

**The University of New Brunswick
Curriculum Vitae**

Kelly Roland Leslie Herbert Munkittrick

I. Personal Data

A. Details

201 CRI, Canadian Rivers Institute, University of New Brunswick, Saint John, New Brunswick E2L 4L5 Canada Office Phone No. (506) 648-5825; Fax: (506) 648-5811 Email: krm@unbsj.ca	7 Rynlon Crescent Quispamsis, New Brunswick E2G 1A5 (506) 849-6326
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B. Education

B.Sc.	Hon. Fish & Wildlife Biology	Guelph	Canada	1980
M.Sc.	Environmental Physiology	Guelph	Canada	1983
Ph.D.	Aquatic Toxicology	Waterloo	Canada	1988

C. Employment History (prior to and at UNB)

Title	Institute	Department	Date
Professor	University of New Brunswick	Biology (Saint John)	01/01 - present
Canada Research Chair in Ecosystem Health Assessment (renewed for 2 nd 7 year term January 2008)			
<i>Date of Appointment and Granting of Tenure: January 16, 2001</i>			
<i>Date of Last Sabbatical: None</i>			
Scientific Director	Canadian Water Network		03/11-present
Associate Director	University of New Brunswick	Canadian Rivers Institute	01/01 – 02/11
Research Scientist	National Water Research Institute, Aquatic Ecosystem Impacts Research Branch	Environment Canada	99/01 - 01/01
Project Chief	National Water Research Institute, Aquatic Ecosystem Conservation Branch	Environment Canada	96/01 - 99/01
Research Scientist	Great Lakes Laboratory for Fisheries and Aquatic Sciences	Fisheries and Oceans	90/05 - 96/01
NSERC Industrial Research Fellow	EVS Consultants	North Vancouver, BC	89/02-90/05

D. Distinctions, Honours, Fellowships, Scholarships

a) Significant local, national and international awards: University of Waterloo 50th Anniversary Science Alumni of Honour Award (2007), UNB Merit Award (2006), Ali Lecturer, University of Guelph, 2004, Moreton Lecturer, Millsaps College, Jackson, MS, 2003, Society for Technical Communication Merit Award – 2001 Florida Technical Communication Competition (For “Development of Methods for Effects Driven Cumulative Effects Assessment Using Fish Populations”).

b) Environment Canada Awards: Environment Canada Special Achievement Award (2000) for role in analysis of EEM data; Prairie and Northern Region Certificate of Recognition for NRBS work, February

1998; Environment Canada Citation of Excellence awarded December 1997 for role in EEM program; NWRI Special Achievement Award, March 1997, for initiating and obtaining international funding for Canada-Germany joint project on development of vitellogenin antibodies.

E. Membership in Professional and Learned Societies

1. Society of Environmental Toxicol. and Chemistry (since 1985)
 2. International Water Association's Specialist Group on Pulp and Paper Industry Wastewaters (since 1996)
- Great Lakes Fisheries Commission Board of Technical Experts, Co-leader Fish Health and Ecosystem Dysfunction theme (2006-present)

F. Other Training

- Radiation Safety Training, May, 2007
- Red Cross First Aid and CPR, May, 2004
- Electrofishing Principles and Techniques, October, 2001

II. Teaching Experience (for more details see Teaching Dossier)

- I moved to UNB from a government science position in 2001 to accept a Canada Research Chair. My undergraduate course responsibilities include Biol 4875 Environmental Techniques and Biol 4825 Ecotoxicology, and I have also taught Biol 4741 Fish Biology and co-administered Biol 4772 Aquatic Ecology, Biol 4483 Applied Ecology & Environmental Monitoring in Irish Ecosystems and Biol 4373 Tropical Marine Biology.
- Since 04, I have graduated 13 MSc students (2 current, 18 lifetime) & 4 PhD students (3 current, 10 lifetime), and 3 PDFs (1 current, 8 lifetime), 11 Honours and Independent Studies theses, and 16 summer undergrad students. Almost all of my past students are still active in the field; of the 34 HQP (grad and honours) since 04, 57% continued in academia, 19% are working in government labs, and 16% are in industry (3 current unknown; lifetime 2/57 have left field). I employ an average of 3-4 summer students as laboratory technicians.
- Since 04, I have sat on >25 Supervisory committees (13 complete, 6 PhD), and have been an examiner on 10 thesis final and qualifying exams at UNB and an external examiner for PhD theses in Canada (2), USA, New Zealand, Chile (2), Sweden and an MSc thesis in Uruguay, and U Waterloo. I was also Director of Graduate Studies, Biology, UNBSJ, from 08-09.
- I currently on 15 supervisory committees at 5 universities, and have adjunct or visiting status at the University of Maine (Orono), 1999-present; Associated Graduate Faculty at the Department of Biology, University of Waterloo, 1991-present; Associate Graduate Faculty at Department of Environmental Biology, University of Guelph, 1991-present; Associate Graduate Faculty at Department of Zoology, University of Guelph, 1994-present; Appointed as a member Centre for Toxicology, University of Guelph, 1993
- I have coordinated graduate courses Biol 6913 Research Methods (7+ years), Biol 6000 Seminars (1 year) and occasionally offer Biol 6185 Pollution Biology. Graduate student training has included 13 MSc and 6 PhD students that have completed their programs, 3 MSc students and 2 PhD students are in progress; 7 of my 19 graduate students at UNB have had NSERC graduate fellowships. Since 2001 have been external thesis examiner in Canada, Sweden, Chile (2), Uruguay, NZ, and USA.
- I regularly offer short courses internationally that range in length from 1 d to 14 d, including courses on river assessment (Chile 2008, 2005), pulp mill impacts (Chile 2007, 2006; Uruguay 2006), endocrine disruption (Uruguay 2007, New Zealand 2003), risk assessment (Mexico 2006, Cuba

2002), using fish to assess pollution (Peru, 2009, Australia 2008, USA 2005, Canada 2007, 2004) and have co-administered a 7-10 d watershed assessment course (Biobio River, Chile 2010, Columbia River 2009, Yukon 2008, Saint John 2006, Fraser 2005, Grand River 2004).

- Hosted visiting scientists from Cuba (3), Chile (3), Sweden, and Argentina, including a Harrison McCain Visiting Professorship from Cuba (Feb-Aug, 2007).

III. Research, Scholarly or Creative Activity

A. General Areas of Academic Interest:

Methodology for cumulative effects assessment; impacts of industrial effluents on fish populations; environmental effects monitoring methodology; fish reproductive physiology; physiological responses to contaminants; identification of cause-effect relationships

B. Research Grants Received (2005-present)

Since 2001, I generated significant funding including substantial funding for infrastructure, research and collaborative programs. I obtained >\$5.5M from CFI, ACOA and NB UITF for a new Canadian Rivers Institute (CRI) building on the Saint John campus of UNB, opened October 13, 2006. I also received more than \$2.5M in research funding (excluding 1.4M\$ of CRC funding) from 16 different agencies or industries. The following list includes only funding since 2005.

Recently held funding

	Organization	Title	Value	Years
Munkittrick	NSERC	Canada Research Chair in Ecosystem Health Assessment,	200 K	01-07
			200 K	08-14
Munkittrick	NSERC	Discovery grant	10K	06-11
Munkittrick	CFI	Electrofishing boat and trailer	74.6 K	07-08
Munkittrick	CFI	Infrastructure support	145 K	09
			122 K	10
			109 K	11
Maclatchy et al.	NSERC Strategic	NSERC STPGP 365212	54.25 K	09
			60.45 K	10
Munkittrick et al.	NSERC Strategic	Understanding the recovery of ecosystems from pulp mill effluent exposure	146 K	10
			247 K	11
			198K	12
Dube et al.	CWN NCE	River assessment project	81K*	08-11
Munkittrick et al.	CWN NCE	Knowledge Transfer Project IWRM	71.5 K	07-08
			78 K	08-09
Munkittrick	CWN NCE	Program Leader Funding	70 K*	06-08
Munkittrick and others	CWN NCE	Canadian Water Network, Saint John River studies	180 K	06-07
			180 K	05-06
Metcalfe and others	CWNNCE	Municipal infrastructure funding for EDCs	25 K	10
			25K	11
			25K	12
Munkittrick et al.	Irving Oil	Little River Study	23.6 K	07
			45.1 K	08
			33 K	09

			62.5 K	10
Munkittrick	NBIF	Research Assistance Initiative	30K	05-08 06-07 07-08
Munkittrick KR	NBIF RAI	Undergraduate scholarship	5K	07-08
Munkittrick	Maine DEP	Impacts of pulp mills on Kennebec River	13.9 K	09
Munkittrick	Maine DEP	Impacts of pulp mills on Androscoggin River	79.7 K	05-09
Haralampides, K and 4 others	St John Port Authority	An improved understanding of the sedimentation, circulation and currents in Saint John Harbour	208.8 K 229.7 K	08 09
Munkittrick KR	Environment Canada	Various projects related to monitoring design	24.2 K*	07-09
KRM	BC MOE	Columbia River	9 K	08

SECTION IV - PUBLICATIONS

		Lifetime	Published	In Press	Submitted
Refereed	Journals	134	117	8	9
	Presentations	37			
	Books	4			
	Book Chapters	36	35		1
Total Refereed Publications		207			
Non-refereed	Departmental and Technical Reports	74			
	Presentations	>600			

A. Articles in Refereed Journals

a) In Press articles

A118 Bosker Thijs, Mark Hewitt, Kelly Munkittrick, Steven Melvin, and Deborah MacLatchy. The effects of final treated effluent and in-mill waste streams from a Canadian thermomechanical pulp and paper mill on mummichog (*Fundulus heteroclitus*) reproduction. Water Qual Res J Can. In Press

b) Published articles

A117 Mower, B.F., K.R. Munkittrick, M.E. McMaster and R.J. Van Beneden. 2011. Response of white sucker to pulp and paper mill effluent in the Androscoggin River, Maine, USA. Environ. Toxicol. Chem. 30:142-153.

A116 Munkittrick, K.R., T.J. Barrett and M.E. McMaster. 2010. Guidance for site-specifically assessing the health of fish populations with emphasis on Canada's Environmental Effects Monitoring Program. Water Qual. Res J Can. 45: 209-221.

A115 Chiang, G., K.R. Munkittrick, R. Orrego and R. Barra. 2010. Monitoring of the environmental effects of pulp mill discharges in Chilean rivers: Lessons learned and challenges. Water Qual. Res J Can. 45: 111-122.

A114 Doherty, C.A., R.A. Curry, and K.R. Munkittrick. 2010. Spatial and temporal movements of white sucker: implications for use as a sentinel species. Trans. Amer. Fish. Soc. 139: 1818-1827.

- A113 Wyn, B., K.A. Kidd, N.M. Burgess, R.A. Curry and K.R. Munkittrick. 2010. Increasing mercury in yellow perch at a hotspot in Atlantic Canada, Kejimikujik National Park. *Environ Sci Technol* 44: 9176-9181.
- A112 Bosker, T, K.R. Munkittrick and D.L. MacLachy. 2010. Challenges and opportunities with the use of biomarkers to predict reproductive impairment in fishes exposed to endocrine disrupting substances. *Aquat. Toxicol.* 100: 9-16.
- A111 McMullin, V.A., K.R. Munkittrick, and D.A. Methven. 2010. Spatial variability of reproductive and size characteristics of the northern mummichog (*Fundulus heteroclitus macrolepidotus*) collected near municipal wastewater discharges. *Water Quality Res J Can* 45:25-34.
- A110 Blonar, C.A., D.L. MacLachy, J.D. Kieffer and K.R. Munkittrick. 2010. Exposure to a mixture of zinc and copper decreases survival and fecundity of *Discocotyle sagittata* (Leuckart) parasitizing juvenile Atlantic salmon, *Salmo salar* L. *Bull. Environ. Contam. Toxicol.* 84: 692-697.
- A109 Barrett, T.J., M.A. Tingley, K.R. Munkittrick and R.B. Lowell. 2010. Dealing with heterogeneous regression slopes in analysis of covariance: new methodology applied to environmental effects monitoring fish survey data. *Environmental Monitoring and Assessment* 166: 279-291.
- A108 Barrett, T.J. and K.R. Munkittrick. 2010. Seasonal reproductive patterns and recommended sampling times for sentinel fish species used in environmental effects monitoring programs in Canada. *Environ. Rev.* 18:115-135.
- A107 Barrett, T.J., R.B. Lowell, M.A. Tingley and K.R. Munkittrick. 2010. Effects of pulp and paper mill effluent on fish: a temporal assessment of fish health across sampling cycles. *Environ. Toxicol. Chem.* 29: 440-452.
- A106 Bowron L. K., K.R. Munkittrick, M.E. McMaster, G. Tetreault and L.M. Hewitt. 2009. Responses of white sucker (*Catostomus commersoni*) to 20 years of process and waste treatment changes at a bleached kraft pulp mill, and to mill shutdown. *Aquatic Toxicology* 95: 117-132.
- A105 Melvin, S.D., K.R. Munkittrick, T. Bosker and D.L. MacLachy. 2009. Detectable effect size and bioassay power of mummichog (*Fundulus heteroclitus*) and fathead minnow (*Pimephales promelas*) adult reproductive tests. *Environ. Toxicol. Chem.* 28: 2416-2425.
- A104 Bosker, T., K.R. Munkittrick and D.L. MacLachy. 2009. Challenges in current adult fish laboratory reproductive tests: suggestions for refinement using a mummichog (*Fundulus heteroclitus*) case study. *Environ. Toxicol. Chem.* 28:2386-2396.
- A103 McMullin, V.A., K. R. Munkittrick and D.A. Methven. 2009. Latitudinal variability in lunar spawning rhythms: absence of a lunar pattern in the northern mummichog (*Fundulus heteroclitus macrolepidotum* Walbaum). *J. Fish Biol* 75: 885-900.
- A102 Blonar, C.A., K.R. Munkittrick, J. Houlihan, D.L. MacLachy and D.J. Marcogliese. 2009. Pollution and parasitism in aquatic animals: A meta-analysis of effect size. *Aquatic Toxicology* 93: 18-28.
- A101 Munkittrick, K.R. 2009. Ubiquitous criticisms of ecological field studies. *Human Ecol Risk Assess* 15(4): 1-4.
- A100 Bosker, T. And K. Munkittrick. 2009. Often overlooked: Biological QA/QC. *Integrat Environ Assess Managem* 5: 489-491.
- A99 Munkittrick, K.R., C.J. Arens, R.B. Lowell and G.P. Kaminski. 2009. A review of potential methods for determining critical effect size for designing environmental monitoring programs. *Environ. Toxicol. Chem.* 28:1361-1371.

B. Books

a) authored books.

- B2 Munkittrick, K.R., M. McMaster, G. Van Der Kraak, C. Portt, W. Gibbons, A. Farwell and M. Gray. 2000. *Development of Methods for Effects-Based Cumulative Effects Assessment Using Fish Populations: Moose River Project*. SETAC Press, Pensacola, FL. 236 pp. + xviii

b) editorial responsibilities

- B4 Munkittrick, K.R., M.E. McMaster and S.C. Courtenay (Special Editors) Special Issue Water Quality Research Journal of Canada, Vol. 37(1): 1-294 (2002). Theme issue: *Environmental Effects Monitoring* January 2002

C. Book Chapters

- C37 Munkittrick, K.R., M.E. McMaster, D.L. MacLatchy and R.A. Curry. Development of a cumulative effects strategy for identifying areas of concern in large river systems. SETAC LA Monograph, submitted
- C35 Dubé, M.G., K. R. Munkittrick and L.M. Hewitt. 2008. Chapter 24, Case Study: Pulp and Paper Mill Impacts. p. 933-970 In (eds. R.T. Di Giulio and D.E. Hinton) *The Toxicology of Fishes*. CRC Press, Boca Raton.
- C34 Munkittrick, K.R., R.A. Curry, J.M. Culp, R.A. Cunjak, D.L. MacLatchy, K.A. Kidd, S.E. Dalton, D.J. Baird and R. Newbury. 2007. The Saint John River. p. 129-145, In (Eds. C. King, J. Ramkissoo, M. Clüsener-Godt & Z. Adeel) *Water and Ecosystems: Managing Water in Diverse Ecosystems to Ensure Human Well-being*. UNU-INWEH, Hamilton, ON. ISBN 92-808-6002-X

D. Non-refereed Contributions – Departmental and Technical Reports

- D73 Arciszewski, T., A. Mercer, K. Kidd and K. Munkittrick. 2011. Hydrocarbon contamination in the sediment of Little River near the historic and current outfalls of the Irving Oil Refinery. Submitted to Irving Oil Ltd. Jan. 2011.
- D72 Gray, M.G. T. Arciszewski and K.R. Munkittrick. 2010. Guidance for the collection and sampling of slimy sculpin (*Cottus cognatus*) in northern Canadian lakes for environmental effects monitoring (EEM). Can. Fish. Aquat. Sci. Tech Reprt.: In Press
- D71 Diamond, J., K. Munkittrick, K. Kidd, S. Bartell, K. Thornton and K. Kapo. 2010. Diagnostic Tools to Evaluate Impacts of Trace Organic Compounds on Aquatic Populations and Communities: Phase I – Prioritization, Development and Testing of Site-Specific Framework WERF Project#: CEC5R08C; Task 2: Development of Diagnostic Tools for Trace Organic Chemicals and Multiple Stressors. Report submitted to WERF, Washington, DC 138 p.
- D70. Munkittrick, K., A. Harwood and M. Dube. 2010. Concept Paper for a Cumulative Effects Monitoring Framework for the Beaufort Sea. Prepared for INAC SRC Publication No. 12946-1E10, April 2010, 61 p.
- D69. Adams, J., A. Mercer, K. Munkittrick and K. Kidd. 2010. 2009 Monitoring Results for Little River. Report submitted to NB Environment for Irving Oil Ltd., April, 2010, 38 p.
- D68 Adams, J. and K. Munkittrick. 2009. 2008 Monitoring results for the Little River. Report submitted to NB Environment for Irving Oil Ltd., April, 2009 29 p.
- D67 Munkittrick, K.R. and M.E. McMaster. 2009. Development of a basin cumulative effects monitoring plan for the Lower Columbia River. Report prepared for Columbia River Integrated Environmental Monitoring Program, 35 p.
- D66 Munkittrick, K.R. 2009. Effects on Fish and Fisheries Resources. Chapter 3 for Environment Canada Pulp and Paper Technical Guidance Document for Environmental Effects Monitoring. National EEM Office, Environment Canada, Gatineau, QC

E. Papers Presented at Professional and Technical Meetings

Since 2004 I have been co-author on >200 conference presentations (average of 30 per year), and presenter of 50. Since 2001 I have given international presentations in Argentina, Australia, Brazil, Chile, Cuba, Finland, France, Mexico, New Zealand, Norway, Scotland, Spain, Thailand and the USA. I have given invited short courses in Australia (2008), Chile (annually 2005-2009), Cuba (2007, 2002, 2000),

Mexico (2006), Uruguay (2006), Ireland (2004), New Zealand (2003), Brazil (2008, 2000), and have previously lectured in France, Switzerland, Germany, Russia, Sweden, England, Kuwait, the Netherlands and Belgium.

SECTION V - SERVICE

A. Service on University, Campus, Faculty and Divisional Committees

- a) *Department and Faculty Level*: Acting Director Graduate Studies, Biology SJ (2008-2009); Department of Biology Level 1 Committee (2001- 04; 2007-2008); Department of Biology, Graduate Studies Committee (GAU) (2002 – 2007); SASE Level II Assessment (2006-07, 2008-2009); SASE member of the Executive for the School of Graduate Studies (2008-present);
- b) *Campus and University Level*: Associate Director and Member Management Board, Canadian Rivers Institute (2001- 2011); Non-Credit Curriculum Committee (2006-present); Radiation Safety Committee (2007-present); Faculty nominating committee, Biology Rep. (2001- present); Executive Committee, School of Graduate Studies (2008-present); UNB SJ NSERC Ranking Committee (2002-03, 2005-09); UNB NSERC Ranking Committee (2007);

B. Service on Professional and Learned Science Committees

Membership on Management Boards, Editorial Boards, Grant Review Committees

- a) Canadian Water Network (NCE)
 - I. Scientific Director, 2011-present
 - II. Consortium Development Coordinator (2010-2011); Theme Leader, Watersheds and Ecosystems (2005-2010); Program Management Committee (2005-present); Chair Pathogens-In-Groundwater Consortium Management Committee (2006-2009); Board of Directors (elected representative, 2001-2004).
- b) Canadian Rivers Institute: Management Board, 2001 – 2011.
- c) Co-Chair, Lake Basins Working Group for the GEF IW:Science project executed by UNU-INWEH on “Enhancing the use of Science in International Waters projects to improve project results”
- d) Great Lakes Fisheries Commission Board of Technical Experts, Co-leader Fish Health and Ecosystem Dysfunction theme (2006-present).
- e) Associate Member, Arthur Irving Academy for the Environment, Acadia University (2007-present)
- f) Gulf of Maine Ecosystems Indicator Partnership: Contaminants Subcommittee (2007); Fisheries and Aquaculture Subcommittee (2007)

Scientific Societies:

- a) Society of Environmental Toxicology and Chemistry (SETAC), since 1985. SETAC World Council (Board of Directors), 2001 – 2004; Chair of SETAC International Programs Committee (1999 – 2004); SETAC World Council Executive Director Search Committee (2004); Member International Programs Committee (2006-present)
- b) International Water Association’s (IWA) Specialist Group on Pulp and Paper Industry Wastewaters (1998-present);
- c) Recent Membership on Editorial Boards
 - I. Editorial Board, Human and Ecological Risk Assessment, 2004-present.
 - II. Associate Editor, Journal of Aquatic Ecosystem Health and Management, 1996-2007.

C. Service on Community Committees

Membership on Water Connections – National Steering Committee, Centre for Sustainable Watersheds (2005-present) and Kennebecasis Watershed Restoration Committee – Advisory Board (2006 – Present)

D. General Professional Service, e.g. refereeing, examining, etc.

Grant Review Committees

- a) Member of Canada Research Chairs College of Reviewers (2001 – present).
- b) Great Lakes Fisheries Commission Board of Technical Experts, Co-leader Fish Health and Ecosystem Dysfunction theme (2006-present).
- c) New Opportunities Fund College of Reviewers (2003-2005); Leadership Opportunities Fund (2006-present).
- d) NSERC Selection Committee of NATO Science Fellowships (2001-2004).
- e) NSERC Selection Committee for Visiting Fellowships in Canadian Government Laboratories (2001-2004).

Review of Manuscripts and Proposals: I average 18 proposal and manuscripts reviews per year. I have reviewed research proposals for the International Foundation for Science (Sweden), Fundacao para a Ciencia e a Tecnologia (Portugal), International German-Israeli research program, Natural Environment Research Council (UK), US EPA (including US EPA Aquatic Systems Ecology STAR and GRO Fellowship review panel 2008), and CICEET (USA), as well as numerous Canadian national and provincial granting agencies. During my career, I have reviewed articles for 34 different international journals.

Conference Chairs and Organizing Cttees

Co- Chair: 7th International Conference on Fate and Effects of Pulp Mill Effluents, June 14-17, 2009, Fredericton NB; Co-Chair, GLFC Fish Health and Ecosystem Dysfunction Workshop, Ann Arbor, MI 4-6 November 2008

Organizing Committee: Organizing Committee, 34th Aquatic Toxicity Workshop, Sept 30-Oct 3, 2007, Halifax, NS; Scientific Committee, VIII Congreso SETAC LA, 8-11 Octubre, 2007, Montevideo, Uruguay; Organizing Committee, EEM Science Symposium 2008, April 29-31, 2008, Gatineau, Quebec; Organizing Committee, CWN Researcher Retreat, June 24-26, 2008, Victoria, BC; Organizing Committee, Overseas Short Course Coordinator, 5th World Congress, SETAC 08, August 3-7, 2008, Sydney, Australia; Organizing Committee - 9th IWA Symposium on Forest Industry Wastewaters, June 14-17, 2009, Fredericton, NB

Session Chaired: State of the Saint John River, 34th Aquatic Toxicity Workshop, Sept 30-Oct 3, 2007, Halifax, NS; Ecotoxicology, 28th Annual SETAC , November 11-15, 2007, Milwaukee, WI; Ecotoxicología, biotecnología i riesgo ambiental (Secretary), IV Congreso Internacional de la Sociedad Cubana de Toxicología, Dec 4-7, 2007, Havana, Cuba; Effects on ecosystems of multiple stressors SETAC World Congress, Aug 4-8, Sydney, Australia

Public Policy Contributions (since 2003)

Science Review Panels: Member of Review Panel for Oil Sands RAMP Studies (2003-2004); Canadian Government Committees: Environment Canada, EEM Science Team (1999 – present), Environment Canada EEM National Team (1995-2006).

Teaching Dossier

Since I hold a Tier 1 Canada research Chair, I am only required to teach one semester of undergraduate courses per year. My normal course work alternates between upper level Ecotoxicology (Biol 4825) and Environmental Techniques (Biol 4875), but I regularly teach graduate courses and short courses in additional areas.

My experience is varied and includes work in industry, government and academia, and touches on many different fields of biology. This multidisciplinary experience is reflected in the approach and style of teaching, and the students benefit from the exposure to real world issues and a variety of ways in which to apply their learning after graduation.

My undergraduate teaching mission and approach focuses on exposing the students to handling real data and exposing them to real world decisions and applied science issues. My courses involve a laboratory component that involves field sampling of fish, invertebrates and water quality near a real-world issue (development, discharge or emerging issue) and data analysis using data contributed from partners, to expose the students to the kinds of situations and decisions they will be required to make after graduation. The courses also involve considerable library and literature work. Since they are not exposed to these issues in many other courses, they regularly rate my course work as among the hardest they experience at UNBSJ.

A. Undergraduate Training

a) Courses Taught (Undergraduate) at UNB

I. Biol 4875 *Environmental Techniques*- Winter 04 (16), Fall 05 (18), Fall 07 (22)

Course outline: A techniques course, in which students gain practical experience in sampling and analytical techniques, including: water, invertebrate and animal sampling in field and lab; and chemical analyses of tissues and water. Appropriate study design and statistical analyses of collected data are emphasized.

II. Biol 4825 *Ecotoxicology* - Winter 03 (12), Winter 04 (1), Winter 05 (8), Fall 06 (22), Fall 08 (21)

Course outline: A theoretical and applied approach to the science of ecotoxicology, including application of the tools and procedures used to understand toxicant fate and effects in ecosystems. Both field (eg. community level environmental "effects" monitoring) and laboratory (eg. LC50 tests) methods for understanding contaminant fates and effects are examined.

III. Biol 4772 *Aquatic Ecology* (Co-administered) – Winter 2004 (33), Fall 05 (1)

IV. Biol 4741 *Fish Biology* Fall UNBF 1999 (17); Fall 00 (12)

V. Biol 4373 *Tropical Marine Biology* "Human Impacts on Coral Reef Fishes" (co-administered) Winter 2006 (19)

VI. Various guest lectures at Universities of Guelph, Waterloo, Queens, Maine (Orono)

b) Undergraduate Training

I. Biol 4090 (Honours) and 4060

- a. Meghan Doyle 2009-10 "The potential use of Atlantic Silverside as indicators of pollution in Saint John harbour"
- b. Leslie Carroll 2006-07 "The reproductive cycle of the redbelly dace (*Phoxinus eos*)."
- c. Adrianus Both 2006-07 (Co-supervisor) Distribution and abundance of long-finned hake in the Gulf of St. Lawrence: a comparison of 1979 and 2002."
- d. Nicole McQuoid 2006-07 (Co-supervisor) Distribution and abundance of flatfish in the Gulf of St. Lawrence: a comparison of 1979 and 2002."
- e. David Young 2005-06 "Assessing the variability in testosterone production in the slimy sculpin."

- f. Christy Mitchell, 2003-04 "A histological comparison of mummichog (*Fundulus heteroclitus*) in contaminated streams entering the Saint John Harbour."
- g. Collin Arens, 2002-03 (Co-Supervisor) "Distribution and abundance of neustonic *Urophycis tenuis* (white hake) in the Southern Gulf of St Lawrence: a comparison of 1979 and 2002."
- II. Other Undergraduate Training
 - a. Tim Barrett 2007-08 (Math and Statistics Department, UNB F) Analysis of Cycle 1 Environmental Effects Monitoring fish survey data. Final report for Statistics 4903.
 - b. Jennifer Ings, 2002-03 "The Index of Biotic Integrity: An overview of the methodology, uses, advantages and disadvantages.". Final report for Biol 3140 (Independent Studies), Biology, UNB SJ;
 - c. Instructed two students on independent studies for the Ecotoxicology course (Biol 4875) - Diane Miller (2003-04), Heidi Leblanc (2006)
- c) Summer Undergraduate Training (since 2001 have supervised >20 undergraduate students). Summer 2009 Meghan Doyle, Summer 2008 Tim Barrett, Ashley Nolan, Meghan Doyle, Emily Nelson, Ben Salmon (co-supervised); Summer 07 Leslie Carroll, Tim Barrett; Summer 06 Leslie Carroll; Summer 05 Lisa Bowron, Jenn Adams, Leslie Carroll;
Technical Staff: Jenn Adams (fall 09); Lisa Bowron (summer 08, spring, summer 09), Vince McMullin (summer 08), Leslie Carroll (Summer 07), Collin Arens (June 07-Apr 08)

B. Development of New Courses

- a) Undergraduate - Biol 4825 Ecotoxicology; Biol 4875 Environmental Techniques; Biol 4483 Applied Ecology and Environmental Monitoring
- b) CWN Graduate Student Watershed Courses, Co-developed concept offered on the Grand River (ON, 2004), Fraser River (BC, 2005), Saint John River (2006) and Yukon River (2008). Hosted CWN Watersheds Course, Saint John River, June 21-29, 2006 – 10 d short course on watershed management hosting >30 graduate students from 4 countries and across Canada

C. International Courses

- a) Chile – Centro de Ciencias Ambientales, EULA-Chile Centre, Universidad de Concepcion
 - I. Jan 19-23, 2009 "Design of biomonitoring programs" (18) Co-taught
 - II. Jan 9-18, 2008 "Multiple stressors in aquatic ecosystems " (25) Co-taught
 - III. Jan 17-26, 2007 "The pulp mill industry and its impacts on aquatic ecosystems" (25) Co-taught.
 - IV. Jan 4-13, 2006, "The pulp mill industry and its impacts on aquatic ecosystems" (25) Co-taught.
 - V. Jan 3- 9, 2005, "Monitoreo de efectos ambientales de estresores multiples en sistemas fluviales" (18) Co-taught.
- b) Brazil, Dec 8-11, 2008; hosted by Aplyisa, Vittoria, course on "Ecotoxicological Studies of the Effects of Pulp and Paper Mill Effluents on Fish" (20 students) co-taught
- c) Uruguay, Universidad de Republica, Facultad de Ciencias, Montevideo
 - I. October 12, 2007 Endocrine disruption (3 lectures),
 - II. December 5-8, 2006, "Biological monitoring of pulp mill effluents" (25)
- d) Mexico – CIAD, Mazatlan, July 11-15, 2006, "Ecological risk assessment" (30) Co-taught.
- e) Ireland, Biol 4483 "Applied Ecology & Environmental Monitoring in Irish Ecosystems" (co-taught 23 - 2004).
- f) New Zealand - "Endocrine Disruptors", SETAC Asia-Pacific – Aust. Soc. Ecotox. , Sept 30, 2003, Christchurch, NZ (0.5 days).
- g) Cuba, U. of Havana – 2002 "Advanced Topics in Ecotoxicology" (20), 10 days and 2000 - "Ecotoxicology" (co-developed) (35) 5 days
- h) Small Fish Short course
 - I. Using Fish in Environmental Monitoring (0.5 d course) in Fredericton, NB (Oct 22, 2008 ; 25 students), Halifax, NS (April 16, 2009 ; 45), Montreal, QC (April 24; 23), Edmonton, AB (May

- 25;19), Saskatoon, SK (June 29;32), Vancouver, BC (July 14; 40), Nelson BC (July 20;15), and Burlington, ON (Jan 8' 45)
- II. Peru – “Using Fish in Environmental Monitoring” Lima IX Congreso de la Sociedad de Química y Toxicología Ambiental de Latinoamérica (SETAC LA)-II Congreso SETAC PERU, Lima (Oct 5, 2009; 10 students)
 - III. Saskatoon SK - Using small-bodied fish species in Environmental Effects Monitoring, 35th Aquatic Toxicity Workshop, (Oct 5, 2008, 16 students)
 - IV. Sydney, Australia Using Fish in Environmental Monitoring (0.5 d short course, 18 students) at SETAC World Congress, Aug 3, 2008
 - V. Using small-bodied fish species in Environmental Effects Monitoring, 34th Aquatic Toxicity Workshop, September 30, 2007, Halifax, NS,
 - VI. USA 1 day short course “Using Small-Bodied Fish Species in Environmental Monitoring”, Baltimore, MD November 10, 2005 (25 participants 2005).
 - VII. Canada 1 day short course “Using Small-Bodied Fish Species in Environmental Monitoring”, Charlottetown, PEI October 22, 2004 (25 participants).

E. Graduate Students Supervised

Student research supervised or co-supervised: MSc 16 (5 current); PhD 8 (2 current); BSc 7 (1 current); PDF 8 (1 current); Supervisory Committees: 27 (15 current)

a) Current Graduate Students

MSc

2008 Gila Somers Dept. Biology, UNB SJ

Cumulative effects on the Kennebecasis River due to land use fragmentation.

2010 Meghan Doyle Dept Biology, UNB SJ C. Martyniuk

Molecular responses of mummichog to EE2

2010 Paulina Bahamonde Dept. Biology UNB SJ

Detecting effects of sewage discharges on reproductive performance of darter spp.

PhD

2009 Sumith Jayakody Dept. Biology, UNBSJ

Effects of agricultural activity on Sri Lankan fish populations

2009 Noelia Rivas Facultad de Ciencias, Universidad de la Republica, Uruguay; Co-Supervised

Efectos a nivel comunitario, poblacional e individual en peces de cuencas con actividad agricola de rotacion soja-trigo en los departamentos de Rio Negro y Soriano

2008 Tim Barrett Dept Biology, UNB SJ

Species-specific adjustments for environmental monitoring plans using fish

b) Graduate Student Supervisory Committees (25 total, 11 current at 4 Universities)

c) Completed Graduate Students

MSc (2 Previous)

Mary Sollows, M.Sc. 2006-2010. Size, age distribution and conservation status of the Freshwater Pearl Mussel *Margaritifera margaritifera* (L.) in the Kennebecasis River, New Brunswick, Canada (defense Sept 8, 2010)

- Jennifer Adams, M.Sc. 2006-2008. The use of laboratory and field data to evaluate the response of Little River fish populations to improved oil refinery wastewater. (Co-supervised, D. MacLatchy) (defense November 17, 2008)
- Steve Melvin, M.Sc. 2006-2008. Reproductive endocrine response of two small-bodied fish, the mummichog (*Fundulus heteroclitus*) and the fathead minnow (*Pimephales promelas*) exposed to pulp mill effluent (Co-supervised, D. MacLatchy) (defense September 11, 2008) Continuing graduate student
- Lisa Bowron, M.Sc. 2006-2008. Responses of white sucker (*Catostomus commersoni*) populations to changes in pulp mill effluent discharges. (defense June 20, 2008). Current – Research Associate, CRI
- Vince McMullin, M.Sc. 2006-2008. An investigation of temporal and spatial reproductive variability associated with northern mummichog (*Fundulus heteroclitus macrolepidotus*) spawning activity in the lower Saint John River. (defense May 26, 2008) (Co-supervised Dave Methven). Current – Research Associate, CRI
- Tim Arciszewski, M.Sc. 2005-2007 Population-level responses of fish and invertebrates to municipal and industrial effluents in a complex receiving environment. Dept. Biology, UNB SJ (defense August 24, 2007) (Co-supervised Karen Kidd), Current – Consulting, BC
- Jason Casselman, M.Sc. 2004-2007 Ecology and community structure of the Saint John Harbour fish assemblage, Dept Biology, UNB SJ (Co-supervised D. Methven) (defense April 24, 2007). Current – Consulting, BC
- Collin Arens, M.Sc. 2003-2007. Nearshore fish community structure in the southwest Bay of Fundy and northwest Atlantic: comparing assemblages across multiple spatial and temporal scales. Dept Biology, UNB SJ (Co-supervised D. Methven) (defense April 19, 2007) Current: Biologist, UNB SJ
- Karma Tenzin, M.Sc. 2002-2006. The design of a non-lethal fish monitoring program for rivers in Bhutan. Current: government training program, Bhutan (defense April 27, 2006)
- Jonathan Freedman, M.Sc. 2003-2005. Movement patterns and trophic structure of a reservoir fish community assessed using stable isotope analysis. (Co-supervised A. Curry)(defense September 27, 2005) Current: PhD Student Penn State U
- Genevieve Vallieres, M.Sc. 2002-2005. An effects-based assessment of the health of fish in a small estuarine stream receiving effluent from an oil refinery. (Co-supervised, D. MacLatchy) (defense May 16, 2005) Current: Golder Consulting, Saskatoon, SK
- Jennifer Peddle M.Sc. 2001-2004 Biodiversity and community ecology of the parasites of the three-spine stickleback, *Gasterosteus aculeatus*, in the southern Gulf of St. Lawrence (defense September 7 2004) Current: Provincial Gov't, BC
- Chad Doherty, M.Sc. 2001-2004 Movement patterns and biology of white sucker in a riverine environment exposed to multiple stresses (Co-supervised, A. Curry) (defense August 2004) Current: Hatfield Consultants, Alberta
- Lottie Vallis, M.Sc. 2000-2003 The potential use of rock gunnel (*Pholis gunnellus*) as a bioindicator in Saint John Harbour, New Brunswick, Canada (Co-supervised, D. MacLatchy) (defense December 17, 2003) Current Environment Canada, Halifax
- PhD (2 Previous)*
- Thijs Bosker, Ph.D., 2006-2009. Short-term adult fish reproductive tests: evaluation, refinement and application. (Co-supervised, D. MacLatchy) (defense July 28, 2009)
- Chris Blonar, Ph.D., 2001-2008. Parasites as biological indicators of pollution: metal contamination and *Discocotyle sagittata* infection on juvenile Atlantic salmon. (Co-supervised, D. MacLatchy) (defense October 16, 2008)
- Sandra Brasfield, Ph.D. 2002-2007. Investigating and interpreting reduced reproductive performance in fish inhabiting streams adjacent to agricultural operations. (defense July 5, 2007). Current: US ACOE, Vicksburg, MS

Brendan Galloway, Ph.D. 2000-2005. Evaluating the suitability of fish species for environmental monitoring programs (Co-supervised, A. Curry) (defense May 31, 2005) Current Golder Consultants, Calgary

Michelle Gray, Ph.D. 1999-2003 Assessing Non-Point Source Pollution in Agricultural Regions of the Upper St. John River Basin Using the Slimy Sculpin (*Cottus cognatus*) (Co-supervised, R. Cunjak; defense December 18) Current: Training Coordinator, CRI, UNB

Postdoc (5 Previous)

Thijs Bosker (Netherlands), 2009

Craig Milestone (Co-supervisor, New Zealand), 2007

Rodrigo Orrego (2006), from U de Concepcion, Chile

d) Graduate Student Supervisory Committees (11 current, 12 completed)

Currently: Aaron Bennett (MSc, UNB SJ, Macdonald); Ian Butts (PhD, UNB SJ, Litvak); Heather Doyle (MSc, UNB SJ, Houlahan); Tom Gallant (PhD, UPEI, Arkuwe); Tony Gazeas (MSc, UNBF, Baird); Tim Jardine (PhD, UNB SJ, Kidd); Paul Lepage (MSc, U Waterloo, Dixon); Barry Mower (PhD, U Maine, Orono, van Beneden); Sandy O'Neal (Ph.D. UNB SJ, Macdonald); Joe Mudge (MSc, UNB SJ, Frego);

Completed (since 2001): Veronique David (MSc, UNB SJ, Macdonald) 2003; Dan Baker (MSc, UNB SJ, Kieffer) 2004; Andrea Bremner (MSc, UNB SJ, Frego) 2005; Rebecca Ibey (Peters) (MSc, UNB SJ, Maclatchy) 2005; Alison Johnson (MSc, UNB F, Peake) 2007; Cheryl Klassen (MSc, UNB F, Peake) 2007; Marilyn Kullman (MSc, UNB SJ, Kidd) 2006; Kevin Shaughnessey (MSc, UNB SJ, Maclatchy) 2005; Mark Skinner (MSc, UNB F, Curry) 2005, Rachel Keller (MSc, UNB F, Cunjak), M.-H. Theriault (MSc, U de Moncton, Courtenay)

Examination Committees

a) Defense examinations

Marie-Helene Theriault MSc Ude Moncton 2005; Doris Smith, Biology, UNBF PhD Biology Sept, 2002; Tracey Cochrane, MSc Defense Cttee, Geology UNBF Jan 2001; Trish Edwards, MSc UNBF Biology May 2001; Erik Bataller PhD UNBF Biology Nov 2001

Chaired: Roz Smedley, MSc UNB F, May, 2007; Rebecca Ibey-Peters, MSc, UNB SJ, April 2005; Danny Jardine, MSc UNB SJ Sept 2004; Amanda Bremner, UNB SJ Biology July 2004; Jacob van de Sande UNB F Biology Feb 2004; Tim Jardine, Dec, UNB SJ Biology Dec 2003; Sean Corrigan, Biology, UNBF Biology MSc Apr 2002; Scott MacNeill, MSc UNBF Biology December 2001;

b) External Examiner for Theses

Ph.D. Plant and Environmental Sciences, University of Gothenburg, Sweden (Dec 2008); Biology, University of Waterloo (March 2007); Centro EULA, Universidad de Concepcion, Chile (2005); Biology, University of Waikato (NZ) (2004); Environmental Biology, University of Guelph; Zoology, University of Guelph

M.Sc. Biologie, U de Moncton; Memorial University, Trent University, Watershed Ecosystems Program; Biology, University of Waterloo; Zoology, University of Guelph

M.Sc. Proposals Universidad de la Republica, Facultad des Ciencias, Montevideo, Uruguay (Dec 2006)

c) Comprehensive Examination: Thijs Bosker, UNB SJM Biology (2007); Heidi Swanson, UNB SJ Biology (2007); Robyn OKeefe, UNB F Biology (2003); P.V Saranyan UNB F Biology Feb 2002; Rainie Sharp, UNBSJ October (2001); Shawn Flynn UNB F Biology (2001); Melanie Hobbs UNB F Engineering (2000)