (diatoms, cladocerans) analyses of recent and old sediments were conducted by Queen's University. A data sharing agreement has been developed between the Cooperative Freshwater Ecology Unit and OGS. Data analyses are in progress for all aspects of this project.

Additional chemical and biological lake surveys were completed on 29 lakes in north-western Ontario around the Ring of Fire area in July 2012, by Laurentian and Queen's Universities. This study was developed in collaboration with the First Nation communities at Fort Hope, Neskantaga and Webequie.

Northern Rivers

During 2012, in collaboration with Albert Chookomolin of Peawanuck, fish (brook charr, pike) were collected from the Sutton River for analyses of Hg and other contaminants, stable isotopes, and determination of age and growth. This adds to the previous fish sampling of northern rivers (Severn, Winisk, Pipowatin, Majikan, Tamuna, Mintiagan) completed in 2011. Recording thermisters were placed at various locations in the Sutton (Albert Chookomolin, Peawanuck), Pipowatin, Black Currant and Majikan rivers (Timothy Miles, Fort Severn) in early summer 2012. These thermisters were retrieved in the fall, after tracking water temperatures during the anadromous brook charr runs on these rivers.



Far North sampling sites 2009-2012

Northern Fisheries Research Program

This program improves our understanding and aids the management of the fish populations that support the recreational, commercial and subsistence fisheries of northern Ontario. The program is led by Tom Johnston (OMNR) and has included a variety of projects examining the biology, ecology, and ecotoxicology of northern fish populations. Work on this program in 2012 was primarily directed at two fields of research: **i) Mercury bioaccumulation and food web structure in northern fish populations.** This work is funded by the OMOE Environmental Monitoring and Reporting Branch, the OMNR Far North Branch, the OMNR Aquatic Research and Development Section, the Invasive Species Partnership Fund, and NSERC. An extensive study of temporal changes in fish mercury concentrations across the boreal shield ecozone of northern Ontario was published in 2012 (Tang et al). Selected populations from this study are being examined further to determine how food web structure and body growth influence mercury bioaccumulation in co-habiting piscivorous fishes. A research project comparing walleye and smallmouth bass trophic ecologies in relation to water clarity was completed in 2012 (Stasko, MSc thesis). Research examining mercury bioaccumulation in fish populations of

Ontario's Far North, as well as a study of the influence of spiny water flea invasion on the Lake Nipissing food web continued in 2012. **ii) Reproductive ecology of northern fishes.** This research is funded by the OMNR Aquatic Research and Development Section, Fisheries and Oceans Canada, Natural Resources Canada, NSERC and Newmont Mining. Research on the reproductive ecology of burbot was completed in 2012. This work, in addition to studies of burbot trophic ecology, is part of a collaborative research project with Fisheries and Oceans in Yellowknife, NT (Cott, PhD thesis).

The Freshwater Invertebrate Reference Network of Northern Ontario (FIRNNO)

Biological indicators such as benthic macroinvertebrates (BMI) are useful in gauging the degree of impact due to anthropogenic activities. The simplest approach involves the collection of BMI data prior to the activity at paired control and impact areas and the comparison to BMI data after the activity. The traditional before-after/ upstream-downstream (BACI) study design is not always feasible due to confounding issues and geographical limitations, hence alternative designs have been proposed. The Reference Condition Approach (RCA) to bioassessment is based on the premise that when a site is to be assessed, its BMI community is compared to that of many minimally impacted reference sites with similar habitat characteristics. The implementation of the RCA design generally requires a large network of reference sites encompassing many habitat types from which to match a site of interest. Such a network is currently maintained by Co-op Unit.

The Freshwater Invertebrate Reference Network of Northern Ontario (FIRNNO) was designed to assist the metal mining industry in locating suitable reference sites to meet the Environmental Effects Monitoring (EEM) requirements of the Fisheries Act. The objectives of this project are

- to develop and maintain a large network of reference sites to define the normal range of Northern Ontario benthic macroinvertebrate (BMI) communities
- to maintain an accessible database of BMI abundance and chemical/physical habitat characteristics for Northern Ontario lakes and streams
- to assess and monitor mining and other anthropogenic effects on surface waters by detecting any change in BMI community structure.

Since FIRNNO's establishment in 2003, BMI data for over 400 sites have been collected in the vicinity of 4 mining centers including Red Lake, Hemlo, Sudbury and Timmins along with accompanying water chemistry as well as site, channel and watershed level habitat data. Various modeling strategies have been explored including the Nearest Neighbour technique (NN). Here the BMI community of a discharge site is compared to the BMIs at the reference sites that most resemble the discharge site in habitat using ordination techniques

The core program is complemented by work being done to understand the impact of various sources of variability on the assessment of a discharge site. We are investigating the effects of temporal, spatial, replication and methodological factors, confounding anthropogenic effects, as well as various statistical approaches. In 2012, fall sampling continued with 63 benthic samples collected from a mixture of long term and new sites.

The addition of another year of data for a number of sites will help gain a better understanding of inter-annual temporal variation as it pertains to the assessment of an affected site. Some new sites were sampled in the area north of Capreol where a chromite smelter facility may be constructed. Adding reference sites in this area will better prepare us to evaluate potential effects from the construction and operation of that smelter.

We were invited to participate in the publication of a special issue of Freshwater Science wherein the performance of several benthic invertebrate data analysis techniques are compared. We are among several international contributors who were invited to apply their analysis techniques to three common data sets and write up the results. This peer-reviewed collection of papers is expected to be published in late 2013 or early 2014.

SMART-MINE Program: Finding Microbial Solutions to Ecosystems Problems

The SMART- Mine program is 5 year $1.65 NSERC funded CREATE program designed to train students in a multi-disciplinary research to provide the mining industry with highly qualified personnel in environmental management and restoration of ecosystem services at mining locations around the world. Laurentian University joins with University of Montreal, INRS, McMaster, and Ottawa universities in this bilingual Quebec/Ontario program. Bacterial metabolism represents the root cause of deleterious mine drainage, but also a significant untapped opportunity to enhance mine sustainability through strategic characterization of its roles in these ecosystems. In addition to providing students with hands-on experience, the SMART-MINE initiative will provide them with training in analytical and environmental chemistry, mine waste mineralogy, biogeochemistry, ecotoxicology, environmental genomics and molecular microbiology using state-of-the-art instrumentation and modeling approaches. Graduate projects will range from fundamental laboratory-based projects on membrane protein transport to large-scale field studies on the bioremediation of mine drainage. This bilingual Quebec/Ontario training program will form a new generation of environmental scientists who understand the needs of mining industries and are prepared to propose innovative solutions to improve the environmental sustainability of this key Canadian economic sector. With the increasing overlap associated with expansion of mining activities into the Canadian north, between Canadian mining activities and First Nations communities, this SMART-MINE will emphasize First Nations representation and involvement.

VLWLC students supported through SMART-MINE are planning to work on microbial processes that contribute to the "polishing effect "of the Xstrata wetland in Sudbury.

Biomremediation Workshop

A new series of workshops on bioremediation has been established at VLWLC in partnership with the Goodman School of Mines. The agenda from our first two meeting were:

November 23, 2012
Special Workshop: Industrial Wetlands, Bioremediation Processes and Potential

- Welcome – Dr. Yves Alarie – Director of Research
- Nadia Mykytczuk - Introduction and Opening remarks
- Nathan Basiliko - Microbial feedbacks of industrially-impacted northern peatlands
- Lisa Leger/Lorax consulting - Overview of the Xstrata Nickel Wastewater Wetland Treatment Area
- Daniel Campbell - The Development of Protocols to Rehabilitate Terrestrial and Peatland Ecosystems in the Hudson Bay Lowland After Mining - Phase II
- Peter Beckett/Graeme Spiers - Monitoring for Impact and Closure at Gold Mines on the Northern Shield Margins
- Nadia Mykytczuk - Synthesis/discussion, plans for projects and review

March 27th, 2013
Completing the Mining Cycle: Bioremediation and the Restoration of Ecosystem Services

- John Gunn (VLWLC) Welcome
- Daniel Campbell(MIRARCO) Reclamation of Mine Wastes in the Far North
- Graeme Spiers(ELRFS / LU Dept. of Chemistry) Biogeochemical Impacts on Minerals Industry Materials – From rocks to anthrosols
- Nadia Mykytczuk (VLWLC) Microbial bioleaching : Metal recovery and remediation of Sudbury tailings
- Mairi Best (VLWLC)Submarine Tailings: Overview and Global Examples
- Roberta Pedlar-Hobbs (Denison Env. Serv.) Denison Tailings Management Program
- John Bailey (OMOE / VLWLC) Recovery of Contaminated Lakes: Sudbury vs. Elliot Lake comparison
- Peter Beckett (VLWLC) From Waste to Biofuels
- Bruce Jago (Goodman School of Mines) Wrap Up

Canada Excellence Research Chair in Northern Watershed Science for Responsible Development (CERC)

Our CERC application of 2012 was one of 46 applications submitted to the Tri-Council committee from universities across Canada, but was not selected among the 11 that have now proceeded to Phase 2. However, the CERC application was a critically important process that will help us focus in on long-term strategic needs for VLWLC, and help us prepare for the next CERC competition in 2015. A brief summary of our application and the panel comments on the 6 judging criteria follows.

Summary: The Canada Excellence Research Chair in Northern Watershed Science for Responsible Development at Laurentian University will lead a multidisciplinary research team in a global effort to understand how development in subarctic watersheds can occur without compromising the ecosystem services (e.g. carbon sequestration, flood control, water purification) these systems provide. Research will initially focus on the potential interaction of development and changing climate on the functioning of the massive watersheds around Hudson Bay. The Chair will be a leader in establishing international collaborations of researchers sharing science for policy and decision-making that will benefit local Aboriginal communities and all Canadians.

Criterion 1

While the review panel noted that the group is very solid and has an emerging strength in the field of environmental microbiology, it did not see evidence in the proposal of integration between the different researchers at the institution.

Criterion 2

Given the global importance of wetland areas, the panel saw significant potential in the proposed research. The panel was not convinced, however, that the proposed research as articulated by the institution could realize this potential given its narrow focus and lack of global vision.

Criterion 3

The review panel judged that the application fit clearly under the "Environmental Science and Technologies" and "Natural Resources and Energy" priority areas. It also found the focus of the research to be of great national interest, yet because of the problems raised in Criterion 1 and 2, it was not convinced that the university could have an optimal impact in this area.

Criterion 4

The review panel would have liked to see a more definite set of plans for the sustainability of this chair.

Criterion 5

The review panel recognized that the university was committed to the chair. However, the plan for leveraging funds in support of the chair did not appear to be well developed and consequently may not have a high likelihood of success.

Criterion 6

The review panel agreed with the university that the research has the potential to have impact on policy, but it found that the proposal would have required a better articulation of how this impact would be achieved.

Canadian Network for Aquatic Ecosystems Services (CNAES)

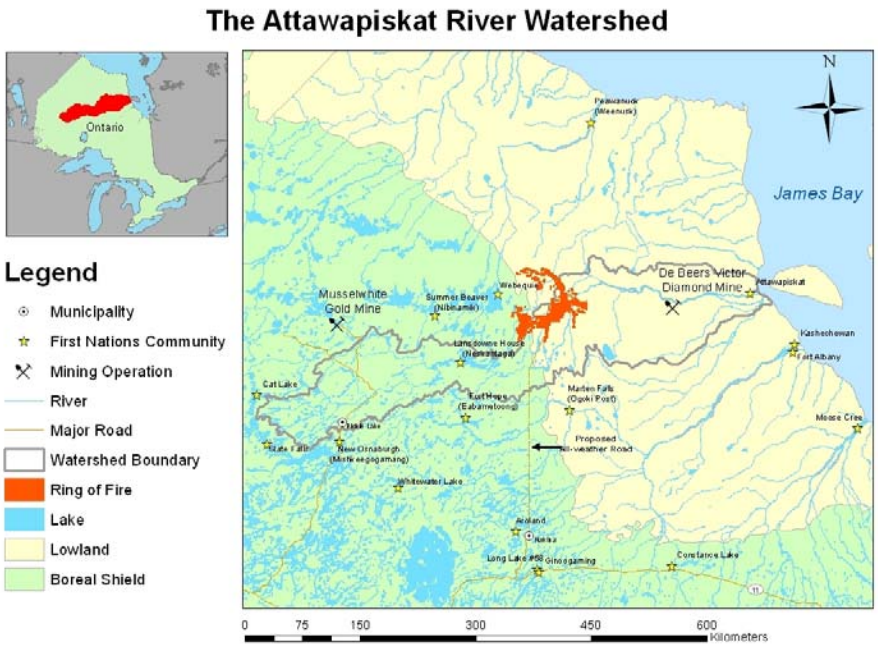
Networks Lead Scientist

Dr. Don Jackson, University of Toronto

LU/CFEU participants: J. Gunn, D. Campbell, B. Keller, J. Bailey. T. Johnston, D. Pearson

Summary

Aquatic ecosystems are recognized for the many direct ecological, social and economic benefits they provide (e.g. fisheries, drinking water) but they also provide many services not well recognized, including hydrologic and nutrient regulation, and waste processing. Increasingly the importance and associated economic value of these ecosystems are being recognized (e.g. Canada's Roundtable on the Economy and the Environment), including most recently by the United Nations General Assembly in creating the Inter-governmental Panel on Biodiversity and Ecosystem Services (IPBES 2011). This, and related conventions and agreements, require Canada to develop detailed knowledge and policy to address issues specific to ecosystem services. Furthermore, there are plans for extensive development of remote northern areas throughout Canada (e.g. Quebec's Plan Nord, Ontario's Far North Act) for mineral, petroleum and hydroelectric resources. However we have limited knowledge about how these developments may impact these ecosystems, and how to manage these ecosystems to allow enhanced development. The Canadian Network on Aquatic Ecosystem Services (CNAES) will provide the collaboration from academia, industry and government to develop knowledge about, and provide training on, the relationship between these ecosystem services and stressors (e.g. development, climate change). Research will lead to the production of necessary tools to detect impacts on these systems, appropriate restoration targets, and the understanding essential for policy and management development. Canada's aquatic ecosystems are tremendously varied, so CNAES takes a watershed-based approach to address under studied systems (northern wetlands), knowledge gaps associated with forest-stream and lake ecosystems, and linkages across these systems. CNAES will determine how properties of ecosystem services from these systems vary due to spatial and temporal scale in order to provide results that have general applicability, rather than being size or site specific. We will develop understanding and management tools for government and industry through the study of predominant Canadian landscapes.



The Attawapiskat watershed is one of the principal study sites for the LU/CFEU scientists and students participating in the Canadian Network for Aquatic Ecosystem Services (CNAES).

*NSERC funding***:** Total of $4,416,625.00 over 5 years (2012-16)

Participating Universities: Toronto, Laurentian, UBC, UQAM, Western, Guelph, Trent, UNB, Waterloo, McGill, Nipissing

CNAES Graduate Students at LU (to date):
Project 1.3 Characterize the structure and function of aquatic ecosystems
1.3(a) RCA invertebrate surveys – M.Sc. Nicole Novodvorsky (PI John Bailey)
1.3(b) Zooplankton and Phytoplankton – M.Sc. Josef MacLeod (PI Bill Keller)

Project 1.5 Characterize the distribution of Hg and MeHg in surface water and freshwater biota
1.5(a.1) Headwater to Coast Hg Survey – Ph.D. Ashley Warnock (PI Tom Johnston/John Gunn)
1.5(a.2) Headwater Walleye Survey – M.Sc. Alexandra Sumner (PI John Gunn/Tom Johnston)
1.5(b) Stable isotopes and Hg – M.Sc. Tamsen Lahnalampi (PI Tom Johnston/John Gunn)
1.5(c) Anadromy and Hg – T.B.A. (PI Heidi Swanson, Waterloo)

Partnering agencies: Ontario Ministry of the Environment, Ontario Ministry of Natural Resources**,** Canadian Forest Service, Natural Resources Canada**,** Parks Canada**,** Fisheries and Oceans Canada, Central & Arctic Region**,** Le Ministère des Ressources naturelles et de la Faune du Québec

Partnering Industries and Foundations: Debeers Canada, Alberta Innovation Technology**,** Kongsberg Maritime**,** David Suzuki Foundation

TIMEX Project 2012

The year 2012 was the final manipulation year in the TIMEX (Thermocline Induced Mixing Experiment) project on Lac Croche, a 19ha lake trout lake at the University of Montreal field station in the Laurentians in Quebec. The experiment is designed to experimentally manipulate the thermocline depth in this three basin lake (10-13m max depth; one basin separated with a 6m x 200m curtain), using a solar powered lake mixer (Solar Bee ®). The project is a cooperative project involving Laurentian University (J. Gunn), Univ. of Québec at Montréal (B. Beisner, Y. Prairie), Univ. of Montréal (M. Amyot) and Env. Canada (J. Chételat). The project is designed to assess the potential effects of thermocline depth change (due to warming or changing wind speed) on basin heat content, CO_2 and CH_4 flux, Hg in biota and trophic structure. The project began with a pretreatment study in 2007.

Our preliminary findings after the three years of thermocline deepening (2008, 2009, 2010) are as follows: Deepening was associated with an increase in basin heat content, increase in phytoplankton and pelagic fish biomass, increases in CO_2 and CH_4 emissions, and was associated with a decrease in Hg concentration in zooplankton and benthic fish. However, there were also strong, interannual effects related to warming during the 3 years, with the 2010 early spring event producing large changes in stable isotope (C, N) values in invertebrates and small fish.

In 2011 we removed the Solar Bee from the west basin but left the curtain in place to create the 2nd reference year when a full range of chemical and biological studies occur (including the Nordic fish survey). In 2012 we conducted one more manipulation year. Several papers from the TIMEX group were presented at the 2012 CCFFR/SCL meeting in Moncton and the 2013 CCFFR/SCL meeting in Windsor. A number of student theses and publication will be completed in 2013.

Visiting Scholar in Residence Program

It was a great pleasure to have Dr. Bjorn Rosseland, Professor of Ecotoxicology, Norwegian University of Life Sciences, Aas, Norway accept our invitation to be the inaugural visiting scholar in residence at VLWLC. Dr. Rosseland is a research pioneer in the study of acid rain and other atmospheric contaminants on aquatic ecosystems, and he has participated in research programs throughout the world. In advance of his arrival at VLWLC Dr. Rosseland agreed to participate as an official thesis committee member for a student at the Lake Centre. Upon arrival his commitment then rapidly increased and ranged from giving various invited seminars and lectures, to community presentations (Rotary Club) to being the plenary speaker at Ontario Biology Day and the World Water Day event organized by the Nickel District Conservation Authority at the Lakes Centre. Dr. Rosseland contributed daily to the science discussions at the Lake Centre and his presence had a lasting effect on our students and researchers. Dr. Rosseland and his wife Ellen were our honoured guests from Feb. 15 to May 15, 2012. He has accepted an appointment as an adjunct professor in the Dept. of Biology at LU and he will be returning to Sudbury in August 2013 to participate in the TĀLER workshop and Laurentian's OUPFB course "Restoration Ecology of Damaged Watersheds: From Microbes to Fish". Dr. Rosseland will also be conducting an ecotoxicology study of the potential effects of Ca depletion on aurora trout in their native lakes in Lady Evelyn – Smoothwater Park.

Communicating Our Science

The Eagle Awards: Best Picture .... Most Original Picture .... Best Male Actor .... Best Female Actor.... Best Camera Work .... Best Editing .... Best Foreign Film .... Best Science Story ....

Those are not the usual credits earned by graduate students in a Biology class but they do symbolize the mix of excellent science and communication skills valued by the Co-op Unit. Graduate students from the Science Communication and Biology programs combined their talents in the Winter term to create the best yet video-stories about their BIOL research projects for the Eagle Awards Gala held in the Lake Centre on April 2nd. The quality was greatly enhanced by a donation of $10,000 from Vale Ltd. for cameras, microphones and high quality editing software. We began the experiment three years ago. The best of the results will soon be on our web site.

Science Communication students meet and work at the west end of the ground floor of the Lake Centre. David Pearson of the Co-op Unit is the Laurentian Co-Director of the program. Science North is a partner with the university in offering the only Graduate program in Science Communication in Canada.

Enrolment in the 10 month program was a respectable 10 students in 2012-2013 including an exchange student from France. Applications for 2013-14 have already reached that number.

They include several students with a Masters degree and one with a Ph.D. from as far away as India, New Zealand and Barbados.

After last year's donation of $250,000 from the TD Bank Group, the program's endowment fund for student bursaries and scholarships is now almost $1/2 million. Interest is used to support SCOM students.

Sixty-seven students have now graduated from the program since 2006 and have taken jobs in places such as the Council of Canadian Academies, the Perimeter Institute, Jacques Whitford Environmental Consultants, the Ministry of the Environment, the Canadian Foreign Service, Pollution Probe, World Wildlife Fund, the Toronto Regional Conservation Authority, the Royal Ontario Museum, Science North, the Sudbury Neutrino Observatory, several exhibit design companies, and as science and medical writers.

Students have been interns – a 2 month internship is required - during their program at the Natural History Museum in London, the Harvard Museum of Comparative Zoology, Let`s Talk Science, Canadian Geographic, the Canadian Polar Commission, the Great Lakes Forest Centre, CERN, the "Science Times" in Beijing, the "Discovery Channel" in Toronto, the "Experimentarium" in Copenhagen, as well as working with young people on science activities in Fort Hope, a remote First Nation community in Far North Ontario, and provincial government ministries, in science centres, and in exhibit design companies. It remains the only program of its kind in North America. For more information see www.sciencecommunication.ca

The first undergraduate science communication course at Laurentian, "Presenting and Communicating Research", will be offered in September as a required course in the Social Sciences Research Certificate.

The Far North of Ontario

Communicating about research that starts with field work in the Far North of Ontario is becoming increasingly important as communities raise concerns about the possible impacts of resource development in their traditional territory. Theme 1 of the NSERC Aquatic Ecosystem Services Network is focused on the Attawapiskat Watershed that forms a 750km long, 50,500km^2 corridor from James Bay to Attawapiskat Lake on the Canadian Shield. With the Co-op's partners all involved in Theme 1 projects, it should be possible to widen the engagement of the communities in the watershed by, for example, including young people in the schools in science activities related to the fieldwork, as well as engaging the community as a whole in a dialogue about the science in the watershed.

Communities Adapting to Changing Climate in Far North Ontario

Funding from NRCan in late 2011 enabled climate change vulnerability and risk assessments in four Far North Ontario communities: Fort Severn, Fort Hope (Eabametoong FN), Webequie, and Constance Lake. Collecting community observations or traditional knowledge of changes in

weather patterns has been completed. Dialogue about risks and adaptation options is the next step with those communities combining community observations with extrapolation of 1980 to 2010 trends and climate modelling to 2050. Community–based Climate Change Adaptation Plans will be drafted during the next year through dialogue with each of the four communities. This work is being done in collaboration with the Ontario Centre for Climate Impact and Adaptation Resources on campus.

Far North Youth in Science Opportunity Program (FNO-YSOP)

An initiative that aims to motivate interest in science among young people in Far North Ontario communities is at the youthful and informal end of the spectrum of science communication this year. The purpose is to play a role in opening a path for First Nation youth from remote communities toward high school and eventually post-secondary science credits. Fun, field activities related to our research will be at the core of what we are making available to communities. Two pilot projects will take place in the summer of 2013 which we see as demonstrating the potential of FNO-YSOP and becoming a foundation for expansion into more communities in 2014. We are co-operating with Science North which reaches many road accessible First Nation communities but rarely visits remote communities. Heidi Swanson's experience and work in Nunavut and the North West Territories will be invaluable as more activities are designed and planned. Chantal Sarrazin-Delay, working with Bill Keller, will be important in the launch of the program this summer and an excellent example of versatility in playing different roles from research to training and youth engagement in the Far North.

Academic Programs and Modular Courses

The teaching facilities at the VLWLC were well used in 2012 with both undergraduate (BIO 3377, 4386, 4756, 4907) and graduate (BIO 5056) courses in Biology as well as the following Science Communication courses offered here:
SCOM 5016- Audiences and Issues
SCOM 5036 – Theory and Principles of Science Communication
SCOM 5056 – Design Theory in Science Communication
SCOM 5066 - Science Communication Practice
SCOM 5096 – Communicating Science through Information Technology
SCOM 5106 – Communicating Science through Mass Media

The Ontario University Program in Field Biology (OUPFB) as well as the PhD in Boreal Ecology also call the Lake Centre home. A unique course involving First Nation engagement was held in 2012/2013 that made extensive use of the VLWLC video conferencing facility. This course (BIO 4907 – Fisheries Science for Stressed Ecosystems) was created in consultation with Matawa Tribal Council staff and was designed to address the science needs of the Far North communities to answer fisheries questions related to industrial development and climate change in their traditional areas. Each student took a questions posed by community members and addressed it during a March 21, 2013 video conference presentation to First Nation

Community representatives gathered in Thunder Bay. The student presentations were much appreciated.

4th year Biology Students in BIO 4907 present to First Nation Community Representatives.

Next year we will be working in partnership with the Goodman School of Mines to develop a short course for students and mining professionals in the area of bioremediation.

Watershed Talks and Biology Seminar Series

Seminars during the 2012/2013 season included:

- Mairi Best, University of Victoria, Victoria, BC, "How real time interactive remote sensors are changing how we do marine science"
- Peter Whittington, University of Waterloo, The hydrology of disturbed peatlands
- Gustavo Ybazeta, University of Toronto, The fish, the tree, and the clock: Applications of phylogenetics and biogeography
- Kiyoshi Sasaki, Laurentian University, Endangered traditional beliefs in Japan: Human-caused rapid evolution in snakes and influences on snake conservation
- Brendan McConkey, University of Waterloo, Evolution of protein fold and function: Analysis of functional and structural divergence in protein families
- Bjorn Rosseland, Life Science University, Oslo, Norway, Assessing food web structure using stable isotopes in African rift valley lakes
- Franco Mariotti, Science North, Sudbury, The wilds of New Zealand: Landscapes, wildlife, and conservation
- Whitfield Gibbons, Savannah River Ecology Lab, University of Georgia,
- Heidi Swanson, University of Alberta, Mercury rising? Interactions of life history, trophic ecology, and mercury bioaccumulation in coastal Arctic lakes
- Nikhil Lobo, University of Western Ontario, London, ON
- Andrew Tanentzap, York University, Ecological ghosts and the resurrection of extinct megafauna
- Alex Smith, University of Guelph, Diversity, crypsis and phylogenetic community structure of ants along a neotropical elevational gradient
- Tom Johnston, VLWLC/OMNR, A brief history of mercury

- John Ratcliffe, Sound Communication Group, Institute of Biology, University of Southern Denmark, Superfast and ultrasonic: Design constraints on signal production in laryngeal echolocating bats
- Norman Yan, York University, What's an applied ecologist to do in an increasingly complicated world?
- Jeff Bowman, Trent University, Wild Turkeys
- Nadia Mykytczuk, VLWLC, Laurentian University, Life at 79N: Microbial communities in the Canadian high arctic

Conference Organizing, Program Coordination and Editorial Activities

Arnott, S. Associate Editor of the Journal of Applied Ecology

Arnott, S. Served as Chair of ASLO Meetings Committee – responsible for organizing student presentation judging

Beckett, P. Served on the Organizing Committee for the Ontario CLRA/OMA Annual Reclamation Symposium

Beckett, P. Served on the Steering Committee for the CLRA/Mirarco Lunch-time Reclamation Discussion Group

Belzile, N. Served as Associate Editor for the Journal of Geochemical Exploration

Belzile, N. Served on the Editorial Board of ISRN Environmental Chemistry

Belzile, N. Served on the Editorial Board of Green and Sustainable Chemistry

Gunn, J. Served as Programme Co-Chair for the Organizing of the 2013 SCL/CCFFR Conference held in Windsor, ON. 3-5 January 2013

Gunn, J. Served as Coordinator for the Boreal Ecology PhD Program.

Keller, W. Guest Editor for a special issue of Arctic, Antarctic and Alpine Research, on the Hudson and James Bay Drainage.

Kreutzweiser, D. Served as Associate Editor, Canadian Journal of Forest Research

Kreutzweiser, D. Organizing Committee. Biophysical Indicators of Reclamation Success, Edmonton, Alberta, March 20-22, 2012.

Ramcharan, C. Served as Director of Laurentian's Environmental Science BSc program.

Ramcharan, C. Served as Associate Editor of the Canadian Journal of Fisheries and Aquatic Sciences

Yan, N. Served as Chair, Multiple stressors theme session, 2012 SCL/CCFFR Conference

Partners and Collaborators

Industry

Vale Ltd. Xstrata Nickel

Government Funding Partners

City of Greater Sudbury
NSERC
CFI/OIT
FedNor/MNDM
Environment Canada
Industry Canada
Fisheries and Oceans Canada
Can. Wildlife Service

Scientist Collaborators

Laurentian University
Queen's University
University of Lethbridge
Centre for Ecology and Hydrology, UK
University of New Brunswick
Université du Québec à Montréal
University of Winnipeg
Univ. of Western Ont.
Cambrian College
University of Guelph
University of Waterloo
Wilfrid Laurier University
University of Turku, FI
University of Alberta
Univ. of British Columbia
Univ. of Windsor
York University
University of Toronto
Indiana University
University of Ottawa
Univ. of Montreal
Trent University
Univ. of Canberra
McGill University

Others

Canada-Ontario Invasive Species Centre
Forest Ecosystem Science Cooperative
Friends of Killarney Park
Ontario Power Generation
MIRARCO

Publications

Co-op Unit Members authored or co-authored numerous publications:

Audet, C., S. MacPhee, and W. Keller. 201_. Colonization of constructed ponds by crustacean zooplankton: local and regional influences. J. Limnol. In press.

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Conference Presentations

Altshuler, I. and N.D. Yan. Gene Expression under multiple stressors in Daphnia pulex. 2012 Early Career Scientists Symposium, University of Michigan, Ann Arbor, MI. March 31, 2012

Auld, R.R., N.C.S. Mykytczuk, L.G. Leduc and T.J.S. Merritt. Characterizing the microbial acid mine drainage community using culturing and deep sequencing techniques. Evolution Ottawa, 1st Joint congress on Evolutionary Biology, Ottawa, Canada. 6-10 July, 2012

Auld, R.R., N.C.S. Mykytczuk, L.G. Leduc and T.J.S. Merritt. Variation of microbe communities living in acid mine drainage, between winter and summer months. Laurentian University Graduate Student Symposium, Sudbury, Canada. February, 2012

Bennett, P., B.T. Stackhouse, G. Lamarche-Gagnon, N.C.S. Mykytczuk, L.G. Whyte and T.C. Onstott. Methane and Carbon Dioxide Gas Dynamics in High-Arctic Permafrost Polygons. 2012 Fall Meeting, AGU, San Francisco, California. 3-7 December, 2012

Bradley, J., S. Watson, B. Keller and C. Ramcharan. Relative strengths of taxonomic versus functional groups in explaining variation in phytoplankton communities along a trophic gradient. Canadian Association of Water Quality Annual Conference. Burlington, ON. Feb 2012,

Brown, A. and N.D. Yan. Interacting effects of multiple stressors on ecotoxicological thresholds for Ca and Cl. Canadian Water Network Fall 2012 Meeting, Nipissing University, Bracebridge, ON. 22 October, 2012

Celis-Salgado, M. and N.D. Yan. Recent trends in toxicity to daphniids in Sudbury's urban lakes. Vale Base Metals sustainability Research Day, Vale Inc, Toronto, ON. 7 June, 2012

Celis-Salgado, M. and N.D. Yan. Daphniid recovery in Sudbury lakes: are we there yet. 3rd annual TALER workshop, Terrestrial Aquatic Linkages for ecosystem recovery. Vale Living with Lakes Centre, Sudbury, ON. 13 April, 2012

Chan, K. and N.D. Yan. Factors influencing Ni toxicity in Hyalella azteca. 3rd annual TALER workshop, Terrestrial Aquatic Linkages for ecosystem recovery. Vale Living with Lakes Centre, Sudbury, ON. 13 April, 2012

Cott, P.A., A.D. Hawkins, D. Zeddies, B. Martin, T.A. Johnston, J.D. Reist, J.M. Gunn and D.M. Higgs. Sound Production by *Lota lota*. Presentation. NWT Environmental Monitoring Annual Results Workshop Yellowknife, NWT. 21-23 January 2013.

Cott, P.A., A.M. Muir, C.C. Krueger, T.A. Johnston, M.M. Guzzo, P.J. Blanchfield and J.M. Gunn. Buoyancy control mechanisms of fish in deepwater Nearctic lakes. Society of Canadian Limnologists / Canadian Conference for Fisheries Research. Windsor, ON. 7-9 January 2013. Invited

Cott, P.A., T.A. Johnston and J.M. Gunn. Sexual dimorphism in burbot. 142nd Annual Meeting of the American Fisheries Society, St. Paul, MN, USA, 19-23 August 2012.

Cott, P.A., D.M. Higgs, D. Zeddies, T.A. Johnston, A.D. Hawkins, B. Martin and J.M. Gunn. Song of the burbot: sound production and reception by *Lota lota*. 10th International Congress on the Biology of Fish, Madison, WI, USA, 15-19 July 2012.

Cott, P.A., T.A. Johnston and J.M. Gunn. Burbot reproduction across a latitudinal gradient. 10th International Congress on the Biology of Fish, Madison, WI, USA, 15-19 July 2012.

Gibson, C. and N.D. Yan. Protective effects of DOM on Daphnia. 3rd annual TALER workshop, Terrestrial Aquatic Linkages for ecosystem recovery. Vale Living with Lakes Centre, Sudbury, ON. 13 April, 2012

Gibson, C. and N.D. Yan. An inquiry on protective effects of natural organic matter to an Daphnia hybrid exposed to water-borne nickel. Society of Canadian Limnologists and Canadian Conference for Fisheries Research, Moncton, NB. 5-7 January, 2012

Gillespie, M. and J. Gunn. Effects of Experimental Thermocline Deepening on Fish Community Dynamics and Trophic Ecology in Lac Croche, Québec. Society of Canadian Limnologists / Canadian Conference for Fisheries Research, Moncton NB. 5-7 January 2012.

Goral, M. and N.D. Yan. Can the prediction of seasonal and long-term zooplankton abundance in Harp Lake be improved using the wind field at daily time steps. IAGLR conference, Cornwall, ON. May 2012

Goral, M. and N.D. Yan. Can the prediction of long-term zooplankton abundance be improved using the wind field over Harp Lake. Society of Canadian Limnologists and Canadian Conference for Fisheries Research, Moncton, NB. 5-7 January, 2012

Grigull, J., S. Gholami and N.D. Yan. Long term changes in lake nutrient sotichiometery: effects on plankton productivity and species composition. Canadian Water Network Fall 2012 Meeting, Nipissing University, Bracebridge, ON. 22 October, 2012

Gunn, J.M. Impacts of Roads on Fish and Wildlife. OMNR Timmins, ON February, 2012

Gunn, J.M. Can the environment save the economy? Oral presentation at Science and Politics Between the Sheets, Laurentian University, Sudbury, ON, Canada, 21 March 2012

Gunn, J.M., B. Keller, J. Bailey and N. Yan. Chemical and biological recovery of aquatic systems in Sudbury, ON, Canada. UN-ECE ICP Waters, 28th Task Force Meeting, Italy. 8-10 October, 2012

Hultman, M.T., I. Allan, Y. Song, K. Schimer, B.O. Rosseland and K.E. Tollefsen. Characterising the toxicity and metabolic clearance of benzo(a)pyrene using non-animal (alternative) testing. SETAC Europe 22nd Annual Meeting / 6th SETAC World Congress, Berlin, Germany. 20-24 May, 2012

Johnston, T.A., P.A. Cott, H.K. Swanson, A.D. Stasko, R.W.-K. Tang and J.M. Gunn. Ontogenetic patterns in isotopic composition of northern fishes. Oral presentation at the 142nd Annual Meeting of the American Fisheries Society, St. Paul, MN, USA, 19-23 August 2012.

Johnston, T.A. Egg quality variation in an iteroparous fish in the wild and in captivity. Oral presentation at the First Joint Congress on Evolutionary Biology and Annual Meeting of the Canadian Society of Ecology and Evolution, Ottawa, ON, Canada, 6-10 July 2012.

Johnston, T.A. Can sustainable resource management be reconciled with economic growth? Oral presentation at Science and Politics Between the Sheets, Laurentian University, Sudbury, ON, Canada, 21 March 2012.

Jokela, A., S.E. Arnott, and B. Beisner. Abiotic and biotic factors mediate the impact of an introduced predator (Bythotrephes longimanus). Joint Congress on Evolutionary Biology and Annual Meeting of the Canadian Society of Ecology and Evolution, Ottawa, ON, Canada, 6-10 July 2012.

Jokela, A., S.E. Arnott, and B. Beisner. The influence of abiotic and biotic factors on the distribution and impact of Bythotrephes longimanus. CAISN AGM and Conference, Montréal, QC, Canada, 2012

Jokela, A., S.E. Arnott, et B. Beisner. L'influence de la lumière sur l'impact de la prédation par une espèce exotique envahissante (Bythotrephes longimanus). Symposium du GRIL (Groupe de recherche interuniversitaire en limnologie et en environnement aquatique), St-Ferdinand, QC, Canada, 2012

Jokela, A., S.E. Arnott, and B. Beisner. The influence of light on the foraging impact of Bythotrephes longimanus. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Kielstra, B., S.E. Arnott, and J.M. Gunn. The contributing role of landscape characteristics on colonization and distribution of a freshwater amphipod (Hyallela azteca) in Sudbury, Ontario. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Kim, N. and N.D. Yan. Impacts of prey quality on the invasive aquatic zooplanktivore Bythotrephes. Society of Canadian Limnologists and Canadian Conference for Fisheries Research, Moncton, NB. 5-7 January, 2012

Kreutzweiser, D. Ecological impacts of invasive forest insects and their control products: which are worse? Departmental Seminar, Department of Biology, Wilfrid Laurier University, Waterloo, Ontario, 23 January 2013.

Kreutzweiser, D., S. Capell, D. Nisbet, P. Sibley and T. Scarr. Some ecological implications of emerald ash borer induced loss of ash in riparian forests. National Forest Pest Management Forum, Ottawa, Ontario, 4-6 December 2012.

Kreutzweiser, D., I. Aubin, K. Ryall, S. Holmes, L. Venier, P. Sibley and T. Scarr. Ecological impacts of emerald ash borer on forest and riparian (shoreline) ecosystems. 36th Annual Forest Health Review, Orillia, Ontario, 25 October 2012. Invited.

Kreutzweiser, D., A bio-indicator of forest stream health for effectiveness monitoring of forest management guidelines; final report. Forest Ecosystem Science Cooperative Annual Meeting, Thunder Bay, Ontario, 17-19 October 2012. Invited.

Kreutzweiser, D., S. Capell, D. Nisbet, P. Sibley and T. Scarr. Impacts of emerald ash borer on riparian forests. North Central Forest Pest Workshop, Sault Ste Marie, Ontario, 24-27 September 2012.

Kreutzweiser, D., S. Capell, D. Nisbet, P. Sibley and T. Scarr. Impacts of an invasive insect pest, emerald ash borer, on riparian forest structure and function. American Water Resources Association Specialty Conference on Riparian Ecosystems, Denver, Colorado, 27-29 June 2012.

Kreutzweiser, D., P. Sibley, B. Naylor, R. Mackereth and S. Holmes. Re-visiting the use of riparian buffers in forestry: Implications of natural disturbance emulation for aquatic ecosystems. Departmental Webinar, Natural Resources Canada, Canadian Forest Service, Sault Ste Marie, Ontario, 17 January 2012.

Lau, C.Y.M., B.T. Stackhouse, K. Chourey, R.L. Hettich, T.A. Vishnivetskaya, S.M. Pfiffner, A.C. Layton, N.C.S. Mykytczuk, L.G. Whyte and T.C. Onstott. Identifying active methane-oxidizers in thawed Arctic permafrost by proteomics. 2012 Fall Meeting, AGU, San Francisco, California. 3-7 December, 2012 Poster

Lau, M.C.Y., B. Stackhouse, N.C.S. Mykytczuk, L. Whyte and T.C. Onstott. Impact of permafrost thawing on global climate: a battle among microorganisms. International Polar Year Conference, Montreal, Canada. 23-27 April, 2012.

Lay, C.Y., N.C.S. Mykytczuk, É. Yergeau, G. Lamarche-Gagnon, C. Greer and L.G. Whyte. A metagenomic study and active 16S rRNA pyrosequencing analysis of a High Arctic subzero hypersaline spring. 14th International Symposium on Microbial Ecology (ISME14), Copenhagen, Denmark. 19-24 August, 2012. Poster

Lay, C-Y., N.C.S. Mykytczuk, É. Yergeau, G. Lamarche-Gagnon, C.W. Greer and L.G. Whyte A metagenomic study combining active microbial profiling and pyrosequencing of the Lost Hammer High Arctic Saline Spring. International Polar Year Conference, Montreal, Canada. 23-27 April, 2012. Poster

Lemmen, K.D., and S.E. Arnott Investigating Local Adaptation in Goose Impacted Subarctic Ponds using Resurrection Ecology. Joint Congress on Evolutionary Biology and Annual Meeting of the Canadian Society of Ecology and Evolution, Ottawa, ON, Canada, 6-10 July 2012. Poster

Lemmen, K.D., and S.E. Arnott. Changes in the Resting Egg Banks of Goose-Impacted Subarctic Ponds. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Mykytczuk, N.C.S., S.J. Foote, C.R. Omelon, G. Southam, J. Lawrence and L.G. Whyte. Subzero growth and adaptation; insights from *Planococcus halocryophilus* sp. nov. Or1 in Canadian high Arctic permafrost. 14th International Symposium on Microbial Ecology, Copenhagen, Denmark. 19-24 August, 2012

Mykytczuk, N.C.S., C. Sadlier, E.J. Szkokan-Emilson, D. Kreutzweiser and J. Gunn. The role of microbes in TĀLER: Terrestrial Aquatic Linkages for Ecosystem Recovery. 14th International Symposium on Microbial Ecology (ISME14), Copenhagen, Denmark. 19-24 August, 2012. Poster

Mykytczuk, N.C.S., S. Twine, B. Wing, S. Foote, K. Fulton, C.W. Greer and L.G. Whyte. Analog studies of brine cryoenvironments in the Canadian high Arctic. 22nd VM Goldschmidt Conference, Montreal, Canada. 24-29 June, 2012. Invited

Pellerin, A., N.C.S. Mykytczuk, R. Austin, G.M. Zane, L. Whyte, J. Wall and B. Wing. Evolutionary response of S isotope fractionation by sulfate reducing microorganisms. 22nd VM Goldschmidt Conference, Montreal, Canada. 24-29 June, 2012.

Quinn, L. and N.D. Yan. Role of warming water temperatures on fatty acids of key algal species found in southern Canadian Shield lakes. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Ramcharan, C.W. 2013. The ecological and sociological factors in deciding endpoints for ecosystem recovery. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Toronto, ON. January 2013

Ramcharan, C.W. 2012. Factors that affect bluegreen algae blooms in northern lakes. First Nations Water Quality Conference (Sponsored by Health Canada). Sault Ste. Marie, Ontario. November 2012

Rosseland, B.O. and R. Borgstrøm. Stable isotopes of N and C are needed to understand mercury levels in different fish communities. UN-ECE ICP Waters, 28th Task Force Meeting, Italy. 8-10 October, 2012

Song, Y., B. Salbu, L.S. Heier, H-C. Teien, O.C. Lind, D. Oughton, K. Petersen, B.O. Rosseland, L. Skipperud and K-E. Tollefsen. Hepatic transcriptomic profiling identifies concentration-dependent mechanisms of depleted uranium toxicity in Atlantic salmon (Salmo salar). SETAC Europe 22nd Annual Meeting / 6th SETAC World Congress, Berlin, Germany. 20-24 May, 2012

Stackhouse, B.T , N.C.S. Mykytczuk, G. Lamarche-Gagnon, A.C. Layton, S.M. Pfiffner, T.A. Vishnivetskaya, N. Saad, L.G. Whyte and T.C. Onstott. Long Term Thawing Experiment on High Arctic Polygonal Tundra: Spring Thaw Gas Flux Dynamics and Soil Properties. 2012 Fall Meeting, AGU, San Francisco, California. 3-7 December, 2012 Poster

Stackhouse, B., N. Mykytczuk, G. Lamarche-Gagnon, L. Whyte and T.C. Onstott. Soil and Water Chemistry of Polygonal Terrain in the High Canadian Arctic. International Polar Year Conference, Montreal, Canada. 23-27 April, 2012. Poster

Stasko, A.D., T.A. Johnston and J.M. Gunn. Quantifying isotopic niche overlap: The role of water clarity in resource partitioning between walleye and smallmouth bass in Boreal Shield lakes. Oral presentation at the 142nd Annual Meeting of the American Fisheries Society, St. Paul, MN, USA, 19-23 August 2012. *Winner of 1st Runner-up, Best Student Presentation Award, AFS Annual Meeting*

Stasko, A.D., T.A. Johnston and J.M. Gunn. Quantifying isotopic niche overlap: The effect of water clarity on dietary resource partitioning between two piscivores in Boreal lakes. Oral presentation at the First Joint Congress on Evolutionary Biology and Annual Meeting of the Canadian Society of Ecology and Evolution, Ottawa, ON, Canada, 6-10 July 2012.

Stasko, A.D., T.A. Johnston and J.M. Gunn. Quantifying niche overlap in isotopic space: the effect of water clarity on resource partitioning between native walleye and invasive smallmouth bass. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Symons, C.C., and S.E. Arnott. Timing is everything: priority effects alter post-disturbance invasibility. Joint Congress on Evolutionary Biology and Annual Meeting of the Canadian Society of Ecology and Evolution, Ottawa, ON, Canada, 6-10 July 2012.

Symons, C.C., J.N. Sweetman, M. Pedruski, and S.E. Arnott. Evaluating the impacts of recent environmental change on freshwater ecosystems in Wapusk National Park. International Polar Year, Montreal, 2012.

Symons, C.C., S.E. Arnott, J.N. Sweetman, K.D. Lemmen, and M. Pedruski. Community response to environmental change in Wapusk National Park lakes and ponds. Queen's University Arctic Day, Kingston, 2012.

Symons, C.C., S.E. Arnott, and J.N. Sweetman. The adaptability of zooplankton communities undergoing environmental change. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Szkokan-Emilson, E.J., Gunn, J., and Watmough, S. Drought-induced flux of metals from peatlands in watersheds vulnerable to extreme events. Biogeomon 2012, Maine, USA. 15-20 July 2012.

Szkokan-Emilson, E., S.Watmough and J.M. Gunn. Drought-induced fluxes of metals and nutreints to lakes from peatlands in catchments vulnerable to extreme events. Society of Canadian Limnologists / Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Tang, R.W.-K., A.D. Stasko, T.A. Johnston and J.M. Gunn. The relative influence of food web position and growth rate on interspecific variation in mercury concentrations of boreal piscivores. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Turner, K., S.E. Arnott, B. Schamp. Dispersal increases negative co-occurrence patterns in an experimental zooplankton community. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Watkins, K., M. Gillespie and J. Gunn. Response of nearshore benthic invertebrate communities to artificial deepening of the thermocline. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012. Poster.

Yan, N.D. What's an applied ecologist to do in an increasingly complicated work. 2012 Vale Watershed Lecture, Vale Living with Lakes Centre, Laurentian University, Sudbury Ontario, 23 November, 2012.

Yan, N.D. *Daphnia's* loss is *Holopedium's* gain: Effects of logging, climate change, acid rain, and invading *Bythotrephes* on composition of large Cladocera in Canadian Shield lakes. Dorset Environmental Science Centre, Dorset, ON, 18 June, 2012.

Yan, N.D. Field evidence for recovery in water quality and biota in urban lakes of the Sudbury region. Vale Base Metals sustainability Research Day. Vale Inc, Toronto, ON, 7 June, 2012.

Yan, N.D. Preparing manuscripts for publication in the environmental sciences. A 3 hour workshop, 3rd annual TALER workshop, Terrestrial Aquatic Linkages for ecosystem recovery, Vale Living with Lakes Centre, Sudbury, Ontario. 13 April, 2012. Invited.

Yan, N.D. The Spiny Water Flea: The Worst Threat to the Biodiversity of Our Lakes Since Acid Rain. Biology Colloquium, York University, 19 January 2012.

Yuille, M.J., Johnson, T.B., and S.E. Arnott. Energetic effects of Hemimysis anomala on yellow perch (Perca flavescens) in Lake Ontario. 55th Ann. Conf. on Great Lakes Research, Cornwall, ON, May 13-17, 2012.

Yuille, M.J., Johnson, T.B., and S.E. Arnott. Energetic effects of Hemimysis anomala on yellow perch (Perca flavescens) in Lake Ontario. Society of Canadian Limnologists /Canadian Conference for Fisheries Research, Moncton, NB, Canada, 5-7 January 2012.

Research Grants

Arnott, S

- NSERC Strategic Network NSERC Network on Aquatic Invasive Species (29 PIs, Lead: Hugh MacIsaac)
- Polar Continental Shelf Project (helicopter) Assessing the role of landscape characteristics in influencing community response to environmental change
- NSERC Discovery, The influence of dispersal on ecosystem response to environmental change, 2010-2014
- Great Lakes Fisheries Commission, Toxicokinetic and food web models to quantify the effects of Hemimysis anomola on Great Lakes food webs. (with Tim Johnson, MNR and Linda Campbell) 2010-2012
- Chancellor's Research Award, The interaction between dispersal and local conditions in biological recovery of zooplankton communities, 2008-2012
- NSERC Strategic Network, NSERC Network on Aquatic Invasive Species (29 PIs, Lead: Hugh MacIsaac) 2011-2015
- Polar Continental Shelf Project, Assessing the role of landscape characteristics in influencing community response to environmental change, 2012
- NSERC RTI, Remote, real-time climate change network (PI Steve Lougheed), 2012

Basiliko, N

- CFI Leaders Opportunity Fund grant to equip the environmental microbiology lab at the VLWLC

Belzile, N

- VALE Canada Investigation on nanoparticles to remove metals from mine waters (with Chen and Mercier)
- CORFO Chile Cleaning of mine waters using recycled waste materials and nanoparticles (with Pizarro, Chen and Mercier)
- CEMI Effect of microwave on mine tailings

Gunn, J

- NSERC Canadian Network for Aquatic Ecosystem Services
- NSERC Discovery, Terrestrial/aquatic linkages in the recovery of disturbed ecosystems
- NSERC Industrial CRD with Vale Ltd. and Xstrata Ltd. Terrestrial Aquatic Linkages for Ecosystem Recovery
- OMOE, Mercury Contamination of Fish in Ontario's Boreal Shield (with T. Johnston)
- OMOE, Mercury Bioavailability after Small Reservoir Development
- City of Greater Sudbury, Urban Lakes Restoration
- NSERC CRC, Stressed Aquatic Systems
- Far North Information and Knowledge Management (FNIKM), OMNR Mercury in Far North Fish Populations (with Johnston/Keller)

- Canadian Water Network, monitoring cumulative effects in the Muskoka River Watershed (with Bailey/ Jones)

Johnston, T

- NSERC Canadian Network for Aquatic Ecosystem Services
- Aquatic Research and Development Section ,Ontario Ministry of Natural Resources, Northern fisheries research
- NSERC Discovery Grants Program, Reproductive ecology of boreal fishes
- Far North Information and Knowledge Management Program, Ontario Ministry of Natural Resources, Mercury in fish communities of Ontario's Far North. (with Gunn/Keller)
- Invasive Species Partnership Fund, Ontario Ministry of Natural Resources, Changes in the Lake Nipissing fish community following the invasion of the spiny water flea, *Bythotrephes longimanus* (Johnston et al.)
- Newmont Mining Inc. Ecology, Life history and subsistence importance of anadromous lake trout (*Salvelinus namaycush*) in the Canadian Arctic (Swanson et al.)
- OMOE, Mercury Contamination of Fish in Ontario's Boreal Shield (with J. Gunn)

Keller, B

- NSERC Canadian Network for Aquatic Ecosystem Services
- Wildlife Conservation Society, The W. Garfield Weston Foundation
- Ontario Ministry of the Environment, Climate Change and Multiple Stressor Research Support
- FNIKM, OMNR Mercury in Far North Fish Populations (with Johnston/Gunn)

Kreutzweiser, D

- NSERC SNG - Canadian Network for Aquatic Ecosystem Services, Theme II Healthy Forests and Health Aquatic Ecosystems (partner)
- Forest Ecosystem Science Cooperative and the Sustainable Forestry Initiative Conservation and Community Partnership Grant – Landscape scale effects of disturbance on aquatic systems
- Invasive Species Centre Partnership Fund, Ecological impacts of forest invasive insect pests on Ontario's landscape
- Forest Ecosystem Science Cooperative, Bioindicators of forest stream health.

Yan, N

- NSERC Discovery Grant: Transforming daphniid ecotoxicology for softwater lakes in a warming, multi-stressor world (2012-2017)
- NSERC CREATE Training Program in Aquatic Ecosystem Health: integrative approaches for studying multiple stressors (ERAMUS) (Yan is one of 11 co-PI's in this CREATE grant) (2011-2016)
- Canadian Water Network Muskoka River Watershed Consortium Grant (2012-2014) Yan is one of 8 co-PIs)

- NSERC Network on Aquatic Invasive Species (Yan is one of 26 co-PI's in this network grant (2011-2016)

Theses Completed

Graduate

Cott, Pete, PhD in Boreal Ecology. Life history and reproductive ecology of a mid-winter spawner: the Burbot (Lota lota). Laurentian University, Sudbury, ON (Gunn/Johnston)

Kim, N. 2012. PhD. Factors affecting the life history and establishment success of the invasive spiny water flea, *Bythotrephes longimanus*, in Canadian Shield lakes. York University, Toronto, ON (Yan)

Palmer, M. 2012. PhD. Aquatic responses to multiple environmental stressors. Awarded with Distinction, York University, Toronto, ON (Yan)

Truong, Yen Thi Hoang, Ph.D. in Boreal Ecology. Effects of selenium on mercury methylation by the sulfate reducing bacterium (Desulfovibrio desulfuricans). Laurentian University, Sudbury, ON (Belzile)

Bresnehan, A. MSc. Fleeing predation: the effect of copper exposure on inducible antipredator defenses in Daphnia pulicaria clones from a historically metal-contaminated lake. Queen's University, Kingston, ON. (Arnott)

Goral, M. MSc. Does consideration of the wind field improve predictions of zooplankton abundance in Harp Lake, Ontario? York University, Toronto, ON (Yan)

Stasko, Ashley, MSc. The role of water clarity in structuring niche dimensions and overlap between smallmouth bass and walleye. Laurentian University, Sudbury, ON (Gunn/Johnston)

Symons, Celia. MSc. Windows of opportunity: The timing of dispersal events influences zooplankton community resonse to environmental change in Subarctic ponds. Queen's University, Kingston, ON. (Arnott)

Yuille, Michael. J. MSc. Ecological effects of Hemimysis anomala on the nearshore fish community of Lake Ontario. Queen's University, Kingston, ON. (Arnott)

Undergraduate

Audet, Chantal, BSc Honours. Colonization of Constructed Ponds by Crustacean Zooplankton: Local and Regional Influences. Laurentian University, Sudbury, ON (Keller)

Béchard, Yvette, BSc Honours. The relationship between otolith growth and somatic growth in adult fishes. Laurentian University, Sudbury, ON (Johnston)

Bernstein, R. B.Sc. Honours. The effect of decreasing Ca and P concentrations and increasing DOC concentrations on Holopedium and Daphnia in Canadian Shield lakes. York University, Toronto, ON (Yan)

Goto, Sara, BSc Honours.The effect of predator type on the vertical distribution of Daphnia spp. Queen's University, Kingston, ON (Arnott)

Hamilton, Graeme, and Nugent, Brent, BSc Honours. Food web positions and trophic niche dimensions of lake whitefish (*Coregonus clupeaformis*) and white sucker (*Catostomus commersoni*) in boreal lakes inferred from stable isotope analyses. Laurentian University, Sudbury, ON (Johnston)

Pecorski, Steve, BSc Honours. Effects of piscivore introduction on lakes recovering from acidification and metal contamination in Sudbury, Canada. Queen's University, Kingston, ON (Arnott)

Sadlier, Caroline, BSc Honours. The relationship between lake and watershed characteristics and variation in δ15N and δ13C values at the base of the food webs in Boreal Shield lakes. Laurentian University, Sudbury, ON. 2012 (Gunn).

Sauder, Janel, BSc Honours. The Effects of Land Cover on Daisy Lake's Water Quality. Laurentian University, Sudbury, ON. 2012 (Gunn)

Steele, Sam, BSc Honours. Assessing the chemical and biological recovery of lakes in Killarney Park from regional acid deposition from 1972 to 2011: the recovery of acid-damaged crustacean zooplankton communities. Queen's University, Kingston, ON (Arnott)

HQP Supervised

Bernstein, Rebecca, BSc Honours. In progress (Yan)
Despande, Prachi, BSc Honours. In progress (Yan)
Elsasser, McKenna, BSc Honours. In progress (Johnston)
Furlanetto, Katrina, BSc Honours. In progress (Arnott)
King, Meagan, BSc Honours. In progress (Arnott)
McDonald, Kent, BSc Honours. In progress (Arnott)

Sardelis, Stephanie, BSc Honours. In progress (Arnott)
Sprott, Adam, BSc Honours. In progress (Arnott)
Watkins, Karrah, BSc Honours. In progress (Gunn)
Yu, Xiao, B.Sc. Honours Biochemistry. In progress (Belzile)

Alzharani, Ali, MSc Candidate, Chemical Sciences, Laurentian (Belzile)
Brekke, Lorraine (Sawdon), MSc Candidate, Laurentian (Gunn/Johnston)
Brown, Arran, MSc Candidate, York University (Yan)
Geiger, Christine (Gibson), MSc Candidate, York University (Yan)
Gillespie, Michelle, MSc Candidate, Laurentian (Gunn)
Goral, Melanie, MSc Candidate, York University (Yan)
Kielstra, Brian, MSc Candidate, Queen's University (Arnott/Gunn)
Lahnalampi, Tamsen, MSc Candidate, Laurentian (Johnston/Gunn)
Lemmen, Kim, MSc Candidate, Queen's University (Arnott)
MacLeod, Josef, MSc Candidate, Laurentian (Gunn/Keller)
Nisbett, David, MSc Candidate, University of Guelph (Sibley/Kreutzweiser)
Ross, Alex, MSc Candidate, Queen's University (Arnott)
Sadlier, Caroline, MSc. Honours. In progress (Mykytczuk/Gunn/Kreutzweiser)
Sharko, Tanya, MSc Candidate, Royal Roads University (Kreutzweiser)
Sinclair, James, MSc Candidate, Queen's University (Arnott)
Stasko, Ashley, MSc Candidate, Laurentian University (Gunn/Johnston)
Wallace, Kylie, MSc Candidate, Laurentian University (Gunn/Kreutzweiser)
Azan, Shakira, PhD student, Queen's University (co-advised with N. Yan)
Cott, Pete, PhD Candidate, Laurentian (Gunn/Johnston)
Hasnain, Sarah, PhD student, Queen's University (co-advised with T. Day)
Jokela, Anneli, PhD Candidate, Queen's University (Arnott/Beisner)
Jones, Chris, PhD Candidate, Laurentin (Bailey/Gunn)
Kim, Natalie, PhD Candidate, York University (Yan)
Palmer, Michelle, PhD Candidate, York University (Yan)
Szkokan-Emilson, Erik, PhD Candidate, Laurentian (Gunn/Watmough)
Truong, Yen Thi Hoang, PhD Candidate, Boreal Ecology, Laurentian (Belzile)

Celis-Salgado, Martha, PDF, York University (Yan)
Kelly, Noreen, PDF, York University (Yan)
Smith, Andrea, PDF, York University (Yan)
Tanentzap, Andrew, Banting PDF, York University (Yan)

Radtke, Leanne, Research technician, York University (Yan)
Ryckman, Courtney, Research technician, York University (Yan)
Lucy-Evans, Vincent, Research technician, York University (Yan)

Staff

Laurentian University Science Building
Alarie, Yves – Biosystematics
Belzile, Nelson - Environmental Chemistry
Dirszowsky, Randy – Geomorphology/Paleolimnology
Ramcharan, Charles - Aquatic Ecologist

Canadian Forest Services, Sault Ste. Marie
Kreutzweiser, David – Land Water Linkages

Norwegian University of Life Sciences
Rosseland, Bjorn

Queens University
Arnott, Shelley

University of Waterloo
Swanson, Heidi

York University
Yan, Norman

Living with Lakes Centre
Antoniolli, Nathan, Term Fisheries Technician
Bailey, John – MOE Research Scientist/ LU Adjunct
Bamberger, Elizabeth – Business Manager, LU
Beckett, Peter - Education and Outreach, Faculty LU
Campbell, Daniel –Research Scientist MIRARCO/Lakes Centre
Corston, Andrew – Fisheries Technician
Fram, Kim - Invertebrate Taxonomist
Gillespie, Michelle – NOHFC Intern, Living with Lakes Transition Assistant
Greene, Stacey – Field Assistant, MOE
Gunn, John – Canada Research Chair in Stressed Aquatic Systems, LU
Haslam, Lee – Senior Fisheries Technician, MNR
Heneberry, Jocelyne - Monitoring Coordinator, MOE
Johnston, Tom – MNR Senior Research Scientist/LU Adjunct
Keller, Bill – Director, Climate Change and Multiple Stressor Aquatic Research, LU
McCourt, Jason – Environmental Officer, MOE
Mykytczuk, Nadia – Research Scientist, VLWLC
Oman, Karen – Research and Administration, LU
Pearson, David - Urban Lakes Coordinator/Science Communication, Faculty LU
Sarrazin-Delay, Chantal - Biomonitoring Biologist
Witty, Lynne – Invertebrate Taxonomist

Field Technicians and Research Assistants

Aelick, Miranda, Grade 12 Co-op student, Ecole secondaire MacDonald-Cartier
Elsasser, McKenna, LU
Gendron, Denis, LU
Gunn, Kelsey,
Legault, Joseé
Sabel, Crystal, LU
Watkins, Karrah, LU

Visiting Scientists

Best, Mairi - School of Earth and Ocean Sciences, University of Victoria
Rosseland, Bjorn – Norwegian University of Life Sciences
Whittington, Pete – University of Waterloo