

## **COOPERATIVE FRESHWATER ECOLOGY UNIT ANNUAL REPORT 2001 - 2002**

### **New Staff**

- Jocelyne Heneberry was the successful candidate for the position of Coordinator, Northern Lake Monitoring with the Ministry of the Environment (MOE) at the Co-op Unit. This new position is a major contribution to the resources of the unit. We welcome Jocelyne to this position and thank her for her past efforts at the Co-op Unit as a staff member of Laurentian University.
- Dr. Charles Ramcharan is the new aquatic ecologist in the Biology Department at Laurentian University. Charles joins the Co-op Unit under a partnership agreement with MOE. We greatly welcome his participation.

### **Conferences, Workshops, and Invited Presentations**

- The Co-op Unit hosted the 2002 Sudbury Restoration Workshop on Feb. 20, 2002. It was the largest yet with about 200 registrants. The themes were: 1) Mining Impacts on Northern Ecosystems, 2) Climate Change, Assessment, Impacts and Adaptation, and 3) Recovery from Acidification. The workshop was followed by the inaugural meeting of the Canadian Climate Impacts and Adaptation Research Network (C-CIARN), Ontario Node, on Feb. 21, 2002. The C-CIARN meeting was hosted by Dave Pearson and Elizabeth Bamberger.
- John Gunn hosted the final Canadian meeting of the Canada/Norway Northern Lakes Recovery Study (NLRS) at Laurentian University on Feb. 21, 2002. On Sept. 9-11, 2002, the NLRS research participants met in Grimstad Norway for an international workshop "Models for Biological Recovery from Acidification in a Changing Climate".
- John Gunn was the invited keynote speaker for the Lake Trout Symposium, Whitehorse, Yukon, Aug. 7, 2002.
- Bill Keller chaired a session on "Ecological Impacts of Mining and Refining of Nickel" at the Sixth International Nickel Conference, Murmansk, Russia, Sept. 1-6, 2002. He also participated in a special session at the Nickel Conference on "Environmental Remediation" which focused on experiences with aquatic and terrestrial recovery/rehabilitation in the Sudbury area.

- Bill Keller participated in the U.S. Climate Change Science Program Planning Workshop for Scientists and Stakeholders, in Washington D.C., Dec. 3-5, 2002.
- Dave Pearson gave an invited presentation, on behalf of C-CIARN Ontario, to the Senate Committee on Agriculture and Forestry Impacts and Adaptation to Climate Change in Ontario, in Ottawa, Dec. 5, 2002.
- Dave Pearson gave an invited presentation "Environmental History and Challenges in Northern Ontario" to the inter-ministerial "Resource Cluster", Sudbury, Oct. 29, 2002.
- Planning and organization of the 2003 joint Canadian Conference for Fisheries Research and Canadian Society of Limnologists Annual Meeting occurred throughout much of 2002. The Co-op Unit hosted this national meeting on Jan. 2-5, 2003 in Ottawa.

## **Publications**

Two large publication projects are nearing completion by Co-op Unit Staff:

- 1) The 2003 Special Issue of AMBIO "Biological Recovery from Acidification" edited by J. Gunn, W. Keller, E. Snucins, C. Brereton, S. Sandoy, and N. Yan. This special publication which will be 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, by J.M. Gunn, R.L. Steedman and R.A. Ryder. 2002. "Boreal Shield Watersheds: Lake Trout Ecosystems in a Changing Environment".CRC/Lewis publishers.

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

Arnott, S.E., P.J. Dillon, K. Somers, and W. Keller. 200\_. 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* (in press).

Arnott, S.E., B. Keller, N. Yan, P. Dillon, M. Paterson, and D. Findlay. 200\_. Using temporal coherence to determine responses to climate change in boreal shield lakes. *Journal of Environmental Monitoring and Assessment* (in press).

- Arnott, S.E., N.D. Yan, W. Keller, and K. Nicholls. 2001. The influence of drought-induced acidification on the recovery of plankton in Swan Lake. *Ecological Applications*. 11: 747-763.
- Chen, W., N. Belzile and J.M. Gunn. 2001. Antagonistic effects of Se on Hg uptake in perch and Walleye? *Limnology and Oceanography* 46: 1814-1818.
- Curry, R.A., C. Brady, and G.E. Morgan. 2003. Effects of recreational fishing on population dynamics of lake-dwelling brook trout. *North American Journal of Fisheries Management* 23:35-47.
- Dixit, S.S., W. Keller, A.S. Dixit, and J.P. Smol. 2001. Diatom-inferred dissolved organic carbon reconstructions provide assessments of past UV-B penetration in Canadian shield lakes. *Canadian Journal of Fisheries and Aquatic Sciences* 58:543-550.
- Gunn, J.M. 2002. Impact of the 1998 El Nino on a lake charr population recovering from acidification. *Environmental Biology of Fishes* 64:343-351.
- Gunn, J.M. and S. Sandøy. 2001. Northern Lakes Recovery Study (NLRS) – Biomonitoring at the ecosystem level. *Water Air Soil Pollution* 130: 131-140.
- Gunn, J.M., W. Keller, R. Sein and P. Beckett. 2001. Liming of acid and metal contaminated catchments for the improvement of drainage water quality. *Water Air Soil Pollution* 130: 1439-1444.
- Gunn, J.M., E. Snucins, N.D. Yan, and M.T. Arts. 2001. Use of water clarity to monitor the effects of climate change and other stressors on oligotrophic lakes. *Journal of Environmental Monitoring and Assessment*. 67(1/2): 68-88.
- Gunn, J.M. 2003. Introduction to the special issue on biological recovery from acidification: Northern Lakes Recovery Study. *Ambio* (in press)
- Halvorsen, G.A., J. Heneberry, and E. Snucins. 2001. Sublittoral chironomids (Diptera: Chironomidae) as indicators of acidification. *Water Air Soil Pollution* 130: 1385-1390.
- Henderson B.A. and G.E. Morgan. 2002. Maturation of walleye by age, size and surplus energy. *Journal of Fish Biology*. 61:999-1011.
- Jeffries, D.S., T.G. Brydges, P.J. Dillon, J. Dupont, J.M. Gunn, H.H. Harvey, W. Keller, and D.C.L. Lam. 2001. Aquatic Acidification, pp. 27-32, in Proc. Wkshp. on Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada. Toronto, ON, Jan. 22-24, 2001. Environment Canada, Burlington, ON. ISSN 1499-5905 No.1.
- Jeffries, D.S., T.G. Brydges, P.J. Dillon, and W. Keller. 200\_. Monitoring the results of Canada/U.S.A. acid rain control programs: some lake responses. *Journal of Environmental Monitoring and Assessment* (in press).
- 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* (in press).

- Keller, W., P. Dillon, J. Heneberry, M. Malette, and J.M. Gunn. 2001. Sulphate in Sudbury, Ontario, Canada lakes: recent trends and status. *Water Air Soil Pollution* 130: 793-798.
- Keller, W., S.S. Dixit, and J. Heneberry. 2001. Calcium declines in Northeastern Ontario lakes. *Canadian Journal of Fisheries and Aquatic Sciences* 58: 2011-2020.
- Keller, W., N.D. Yan, K.M. Somers, and J.H. Heneberry. 2002. Crustacean zooplankton communities in lakes recovering from acidification. *Canadian Journal of Fisheries and Aquatic Sciences* 59: 726-735.
- Keller, W., J.H. Heneberry, and S.S. Dixit. 2003. Decreased acid deposition and the chemical recovery of Killarney, Ontario, lakes. *Ambio* (in press).
- 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).
- Kelso, J.R.M., N.P. Lester, J.M. Gunn, K.E. Smokorowski, W.G. Cole, C.K. Minns, R.J. Steedman, K.H. Mills. A framework for the advancement of aquatic science - lake habitat experiments as an example. *Aquatic Ecosystem Health and Management Society* (submitted).
- Larssen, T., C.I. Brereton, and J.M. Gunn. 2003. Dynamic modelling of recovery from acidification of lakes in Killarney Park, Ontario, Canada. *Ambio* (in press).
- Morgan, G.E., M.D. Malette, R.S. Kushneriuk, and S.E. Mann. 2002. 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, Percid community synthesis. Ontario Ministry of Natural Resources. 188p.
- Pearson, D.A.B., A. Lock, N. Belzile, and R. Bowins. 2002. Assessing Kelly Lake's history as a natural trap for mining industry and municipal effluent during the growth of Sudbury. Chapter 8 *in*: Rousell, D.H. and Jansons K. (eds.). *Physical Environment of the City of Greater Sudbury*. Ontario Geological Survey, Special Volume 6: 174-192.
- Pearson, D.A.B., J.M. Gunn, and W. Keller. 2002. The past, present, and future of Sudbury's lakes. Chapter 9 *in* Rousell, D.H. and Jansons K. (eds.) *Physical Environment of the City of Greater Sudbury*. Ontario Geological Survey, Special Volume 6: 195-215.
- 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* (in press).
- Prevost F. and D.A.B. Pearson. 2002. Map of the lakes, rivers and wetlands of the City of Greater Sudbury, 1:125,000. For chapter 9 *in*: Rousell, D.H. and Jansons K. (eds.). *Physical Environment of the City of Greater Sudbury*, Ontario Geological Survey Special Volume 6.

- Schartau, A.K.L., B. Walseng, and E. Snucins. 2001. Correlation between microcrustaceans and environmental variables in Killarney lakes, Sudbury, Canada. *Water Air Soil Pollution* 130: 1325-1330
- Snucins, E. and J.M. Gunn. 2003. Use of rehabilitation experiments to understand the recovery dynamics of acid-stressed fish populations. *Ambio* (in press).
- Snucins, E. 2003. Recolonization of acid-damaged lakes by the benthic invertebrates *Stenacron interpunctatum*, *Stenonema femoratum*, and *Hyalloella azteca*. *Ambio* (in press).
- Snucins, E., J.M. Gunn, W. Keller, S. Dixit, A. Hindar, and A. Henriksen. 2001. Effects of regional reductions in sulphur deposition on the chemical and biological recovery of lakes in Killarney Park, Ontario, Canada. *Journal of Environmental Monitoring and Assessment* 67: 179-194.
- Vinebrooke, R. D., S.S. Dixit, M. D. Graham, J. M. Gunn, Y. W. Chen and N. Belzile. 2002. Whole-lake algal responses to a century of acidic deposition on the Canadian Shield. *Canadian Journal of Fisheries and Aquatic Sciences* 59: 483-493.
- Witty, L.M. 2002. Practical Guide to Identifying Crustacean Zooplankton. Cooperative Freshwater Ecology Unit Report.
- 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* (in press).

### **Conference and Workshop Presentations**

- Davidson, J., B. Keller, K. Somers, and G. Watson. 2002. Benthic invertebrate reference conditions for specific stream habitats in the Sudbury region. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Futter, M., B. Keller, J. Heneberry, and K. Somers. 2002. Patterns and trends in Sudbury lake chemistry. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Gunn, J., C. Brereton, B. Keller, S. Mallory, and E. Snucins. 2002. Killarney Park lakes as sensitive sites for monitoring acidification, recovery, climate change and other stressors. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Keller, B., S. Dixit, and J. Heneberry. 2002. Calcium declines in Sudbury area lakes. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Keller, W. and J.M. Gunn. 2002. Sudbury as an international restoration site. Sudbury. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Keller, B., J. Heneberry, S. Dixit, and J. Gunn. 2002. Changes in UV-B penetration in Killarney lakes. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.

- Keller, B., N. Yan, K. Somers, and J. Heneberry. 2002. Recovery of zooplankton species richness in Sudbury area lakes. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Keller, W., N. Yan, and J. Gunn. 2002. Biological recovery of lakes affected by smelter emissions in the Sudbury, Ontario, Canada area. p. 71, in Proc. Sixth Internat. Nickel Conf., Murmansk, Russia, Sept. 1-6, 2002.
- Keller, W. and N. Yan. 2002. Empirical observations on the recovery of crustacean zooplankton in lakes near, Sudbury, Ontario, Canada. p. 20, In Proc. Wkshp. on Models for Biological Recovery from Acidification in a Changing Climate. Grimstad, Norway, Sept. 9-11, 2002. Rapport LNR 4589-2002, Norwegian Institute for Water Research.
- Patrick, K., J. M. Gunn, and M. Futter. 2002. Models to predict ice-off dates from under ice temperature. Am. Soc. Limnol. Oceanogr., Victoria, B.C.
- Pearson, D.A.B. 2002, Protecting Drinking Water Sources. Drinking Water in Northern Communities: Upper Lakes Environmental Research Network, Sault Ste Marie, March 6, 2002.
- Pearson, D.A.B. 2002. Implications of climate change for Northern Ontario lakes. Special Stakeholders Summit "Towards Harmony and Sustainable Use Among the Ontario Fisheries Community", April 5-6, 2002, Sagamok Anishnawbek First Nation, Massey, Ontario.
- Pearson, D.A.B. and Courtin. 2002. Impacts and Adaptation to Climate Change in Ontario. On behalf of C-CIARN Ontario: Invited presentation to the MNR Fish and Wildlife Advisory Board, Toronto, Dec 6, 2002.
- Snucins, E., J. Gunn, and B. Keller. 2002. Repeated liming of one of the native aurora trout lakes in Lady Evelyn-Smoothwater Park. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Snucins, E. 2002. Recovery of fish and benthic invertebrates in Killarney lakes. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.
- Yan, N., S. Arnott, B. Keller, A. Persaud, C. Holt, J. Gunn, P. Dillon, and R. Girard. 2002. Identifying the effects of multiple stressors on ecological processes influencing recovery of biota from acidification. Sudbury Restoration Workshop, Sudbury, Feb. 20, 2002.

### **Theses Completed**

Jennifer Davidson, M.Sc., "Applying the Reference Condition Approach to Monitor Invertebrates in Streams of the Sudbury Mining Area" (Thesis was successfully defended on Dec. 17, 2002).

Alan Lock, M.Sc., "Mobility and Deposition of Ni, Cu and PO<sub>4</sub> in Kelly Lake, Ontario".  
(Thesis was successfully defended on Dec. 15, 2002).

### Co-op Unit Staff 2002

#### Ramsey House:

John Gunn-Fisheries Scientist  
Ed Snucins-Rehabilitation Biologist  
Christine Brereton-NLRS Biologist  
Leila Tuhkasaar-Data Clerk

Bill Keller-Limnologist  
Lisa Scott-Data Clerk  
Seija Mallory-Fisheries/Park Biologist

#### Laurentian University Science Building:

Shelley Arnott-Aquatic Ecologist  
Francois Prévost-GIS Specialist  
Chantal Rozon-Sudbury 2003  
Dana Wilson-Urban Lakes

Dave Pearson-Urban Lakes Coordinator  
Lynne Witty-Zooplankton Taxonomist  
Heather Conroy-C-CIARN

#### Water House:

Jocelyne Heneberry-Monitoring Coord.  
Stephan Morneau-Limnology Technician

Brent Metcalfe-Limnology Technician

#### Fish House:

George Morgan-Extension Biologist  
Martyn Futter-Data Manager  
Derek Farrer-Fisheries Technician

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

#### Bug House:

Tim Kingshott-Fisheries Technician  
Julie Leduc-Data Manager

Lee Haslam-Fisheries Technician

#### M.Sc. and B.Sc. (Honours) Students:

Al Lock  
Amy Dawson  
Allison Cooper  
Tania Delongchamps  
Tyler Tunney  
Jan Latour

Angela Strecker  
Nathalie Fournier  
Kendra Patrick  
Tom Kleinboeck  
Jen Davidson

#### Field Technicians and Research Assistants:

Kelly Thibeau  
Elizabeth Hatton  
Kevin Shaughnessy  
Sophie Lawrence  
Robert Hobbs

Allison Lickley  
Jennifer Babin  
Claire Beatty  
Robert Godwin