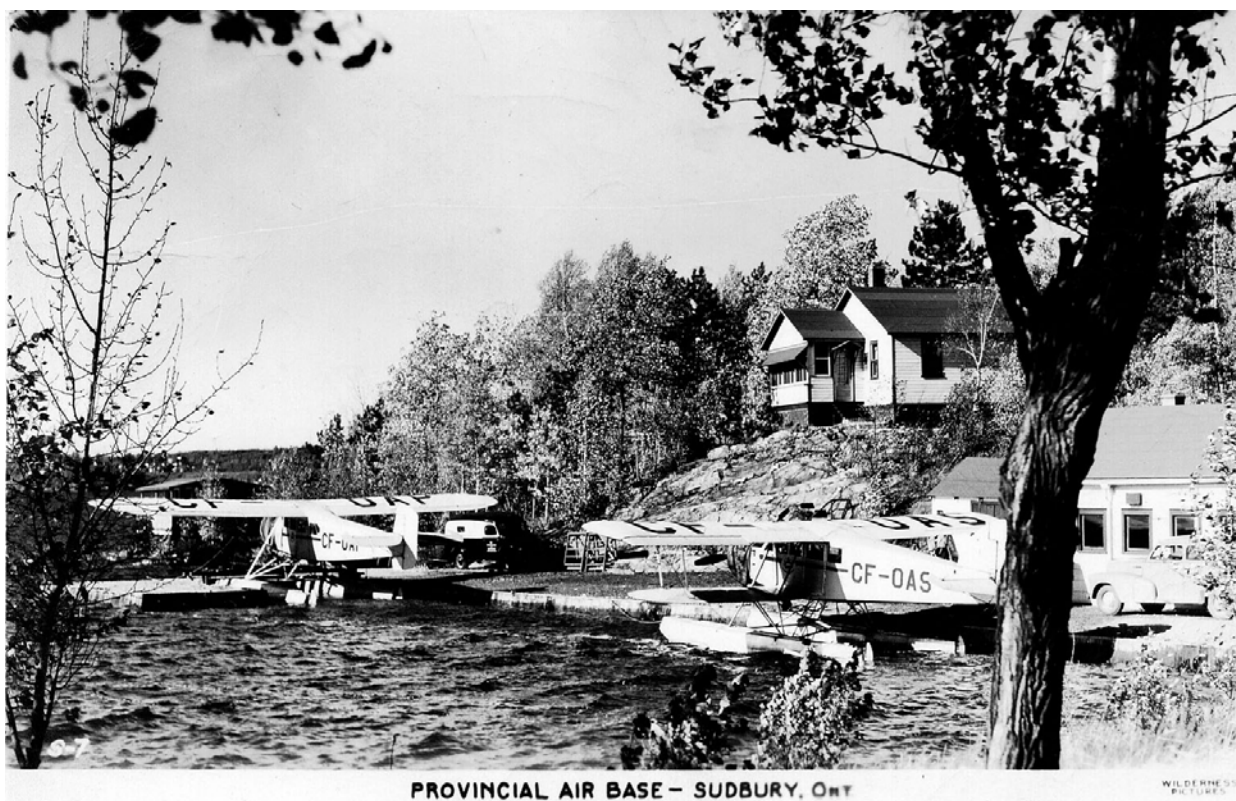


Cooperative Freshwater Ecology Unit Annual Report 2003



80th Anniversary as a Conservation Site

Ontario Provincial Air Services Base at Current Co-op Unit Site

(Circa 1930)



Cooperative Freshwater Ecology Unit Annual Report 2003

New Members and Achievements

- Dr. David Pearson received the prestigious McNeil Medal for Science Communication from the Royal Society of Canada.
- Dr. John Gunn received the Tier I Canada Research Chair in Stressed Aquatic Systems at Laurentian University. This appointment is for 7 years, and was accompanied by an \$800,000 CFI grant to facilitate the construction of an Aquatic Restoration Laboratory at the Co-op Unit.
- Drs. Yves Alarie (Biosystematics, Laurentian) and Nelson Belzile (Environmental Chemistry, Laurentian) were both formally recognized as associate members of the partnership in 2003. Dr. Alarie also received the Laurentian University Research Excellence Award for his work in the biosystematics of water beetles.
- Dr. Norman Yan received the Premier's Research Excellence Award (PREA).

Conferences, Workshops, and Invited Presentations

- The Co-op Unit hosted the 2003 Canadian Conference for Fisheries Research (CCFFR) and Society of Canadian Limnologists (SCL) Annual Meeting in Ottawa. This was one of the largest CCFFR/SCL conferences ever with over 426 registrants.
- The Coop Unit organized two workshops (with representatives of MOE, Laurentian U., Acadia U., Environment Canada, Inco Ltd., Placer Dome, Ltd., Goldcorp Inc., Newmont Canada Inc., and Williams Operating Corp.) to develop the study design for a Benthic Invertebrate RCA Biomonitoring network for Northern Ontario to meet Metal-mining EEM Requirements.
- Alarie, Y. 2003. Water Beetle Communities in lakes recovering from acidification Annual meeting of the Entomological Society of America, Cincinnati, Ohio, Symposium Conservation of Aquatic Insects: Research and Society (with S.E. Arnott). INVITED SPEAKER.

- Arnott, S.E. 2003. Biological recovery of lakes from acidification: local and regional factors. Northwest Fisheries Science Center, Seattle, Washington. INVITED SEMINAR.
- Gunn, J.M. 2003. Lake Charr: An icon for ecosystem sustainability. Marcel Ali Memorial lecture, University of Guelph, Guelph, Ontario. INVITED LECTURE.
- Ramcharan, C.W. 2003. New directions in lake food webs. Department of Zoology, University of Toronto, Mississauga, Ontario. INVITED SEMINAR.
- Ramcharan, C.W. 2003. New directions in lake food webs. Department of Zoology, Oklahoma State University, Oklahoma City, Oklahoma. INVITED SEMINAR.
- Yan, N. 2003. Ecological recovery recollected: lessons of environmental hope from aquatic ecology – Zoological Education Trust (ZET), Canadian Society of Zoologists, University of Waterloo, Waterloo, Ontario. INVITED PLENARY.
- Yan, N. 2003. Lessons learned from the ecological recovery of Sudbury lakes, 2003. Living with Lakes Forum, INCO Cavern, Science North, Sudbury, Ontario. INVITED PLENARY.

Field Courses

Limnology of Stressed and Recovering Aquatic Systems

- Dr. Shelley Arnott, Instructor. A. Dawson and A. Strecker, Teaching Assistants. Killarney Research Station, August 24-September 6, 2003.

Eleven students from six universities in Ontario made use of the Co-op Unit research facility at Killarney Park and spent two weeks conducting comparative and experimental studies on the ecology of stressed and recovering lakes. Studies included comparisons of zooplankton grazing rates, UV effects, macro-invertebrate predator effects, and resting egg densities among acid, recovering, and non-acidified lakes. As part of their training, each student gave a public lecture at the Killarney Amphitheatre on the effects of acidification on lake chemistry and biology.

Freshwater Biology

- Dr. Charles Ramcharan, Instructor. Grundy Provincial Park, September, 2003.

Dr. Ramcharan facilitated the freshwater biology module as part of Laurentian University's multidisciplinary Field Camp course at Grundy Provincial Park.

Publications

Two large publication projects were completed by Co-op Unit Staff:

- 1) The 2003 Special Issue of AMBIO "Biological Recovery from Acidification" edited by J. Gunn, S. Sandøy, W. Keller, C. Brereton, E. Snucins and N. Yan, AMBIO 32 (#3), April 2003.

This special publication which was published in both English and Chinese features 17 papers on recovery from acidification with the main emphasis on findings of the 1997-2002 NLRS Study in Killarney Park.

- 2) A book on lake trout in the Boreal Shield, edited by J.M. Gunn, R.L. Steedman and R.A. Ryder. 2004. "Boreal Shield Watersheds: Lake Trout Ecosystems in a Changing Environment." CRC/Lewis publishers, Boca Raton, Florida. ISBN 1-5667-0646-7, 528pp.

This book brings together the work of an international group of scientists who specialize in aquatic science and environmental management. They explore the functioning of Boreal Shield ecosystems, focussing on the lake trout, the classic coldwater species of northern glaciated lakes, using it as an indicator of environmental change and as a model to measure the effectiveness of management actions. Maps and descriptions of several important EMAN long-term monitoring sites and an atlas describing more than 3000 lake trout lakes in the region are special components of the book.

Co-op Unit Staff authored or co-authored numerous recent publications:

Arnott, S.E., P.J. Dillon, K. Somers and W. Keller. 2003. Inter- and intra-annual variability in acidification-related parameters in lakes with different flushing rates and acid deposition histories. *Journal of Environmental Monitoring and Assessment* 88: 21-37.

Arnott, S.E., B. Keller, N. Yan, P. Dillon, M. Paterson and D. Findlay. 2003. Using temporal coherence to determine responses to climate change in Boreal Shield lakes. *Journal of Environmental Monitoring and Assessment* 88: 365-388.

Belzile, N., Y.-W. Chen, J.M. Gunn and S.S. Dixit. (200_). Sediment trace metal profiles in lakes of Killarney Park, Canada: from regional to continental influence. *Environmental Pollution* (in press).

- Boudreau, S.A. and N.D. Yan. 2004. Auditing the accuracy of a volunteer-based surveillance program for the aquatic invader, *Bythotrephes*. *Environmental Monitoring and Assessment* 91: 17-26.
- Boudreau, S.A. and N.D. Yan. 2003. The differing crustacean zooplankton communities of Canadian Shield lakes with and without the non-indigenous zooplanktivore, *Bythotrephes*. *Canadian Journal of Fisheries and Aquatic Sciences* 60: 1307-1313.
- Curry, R.A., C. Brady and G.E. Morgan. 2003. Effects of recreational fishing on the population dynamics of lake-dwelling brook trout. *North American Journal of Fisheries Management* 23: 35-47.
- Doka, S.E., D.K. McNicol, M.L. Mallory, I. Wong, C.K. Minns and N.D. Yan. 2003. Assessing potential for recovery of biotic richness and indicator species due to changes in acidic deposition and lake pH in five areas of southeastern Canada. *Environmental Monitoring and Assessment* 88: 53-101.
- Girard, R., N.D. Yan, J. Heneberry and W. Keller. 2003. Physical and chemical data series from Clearwater, Lohi, Middle and Hannah lakes near Sudbury Ontario: long term responses to liming and natural recovery from historical acidification and metal contamination. Data Report.
- Gunn, J.M. and R. Pitblado. 2004. Lake Trout, the Boreal Shield and the Factors that Shape Lake Trout Ecosystems. *Boreal Shield Watersheds: Lake Trout Ecosystems in a Changing Environment*, J.M. Gunn, R.J. Steedman and R.A. Ryder, Eds., Lewis Publishers, Boca Raton, FL, pp. 3-19.
- Gunn, J.M. and R. Sein. 2004. Effects of Forestry Roads on Reproductive Habitat and Exploitation of Lake Trout. *Boreal Shield Watersheds: Lake Trout Ecosystems in a Changing Environment*, J.M. Gunn, R.J. Steedman and R.A. Ryder, Eds., Lewis Publishers, Boca Raton, FL, pp. 265-278.
- Gunn, J.M. and S. Sandøy. 2003. Introduction to the special issue on biological recovery from acidification: Northern Lakes Recovery Study. *Ambio* 32: 162-164.
- Henderson, B.A., N. Collins, G.E. Morgan and A. Vaillancourt. 2003. Sexual size dimorphism of walleye (*Stizostedion vitreum vitreum*). *Canadian Journal of Fisheries and Aquatic Sciences* 60: 1345-1352.
- Holt, C.A. and N.D. Yan. 2003. Recovery of zooplankton communities from acidification in Killarney Park, Ontario, 1972-2000: pH 6 as a recovery goal. *Ambio* 32: 203-207.
- Holt, C.A., N.D. Yan and K. Somers. 2003. pH 6 as the threshold to use in critical load modeling for zooplankton community change with acidification in lakes of south-central Ontario: accounting for morphometry and geography. *Canadian Journal of Fisheries and Aquatic Sciences*. 60: 151-158.
- Jeffries, D.S., T.G. Brydges, P.J. Dillon and W. Keller. 2003. Monitoring the results of Canada/U.S.A. acid rain control programs: some lake responses. *Journal of Environmental Monitoring and Assessment*. 88: 3-20.

- Jeffries D.S., T.A. Clair, S. Couture, P.J. Dillon, J. Dupont, W. Keller, D.K. McNicol, M.A. Turner, R. Vet and R. Weeber. 2003. Assessing the recovery of lakes in southeastern Canada from the effects of acid deposition. *Ambio* 32: 176-182.
- Keller, W., J.H. Heneberry and S.S. Dixit. 2003. Decreased acid deposition and the chemical recovery of Killarney, Ontario lakes. *Ambio* 32: 183-189.
- Keller, W., J.H. Heneberry and J. Leduc. 200_. Linkages between weather, transparency, and thermal structure in a Boreal Shield lake recovering from acidification (under review).
- Keller, W., J.M. Gunn, E. Snucins and S.E. Arnott. 200_. Recovery of acidified lakes in the Sudbury, Ontario, Canada area (in press – NAPAP Report).
- Larssen, T., C.I. Brereton and J.M. Gunn. 2003. Dynamic modeling of recovery from acidification of lakes in Killarney Park, Ontario, Canada. *Ambio* 32: 244-248.
- Lester, N.P. and G.E. Morgan. 2003. Biological reference points for management of walleye (*Sander vitreus*) fisheries. PERCIS III, University of Wisconsin. 2p.
- Molot, L.A., W. Keller, P.R. Leavitt, R.D. Robarts, M.J. Waiser, M.T. Arts, T.A. Clair, R. Pienitz, N.D. Yan, D.K. McNicol, Y. Prairie, P.J. Dillon, M. Macrae, R. Bello and R. Nordin. 200_. Risk analysis of UVB exposure to Canadian inland waters (under review).
- Morgan, G.E. 2002. Manual of instructions * fall walleye index netting (FWIN). Percid Community Synthesis. Diagnostics and Sampling Standards Working Group, Ontario Ministry of Natural Resources, 34p.
- Morgan, G.E., N.P. Lester and T. Morris. 2003. Application of biological reference points to evaluate the status of walleye (*Sander vitreus*) in Ontario. PERCIS III. University of Wisconsin. 2p.
- Morgan, G.E., M.D. Malette, R.S. Kushneriuk and S.E. Mann. 2003. Regional summaries of walleye life history characteristics based on Ontario's fall walleye index netting (FWIN) program 1993 to 2001. Diagnostics and Sampling Standards Working Group, Ontario Ministry of Natural Resources. 195p.
- Persaud, A. D. and N.D. Yan. 2003. UV radiation sensitivity of *Chaoborus* larvae. *Ambio* 32: 219-224.
- Persaud, A.D., M. Arts and N.D. Yan. 2003. Photoresponses of late instar *Chaoborus punctipennis* larvae. *Aquatic Ecology* 37: 257-265.
- Pollard, H.G., J. Colbourne and W. Keller. 2003. Reconstruction of centuries old *Daphnia* communities in a lake recovering from acidification and metal-contamination. *Ambio* 32: 214-218.
- Reynoldson, T.B., W. Keller, K. Somers, G. Watson and C.I. Brereton. 2003. The Development of an Invertebrate Biomonitoring Network for Northern Ontario to Meet Metal-mining EEM Requirements. Study Design Report, Cooperative Freshwater Ecology Unit, Sudbury.

- Schindler, D.W. and J.M. Gunn. 2004. Dissolved Organic Carbon as a Controlling Variable in Boreal Shield Lakes. *Boreal Shield Watersheds: Lake Trout Ecosystems in a Changing Environment*, J.M. Gunn, R.J. Steedman and R.A. Ryder, Eds., Lewis Publishers, Boca Raton, FL, pp. 133-145.
- Snucins, E. and J.M. Gunn. 2003. Use of rehabilitation experiments to understand the recovery dynamics of acid-stressed fish populations. *Ambio* 32: 240-243.
- Snucins, E. 2003. Recolonization of acid-damaged lakes by the benthic invertebrates *Stenacron interpunctatum*, *Stenonema femoratum* and *Hyallela azteca*. *Ambio* 32: 225-229.
- Steedman, R.J., J.M. Gunn and R.A. Ryder. 2004. Boreal Shield Waters: Models and Management Challenges. *Boreal Shield Watersheds: Lake Trout Ecosystems in a Changing Environment*, J.M. Gunn, R.J. Steedman and R.A. Ryder, Eds., Lewis Publishers, Boca Raton, FL, pp. 331-346.
- Vander Zanden, J.K. Wilson, J. Casselman and N.D. Yan. 2004. Species Introductions and Their Impacts in North American Shield Lakes. *Boreal Shield Watersheds: Lake Trout Ecosystems in a Changing Environment*, J.M. Gunn, R.J. Steedman and R.A. Ryder, Eds., Lewis Publishers, Boca Raton, FL, pp. 239-263.
- Walseng, B., N.D. Yan and A.-K. Schartau. 2003. Identifying littoral microcrustacean (Cladocera and Copepoda) indicators of acidification in Canadian Shield lakes. *Ambio* 32: 208-213.
- Wissel, B., N.D. Yan and C.W. Ramcharan. 2003. Predation and refugia: implications for *Chaoborus* abundance and species composition. *Freshwater Biology* 48: 1421-1431.
- Wissel, B. and C.W. Ramcharan. 2003. Plasticity of vertical distribution of crustacean zooplankton in lakes with varying levels of water color. *Journal of Plankton Research* 25:1047-1057.
- Wissel B., W.J. Boeing and C.W. Ramcharan. 2003. Effects of water color on predation regimes and zooplankton assemblages in freshwater lakes. *Limnology and Oceanography* 48:1965-1976.
- Yan, N.D., B. Leung, W. Keller, S.E. Arnott, J.M. Gunn and G. Raddum. 2003. Developing conceptual frameworks for the recovery of aquatic biota from acidification. *Ambio* 32: 165-169.

Conference and Workshop Presentations

- Arnott, S.E., B. Keller, C. Holt and N.D. Yan. 2003. Local and regional-scale assessment of zooplankton recovery from acidification, The Ecological Society of America, Savannah, Georgia.
- Belzile, N., Y.-W. Chen, J.M. Gunn, Y. Alarie, J. Tong, C. Lang, G.J. Wu and L. Li. 2003. The importance of selenium in the bioassimilation of mercury by aquatic

- organisms. 4th Annual Meeting of the Collaborative Mercury Research Network, Saint John, New Brunswick.
- Belzile, N., Y.-W. Chen, J.M. Gunn and Y. Alarie. 2003. La chimie environnementale et la région de Sudbury. ACFAS, Sudbury, Ontario.
- Binks, J., S.E. Arnott and W.G. Sprules. 2003. The influence of biotic and abiotic factors on zooplankton community recovery from acidification, Society of Canadian Limnologists, Ottawa, Ontario.
- Cooper, A. and S.E. Arnott. 2003. The influence of macro-invertebrate predators on the recovery of zooplankton communities in Swan Lake, Sudbury, Ontario. Society of Canadian Limnologists, Ottawa, Ontario.
- Dawson, A. and S.E. Arnott. 2003. The effects of intra-annual pH fluctuations on recovering zooplankton communities in Swan Lake, Sudbury, Ontario. Society of Canadian Limnologists, Ottawa, Ontario.
- Dawson, A. and S.E. Arnott. 2003. The effects of intra-annual pH fluctuations on recovering zooplankton communities in Swan Lake, Sudbury, Ontario. The Ecological Society of America, Savannah, Georgia.
- Delongchamp, T., J.M. Gunn, N. Belzile, Y.-W. Chen and J. Tong. 2003. Antagonistic effects of selenium on mercury accumulation by invertebrates and fish in Sudbury area lakes. Canadian Conference for Fisheries Research, Ottawa, Ontario.
- Filion, J.M. and N.D. Yan. 2003. A large-volume, high-efficiency plankton net with a microprocessor to monitor depth and efficiency: collecting large, rare invertebrates in defined depth strata. Society of Canadian Limnologists, Ottawa, Ontario.
- Jackson, A. and S.E. Arnott. 2003. The recovery of freshwater zooplankton from acidification. Canadian Aboriginal Science and Technology Society Conference, Saskatoon, Saskatchewan.
- Jackson, A. and S.E. Arnott. 2003. The effect of the macro-invertebrate predator *Graphoderus liberus* on recovering zooplankton communities in Swan Lake, Sudbury. Ontario Ethology and Ecology Conference, Hamilton, Ontario.
- Lang, C.Y., Y.-W. Chen, M. Wang and N. Belzile. 2003. Geochemical behaviour of mercury in lake sediments. 4th Annual Meeting of the Collaborative Mercury Research Network, Saint John, New Brunswick.

- Li, L., Y.-W. Chen and N. Belzile. 2003. Elemental selenium in lake sediments: Extraction by carbon disulfide and determination by hydride generation atomic fluorescence spectrometry. 4th Annual Meeting of the Collaborative Mercury Research Network, Saint John, New Brunswick.
- Patrick, K., J.M. Gunn and M. Futter. 2003. Timing of lake stratification in clear and coloured lakes. Canadian Society of Limnologists, Ottawa, Ontario.
- Persaud, A. and N. Yan. 2003. Photoresponses of late instar *Chaoborus punctipennis* larvae. Society of Canadian Limnologists, Ottawa, Ontario.
- Ramcharan, C.W., N.D. Yan and B. Keller. 2003. Can herbivorous zooplankton control algae blooms? Society of Canadian Limnologists, Ottawa, Ontario.
- Ramcharan, C.W. 2003. Zooplanktivory in lakes: Have we nabbed the wrong suspect? Dorset *Bythotrephes* Workshop, Dorset, Ontario.
- Snucins, E. 2003. The Nordic Method: a new tool for fish community assessment in Ontario's Boreal Shield lakes. Canadian Conference for Fisheries Research, Ottawa, Ontario.
- Snucins, E. 2003. Restoration of the Aurora Trout to its native habitat. Species at Risk Workshop, Dorset, Ontario.
- Strecker, A. and S.E. Arnott. 2003. The effects of an invasive invertebrate predator, *Bythotrephes longimanus*, on zooplankton communities in lakes recovering from acidification. Society of Canadian Limnologists, Ottawa, Ontario.
- Strecker, A.L. and S.E. Arnott. 2003. The effects of an invasive invertebrate predator, *Bythotrephes longimanus*, on zooplankton communities recovering from acidification. The Ecological Society of America, Savannah, Georgia.
- Strecker, A.L. and S.E. Arnott. 2003. The effects of an invasive invertebrate predator, *Bythotrephes longimanus*, on zooplankton communities in lakes recovering from acidification. Ontario Ecology and Ethology Colloquium, Hamilton, Ontario.
- Strecker, A.L. and S.E. Arnott. 2003. *Bythotrephes* in lakes recovering from acidification. Dorset Aquatic Invaders Workshop, Dorset, Ontario.
- Tong, J., Y.-W. Chen, J.M. Gunn, Y. Alarie and N. Belzile. 2003. Methylmercury and selenium in the food chain. 4th Annual Meeting of the Collaborative Mercury Research Network, Saint John, New Brunswick.
- Tunney, T., T. Kleinboeck, E. Snucins and J.M. Gunn. 2003. Seasonal variation in the catches of smallmouth bass (*Micropterus dolomieu*) and yellow perch (*Perca*

flavescens) in NORDIC Multimesh Gill Nets. Canadian Conference for Fisheries Research, Ottawa, Ontario.

Wu, G.J., Y.-W. Chen, V. Appanna and N. Belzile. 2003. Interaction of selenium and mercury in *Pseudomonas fluorescens*. 4th Annual Meeting of the Collaborative Mercury Research Network, Saint John, New Brunswick.

Yan, N.D. 2003. Long-term changes in mean cladoceran body size in Dorset lakes: effects of an invader, recovery from acidification and nutrients. Society of Canadian Limnologists, Ottawa, Ontario.

Theses Completed

Carolyn Hunt, M.Sc., "Metal Concentrations and Algal Microfossil Diversity in Pre-Industrial (Pre-1880) Sediment of Lakes Located on the Sudbury Igneous Complex (SIC) in Sudbury, Ontario, Canada." (Thesis successfully defended on June 4, 2003).

Jan J. Latour, M.Sc., "Human Preferences and Choices and How They May Affect Lake Nipissing's Recreational Walleye Fishery." (Thesis successfully defended on September 23, 2003).

Lu Li, M.Sc., "Elemental Selenium in Lake Sediments: Extraction by Carbon Disulfide and Determination by Hydride Generation Atomic Fluorescence Spectrometry." (Thesis successfully defended on October 28, 2003).

Amy Dawson, M.Sc., "Effects of Short-term pH Variability on Zooplankton Communities Recovering from Acidification." (Thesis successfully defended on November 27, 2003, Queen's University).

Jessie Binks, M.Sc., "Local Versus Regional Factors: What Controls the Recovery of Zooplankton Species Diversity from Cultural Acidification?" (Thesis successfully defended on November 28, 2003, University of Toronto).

Kendra Patrick, M.Sc., "Timing of Lake Stratification and Ice Cover in Small Northern Ontario Lakes." (Thesis successfully defended on December 10, 2003).

GaoJun Wu, M.Sc., "Selenium and Mercury Assimilation and Detoxification in *Pseudomonas fluorescens*." (Thesis successfully defended on December 16, 2003).

Co-op Unit Staff 2003

Ramsey House:

John Gunn-Fisheries Scientist
Ed Snucins-Rehabilitation Biologist
Seija Mallory-Fisheries/Park Biologist

Bill Keller-Limnologist
Cristina Greco-Data Clerk
Leila Tuhkasaari-Data Clerk

Laurentian University Science Building:

Charles Ramcharan-Aquatic Ecologist
Lynne Witty-Zooplankton Taxonomist
Nelson Belzile-Environmental Chemistry

Dave Pearson-Urban Lakes Coordinator
Heather Conroy-C-CIARN
Yves Alarie-Biosystematics

Water House:

Jocelyne Heneberry-Monitoring Coord.
Amanda Skelly-Water Quality Technician

Katie Beach-Water Quality Technician

Fish House:

George Morgan-Extension Biologist
Julie Leduc-Data Manager
Derek Farrer-Fisheries Technician

Mike Malette-Data Manager
Colin Cahill-Fisheries Technician
Jason Houle-Fisheries Technician

Bug House:

Tim Kingshott-Fisheries Technician
Christine Brereton-Biomonitoring Biol.

Lee Haslam-Fisheries Technician
Jennifer Davidson-Invertebrate Biol.

Ph.D., M.Sc. and B.Sc. (Honours) Students:

Allison Cooper
Amy Dawson
Tania Delongchamps
Larry Ferguson
Momoko Kawai

Tom Kleinboeck
Jan Latour
Kendra Patrick
Angela Strecker
Tyler Tunney

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Kim Carmichael
Andrea Chute
Kim Fram
Robert Godwin
Jake Irwin
Emily Lemieux
Allison Lickley

Martin Rudd
Chantal Sarazin-Delay
Rob Sneider
Kelly Thibeault
Joshua Woods
Sarah Woods