

# Annual Report

## 2016-2017



*Make  
Every River  
a Healthy  
River*

# Canadian Rivers Institute Annual Report 2016-2017

**The annual report was prepared by Anne Levesque (CRI Executive Director) and Jess Kidd (Courtenay Lab, University of Waterloo).**

**Report edited by Jon MacNeill (Conservation Council of New Brunswick) and designed by Jess Kidd.**

**This annual report comprises highlights and is a small sample of the initiatives completed this fiscal year (May 1, 2016 – April 30, 2017) by the CRI community. The detail within is not exhaustive, as there are many initiatives of the CRI network that are important and also merit acknowledgement.**



Photo by Jess Kidd

The Canadian Rivers Institute (CRI), established in 2001 and hosted by the University of New Brunswick, aims to “make every river a healthy river.”

“At CRI we use the best available science to find answers to the important questions being asked today. Whether it is a government department, industry looking to develop better management processes, or watershed groups wanting to understand the health of their river, every one of our projects is providing a much-needed answer to stakeholder questions. With the changes occurring around the world and particularly the stress being put on our aquatic ecosystems, it’s important now more than ever to have the multidisciplinary, collaborative approach to problem solving provided by the CRI.”

- Dr. Michael van den Heuvel, Institute Director based at the University of Prince Edward Island

CRI advances river research through our network of aquatic scientists at:

- Environment and Climate Change Canada (ECCC)
- Institut nationale de la recherche scientifique, Université de Québec
- Okanagan College
- Stantec Inc.
- University of Florida (USA)
- University of Guadalajara, Mexico
- University of Lethbridge
- University of New Brunswick
- University of Ontario Institute of Technology
- University of Prince Edward Island
- University of Saskatchewan
- University of Waterloo
- University of Wisconsin-Parkside
- Western University
- Wilfrid Laurier University
- Prothea Group (Milan, Italy)

These scientists and their networks of research associates, graduate students and staff, support governments, businesses and communities in making smart, evidence-based decisions through high-impact research.

The partnership between UNB and CRI has been critical and ensures the CRI’s capacity to undertake important national and international research, scientific and educational projects and collaborations for over 16 years.

# Director's Message



It has once again been my privilege to be the Director of the CRI over the past year. I would like to thank all of the world-class Science Directors, Associates, and Students that have contributed their time and energy to our unique national network. The highlight of this year for me was the development of an operational plan for the CRI. The CRI has spent many years developing our vision and science plan and the operational plan signifies the first step forward to bring all of that thinking to tangible outcomes.

The CRI with its partners will focus on a number of these priorities in the coming year. The CRI will continue to establish itself as the national leader in environmental flows research. Thanks to Science Director Andre St-Hilaire, we have a national workshop planned for early in the year to address research priorities. The CRI is maintaining and growing its presence as a leader in Atlantic salmon research with the CAST program and other initiatives. The CRI will also continue to develop a presence in Arctic biodiversity and northern Rivers with Wilfrid Laurier University and plans for a 2018 conference are well underway. Finally, as part of our involvement with the development of the International Water Decade Alliance, CRI is developing a broader role to help Canada be at the table for global water issues. New initiatives will continue to arise and the CRI executive will continue to allocate resources to those initiatives that bring us together as a national team.

It is no secret that many of the Science Directors are getting more than a little grey hair. After 16 years, the CRI is experiencing a turnover and career transition - one of our founding members will retire in the next year, one is now a University President! The future of the CRI lies in young, eager and brilliant scientists that will become the new CRI. So, a big welcome to Natacha, Tim, Jessica and Steve our four new Science Directors, three of whom have had some component of their training through the CRI. There are also a number of talented young scientists, also trained in the CRI, waiting in the wings to become Science Directors. Those individuals that we train are the virtual fountain of youth for the CRI.



*Photo by Carissa Grove*

Training has always been a cornerstone of the CRI and will continue to be one of our main missions that sets us apart from all others. Growing our training for the next generation of academics, professional, and community-based scientists will be one of our primary missions going forward. This year we celebrated the completion of CREATE WATER (thanks to Science Director Michelle Gray) and we supervise over 100 graduate and undergraduate students. We have also realized great success in training community-based scientists, particularly with the CABIN program training (thanks again Michelle). Moving into next year, the CRI will also be rejuvenating our training in hydrology, habitat and restoration, areas that are at the core of what we do. We will continue to strive to make CRI the go-to institute for training in aquatic sciences.

Growth towards an effective national network does not come without its challenges. As we continue to expand west of the Atlantic provinces, CRI has a rapidly growing critical mass of scientists in Ontario, and a Management Board populated with accomplished individuals from coast to coast. However, there are hurdles to overcome in order to unite as an institute in such a vast country. This is particularly true of our student network and we must focus on innovative solutions to give all of our student a sense of CRI identity as our highest priority.

It is no secret that the person holding everything together is our Executive Director. Thanks again to Anne Levesque for continuing to push us forward and always challenging our notions of where the CRI is going. Thanks as well to our former Chair of the Science Director Board, Donald Baird. Donald's professionalism helped guide the executive committee for the past two years. Wishing you all the success for 2018. Go forth and make every river a healthy river.

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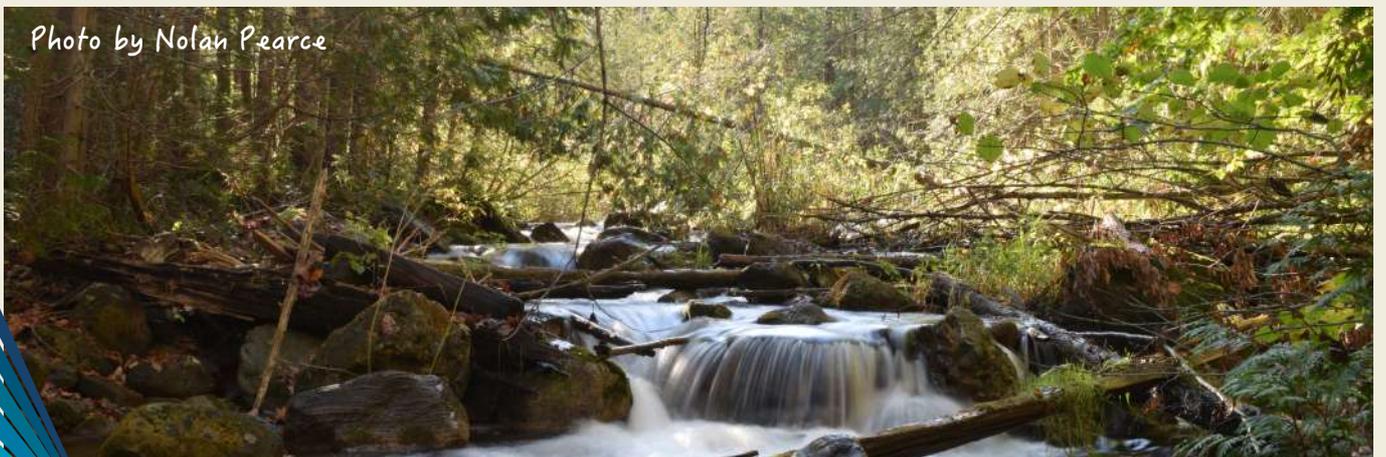
## PRELUDE

Worldwide, clean freshwater is one of our most important resources. Management of freshwater, especially under the threat of a changing climate, is central to economic stability for communities around the world. As we advance our understanding of river ecosystems, adoption of innovative science to inform monitoring and river management is needed at home and around the world. In the face of mounting uncertainty surrounding the effects of climate change and increased social demands on water, the importance of understanding and assessing river health has become an international priority for the science and policy sectors.

Canada is ranked 4<sup>th</sup> in the world in total renewable water resources. As public concern over freshwater issues continues to grow, there is increasing pressure to address societal needs while sustaining healthy aquatic ecosystems.

Since its inception in 2001, the researchers at the Canadian Rivers Institute (CRI) have worked collectively and with multiple stakeholders to resolve complex environmental and social issues related to the integrity of aquatic ecosystems.

*Photo by Nolan Pearce*



# Section 1: 2016-2017 Highlights

“At CRI we use the best available science to find answers to the important questions being asked today. Whether it is a government department developing water regulations, industry looking to develop better management processes, or watershed groups wanting to understand the health of their river, all of our projects are providing much-needed answers to stakeholder questions. With the changes occurring around the world and particularly the stress being put on our aquatic ecosystems, it’s important now more than ever to have the multidisciplinary, collaborative approach to problem solving provided by the CRI.”

- Dr. Michael van den Heuvel, Institute Director

From four founding members at UNB in 2001, the CRI today has grown to 23 Science Directors, 83 Research Associates, 100 graduates and undergraduate honours students, 29 research and administrative staff, and over 450 student and research alumni across the country and around the world. The CRI goal of “making every river a healthy river” is an incredibly complex undertaking, but it is one of the reasons CRI has remained at the forefront of river science.

The CRI’s research plan focuses on protecting and improving the health of rivers by conducting the innovative science needed to create a paradigm shift in river management, including:

- Developing meaningful indicators and promoting thresholds of change for aquatic ecosystems
- Understanding sustainable links between water flow and biological processes in rivers
- Advancing monitoring and management practices related to how human activities affect aquatic ecosystems

CRI is recognized worldwide for its partnerships with government and industry to advance applied research and improve management practices. The CRI 2016-17 report provides a sample of the work being done by the hundreds of CRI members.

# Four new Science Directors



## Natacha Hogan, University of Saskatchewan

Natacha Hogan is native to Prince Edward Island, and originally joined CRI as a postdoctoral research fellow working with Science Director Michael van den Heuvel at the University of Prince Edward Island. Her post-doctoral research with the CRI examined the impact of aquatic reclamation strategies for oil sands-impacted sites and changing water quality on native fish health.

Currently, Natacha is an Assistant Professor in the Department of Animal and Poultry Science and Toxicology Centre at the University of Saskatchewan. Her expertise is in the areas of environmental, biomedical and nutritional toxicology.

She is one of five Northern Ecosystem Toxicology Initiative (NETI) researchers. The mandate of NETI is to evaluate the toxicological issues of concern to Saskatchewan and Canada's northern regions. Natacha is also a member of the

Global Institute for Water Security where they lead and initiate water research activities at the University of Saskatchewan with affiliated partners including Environment and Climate Change Canada, and Agriculture and Agri-Food Canada. She is a member of the research team for the Aquatic Impact Assessment of Municipal Effluents (AIME) with the Canadian Water Network (CWN), a project to characterize and assess the effects of municipal wastewater effluent and its possible impacts on downstream aquatic organisms.

She uses her training as a toxicologist to address contaminant issues in animal health, and this past year, Natacha was in the news for her research in preventing the decline of salamanders and newts in North America.

*"As a Science Director, I get to be part of a dynamic network of scientists working together to learn about issues related river 'health', whether that be water quality, flow, the health of organisms that reside in rivers and how all of this impacts how we value and use river systems. This network also provides training, mentoring, and opportunities for students - helping them develop into future aquatic scientists who will contribute innovative ideas to protecting water resources here in Canada and globally."*

*- Natacha Hogan, Science Director*



## Tim Jardine, University of Saskatchewan

Tim Jardine grew up in New Brunswick along the banks of the Miramichi River. Originally a CRI student, Tim studied at UNB with Science Director Deborah MacLatchy for his MSc and Science Director Karen Kidd for his PhD. During his time at UNB, Tim studied the effects of a pulp and paper mill on salmon as they migrated from the Miramichi to the ocean, and how migratory salmon and trout use different areas of rivers and coasts to feed and grow.

Currently, Tim is an Assistant Professor in the School of Environment and Sustainability and Toxicology Centre at the University of Saskatchewan. His expertise is in using ecological tracers to understand energy and contaminant cycling in rivers, estuaries and reservoirs. He is the academic lead in the Saskatchewan River Delta as a member of the Delta Dialogue Network (DDN), which brings together community leaders and youth with graduate students to study changes in hydrology, ecology and economy. He is also a researcher, through the Canadian Water Network (CWN), for the Slave Watershed Environmental Effects Program (SWEEP). SWEEP is a community-based monitoring program that is enabling communities to collect, interpret and use environmental indicators to assess changes to the ecological health of the Slave River and Delta. Tim is also a member of the Global Institute for Water Security where they lead and initiate water research activities at the University of Saskatchewan with affiliated partners including Environment and Climate Change Canada, and Agriculture and Agri-Food Canada.

Tim is currently collaborating with Science Director Karen Kidd to study the global drivers of mercury biomagnification. He is also working with Science Directors Allen Curry and Donald Baird, and Associate Wendy Monk to bring environmental flows into watershed modelling. Finally, Tim is also working with Science Director Mark Servos on new applications of environmental DNA of fish communities.

*"I was motivated to become a Science Director because of my long-standing interest in the CRI. I was one of the first-ever CRI students (MSc 2001-2003, supervised by Dr. MacLatchy) and watched it grow from its inception through my PhD (2005-2009, supervised by Dr. Kidd) and while working as a Science Manager in the SINLAB (2003-2008). My hope is to help continue fostering a Western CRI presence with my fellow Prairie Science Directors Natacha Hogan and Steve Wiseman." - Tim Jardine, Science Director*



## Jessica Orlofske, University of Wisconsin-Parkside

“CRI has become a model of interdisciplinary, collaborative training and research. The CRI facilitates science with impact by translating the expertise of science directors, students, associates, and community members into policy and management to protect and sustain aquatic ecosystems.”

- Jessica Orlofske, Science Director

Jessica was raised in Milwaukee, WI. Her expertise is in invertebrate ecology and conservation with an emphasis on the application of aquatic invertebrates for monitoring ecosystem health. She originally joined CRI as a PhD student with Science Director Donald Baird. While at UNB, her research focused on understanding how insect community trait and taxonomic structure respond to variation in flow habitats.

Currently, Jessica is an assistant professor in the Department of Biological Sciences at the University of Wisconsin-Parkside. The aquatic research in Jessica’s lab focuses on the Great Lakes region, an area with strong connections to Canada through shared aquatic resources. Her research applies aquatic ecosystem monitoring and insect conservation to coastal wetland restoration, river flow management, including watershed diversions and dam management, characterizing the critical habitat for protected invertebrates, such as dragonflies,

and measuring the sublethal effects of climate change on aquatic invertebrates. Jessica is a member of the University of Wisconsin-System Advisory Council for Water Research Collaborative, and works with academic and community partners to develop and support research programs that address local needs, provide training opportunities for undergraduate and graduate students, and inform management and policy. Jessica and her students also actively engage in community outreach through partnerships with the Racine Health Department, the Root River Environmental Education Community Center, the Milwaukee Public Museum, and the Urban Ecology Center.

This past year, she received a John J. Brander and Christine E. Rundblad Research Fellowship that allowed her to expand the scope of her dragonfly research.



## Steve Wiseman, University of Lethbridge

Steve Wiseman was raised in Newfoundland. He completed his graduate degrees at the University of Waterloo, and a postdoctoral fellowship at the University of Saskatchewan. Much of his research has been focused on characterizing the adverse effects of process-affected water generated in the mining industry in northern Alberta.

Currently, Dr. Wiseman is an Associate Professor in the Department of Biological Sciences at the University of Lethbridge, and a Tier II Canada Research Chair in Aquatic and Mechanistic Toxicology. His expertise is in the molecular and biochemical mechanisms of both adaptive and maladaptive responses in aquatic organisms, particularly fishes, exposed acutely or chronically to natural and anthropogenic chemical stressors. His research program focuses on determining whether chemical stressors in aquatic systems pose a risk to aquatic organisms.

*"Becoming a Science Director with the CRI was a unique opportunity to join a group of world-renowned scientists from a variety of disciplines who are performing science that is making a difference to the health of river ecosystems across Canada ."*

*- Steve Wiseman, Science Director*



*Photo by Jess Kidd*

# National collaboration to advance aquatic research in Canada

## **Advancing Canada's scientific understanding of cumulative impact assessment**

There is growing agreement in Canada that protecting the environment and sustaining its structure and functions requires thinking about, planning, and managing all of our activities together within a particular geography in a more coordinated fashion.

Decision makers need to consider potential impacts of everything we do within watersheds, individually and in aggregate, on the waters that flow through them and the biota they support. In almost all cases, political boundaries do not coincide with geographical boundaries, and for monitoring of the water, and the plants and animals dependent on the water, coordination would be better managed within the area of land drained by a river, the catchment or watershed.

This is the idea behind Cumulative Effects Assessment (CEA), which is increasingly being recognized and specified in Canadian legislation from shore to shore to shore, from the Northwest Territories' Cumulative Impact Monitoring program to British Columbia's Water Sustainability Act to Prince Edward Island's proposed Water Act.

Predicting impacts of our activities on lakes, rivers, estuaries and coastal environments, and also groundwater, is a difficult thing to do. The scientists of the Canadian Rivers Institute (CRI), however, have significantly advanced the science and understanding of this process through its leadership role within the Canadian Water Network's Canadian Watershed Research Consortium.

In 2010, the Canadian Water Network (CWN) held a competition to identify groups across the country that had a need, and capacity, to develop monitoring programs in support of CEA at the watershed or regional levels.

Over the next two years, six groups were selected as 'research nodes' within the Canadian Watershed Research Consortium (CWRC): two in the Canadian Maritimes, two in Ontario and one in each of Manitoba and the Northwest Territories.



Photo by Jess Kidd

CRI was critical in the success of this national initiative, with its scientists leading three of the six research nodes while two nodes had heavy involvement from CRI research associates (as outlined below).

Research for each node was completed by 2016. Detailed technical reports, journal publications and brief, plain-language syntheses of results were released and are now available on the CWN website.

With the research phase of the CWRC now complete, node partnerships have turned their attention to implementation of the monitoring recommendations provided by their research teams.

Dr. Michael van den Heuvel, CRI Director and leader of the research team for the Northumberland Strait – Environmental Monitoring Partnership (NorSt-EMP), one of the research nodes in New Brunswick, said the work involved in the CWRC was a perfect fit for CRI.

“We’re a very applied research institute and we like to work with solutions for end-users. Our aim is to support water resource managers in understanding how aquatic ecosystem such as rivers and estuaries

function and knowing the best monitoring frameworks to apply,” Dr. Van den Heuvel said.

Dr. van den Heuvel noted the national initiative also aligned well with one of CRI’s overarching goals of training the next generation of skilled aquatic scientists, providing invaluable experience to dozens of students across the country.

“Students in these nodes had the opportunity to interact with a multitude of end-users — from different organizations such as the federal government, provincial government, NGOs and industry,” he said. “It’s quite a unique opportunity for students to interact with so many end-users in terms of how their research is regarded and being used.”

Adds Dr. Simon Courtenay, CRI Science Director who also worked on the NorSt-EMP node, “I think these projects involved cutting-edge research, but also, what’s exciting for the students is the chance to be part of something bigger. They were involved in a program that had nodes all across Canada, trying to address the same questions but in different geographies and with different particulars.”



Photo by Anna Meissner

CRI scientists involved in the Canadian Water Network's Canadian Watershed Research Consortium include:

### **Northumberland Strait – Environmental Monitoring Partnership**

Research led by **Michael van den Heuvel**, CRI Director and Canada Research Chair in Watershed Ecological Integrity (University of Prince Edward Island); **Kerry MacQuarrie**, CRI Science Director and Canada Research Chair in Groundwater-Surface Water Interactions (University of New Brunswick); **André St-Hilaire**, CRI Science Director based at the INRS-ETE (Université du Québec), **Simon Courtenay**, CRI Science Director and Scientific Director of the Canadian Water Network (University of Waterloo); and CRI Research Staff **Christina Pater** (UPEI)

### **Tobacco Creek Watershed**

**Joseph Culp**, CRI Science Director (UNB), **Adam Yates**, CRI Science Director (Western University), and **Patricia Chambers**, CRI Research Associate (UNB)

### **St. John Harbour Watershed**

CRI Science Directors **Simon Courtenay**, **Allen Curry**, **Karen Kidd** and **Kelly Munkittrick** (former SD), and CRI Research Associates **Marie-Josée Abgrall** (Parks Canada), **Heather Hunt** (UNB), and **David Methven** (UNB) led and conducted research through CWN's NorSt-EMP.

### **Grand River Watershed**

Led by CRI Science Directors **Mark Servos** (University of Waterloo) and **Adam Yates** (Western University).

### **Slave Lake Watershed**

Research led by CRI Science Director **Tim Jardine** (University of Saskatchewan).



Photo author unknown

## Supporting the assessment of the health of Canada's rivers

CRI Scientists have made significant contributions to the management of Canadian waters throughout the past 16 years. One example is CRI's involvement as advisors to the World Wildlife Fund's five-year initiative to assess the health of 25 watersheds in Canada. This project, which was completed in 2017, is the first national initiative to assess both the health and threats to Canada's rivers. The health assessment looked at river flow, water quality, fish, and benthic invertebrates. The threat assessment looked at stressors, including pollution, habitat loss, fragmentation, water use, invasive species, alteration to flows, and climate change.

## Advising national and international panels

CRI Science Director Dr. André St-Hilaire was appointed to the federal government's National Advisory Panel. The Minister of Environment and Climate Change Canada and Alberta's Minister of Environment and Parks made the announcement on June 8, 2017. The 14-member panel of wildlife, water and conservation experts who will advise provincial and federal ministers on

protecting at least 17% of Canada's land and freshwater through a network of parks, protected and conserved areas, and other area-based conservation measures by 2020, which is a goal set to meet Canada's international commitment to biodiversity conservation.

Dr. St-Hilaire was also appointed as the Canadian lead of the Inter. national Joint Commission (IJC) Review Panel on the Lake Champlain & Richelieu River watershed study. The IJC is an international organization that prevents and resolves disputes between Canada and the United States in regards to boundary and transboundary water issues. The objective of the watershed study is to evaluate the causes, impacts, risks, and solutions to flooding in the Lake Champlain-Richelieu River basin.

Dr. St-Hilaire is actively advancing the understanding of Canada's watercourses through his lab's research in water temperature and sediment in rivers, with over 10 published journal articles this past year.



# Regional collaboration to advance aquatic research in Canada

## Leading a new frontier: dam renewal and removal science

As tens of thousands of large hydro dams in North America, built in the hydro heydays of the 1940s and 50s, near the end of their service lives, governments and power utilities are increasingly being faced with big-cost decisions about their future. Determining the fate of an aging hydro facility, should it be rebuilt from scratch, refurbished for continued use, or decommissioned so the river returns to a natural state, is a mammoth undertaking, forcing decision makers to consider a wide range of potential outcomes and impacts, including economic, environmental and social.

Fortunately, an emerging science is arming decision makers with the tools and expertise needed to make the best possible choice, and at the frontlines of this new field are the scientists of the CRI.

"It's an emerging field of study, dam renewal and removal," says Science Director Dr. Allen Curry. "And we have been groundbreaking in trying to sort out all of the questions around these decisions in terms of protecting the environment, making sure you have energy supply, and protecting people and communities."

Dr. Curry is the principal investigator of the Mactaquac Aquatic Ecosystem Study (MAES) on the iconic St. John River in New Brunswick. The study was commissioned by the provincial energy utility, NB Power, to inform the utility's options for the Mactaquac Generating Station, a 672 MW run-of-the-river hydroelectric facility that was built in 1968 and is fast approaching the premature end of its service life.

In order to make a decision for a preferred option, NB Power engaged the scientists at CRI to design a large, multidisciplinary aquatic ecosystem study, making it the first comprehensive study of a large dam renewal or removal project at this scale in the world. Dr. Curry, the team of CRI scientists at the UNB Fredericton campus and various other academic institutions, are developing a hub of scientific expertise that can provide energy utilities around the world with the methods, models and scientific advice they need for infrastructure reviews and future environmental impact assessments.

"We are gathering baseline river data related to biodiversity, fish passage, sediment buildup and modelling changes to flows and consequences to the river ecosystem under a series of options such as removal, rebuild or technological upgrades," Curry says of the MAES project.



Photo by Énergie NB Power

This comprehensive approach allows us to predict how a river will react and make science-based advice for improving the desired option. That could mean designing and installing more effective fish passage through the reservoir during a rebuild, or predicting the return, or not, of native fish and other species with flow restoration after a removal.

“In a lot of ways, we are setting the stage for what’s going to be tens of thousands more of these similar decisions that are going to take place worldwide — what do you do with these aging facilities and structures?” Helping governments and utilities make these decisions, along with the eventual execution of the preferred option, is big business, and it’s only getting bigger.

Jeff Duda, a research ecologist with the US Geological Survey’s Western Fisheries Research Centre, says there are more than 80,000 large hydro facilities in the National Inventory of Dams that are nearing the end of their life in the United States alone.

“We’re talking an estimated billions of dollars to address our fleet of aging dams. In the U.S., national estimates are billions, if not tens of billions of dollars,” Duda says.

Duda, who also serves on the science

advisory board of the MAES project, says the cutting-edge research and expertise being developed in reservoir science at CRI will prove invaluable as more and more utilities are faced with tough, expensive decisions.

“As a case study, I absolutely think the studies CRI is doing to determine the potential outcomes of dam renewal at Mactaquac, and the degree that decisions will be informed by the scientific studies, this whole process is very much something that could be used as a guide by other large dam projects worldwide that are having to evaluate what to do with a dam that is approaching the end of its design life,” Duda says.

“The way that these large-scale ecosystem studies are taking place — where you’re bringing together folks from various biological and physical backgrounds, along with engineers and the folks who are going to be responsible for making the changes that are needed at the dam — all of that is going to be really important to learn from.”

After three years of study, Phase One of the MAES project — involving the assessment of the key baseline environmental conditions and description of the environmental challenges and opportunities of the renewal or removal options — is now wrapping up.



Photo by Jess Kidd

NB Power decided in December 2016 to refurbish the existing facility under the newly-added 'Life Achievement Option,' extending its lifespan until 2068.

And CRI scientists will be busy. Curry says the refurbishment route was the most complicated of all four options in terms of sustaining a healthy St. John River, noting the St. John is the most diverse fish community on the eastern seaboard, home to 55 species of fish, including at least three invasive species and several species of concern.

Curry says it's exciting for CRI scientists to be at the forefront of this important, emerging field of study, but what's most exciting for him is the legacy of the expertise being developed through this work at CRI.

"While developing the science, we are also developing the specialists who will fill the jobs required to manage utilities' review processes, conduct impact assessments for regulators, and advise and oversee future removals, rebuilds or constructions," says Curry. "That's the really exciting part for me, and that's the vision behind what CRI is all about: making every river a healthy river, and training the next generation of first-class aquatic scientists who will make it happen."

## MAES research team

**Principal Investigator:** Dr. Allen Curry

**Senior Research Associate:** Dr. Tommi Linnansaari

**Senior Research Associate:** Dr. Wendy Monk

**Project Manager:** Gordon Yamazaki

**Collaborators:** Dr. Jessica Orlofske

### Project Leaders:

Dr. Donald Baird

Dr. Karl Butler

Dr. Joseph Culp

Dr. Katy Haralampides

Dr. John Hughes Clark

Dr. Karen Kidd

Dr. Steve Peake

Dr. André St-Hilaire

### Project Staff & Technicians:

Adam Chateauvert

Mark Gautreau

Ben Wallace

Bronwyn Fleet-Pardy

Samantha Pettey

Caitlin Tarr

Jae Ogilvie

Marni Turnbull

Chris Palmer

### Postdoctoral Research Fellows:

Dr. Meghann Bruce

Dr. Zacchaeus Compson

Dr. Stephen Dugdale

Dr. Mouhamed Ndong

Dr. Laura Noel



Photo author unknown



Photo by Jani Helminen

## Working with local community members to monitor the health of New Brunswick lakes

Science Director Allen Curry is collaborating with the Volunteer Lake Monitoring (VLM) Programme and New Brunswick Department of Environment and Local Government (DELG) to monitor blue-green algae and associated water quality issues in New Brunswick lakes. The occurrences of blue-green algae blooms are increasing in New Brunswick. The challenges the project addresses include:

- the recent emergence of blooms in lakes where such outbreaks are uncommon
- blooms in lakes with no apparent added nutrient sources that typically enhance algae growth in lakes
- the ongoing science that suggests blooms can be linked to climate change

The collaboration encompasses monitoring, science, and education. The CRI has been sampling plankton communities and developing a rapid algae response kit for volunteers. The CRI in partnership with DELG are building the appropriate watershed-scale maps of land use for each of the monitored lakes. This project is funded by the New Brunswick Environmental Trust Fund.

## Advancing the knowledge of Atlantic salmon in the Miramichi River

The Collaboration for Atlantic Salmon Tomorrow (CAST) is led by CRI and UNB researchers. CAST is a partnership of scientists, government agencies, non-government organizations and industry working to stop the decline of Atlantic salmon in eastern Canada. One of CAST's innovative research projects is the ARIS Sonar Population Tracking project.

The ARIS project is introducing novel technology to salmon research in the Miramichi River. The sonar technology implemented in the ARIS project enables fast and accurate fish stock estimates, which will be very useful in making in-season fisheries management decisions. CRI students are making this valuable data available on the CAST website during the salmon migration season.



Photo by Jani Helminen



Photo by Robert Blanchard

### **Tracing contaminants of public health concern through aquatic food webs**

CRI Science Director Dr. Karen Kidd and her team of students and technical staff at UNBSJ are making the link to human health by tracing the existence of persistent contaminants of public health concern in aquatic systems around the world. This research is critical for providing warning signals for potential public health issues, and is advancing the understanding of how the fate of contaminants can be affected by climate change.

To undertake this world-leading research, Dr. Kidd has set up state-of-the-art facilities at UNBSJ that includes wet and dry labs and equipment to analyze tissues, sediments and water for mercury, metals, pesticides, algal toxins, and emerging contaminants such as pharmaceuticals.

### **Ecogenomics: answering complex questions of ecosystem composition for fisheries' conservation**

CRI Science Director Dr. Scott Pavey uses 'big data' supercomputers to scan entire genomes from individual animals, including fish, as well as environmental samples (water and soil). This allows him to investigate at high resolution both the species present in aquatic ecosystems as well as how populations are connected and locally adapted to their environments. These innovative research methods being forged by Dr. Pavey are helping to advise the management of economically important commercial fisheries of Atlantic Cod, Striped Bass, Atlantic Bluefin Tuna and American Eel.

The CRI Genomics Laboratory, based at UNBSJ, is equipped with \$1M of the most modern wet-lab analytical infrastructure and supercomputers.



Photo by Robert Blanchard



Photo by Keegan Hicks

## Improving municipal wastewater effects monitoring, developing next generation of science communicators

Science Director Dr. Mark Servos is investigating municipal wastewater effluent impacts on the Grand River watershed. His research is demonstrating how the science used in the development of an environmental effects monitoring framework for municipal wastewater can address the water quality of receiving waters across Canada. Dr. Servos and his team have been studying the Grand River watershed in southern Ontario for more than a decade, supporting the development of the monitoring frameworks for municipal wastewater to assess the effectiveness of new national secondary treatment standards. The decade-long study has been a multi-jurisdictional collaboration with diverse government partners at the municipal, provincial and federal levels, including the City of Guelph, Regional Municipality of Waterloo, Grand River Conservation Authority, Ontario Ministry of Environment and Climate Change, and Environment and Climate Change Canada.

Dr. Servos' research is also an excellent example of the CRI network collaboration, having worked with a number of Science Directors, representing a diversity of

disciplines on this project, including Drs. Karen Kidd (UNB; tracing contaminants in aquatic environments), Deborah MacLatchy (Laurier; ecotoxicology and comparative endocrinology), Chris Martyniuk (University of Florida; molecular responses to endocrine disrupting chemicals), Kelly Munkittrick (formerly UNB; molecular and mechanistic identification of markers of exposure and molecular pathways of effects), and Adam Yates (Western University; correlative and mechanistic linkages between human activities and ecosystem condition).



Photo by Mark Servos

# Hynes Lecture

**In 2002, the CRI initiated an annual lecture, in recognition of Dr. H.B.N. Hynes, known as “the father of running water ecology”**

In 2016, CRI hosted Dr. Emma Johnston from the University of New South Wales, as the H.B.N. Hynes Lecturer. Dr. Johnston presented two lectures in Fredericton and Saint John entitled “The Coastal Squeeze: Problems and potential for our nearshore marine biodiversity” and “Multistressor interactions and bio-functional monitoring tools for estuaries.”

Dr. Johnston is a Professor, Dean of Science, and Head of the Applied Marine and Estuarine Ecology Lab in the School of Biological, Earth and Environmental Sciences at the University of New South Wales. Dr. Johnston is a rising star in the field of harbour and estuarine ecology. She is an expert in how humans impact harbours, coasts and estuarine habitats, and has an exciting program that both expands our understanding of these systems and provides recommendations for harbour management. Her laboratory is the Sydney Harbour, one of the busiest ports in the southern hemisphere. She also conducts research in Antarctica, the Great Barrier Reef and temperate Australian estuaries.



*Photo by Maja Baska*

## Section 2: The Next Generation of Aquatic Scientists

### Students and post-doctoral fellows join us from all over the world

Our goal is to produce highly-qualified water resource scientists, professionals, and policy makers across Canada and beyond. CRI's focus on applied science - of not only employing the best available science in our research, but ensuring that our science is put into action - is a major draw for students and professionals alike. In 2016-2017, the CRI's Science Directors were academic supervisors to 107 students.

Since its formation, CRI has placed significant emphasis on meeting the global demand for highly-qualified professionals and environmental scientists in aquatic and watershed sciences. Over its first 16 years, the CRI has attracted more than 450 students and postdoctoral fellows from across Canada and the world to study with internationally-renowned river and estuarine experts who are also committed to creating a new generation of informed and engaged professionals.

Approximately 20% of CRI's alumni have come from abroad, including countries such as Bhutan, Chile, China, Finland, Italy, New Zealand, Romania and Senegal. The majority of young scientists go on to work in prominent positions in governments, academia, and private sectors.



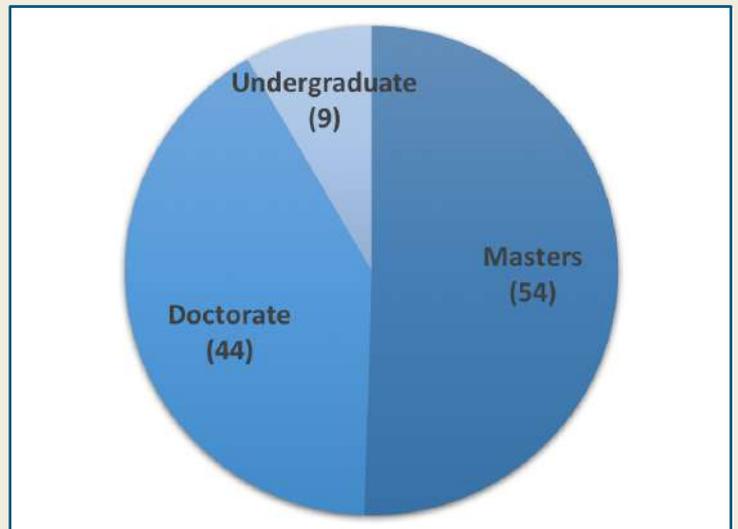
*Photo by Courtney Mcrorie*



51% students studying at UNB (Fredericton (40) and Saint John (15))

49% students studying at other universities across Canada and internationally

CRI Science Directors hosted 14 postdoctoral fellows conducting research, student mentorship and lab management. There were 29 research, laboratory and administrative staff.



In 2016, University of New Brunswick alumnus, Karma Tenzin, was appointed as Zimpon Wogma (Deputy Chamberlain) to his Majesty The King of Bhutan. While studying at UNB, under the supervision of former CRI Science Director Dr. Kelly Munkittrick, Tenzin designed a non-lethal fish monitoring program for rivers in Bhutan. Tenzin obtained his master's degree in biology from UNB in 2006. With the new position, Tenzin is on deputation with the Office of the Gyalpoi Zimpon, His Majesty's Secretariat, where Zimpon Wogmas, from a diversity of backgrounds, support the Gyalpoi Zimpon in delivering His Majesty's Kidu (welfare) to the people of Bhutan.





Photo by Mark Servos

### **CRI provides students with opportunities to gain leadership skills**

The CRI Student Leadership Committee (SLC) is an integral part of the CRI. The SLC is the primary communication link between CRI students and the rest of the network members. The SLC organizes student engagement and educational events, and provides support and resources for every stage of a student's academic program. One of the key responsibilities of the SLC is to help the CRI Science Directors organize and host the annual CRI Days event.

In 2016, CRI Days were organized by the 2015-2016 SLC and hosted at INRS in Quebec City. Students, postdoctoral fellows, and Science Directors from all over Canada, and as far away as Mexico, participated in the event. Students were given the opportunity to present their research and network with students and Science Directors.

### **Members of the SLC 2015-2016:**

Sebastien Ouellet, SLC Chair, INRS

Katrina Krievins, Brock University

Bethany Reinhart, UNB Saint John

Jordan Anderson, University of Ontario  
Institute of Technology

Kyle Knysh, University of Prince Edward  
Island

Jeremy Grimstead, Western University

Robert Rutherford, Wilfrid Laurier University

Nicole Starnes, University of Waterloo

Zoe O'Malley, UNB Fredericton



Photo by Crystal Jarvis

# Support to CRI Students

## CRI 15-year anniversary scholarships

To celebrate CRI's 15<sup>th</sup> anniversary, the SLC was provided funds by the Science Directors to award three student scholarships (\$1,000 value). The three awards were provided to the finalists of a Pecha Kucha presentation competition at the 2016 CRI days. The winners of the competition were Jennifer Thera (MSc candidate, UNB Saint John, presentation: Does cysteine explain variability of mercury in aquatic food webs?), Daniel Arluison (MSc candidate, UNB Fredericton, presentation: Sturgeon: River monsters or gentle giants?), and Brianna Levenstein (MSc candidate, UNB Fredericton, presentation: Investigating the impact of permafrost degradation on Arctic stream ecosystems).



*Photo by Steph Merrill*

## CRI annual H. B. N. Hynes scholarship

Since 2012, the CRI graduate student community has had the opportunity to apply for the scholarship (\$1,000) in honour of Dr. H. B. Noel Hynes. CRI taps into the experiences and support of its collaborators to select the annual award, which is announced at the annual CRI days event. Our selection committee for the 2016-17 Scholarship was made up of distinguished associates Dr. Alex Bielak, Dr. Bob Newbury and Dr. Fred Whoriskey.

The 2016 Hynes Scholarship was presented to graduate student Sean Landsman. Mr. Landsman was recognized for his research that combines an in-depth examination of anadromous fish passage at dams with a focused examination of their influence on freshwater food webs, all while employing multiple analytical tools and crossing into multiple research disciplines. Sean was chosen as the 2016 Hynes Scholarship recipient, because of his articulation of how his research aligns with the legacy of Dr. Noel Hynes, particularly his emphasis on whole-community functioning and the interconnectedness among multiple habitat types, which has directly influenced his research. Mr. Landsman is a PhD student

# CRI completes a five-year CREATE WATER program

“The CREATE program was one of my most valuable experiences. I was able to further my knowledge and skills in my current field of study. As well met some great people, with similar interests and aspirations.”

- Carissa Grove, CREATE student and MSc candidate in Michael Van den Heuvel's lab

In 2011, CRI was awarded more than \$1.5M for its Watershed and Aquatics Training in Environmental Research (WATER) professional development program from the Natural Sciences and Engineering Research Council's (NSERC) Collaborative Research and Training Experience (CREATE). CRI scientists from six different universities collaborated as student supervisors in this multi-year initiative aimed at building the skills of the next generation of highly-qualified and experienced aquatic scientists. Over a five-year program, more than \$1M was provided to 74 undergraduate and graduate students, and post-doctoral scholars located at universities across the country. These students were selected for their research projects that focused on developing solutions to real world problems using environmental technologies in aquatic ecology, hydrology, ecotoxicology, and environmental chemistry.

In addition to the academic research support from CRI Science Directors and Associates, students were provided with hands-on training in professional science skills through technical training courses and exchanges within academia, industry, and government research groups. More than 40 instructors provided over 50 unique online and field courses focused on technical, analytical, management, and communication skills to complement each participants' academic courses and research projects.

A special acknowledgment goes to Science Director Michelle Gray (UNB Fredericton), who joined CRI's founding members and CREATE WATER program principal investigators, Dr. Allen Curry (UNB Fredericton) and Kelly Munkittrick (formerly UNB Saint John), in the development, delivery and administration of the program.

The CRI WATER program is one of the many examples of CRI's contribution to advancing aquatic sciences, forging industrial and business partnerships, and government collaborations to support the development of new science and practices in river management and particularly the training of a new generation of water resource specialists.



Photo by Carissa Grove

"The CRI CREATE WATER Program was a significant contribution to my overall experience as a PhD student at the University of Waterloo. In addition to the network gained, I received essential training in technical skills, which allowed me to excel in my program. I was able to use this training (e.g. statistics and data analysis, habitat assessment, environmental monitoring) to benefit my own studies, including study design, method development, data analysis, and data interpretation. The opportunities provided through CRI have also allowed me to become a well-rounded scientist. I have had the opportunity to learn from an interdisciplinary team of scientists and engineers on water issues in Canada from coast to coast, and internationally through a course on water resource management in South America. All the training acquired through the CRI CREATE WATER Program has given me a unique background, and has provided me with a lot of the skills and certifications that employers in the environmental sector are looking for."

- Keegan Hicks, CREATE student and PhD alumni from the Mark Servos Lab

"Participating in the CREATE program gave me the opportunities to network with students and professionals from across the country in ways most graduate students never to get experience."

- Michael Dunning, CREATE student and MSc candidate in Dr. Mark Servos' Lab

"My experience with CREATE was a good one. I really enjoyed the 5 courses I took, and I feel as though they contributed greatly to my knowledge and understanding of water resources in Canada."

- Carter Chiasson, CREATE student and CRI undergraduate alumni from the Michelle Gray Lab

## Section 3: CRI Training

# CRI's Training of Aquatic Specialists, Professionals & Citizen Scientists

Since 2001, CRI has supported almost 3000 professional development course registrations to students and professionals affiliated with universities, non-government organizations, consulting firms, industries, government agencies, and First Nations from across Canada, the U.S and around the world.

The experience and scientific insight of CRI researchers, coupled with our courses, workshops and research projects, is equipping a new generation of aquatic science practitioners with the latest tools and knowledge to tackle today's challenges for aquatic ecosystems.

In 2016-17, there were 475 registrations for the CRI Training Division's professional development courses, field practicums and webinars in aquatic, environmental and earth sciences.

CRI Training Course Participants

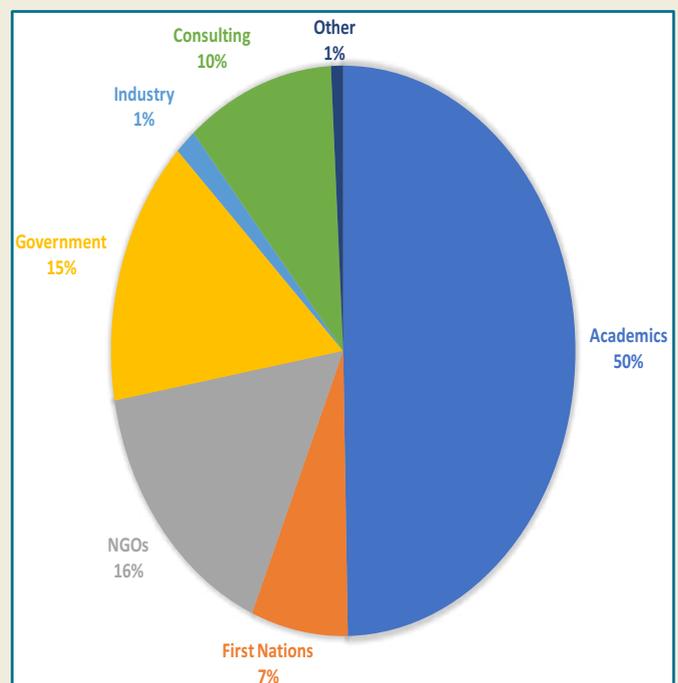


Photo by Nolan Pearce



## Federal government, Canadian Rivers Institute and Canadians team up to support citizen scientists in assessing river health nation wide

CRI continues its partnership with Environment and Climate Change Canada in the development and delivery of the Canadian Aquatic Biomonitoring Network (CABIN), which is a nationally standardized approach to assessing river health using aquatic invertebrates. CRI has helped thousands of Canadians become citizen scientists, working across the country to become stewards of their local rivers and lakes. During the summer of 2016, more than 150 students, water professionals and community volunteers from across the country came together to learn how to assess the health of our waterways by completing the field-training component of (CABIN).

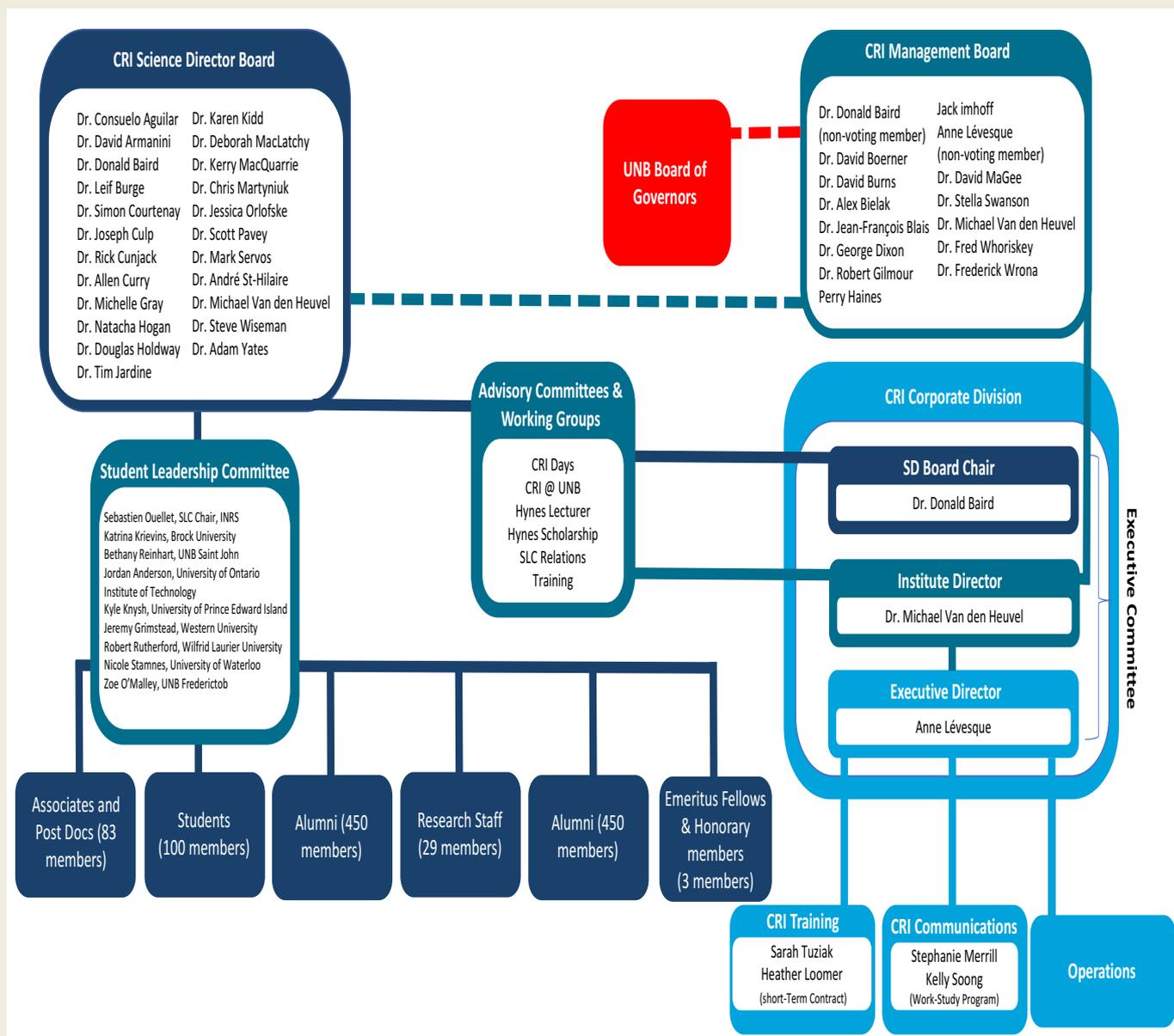
CRI Science Directors and Associates Drs. Donald Baird and Wendy Monk (CRI-UNB) and David Armanini (CRI-Milan, Italy) have developed a model of Atlantic river health using data collected by the CABIN network, including federal and provincial governments and citizen scientists, to support river assessment across the region. The online training and delivery of the program was co-developed by CRI Science Director Dr. Michelle Gray (CRI-UNB), who has been working for a decade to support professionals, students and citizen scientists in their online training of the CABIN certification program.



Photo by Jess Kidd

# Section 4: Governance & Financial Statement

CRI flow chart for the 2016-2017 fiscal period



"The Canadian Rivers Institute (CRI) was born of a pressing need. The world depends on clean fresh water from healthy river ecosystems, yet humanity has not been treating our rivers as if they are essential. We can do better; through planning, restoration and research we can ensure that our river systems are healthy and meet the multiple needs of our communities. CRI's home is in the nuts and bolts of how we can make our rivers healthy. Its formation was bottom-up, created by front line researchers and students who understood the absolute need for healthy rivers. They also knew that big problems require the strength of a network to be applied to solutions if progress is going to be made. This report outlines the activities of the people of the Canadian Rivers Institute. Through their sustained networking, research and restoration work, they are helping to improve rivers in Canada and globally, to the benefit of humanity and the natural world. In the face of a changing climate and the constantly emerging new challenges facing rivers, it is comforting to know that Canada has the world class river scientists to meet its needs at home, and provide leadership abroad."

- Fred Whoriskey, CRI Management Board Chair



CRI was founded at UNB and has been hosted at the New Brunswick University since 2001. The Institute operates two divisions: A Research Division (CRI Science) and a Business and Administrative Services Division (CRI Corporate).

The CRI Science Division is a national network of scientists. Members appointed as Science Directors are part of the CRI Science Director's Board responsible for establishing the Strategic Science Framework and Plan of the Institute; and in identifying CRI's Associates/ Post Docs, Students, and Emeritus Fellows/Honorary members.

The CRI Corporate Division operates the training and administrative sections of the CRI. The day-to-day management of the Institute is the responsibility of CRI Executive who report to the Management Board. The Executive is comprised of the Director, the Executive Director and the chair of the Science Director's Board.

The CRI Management Board provides expertise for the effective operations of the Institute. It offers support to achieve the goals and objectives outlined in the Institute's Strategic Science Framework and Plan; and strategic advice and direction focused on growth and resources required for the aims of the Institute. The Management Board appoints the Director and provides direction on, and reviews, annual financial targets for CRI Corporate.

# CRI financial statement for the 2016-2017 fiscal year

The Institute operates two independent divisions: a Research Division (CRI Science) and a Business and Administrative Services Division (CRI Corporate). The CRI Research Division is supported by the dedicated efforts of CRI Science Directors, Associates, postdoctoral fellows and students who write research proposals to raise the necessary funds to undertake their research. The UNB financial statement reports over \$3.5M raised in grants from CRI researchers in the 2016-17 fiscal year. It is important to note that at this time CRI can only report on funds raised through the host university at UNB.

The CRI Business and Administrative Division is supported thanks in large part to the overhead funds raised through research grants received at the CRI Science Division at UNB. Registration fees of CRI's Training non-credit courses and workshops are also an important source of revenue for the Division. The annual report contains the financial details of the CRI Corporate Division only.



BEGINNING BALANCE, May 1, 2016	469,286.57
<b>FUNDS RECEIVED</b>	
Research grant overhead earnings	109,781.37
Admin Fee from Non-credit courses	22,300.20
Non Credit course fees	74,333.99
Seminar and workshop revenues	5,495.85
Miscellaneous	544.04
Internal Cash Transfer	1,254.51
<b>AVAILABLE FUNDS</b>	<b>213,709.96</b>
<b>SALARY EXPENSES</b>	
Teaching Release ad PI Fees	9,371.67
Employees	180,121.11
Undergrad Students	2,083.08
<b>TOTAL SALARY</b>	<b>191,575.86</b>
<b>NON SALARY EXPENSES</b>	
Travel (boards and management)	38,765.82
Hospitality	658.58
Catering	7,609.60
Room rental	1,453.56
Materials & Supplies	13,439.08
Services, Professional fees/Other fees	62,440.33
Equipment	1,694.10
Vehicles	110.10
Phone	1,037.25
Long Distance	587.42
Membership Fees	605.50
Courses & Tuition Fees	2,692.90
Scholarship	4,000.00
Sponsorship	650.00
UNB Biology Administrative services	27,999.96
Administration expense	22,300.00
<b>TOTAL NON-SALARY EXPENSES</b>	<b>186,044.40</b>
<b>TOTAL COSTS</b>	<b>377,620.26</b>
<b>BALANCE @ APRIL 30, 2017</b>	<b>305,376.27</b>

# Appendix A: Management Board

## **Donald Baird, PhD, Chair, CRI Science Directors' Board**

**Research Scientist, National Water Research Institute, Environment and Climate Change Canada, Visiting Research Professor, Canadian Rivers Institute, University of New Brunswick  
(Non-voting member)**

Dr. Donald Baird is an expert in ecological risk assessment, with particular expertise in the application of ecological theory in environmental problem solving. He is currently focused on developing new ecogenomics and ecoinformatics approaches for large-scale biodiversity assessment in remote regions - focussing on wetland systems in the Peace-Athabasca Delta and Slave River regions of northern Alberta and the Northwest Territories, Canada. Dr. Baird has a BSc and PhD in Zoology from the University of Glasgow, Scotland.



## **Alex Bielak, PhD**

**Founder, Alex Bielak Communications**

Alex is an internationally-recognized pioneer in Science Communication, and Knowledge Translation and Brokering, in the natural resources and water sectors. In the course of a distinguished and varied career, Alex led various initiatives and successful communications campaigns linking science and policy development; authored some key publications in the field; and frequently provided advice on science communications and science-policy linkages at the request of various organizations, and government departments across Canada and internationally, including the UN. Among many awards Alex was recognized by the University of Waterloo, with the Alumni of Honour Award, and he and his team received Environment Canada's "2013 Citation of Excellence" for "outstanding innovation demonstrated in connecting people to science." He continues to serve on a number of Boards and Advisory Committees, and his alter ego is an accomplished food, drink and travel journalist and photographer.



## Jean-Francois Blais, PhD

### Director Institute national de la recherche scientifique - Centre Eau Terre Environnement

Dr. Blais specializes in the development of new physico-chemical and biological technologies for the treatment of effluents, soils, ashes, treated wood wastes, and metallurgical/mining industry wastes polluted by toxic metals (like As, Cd, Cr, Cu, Ni, Pb, Sb and Zn) and others types of contaminants (PAH, PCP, PCDD/F, e.g.). A full professor at the Water, Earth and Environment Center of the National Institute for Scientific Research (INRS-ETE), he is a past holder of the Canada Research Chair in environmental decontamination (2001 to 2011) and also is currently the Director of the INRS-ETE (March 2014). He is co-author of more than 210 research papers and 200 conference presentations, is co-inventor of 18 patents related to new environmental technologies, and has advised on over 45 M.Sc. and 45 Ph.D. student research degrees and is Editor of the Journal of Water Science (Revue des Sciences de l'Eau).



## David Boerner, PhD

### Director General, Water Science and Technology, Environment and Climate Change Canada

Dr. Boerner is responsible for more than 520 scientific and technical professionals in more than 20 regional offices across Canada. His program responsibilities are broad, including forensic analyses and investigations to support ECCC Enforcement actions, regulatory compliance testing, monitoring water quality in waters of federal responsibility, and oversight of federal research programs. Dr. Boerner has led several major science-policy and change initiatives and was previously the Director General responsible for the Geological Survey of Canada. Dr. Boerner holds a B.Sc. in Chemistry from the University of Waterloo, and M.Sc. and Ph.D. in Physics from the University of Toronto.



## David Burns, PhD

### Vice-President of Research, University of New Brunswick

Dr. David Burns has been the vice-president of research at UNB since 2012 where as a member of the senior management team, he has helped to shape UNB's strategic research direction and agenda. Previously, Dr. Burns was a professor of chemistry and experimental medicine at McGill University where he spent 19 years including a stint as the associate dean for the university's faculty of science from 2002 until 2008. Dr. Burns earned a PhD in analytical chemistry at the University of Washington and a bachelor of chemistry and mathematics degree at the University of Puget Sound.



## George Dixon, PhD

### Vice-President, Academic & Provost, University of Waterloo

Dr. Dixon has expertise in aquatic toxicology and environmental risk assessment and management with over 25 years' experience assessing metals and mining activity impacts. He has served as an advisor on metal contamination issues to Environment Canada, the Department of Fisheries and Oceans, the Department of Justice (Canada), the U. S. Environmental Protection Agency, the U. S. National Oceanographic and Atmospheric Administration, the Department of Justice (US) and the World Health Organization, among others. He has supervised over 60 M.Sc. and Ph.D. research projects, co-authored over 180 refereed journal articles, and is Associate Editor of three scientific journals, including the Canadian Journal of Fisheries and Aquatic Sciences.



## Robert Gilmour, PhD

### Vice President Academic & Research, University of Prince Edward Island

Dr. Robert Gilmour, Jr. leads UPEI's Research Services as experienced administrator and well-published researcher who manages a diverse research portfolio encompassing multiple funding sources while maintaining an active laboratory in biomedical and health sciences. Previously, Dr. Gilmour was the Associate Dean for Research and Graduate Education at the College of Veterinary Medicine at Cornell University in Ithaca, New York.



## Perry Haines, P. Eng

### Assistant Deputy Minister, New Brunswick Department of Environment and Local Government

Mr. Haines has worked with the Department of Environment and Local Government for more than 25 years in a variety of capacities. Since 2007 he has been an Assistant Deputy Minister within the Department, responsible for the Environment divisions of the joint Department. Mr. Haines has an undergraduate and graduate degree in Engineering from the University of New Brunswick.



## Michael van den Heuvel, PhD, CRI Director

### **CRI Director and Associate Professor, Departments of Biology and Biomedical Sciences, University of Prince Edward Island**

Dr. Michael van den Heuvel is the Institute Director; the first outside of the University of New Brunswick, expanding CRI's credibility as a national institute. Dr. van den Heuvel was previously the Canada Research Chair in Watershed Ecological Integrity and his research is focused on understanding how agriculture and chemical use influences freshwater and coastal environments by looking at endocrine responses, immunotoxicology, and population health of fish. He is developing methods and solutions to best monitor environmental problems and better protect rivers in Prince Edward Island. Dr. van den Heuvel has a BSc and a PhD from the University of Waterloo.



## Jack Imhof

### **Director of Conservation Ecology for Trout Unlimited Canada**

Jack Imhof specializes in restoration ecology, watershed management and natural channel design and is the Director of Conservation Ecology for Trout Unlimited Canada and an adjunct professor at the University of Guelph, Waterloo and Brock. Jack was a member of a committee that helped to create the community-based watershed fisheries plan for the Grand River and as a result his team received the Ontario government's Amythest Award for Excellence in Public Service. He was the 2010 recipient of the Conservation Award of Excellence from the Credit Valley Conservation for his leadership and dedication to the Credit River Watershed he was also co-recipient in 2009 of a National Recreational Fisheries award along with others of the Grand River Fisheries Implementation Committee.



## Anne Levesque, MBA, CRI Executive Director

### **(Non-voting member)**

Anne Levesque joined CRI as Executive Director in October 2015. She has over 30 years of experience in leading organizations and charities across Canada, and involvement in national environmental groups. Throughout her career, she has supported dozens of organizations and networks in provincial, federal and international policy discussions and in ecological and broader sustainability initiatives. Anne has a Masters in Business Administration from Royal Roads University.



## **Fred Whoriskey, PhD, CRI Management Board Chair**

### **Executive Director, Ocean Tracking Network, Dalhousie**

Dr. Fred Whoriskey has been the Executive Director of Dalhousie University's Ocean Tracking Network since 2010 where he oversees global research infrastructure documenting the movements and survival of aquatic animals and their links to environmental conditions. Dr. Whoriskey's research areas has included the development of sonic tracking programs for Atlantic salmon and impacts of exotic species on native ecosystems and has been heavily involved in public policy issues, especially with regards to environmental impact assessments. He was previously a professor at McGill University, the Vice President, Research and Environment with the Atlantic Salmon Federation and sat on the boards of AquaNet and the Huntsman's Marine Science Centre. Dr. Whoriskey has an undergraduate degree from Brown University in Providence, Rhode Island and a PhD from l'Université



## **Stella Swanson, PhD**

### **Swanson Environmental Strategies Ltd.**

Dr. Stella Swanson's 35-year career has included management of the Aquatic Biology Group at the Saskatchewan Research Council, and consulting positions with SENTAR Consultants (now Stantec) and Golder Associates Ltd. (where she attained the position of Principal). She now owns and operates Swanson Environmental Strategies. Stella's experience spans work for a wide range of industries as well as federal, provincial and territorial governments, First Nations, and NGOs. She has worked on all types of ecosystems, from small saline lakes on the prairies to subarctic watersheds and marine systems off both the east and west coasts of Canada. Stella has contributed to dozens of environmental impact assessments, as well as human health and ecological risk assessments. Stella is currently the Chair of the Joint Review Panel for the Deep Geologic Disposal of Low and Intermediate Nuclear Waste. She was also a member of the Royal Society of Canada's Expert Panel on the Behaviour and Environmental Impacts of Crude Oil Released into Aqueous Environments. Stella's focus is on strategic environmental planning, public consultation and engagement, and expert review.



## Fredrick Wrona, PhD

### **Chief Scientist for the Government of Alberta, Department of Environment and Parks and the Assistant Deputy Minister for the Environmental Monitoring and Sciences Division**

Dr. Wrona continues to have active research programs through his various faculty/research positions in both Canadian and European universities. He has more than 30 years of experience leading or contributing to numerous environmental programs addressing regional, national and international environmental issues related to ecotoxicology, cold regions hydro-ecology, climate impacts on freshwater ecosystems, integrated and adaptive environmental monitoring program design, and cumulative effects assessments. He has published more than 150 peer-reviewed scientific articles, reports and proceedings in these areas and has been the recipient of numerous national and international distinctions and awards. Well acquainted with Alberta, Dr. Wrona served as the Scientific Director of the Northern River Basins Study (1992-96) and was a member of the International Science Advisory Committee of the Alberta Water Research Institute, which is now part of Alberta Innovates – Energy and Environmental Solutions. He also continues to be the scientific program co-lead of the Oilsands Monitoring Program with Environment Canada. Dr. Wrona has served on numerous national and international scientific advisory and review panels; key examples include: Senior Science Strategist and Advisor with Environment Canada leading the scientific design and implementation of the Joint Oil Sands Monitoring Program in Alberta. Canada's Head Delegate to the Arctic Council's, Arctic Monitoring and Assessment Program; and Canada's Head Delegate for the UNESCO-International Hydrology Program.



# Appendix B: Science Directors

## Consuelo Aguilar

Research Professor, Department of the Studies for the Sustainable Development of Coastal Zones, University of Guadalajara

### Contact

coquiaguilar06@yahoo.es - (52) 315 355 6330

### Bio and Research Interests

Dr. Consuelo (Coqui) Aguilar's research group works on estuarine and coastal fish ecology. Research focuses include ecological connectivity among coastal habitats (rivers-coastal wetland-shelf) with emphasis on the nursery function of coastal wetlands, fish migration among habitats, and river-estuarine-coastal fish responses to anthropogenic stressors. Several of her research projects have been funded by Canadian, American, Spanish, and Mexican agencies. For more than 10 years, she has collaborated on research with CRI Science Directors Allen Curry, Karen Kidd, and past Associate Director Kelly Munkittrick.

### CRI History

Dr. Aguilar joined CRI as a Science Director in 2013. Previously, she was a PhD student of CRI Science Director Dr. Deborah MacLatchy.

### Background

- Research Professor, Center for Marine Investigation, University of Havana, Cuba (1981-2011)
- PhD, University of La Habana, Cuba
- MSc, Center for Marine Investigation, University of La Habana, Cuba
- BSc Biological Sciences, University of La Habana, Cuba



### Students

Yureidy Cabrera

### Associates

Dr. Gaspar Gonzalez-Sanson - University of Guadalajara

### 2016-2017 Research Highlights

- Ruiz-Ramírez, S., G. Molina-Arenas, G. Lucano-Ramírez, C. Aguilar, R. F.-O. Juan Ramon, D. Kosonoy-Aceves, and G. González-Sansón. 2017. Reproductive aspects of *Mugil curema* (*Mugiliformes: Mugilidae*) in the Barra de Navidad coastal lagoon, Jalisco, Mexico. *Latin American Journal of Aquatic Research* 45: 443-456.
- Aguilar C., G-S. Gaspar, K. Kidd, K. Munkittrick, R. Curry, D. Kosonov-Aceves, G. Lucano-Ramirez, S. Ruiz-Ramirez, J. R. Flores-Ortega. 2016. Fishes as indicators of untreated sewage contamination in a Mexican coastal lagoon. *Marine Pollution Bulletin* 10.1016/j.marpolbul.2016.08.073

# David Armanini

## Managing Director of Prothea Group

### Contact

d.armanini@protheagroup.com - 39 02 87031314

### Bio and Research Interests

Dr. David Armanini's expertise is in ecological quality assessment, eco-hydrology and functional diversity in freshwater ecosystems. In late 2010, he became the Managing Director of Prothea, an environmental firm based in Milan, Italy. The company is active in renewable energies, water protection and environmental education. Internationally, he is leading the implementation of projects focused on development of bio-assessment systems, environmental impact assessment and management of water resources in Europe, Canada, and Africa. Additionally, he has been directly involved in the implementation of the Water Framework Directive in Italy and Cyprus, focusing on stream type and reference condition identification, benthic invertebrate sampling and defining ecological status.

### CRI History

Dr. Armanini joined CRI as a Science Director in 2011 after two years as a postdoctoral fellow with Science Director Dr. Donald Baird.

### Background

- PhD Natural and Environmental Sciences, Freshwater Ecology, University of Milan, Italy
- BSc & MSc Biological Sciences, Ecology, University of Milan, Italy



### Students

Almudena Lucia Idigoras Chaumel

### Research Staff

Daniele Demartini

### 2016-2017 Research Highlights

- Culp, J., A. Yates, D. Armanini, and D. Baird. 2017. Establishing cause-effect relationships in multistressor environments. In *Methods in Stream Ecology* 335-351.
- Holmes, R., D. G. Armanini, and A. G. Yates. 2016. Best management practice location improves water quality but not ecological condition in southern Ontario streams. *Environmental Management* 57: 1062-1076.

# Donald Baird

**Senior Research Scientist, Water Science & Technology Directorate, Environment and Climate Change Canada (ECCC), and  
Visiting Research Professor, Department of Biology, University of New Brunswick**

## Contact

djbaird@unb.ca | donald.baird@canada.ca - 506-458-7048

## Bio and Research Interests

Dr. Donald Baird is an international leader in the field of ecological risk assessment, with particular expertise in the development of diagnostic approaches to study human impacts. His current research includes the development of new ecogenomics and ecoinformatic/geospatial approaches for large-scale assessment of biodiversity in remote regions. His research group is also actively involved in the development of observation methods focused on whole-ecosystem protection, with ongoing projects across Canada, including the Ottawa River, Atlantic Canadian rivers including the Saint John river floodplain and the Mackenzie (Peace-Athabasca Delta). He actively collaborates with scientists in Canada, and internationally in the UK, Australia, Colombia, Chile and the Netherlands.

## CRI History

Dr. Baird joined CRI as a Science Director in 2003, and was the chair of the Science Directors Board until July 2017.

## Background

- Professor, University of Stirling - Institute of Aquaculture, United Kingdom (1990 - 2003)
- PhD Ecology, University of Glasgow, Scotland
- BSc Zoology, University of Glasgow, Scotland

## Students

Stephanie Connor  
Beverley Hussey  
Natalie Rideout

## Research Staff

Kristie Heard



## Associates

Dr. Colin Curry – University of New Brunswick  
Dr. Zacchaeus Compson - University of New Brunswick  
Dr. Amadeu Soares - Centre for Environmental and Marine Studies, University of Aveiro  
Dr. Anthony Chariton - Commonwealth Scientific and Industrial Research Organisation  
Dr. Daniel Peters - University of Victoria  
Dr. Joel Gibson - University of Guelph  
Dr. Mehrdad Hajibabaei - University of Guelph  
Dr. Paul VandenBrink - Wageningen University  
Dr. Alex Bush - University of New Brunswick

## 2016-2017 Research Highlights

- Baird, DJ, Van den Brink PJ, Chariton AA, Dafforn KA, Johnston EL. (2016). New diagnostics for multiply stressed marine and freshwater ecosystems: integrating models, ecoinformatics and big data. *Marine and Freshwater Research*. 67: 391-392
- De Laender F, Rohr J, Ashauer R, Baird DJ, Berger U, Eisenhauer N, Grimm V, Hommen U, Maltby L, Melian C, Pomati F, Roessink I, Radchuk V, Van den Brink PJ. (2016). Re-introducing environmental change drivers in biodiversity-ecosystem functioning research. *Trends in Ecology and Evolution*. 31: 905-915.
- Spaak JW, Baert JM, Baird DJ, Eisenhauer N, Maltby L, Pomati F, Radchuk V, Rohr J, Van den Brink PJ, De Laender F. (2017). Shifts of community composition and population density substantially affect ecosystem function despite invariant richness. *Ecology Letters*, 20: 1315-1324.
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- Fahner NA, Shokralla S, Baird DJ, Hajibabaei M. (2016). Large-scale monitoring of plants through environmental DNA metabarcoding of soil: recovery, resolution and annotation of four DNA markers. *PLoS One*. 11(6): e0157505.
- Shokralla S, Gibson JF, King I, Baird DJ, Janzen DH, Hallwachs W, Hajibabaei M. (2016). Environmental DNA barcode sequence capture: Targeted, PCR-free sequence capture for biodiversity analysis from bulk environmental samples. *bioRxiv*: 087437.

# Leif Burge

**Adjunct Professor, UBC Okanagan, and  
Associate, Senior Scientist - Fluvial Geomorphology, Stantec**

## Contact

LBurge@stantec.com - (250) 470-4496

## Bio and Research Interests

Dr. Burge is a nationally recognized fluvial geomorphologist with over 20 years of experience solving applied river problems and conducting river research. His experience includes flood response and recovery, natural channel design, hydrotechnical geohazard assessment, hydraulic modelling and fluvial habitat projects. Feature projects include the hydrotechnical and geomorphological impact assessment of the Mount Polley tailings storage facility (TSF) breach and the sediment and erosion control plan for Hazeltine and Edney Creeks, downstream of the TSF breach. He was the design lead for 90 m of channel to mitigate sediment contamination and improve fish habitat on a small creek in the Kootenay region of British Columbia.

## CRI History

Dr. Burge joined CRI as a Science Director in 2011.

## Background

- Senior Scientist, Fluvial Geomorphology, SNC Lavalin (2013-2016)
- PhD Fluvial Geomorphology, McGill University, Canada
- MSc Fluvial Geomorphology, University of Calgary, Canada
- BSc Physical Geography, University of Victoria, Canada



## Research Staff

Megan Hendershot  
David Luzi  
Matt Wood  
Shawn Kilpatrick

## 2016-2017 Research Highlights

- Inflow Design Flood for the Woodworth Dam, BC.
- Hydraulic Response of Active Fluvial Units on the Yakoun River, BC.
- Modelling of Debris Floods on Stoneworks Creek, AB.

# Simon Courtenay

**Professor, School of Environment, Resources and Sustainability, University of Waterloo, and  
Scientific Director of the Canadian Water Network**

## Contact

simon.courtenay@uwaterloo.ca - (519) 888-4567 x 35796

## Bio and Research Interests

Dr. Simon Courtenay's research is focused on estuarine ecology and ecotoxicology, exploring the uses that animals make of the complex environments where rivers meet the sea and how human activities affect that ecology. Currently, he is developing monitoring programs to detect impacts of particular industries and cumulative effects. His work with the Canadian Water Network's Canadian Watershed Research Consortium is presently supporting research in areas across Canada to develop partnerships and monitoring programs in support of cumulative effects assessment at the watershed and regional levels.

## CRI History

Dr. Courtenay joined CRI as an Associate in 2001 and became a Fellow/ Science Director in 2005.

## Background

- Visiting Research Professor, Department of Biology, University of New Brunswick (2005-2014)
- Research Scientist, Fisheries and Oceans Canada (1990-2014)
- PhD Zoology, University of British Columbia, Canada
- MSc Zoology, University of Western Ontario, Canada
- BSc Zoology, University of Western Ontario, Canada



## Students

Kara Cox  
Sondra Eger  
Elaine Ho  
Vince McMullin  
Nicole Stamnes  
Jess Kidd  
Mike Coffin  
Jesse Hitchcock  
Zacharie Sirabahenda  
Kyle Knysh

## Associates

Dr. Bill Annable - University of Waterloo  
Dr. David Methven - University of New Brunswick  
Dr. Derek Armitage - University of Waterloo  
Dr. Heather Hunt - University of New Brunswick  
Dr. Heidi Swanson - University of Waterloo  
Dr. Robert Bailey - University of Ontario Institute of Technology  
Dr. Andrew Trant - University of Waterloo  
Dr. Roland Cormier – Ecoriskmanagement  
Dr. Rob Stephenson - Fisheries and Oceans Canada  
Dr. Marie Clement - Fisheries and Marine Institute, Memorial University of Newfoundland

## 2016-2017 Research Highlights

- Sirabahenda, Z., A. St-Hilaire, S.C. Courtenay, A. Alberto and M.R. van den Heuvel. 2017. A modelling approach for estimating suspended sediment concentrations for multiple rivers influenced by agriculture. *Hydrological Sciences Journal*. Published online: 4 September 2017. <http://dx.doi.org/10.1080/02626667.2017.1367396>
- Hitchcock, J. K., S. C. Courtenay, M.R.S. Coffin, C. C. Pater, and M. R. van den Heuvel. 2017. Eelgrass bed structure, leaf nutrient, and leaf isotope responses to natural and anthropogenic gradients in estuaries of the southern Gulf of St. Lawrence, Canada. *Estuaries and Coasts* 1-13
- Alberto, A., S. C. Courtenay, A. St-Hilaire, and M. R. van den Heuvel. 2017. Factors influencing brook trout (*Salvelinus fontinalis*) egg survival and development in streams influenced by agriculture. *Journal of Fisheries Sciences* 11(2): 9-20
- Coffin, M.R.S., K.M. Knysh, E.F. Theriault, C.C. Pater, S.C. Courtenay and M.R. van den Heuvel. 2017. Are floating algal mats a refuge from hypoxia for estuarine invertebrates? *PeerJ* 5:e3080 <https://doi.org/10.7717/peerj.3080>

# Joseph Culp

**Senior Research Scientist, Water Sciences & Technology Directorate,  
Environment and Climate Change (ECCC), and  
Research Professor, Department of Biology, University of New Brunswick**

## Contact

Joseph.Culp@canada.ca - (506) 471-7727

## Bio and Research Interests

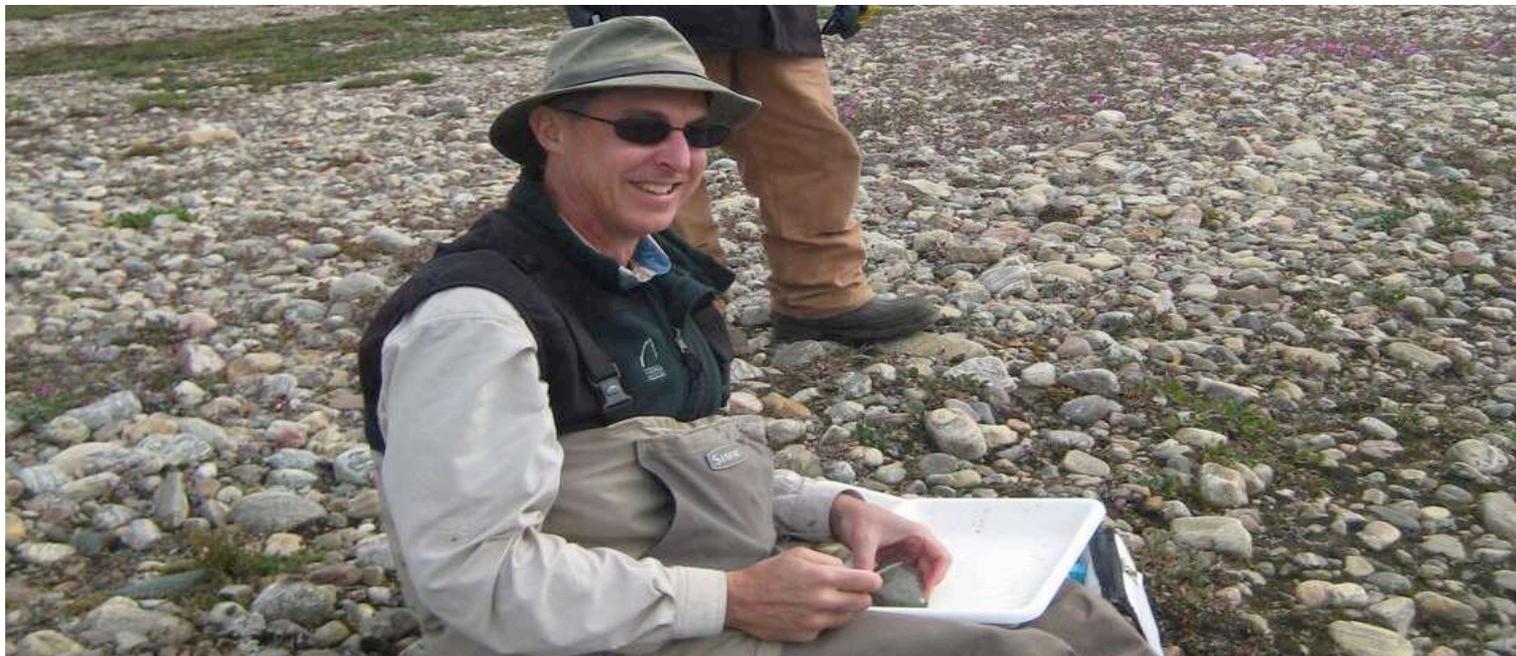
Dr. Joseph Culp's current research investigates the combined effects of nutrients, sediments and insecticides on taxonomic and trait composition of stream benthos through integrated field and mesocosm investigations. Recent investigations also examine the development of aquatic biodiversity monitoring programs for the circumpolar Arctic, and the impacts of permafrost degradation on stream community structure and function. He works collaboratively with researchers across Canada and Europe. In October 2017, Joseph will be joining the Cold Regions Research Centre at Wilfrid Laurier University.

## CRI History

Dr. Culp joined CRI as a Science Director in 2002.

## Background

- PhD, University of Calgary, Canada
- MSc, University of Calgary, Canada
- BSc, University of Oklahoma, USA



### Students

Allison Dykstra  
Julia Howland

### Research Staff

Dave Hryn  
Eric Luiker

### Associates

Dr. Alexa Alexander-Trusiak – ECCC  
Dr. Glen Benoy - International Joint Commission  
Dr. Jen Lento - University of New Brunswick  
Dr. Patricia Chamber - ECCC

### 2016-2017 Research Highlights

- Alexander A, Culp JM, Baird DJ, Cessna A. 2016. Nutrient-contaminant interactions decouple density-dependent responses in aquatic and emergent insects. *Freshwater Biology Special Issue* (doi:10.1111/fwb.12711).
- Chase, J.W., G.A. Benoy, S.W.R. Hann, and J.M. Culp. 2016. Small differences in riparian vegetation significantly reduce land use impacts on stream flow and water quality in small agricultural watersheds. *J. Water and Soil Conservation* 71:192-203.
- Culp, J., A. Yates, D. Armanini, and D. Baird. 2017. Establishing cause-effect relationships in multistressor environments. In *Methods in Stream Ecology* 335-351.
- Culp, J.M., E. Luiker, N.E. Glozier, M. Meding, D. Halliwell and F.J.Wrona. 2017. Dissolved oxygen relationships of under-ice water column and pore water habitat: implications for environmental protection guidelines. *River Research and Applications* 33:461-468.
- Noel, L., F. Baerlocher, J. M. Culp, and S. Sahadevan. 2016. Nutrient enrichment and flow regulation impair structure and function of a larger river as revealed by aquatic hyphomycete species richness, biomass, and decomposition rates. *Freshwater Science* 35: 10.1086/689180.
- Rattan K.J., Corriveau, J.C., Brua, R. B., Culp, J.M. Yates, A.G., and Chambers, P.A. 2017. Quantifying seasonal variation in total phosphorus and nitrogen from prairie streams in the Red River Basin, Manitoba Canada. *Science of the Total Environment* 575:649-659.
- Turak, E., D. Dudgeon, I.J. Harrison, J. Freyhof, A. De Wever, C. Revenga, J. Garcia-Moreno, R. Abell, J.M. Culp, J. Lento, B. Mora, L. Hilarides, and S. Flink. 2017) Chapter 8: Biodiversity observations of fresh waters. In Walters, M. and B. Scholes (eds.) *The GEO Handbook on Biodiversity Observation Networks*. Springer. DOI 10.1007/978-3-319-27288-7\_7
- Wrona, FJ, M Johansson, JM Culp, A Jenkins, JM Karlsson, IH Myers-Smith, TD Prowse, WF Vincent, PA Wookey. 2016. Transitions in Arctic Ecosystems: Ecological Implications of a Changing Freshwater System. *J. Geophys. Res. Biogeosci.* 121:650-674.

# Rick Cunjak

**Professor, Department of Biology and the Faculty of Forestry & Environmental Management, University of New Brunswick**

## Contact

cunjak@unb.ca - (506)-452-6204

## Bio and Research Interests

Dr. Rick Cunjak has over 35 years of experience working on the behavioural ecology of riverine fishes. He is the founder and Director of the Stable Isotopes in Nature Laboratory (SINLAB), which is the first stable isotope facility in the Maritimes, with a primary focus on the application of stable isotopes to ecology. His field-based research program is focused on natural stressors, anthropogenic impacts, and the population dynamics of riverine fishes, particularly Atlantic salmon. His current projects include investigating marine derived nutrients in riverine food webs, winter flow regulation impacts on Atlantic salmon eggs and parr, the use of thermal refugia in large rivers, and the identification of marine migratory patterns of adult salmon based on oxygen stable isotopes.

## CRI History

Dr. Cunjak is the founding Director, and a current Science Director.

## Background

- Tier I Canada Research Chair in River Ecosystem Science
- PhD Biology, University of Waterloo, Canada
- MSc Biology, Memorial University of Newfoundland, Canada
- BSc Marine Biology, University of Guelph, Canada



## Students

Emily Corey  
Adrian Hards  
Michelle Lavery  
Kurt Samways  
Sherr Vue

## Research Staff

Anne McGeachy  
Brent Nawrocki  
Andrea Prentice

## Associates

Dr. Brian Hayden - University of New Brunswick  
Dr. Guillaume Dauphin - University of New Brunswick  
Dr. Jennifer Nafziger - University of Alberta  
Dr. Atso Romakkaniemi - Finnish Game and Fisheries Research Institute  
Dr. Brittany Graham - National Institute of Water and Atmosphere Research  
Dr. David Soto - University of Leuven  
Dr. Tommi Linnansaari - University of New Brunswick  
Dr. Jean-Marc Roussel - National Institute for Agricultural Research  
Dr. Gerald Chaput - Fisheries and Oceans Canada

## 2016-2017 Research Highlights

- Nafziger, J., Y. She, F. Hicks, and R. A. Cunjak. 2017. Anchor ice formation and release in small regulated and unregulated streams. *Cold Regions Science and Technology* 141: 66-77.
- Corey, E., T. Linnansaari, R. A. Cunjak, and S. Currie. 2017. Physiological effects of environmentally relevant, multi-day thermal stress on wild juvenile Atlantic salmon (*Salmo salar*). *Conservation Physiology* 5(1).
- Dugdale, S. J., J. Franssen, E. Corey, N. E. Bergeron, M. Lapointe, and R. A. Cunjak. 2016. Mass stem movement of Atlantic salmon parr in response to high river temperature. *Ecology of Freshwater Fish* 25(3): 429-445.
- Hayden, B., S. M. McWilliam-Hughes, and R. A. Cunjak. 2016. Evidence for limited trophic transfer of allochthonous energy in temperate river food webs. *Freshwater Science* 35(2) 544-558.

# Allen Curry

Professor, Department of Biology and the Faculty of Forestry and Environmental Management, University of New Brunswick

## Contact

racurry@unb.ca - (506) 452-6208

## Bio and Research Interests

Dr. Allen Curry holds the Cloverleaf/Department of Natural Resources Professorship in Recreational Fisheries and is the Assistant Director of the New Brunswick Cooperative Fish and Wildlife Research Unit. His research interests and publications span a diversity of freshwater, estuary, and coral reef sciences, including the ecology of fishes, food webs, and rivers and their landscapes.

## CRI History

Dr. Curry is a founding member, past Director, and current Science Director

## Background

- PhD Zoology, University of Guelph
- MSc Watershed Science, Trent University
- BES Geography and Biology, University of Waterloo

## Students

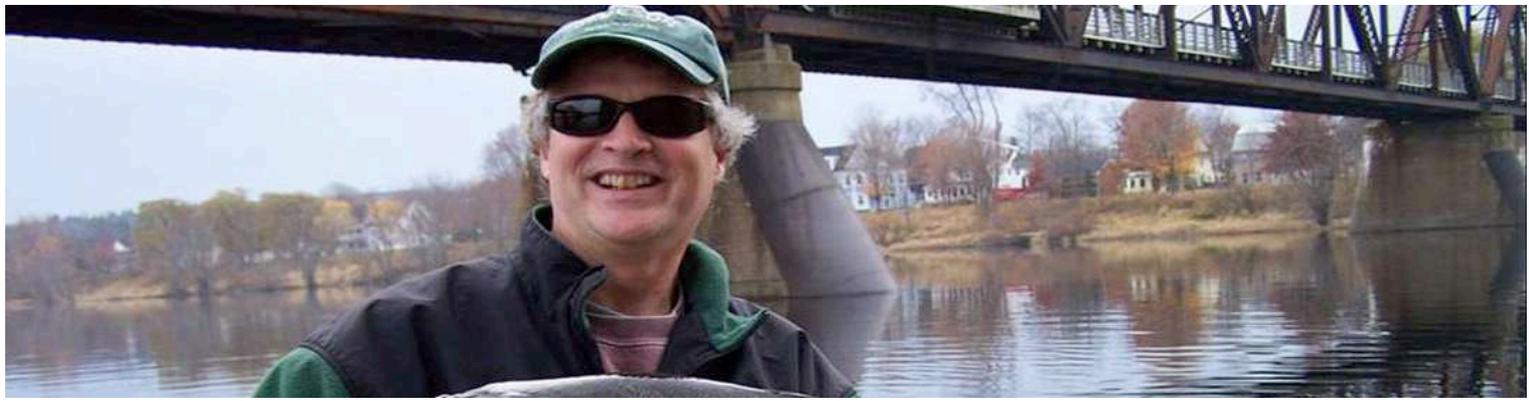
Sam Andrews  
Daniel Arluison  
Amanda Babin  
Kaleb Zelman  
Hilary MacLean  
James McCarthy  
Zoe O'Malley  
Antoin O'Sullivan  
Huy Nguyen  
Jani Helminen

## Research Staff

Bronwyn Fleet-Pardy  
Gordon Yamazaki  
Theo Ellis  
Mark Gautreau  
Samantha Pettey  
Caitlin Tarr  
Adam Chateauvert  
Jae Ogilvie  
Ben Wallace

## Associates

Dr. Laura Noel - University of New Brunswick  
Dr. Meghann Bruce - University of New Brunswick  
Dr. Mouhamed Ndong - University of New Brunswick  
Dr. Stephen Dugdale - University of Birmingham  
Dr. Tommi Linnansaari - University of New Brunswick  
Dr. Wendy Monk - University of New Brunswick  
Cecilia Brooks - Maliseet First Nation  
Dr. Katy Haralampides - University of New Brunswick



## 2016-2017 Highlights

- Andrews, S., Wallace, B., Gautreau, M., Linnansaari, T., and Curry, R.A. 2017. The complex and ephemeral Striped Bass, *Morone saxatilis*, of the Saint John River, New Brunswick: Past, Present and Future. N.A. Journal Fish. Mgt. 37:235-254.
- Dadswell, M.J., Ceapa, C., Spares, A.D., Stewart, N.D., Curry, R.A., Bradford, R.G. and Stokesbury, M.J.W. 2017. Population Characteristics of Adult Atlantic Sturgeon Captured by the Fishery in the Saint John River Estuary, New Brunswick, Canada. Trans. Amer. Fish. Soc. 146:318-330.
- Wallace, B. and R.A. Curry. 2017. Assessing the outcomes of stocking hatchery juveniles in the presence of wild Atlantic Salmon. Env. Biol. Fish. (in press).
- Aguilar-Betancourt, C., González-Sansón, G., Kidd, K.A. Munkittrick, K.R., Curry, R.A., Kosonoy-Acevesa, D., Lucano-Ramírez, G., Ruiz-Ramírez, S. 2016. Fishes as indicators of untreated sewage contamination in a Mexican coastal lagoon. Mar. Pollut. Bull. 113:100-109.
- Dugdale, S.J., St-Hilaire, A., and Curry, R.A. 2016. Automating flow routing and physiographic inputs to the CEQUEAU hydrological model: sensitivity testing on the lower St. John River watershed, Canada. Journal of Hydroinformatics, jh2017051, DOI: 10.2166/hydro.2017.051
- Finley, M.L.D., Kidd, K.A., Curry, R.A., Lescord, G.L., Clayden, M.G., and O'Driscoll, N.J. 2016. A comparison of mercury biomagnification through lacustrine food webs supporting Brook Trout (*Salvelinus fontinalis*) and other salmonid fishes. Frontiers in Environmental Science <http://dx.doi.org/10.3389/fenvs.2016.00023>.
- Curry, R.A., Linnansaari T. 2017-2022. CAST \$1.3 M
- Curry, R.A., Linnansaari T. 2017-2022. CAST: Create a comprehensive recovery strategy to reverse the decline in wild Atlantic Salmon - DFO P&P. \$1.5M
- Curry, R.A., Linnansaari T. 2016-2017. Sub-Population Genetic Structuring of Atlantic Salmon in the Miramichi River - DFO P&P. \$120,000
- Curry, R.A., 2014-2018. Mactaquac Aquatic Ecosystem Study – NSERC CRD. \$2.8M
- Curry, R.A., 2017-2018. Mactaquac Aquatic Ecosystem Study (Amendment Addition) – NSERC CRD. \$513,300
- Curry, R.A., 2013-2016. Environmental science for Mactaquac Renewal – NB Power. \$2.3M
- Curry, R.A., 2016-2017. Environmental science for Mactaquac Renewal (Amendment Addition)– NB Power. \$477,032
- Magnan et al., Curry, R.A., 2014-2019. ÉcoLac - en écologie lacustre et fluviale – NSERC CREATE. \$1.7M
- Curry, R.A., 2017-2018. Addressing Blue-Green Algae Issues for NB Lakes – NBETF. \$50,000
- Curry, R.A., Linnansaari T. 2018-2020. Modelling the Striped Bass Population of the Miramichi – Atlantic Salmon Conservation Fund. \$60,000
- Curry, R.A., Linnansaari T. 2017-2018. Diet of Striped Bass: A literature review – Atlantic Salmon Conservation Fund. \$6,000
- Curry, R.A., 2016-2018. MAES-NB Innovation Fund. \$10,000
- Curry, R.A., 2016-2017. Environmental science for Mactaquac Renewal – NB Power (Amendment Addition). \$477,032
- Curry, et al., 2014-2016. Surface water monitoring/Shale gas development – NB Energy Institute. \$349,170
- Curry, R.A., 2016-2017. Addressing Blue-Green Algae Issues for NB Lakes – NBETF. \$130,000
- Curry, R.A., O'Sullivan, A. 2016-2017. Mapping River Temperature Change – NBWTF. \$5,000
- Curry, R.A., Gautreau, M. 2016-2017. Field Guide to the Inland Fisheries of New Brunswick – NBWTF. \$4,000
- Curry, R.A., Gautreau, M. 2016-2017. Rainbow Trout in the Saint John River – NBWTF. \$8,000

# Michelle Gray

Assistant Professor, Faculty of Forestry and Environmental Management,  
University New Brunswick

## Contact

mgray1@unb.ca - 506-451-6866

## Bio and Research Interests

Dr. Michelle Gray studies freshwater streams and rivers using fish and benthic invertebrates as indicators of environmental and water quality. She has been involved with the development and refinement of guidelines for the federal Environmental Effects Monitoring (EEM) program and for aquatic monitoring in northern Canada. She has designed and conducted aquatic monitoring programs related to diamond and gold mines, pulp mills, agriculture, and shale gas development. Dr. Gray teaches environmental management tools, impact assessment, and practical online and field skills training such as the Canadian Biomonitoring Network (CABIN), electrofishing, and water quality data analysis. Dr. Gray's current research interests continue to look at novel and integrated tools to assess aquatic environmental health, and the utility of small-bodied fish species in monitoring.

## CRI History

Dr. Gray was a graduate student when the CRI was originally formed, completing her PhD with Science Directors Kelly Munkittrick and Rick Cunjak. She was a postdoctoral fellow with CRI Science Director Allen Curry, and then CRI Fellow from 2006 to 2010, when she established CRI's Training and Professional Development Program. From 2010 to 2015, she was the Director of CRI's Training Division, and rejoined as a Science Director in 2016.

## Background

- PhD Biology, University of New Brunswick, Canada
- MSc, Trent University, Canada
- BSc, Trent University, Canada



### **Students**

Allison Dickhout  
Bianca Langille  
Heather Leschied  
Carson White  
Fang Yuan

### **Research Staff**

Alanah Annis  
Adam Chateauvert  
Courtney Johnson  
Louisa Baird  
Kirk Roach

# Natacha Hogan

**Assistant Professor, Toxicology Centre, and the Department of Animal Science,  
University of Saskatchewan**

## Contact

natacha.hogan@usask.ca - (306) 966-6862

## Bio and Research Interests

Dr. Natacha Hogan is a toxicologist with expertise in the areas of environmental, biomedical and nutritional toxicology. Her research program investigates the mechanisms underlying toxicity of both natural and man-made toxicants. The ultimate goal of her research is to establish acceptable risk thresholds for toxicants, which can be used by industry or regulatory bodies in efforts to improve the health of animals and their environments.

## CRI History

Natacha joined CRI as a Science Director in 2016 after being an Associate (2009-2015) and a post-doctoral fellow (2007-2008) with CRI Science Directors Michael van den Heuvel and Deborah MacLatchy.

## Background

- Assistant Professor, Biology Department, University of Prince Edward Island (2009-2011)
- Post-doctoral Fellow, Canadian Rivers Institute/Biology Department, University of Prince Edward Island (2007-2008)
- PhD Biology, University of Ottawa, Canada
- BSc Biology, University of Prince Edward Island, Canada



## Students

Zachary Currie  
Melanie Gallant  
Kean Steeves

## 2016-2017 Research Highlights

- Phalen LJ, Kollner B, Hogan NS, and MR van den Heuvel. 2017. Transcriptional response in rainbow trout (*Oncorhynchus mykiss*) immune cells following in vivo exposure to benzo[a]pyrene. *Environmental Toxicology and Pharmacology* 53: 212-218
- Forzan M, Smith TG, Vanderstichel RV, Hogan NS, and C Gilroy. 2016. Hematologic reference intervals for *Rana sylvatica* (*Lithobates sylvaticus*) and effect of infection with Frog Virus 3 (*Ranavirus* sp, *Iridoviridae*). *Veterinary Clinical Pathology* 45(3):430-443.
- Arens CJ, Arens JC, Hogan NS, Kavanagh RJ, van der Kraak GJ, Berrue F, and MR van den Heuvel. 2017. Population impacts in white sucker (*Catostomus commersonii*) exposed to oil sands-derived contaminants in the Athabasca River. *Environmental Toxicology and Chemistry* (DOI: 10.1002/etc.3735)
- Muldoon B and NS Hogan. 2016. Biomarker responses to estrogen and androgen exposure in the brook stickleback (*Culaea inconstans*): a new bioindicator species for endocrine disrupting compounds. *Comparative Biochemistry and Physiology Part C: Toxicology and Pharmacology* 180:1-10

# Douglas Holdway

**Interim Vice-President, Research, Innovation, International,  
Professor of Ecotoxicology and  
Tier I Canada Research Chair in Aquatic Toxicology, Faculty of Science,  
University of Ontario Institute of Technology (UOIT)**

## Contact

douglas.holdway@uoit.ca - (905) 721-8668 x 2606

## Bio and Research Interests

Dr. Douglas Holdway's expertise is in aquatic toxicology and marine biology with particular interest in the impacts that pulse exposures, such as pesticides, oil spills, toxic industrial chemicals, and pathogens have on the survival, growth, and reproduction of aquatic organisms in various life-stages and under a variety of environmental conditions. He is developing "real-time" biosensors to detect the presence of contaminants in water. Dr. Holdway was awarded UOIT's first Tier I Canada Research Chair in Aquatic Toxicology in June 2004, and renewed in 2011.

## CRI History

Dr. Holdway joined CRI as a Science Director in 2011.

## Background

- Professor of Ecotoxicology, Royal Melbourne Institute of Technology, Australia (1989-2002)
- PhD Marine Biology, Aquatic Toxicology, University of Guelph, Canada
- MSc Marine Biology, Aquatic Toxicology, University of Guelph, Canada
- BSc Marine Biology, Aquatic Toxicology, University of Guelph, Canada



### Students

Jordan Anderson  
Erin Ussery

### Research Staff

John Guchardi - UOIT

### Associates

Andrea Kirkwood - UOIT

### 2016-2017 Research Highlights

- Anderson, J. C., L. Beyger, J. Guchardi, and D. Holdway. 2016. Chronic effects of hydroxypropyl- $\beta$ -cyclodextrin on reproduction in the American flagfish (*Jordanella floridae*) over one complete life cycle. *Environmental Toxicology and Chemistry* 35(6): 1358-1363.
- Orrego, Rodrigo, Craig B Milestone, L Mark Hewitt, John Guchardi, Mohan Kohli, Tatiana Heid-Furley, Alison Slade, Deborah L MacLatchy and Douglas Holdway (2017). Evaluating the potential of effluent extracts from pulp and paper mills in Canada, Brazil and New Zealand to affect fish reproduction: estrogenic effects in fish. *Environmental Toxicology and Chemistry*, 36(6) 1547-1555.

# Tim Jardine

Assistant Professor, School of Environment and Sustainability and Toxicology Centre, University of Saskatchewan

## Contact

tim.jardine@usask.ca - (306) 966-4158

## Bio and Research Interests

Dr. Tim Jardine has been studying aquatic food webs for 15 years across Canada and northern Australia. He leads a large interdisciplinary team studying long-term environmental change in the Saskatchewan River Delta, which is a massive river-wetland in central Canada. He has active international collaborations in Brazil, Singapore, and Australia where he uses ecological tracers to understand energy and contaminant cycling in rivers, estuaries, and reservoirs.

## CRI History

Dr. Jardine joined CRI as a Science Director in 2016. Previously, he was a PhD student with Science Director Karen Kidd, and MSc student with Science Director Deborah MacLatchy.

## Background

- PhD Biology, University of New Brunswick, Canada
- MSc Biology, University of New Brunswick, Canada
- BSc Biology, Dalhousie University, Canada

## Students

Kate Prestie  
Stephen Srayko

## Associates

Dr. Iain Phillips - Saskatchewan Water Security Agency

## 2016-2017 Research Highlights

- Jardine, T.D., and Janz, D.M. 2016-2018. Development of a fish biomonitoring program for northern Saskatchewan. Environmental Damages Fund. \$124,220



- Jardine, T.D., and Hecker, M. 2016-2017. Application of environmental DNA to detect aquatic invasive species. Fish and Wildlife Development Fund. \$29,530
- Jardine, T.D., and Baulch, H.M. 2016. Detecting hot spots and hot moments in river health by combining real-time water quality monitoring and citizen science. NSERC Research Tools and Instruments. \$36,100
- Steelman, T.A., Strickert, G.E.H., Fresque-Baxter, J.A., Reed, M.G., Jardine, T.D., and Shantz, S.D. 2016. Building bridges between deltas: crossing knowledge and cultural divides. SSHRC Connection. \$48,344
- Lindenschmidt, K., P. Jones, L. Bharadwaj, T. Jardine, and L. Doig. 2014-2017. Geospatial models and isotope tracers to identify key fish and animal habitats along the Slave River. NWT Cumulative Impact Monitoring Program. \$120,000.
- Steelman, T., J. A. Fresque-Baxter, S. M. McLachlan, L. A. Bharadwaj, L. E. A. Bradford, T. D. Jardine, P. D. Jones, K.-E. Lindenschmidt, G. M. Poelzer, M. G. Reed, and G. E. H. Strickert. 2014-2016. Delta Dialogue Network. SSHRC Partnership Development Grant. \$199,882
- Jardine, T.D., H. M. Baulch, K. A. Hobson, and D. M. Janz. 2013-2016. Identifying flood- and food-related limits to fish and wildlife production in the Saskatchewan River delta. NSERC Collaborative Research and Development Grant. \$411,158 (with SaskPower)
- Jardine, T.D. 2013-2018. Ecological benefits and toxicological consequences of flooding in river ecosystems. NSERC Discovery Grant. \$135,000
- Mantyka-Pringle, C. S., T. D. Jardine, L. Bradford, L. Bharadwaj, A. P. Kythreotis, J. Fresque-Baxter, E. Kelly, G. Somers, L. E. Doig, P. D. Jones, and K.-E. Lindenschmidt. 2017. Bridging science and traditional knowledge to assess cumulative impacts of stressors on ecosystem health. *Environmental International* 102: 125-137.
- Carr, M. K., T. D. Jardine, L. E. Doig, P. D. Jones, L. Bharadwaj, B. Tendler, J. Chételat, P. Cott, K.-E. Lindenschmidt. 2017. Stable sulfur isotopes identify habitat-specific foraging and mercury exposure in a highly mobile fish community. *Science of the Total Environment* 586: 338-346.
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- Pettit, N.E., Naiman, R.J., Warfe, D.M., Jardine, T.D., Douglas, M.M., Bunn, S.E., and Davies, P.M. 2017. Productivity and connectivity in tropical riverscapes of northern Australia: Ecological insights for management. *Ecosystems* 20: 492-514.
- Jardine, T.D., Rayner, T.S., Pettit, N.E., Valdez, D., Ward, D.P., Lindner, G., Douglas, M.M., and Bunn, S.E. 2017. Body size drives allochthony in food webs of tropical rivers. *Oecologia* 183: 505-517.
- Bond, A.L., Jardine, T.D., and Hobson, K.A. 2016. Multi-tissue stable-isotope analyses can identify dietary specialization. *Methods in Ecology and Evolution* 7: 1428-1437.

# Karen Kidd

**Professor, Department of Biology, University of New Brunswick, and  
Tier 1 Canada Research Chair in Chemical Contamination of Food Webs**

## Contact

karenkidd@mcmaster.ca - (905) 525-9140 x 23550

## Bio and Research Interests

Dr. Karen Kidd studies why some fish and other aquatic life are more contaminated than others in tropical through temperate regions, and the effects of human activities on aquatic ecosystem health. Field studies, including whole ecosystem manipulations, assess how agriculture, aquaculture, forestry, and industrial and municipal effluents affect the health of aquatic organisms, and how stream and lake food webs are structured. She also works on more remote systems in Atlantic Canada to the Canadian Arctic that are contaminated by long-range atmospheric transport and deposition of mercury, pesticides, and industrial chemicals. Together these studies provide a better understanding of downstream impacts of human development and the risks that contaminants pose to aquatic life and fish-eating wildlife and humans. In July 2017, Dr. Kidd will be re-locating to McMaster University where she will be the Jarislowsky Chair in Environment and Health and a Professor in the School of Geography and Earth Sciences.

## CRI History

Dr. Kidd joined CRI as a Science Director in 2004.

## Background

- PhD, University of Alberta, Canada
- BSc, University of Guelph, Canada



### Students

Kelli Charbonneau  
Maitane Erdozain  
Heather Loomer  
Bethany Reinhart  
Jon Rush  
Jennifer Thera  
Jennifer Adams

### Research Staff

Angella Mercer

### Associates

Dr. Lindsay Brin - University of New Brunswick  
Dr. Gustavo Chiang - Fundacion MERI  
Dr. Marcial Arellanos - Instituto Politecnico Nacional  
Dr. Patricia Ceballos - Instituto Politecnico Nacional

### 2016-2017 Research Highlights

- Aguilar C., G-S. Gaspar, K. Kidd, K. Munkittrick, R. Curry, D. Kosonov-Aceves, G. Lucano-Ramirez, S. Ruiz-Ramirez, J. R. Flores-Ortega. 2016. Fishes as indicators of untreated sewage contamination in a Mexican coastal lagoon. *Marine Pollution Bulletin*.
- Graves, S. G., K. A. Kidd, J. E. Houlihan, and K. R. Munkittrick. 2017. General and histological indicators of health in wild fishes from biological mercury hotspot in northeastern North America. *Environmental Toxicology and Chemistry* 36(4): 976-987
- Graves, S. D., K. A. Kidd, K. L. Batchelar, A. M. Cowie, N. J. O'Driscoll, and C. J. Martyniuk. 2017. Response of oxidative stress transcripts in the brain of wild yellow perch (*Perca flavescens*) exposed to an environmental gradient of methylmercury. *Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology* 192: 50-58.
- Baker, L. F., J. F. Mudge, D. G. Thompson, J. E. Houlihan, and K. A. Kidd. 2016. The combined influence of two agricultural contaminants on natural communities of phytoplankton and zooplankton. *Ecotoxicology* 25(5): 1021-1032.

# Deborah MacLatchy

**Professor, Department of Biology, and  
President and Vice-Chancellor, Wilfrid Laurier University**

## Contact

dmaclatchy@wlu.ca - 519-884-0719 x 2859

## Bio and Research Interests

Dr. Deborah MacLatchy is an ecotoxicologist and comparative endocrinologist. She is funded by the Natural Sciences and Engineering Research Council of Canada (NSERC), industry, and federal, provincial and territorial infrastructure platform grants. She is a 2005 recipient, with Irving Pulp and Paper Ltd., and Environment Canada, of a NSERC Synergy award for her collaborative work on the issue of endocrine disruption in aquatic environments caused by industrial contaminants. Her lab has been at the forefront of developing fish bioassays for assessment of mechanisms of action of aquatic endocrine disruptors and in investigating source contaminants of pulp and paper and other wastewater producers. She is a founding member of the Laurier Institute for Water Sciences and the Laurier Centre for Women in Science.

## CRI History

Dr. MacLatchy is a founding member and past Chair of the Science Directors' Board. She is currently a Science Director.

## Background

- Dean of Science, Wilfrid Laurier University, Canada (2007-2009)
- Professor, Department of Biology and Dean of Science, Applied Science and Engineering, University of New Brunswick in Saint John, Canada (2004-2007)
  - PhD, University of Manitoba, Canada
  - BSc, Acadia University, Canada



### Students

Samantha Deeming  
Grant Harrison  
Thiviya Kangasabesa  
Robert Rutherford

### Research Staff

Andrea Lister

### Associates

Dr. Jim McGeer - Wilfrid Laurier University  
Dr. Kevin Stevens - Wilfrid Laurier University  
Dr. Mike Wilkie - Wilfrid Laurier University  
Dr. Scott Smith - Wilfrid Laurier University

### 2016-2017 Research Highlights

- Awarded an honorary doctorate from Acadian University
- Patented process for refining chemicals from pulp and paper mill wastewaters.
- Bosker, T., K. R. Munkittrick, A. Lister, and D. L. MacLatchy. 2016. Mummichog (*Fundulus heteroclitus*) continue to successfully produce eggs after exposure to high levels of 17 $\alpha$ -ethinylestradiol. *Environmental Toxicology and Chemistry* 35(5): 1107-1112.

# Kerry MacQuarrie

Professor Department of Civil Engineering, University of New Brunswick

## Contact

ktm@unb.ca - 506-453-5121

## Bio and Research Interests

Dr. Kerry MacQuarrie's research currently focuses on groundwater-surface water interactions, nitrate attenuation in groundwater in riparian zones, and far-field hydrogeological aspects of deep waste disposal. His research typically integrates numerical modeling with hydrological, water temperature, and/or geochemical field studies.

## CRI History

Dr. MacQuarrie joined CRI as a Science Director in 2004.

## Background

- Tier II Canada Research Chair in Groundwater-Surface Water Interaction (2003-2013)
- PhD Earth Science - Hydrogeology, University of Waterloo, Canada
- MSc Earth Science - Hydrogeology, University of Waterloo, Canada
- BScE Civil Engineering, University of New Brunswick, Canada



## Students

Martin Boissonault  
Ian Bragdon  
Christine Chase  
Calvin O'Neil  
Diana Loomer  
Tana Yun

## Associates

Dr. Dennis Connor – University of New Brunswick  
Dr. Serban Danielescu – Agriculture and Agri-Food Canada/  
Environment and Climate Change Canada

## 2016-2017 Research Highlights

- Su, D., K.U. Mayer, and K.T.B. MacQuarrie, 2017, Parallelization of MIN3P-THCm: a high performance computational framework for subsurface flow and reactive transport simulation, *Environmental Modelling and Software*, 95, 271-289.
- Morton, S.M., K.T.B. MacQuarrie, D. Connor, and B.L. Kurylyk, 2017, Monitoring changes in near-well hydraulic conditions as a means to assess aquifer clogging, *ASCE Journal of Hydrologic Engineering*, 22(2), 04016057.
- Kurylyk, B.L., R.D. Moore, and K.T.B. MacQuarrie, 2016, Scientific Briefing: quantifying streambed heat advection due to groundwater-surface water interactions, *Hydrological Processes*, 30(6), 987-992, doi: 10.1002/hyp.10709.
- Bea, S.A., K.U. Mayer, and K.T.B. MacQuarrie, 2016, Reactive transport and thermo-hydro-mechanical coupling in deep sedimentary basins affected by glaciation cycles: Model development, verification and illustrative example, *Geofluids*, 16(2), 279-300, doi: 10.1111/gfl.12148.

# Chris Martyniuk

Associate Professor, Center for Environmental and Human Toxicology and  
Department of Physiological Sciences, University of Florida

## Contact

cmartyn@ufl.edu

## Bio and Research Interests

Dr. Chris Martyniuk's laboratory uses environmental transcriptomics and proteomics, and associates molecular changes to higher levels of biological organization to achieve this. Additionally, his research utilizes bioinformatics to integrate molecular data to better link molecular initiating events to adverse outcomes in aquatic organisms, for example decreased reproductive output or stress. Key words associated with his research include genomics, environmental impacts, fish, reproductive physiology, water protection, aquatic toxicology, protein biotechnology, bioinformatics, toxicity testing, and bioassays.

## CRI History

Dr. Martyniuk joined CRI as a Science Director in 2009.

## Background

- Tier II Canada Research Chair in Molecular Ecology
- Professor, Department of Biology, University of New Brunswick, Canada
- PhD Biology, University of Ottawa, Canada
- MSc Zoology, University of Guelph, Canada
- BSc Biology, Simon Fraser University, Canada



## Students

Kathleena Sarty  
Jennifer Adams

## 2016-2017 Research Highlights

- Marjan, P., L. Bragg, D. L. Maclatchy, M. Servos, and C. J. Martyniuk. 2017. How does reference site selection influence interpretation of omics data?: Evaluating liver transcriptome responses in male rainbow darter (*Etheostoma caeruleum*) across an urban environment. *Environmental Science and Technology* 51(11): 6470-6479.
- Cowie, A. M., K. I. Sarty, A. Mercer, J. Koh, K. A. Kidd, and C. J. Martyniuk. 2017. The pesticide dieldrin disrupts proteins related to oxidative respiration and mitochondrial stress in the central nervous system. *Data Brief*. doi:10.1016/j.dib.2017.03.008.
- Cowie, A. M., K. I. Sarty, A. Mercer, J. Koh, K. A. Kidd, and C. J. Martyniuk. 2017. Molecular networks related to the immune system and mitochondria are targets for the pesticide dieldrin in the zebrafish (*Danio rerio*) central nervous system. *J Proteomics* doi: 10.1016/j.jprot.2017.02.003.
- Sarty K. I., A. Cowie, and C. J. Martyniuk. 2017 The legacy pesticide dieldrin acts as a teratogen and alters the expression of dopamine transporter and dopamine receptor 2a in zebrafish (*Danio rerio*) embryos. *Comp Biochem Physiol C Toxicol Pharmacol*. doi: 10.1016/j.cbpc.2017.01.010.
- Marlatt V. L., and C. J. Martyniuk. 2017. Biological responses to phenylurea herbicides in fish and amphibians: New directions for characterizing mechanisms of toxicity. *Comp Biochem Physiol C Toxicol Pharmacol* doi:10.1016/j.cbpc.2017.01.002. Epub 2017 Jan 19. Review.

# Jessica Orlofske

**Assistant Professor, Department of Biological Sciences, University of Wisconsin-Parkside**

## Contact

orlofske@uwp.edu - (262) 595-2547

## Bio and Research Interests

Dr. Jessica Orlofske's research encompasses invertebrate ecology and conservation with an emphasis on the application of aquatic invertebrates for monitoring ecosystem health. Dr. Orlofske specializes in integrating invertebrate life-history characteristics (functional traits) with traditional taxonomic information to enhance the sensitivity and diagnostic ability of biomonitoring programs. Additionally, Dr. Orlofske incorporates similar functional trait approaches to understand the vulnerability and viability of imperiled invertebrates. Her recent projects include the bioassessment of a Great Lakes watershed, monitoring ecosystem recovery following coastal wetland restoration, and biodiversity and risk assessment of threatened and endangered riverine dragonflies.

## CRI History

Dr. Orlofske joined CRI as a Science Director in 2016, after she was a post-doctoral fellow with Science Director Donald Baird.

## Background

- PhD Biology, University of New Brunswick, Canada
- MSc Ecology and Evolutionary Biology, Iowa State University, USA
- BSc Biology, and Wildlife Ecology and Management, University of Wisconsin, USA



## Students

Nick Bielski  
Liv Gripko  
Josie Ackmann  
William Blake  
Emily-Lou La Martina  
Kyle Butler  
Jordan Stepro  
Nora Willkomm  
Danielle Tesar

## Associates

Dr. Christopher Tyrrell – Milwaukee Public Museum

## 2016-2017 Research Highlights

- Prioritization of restoration in the Oak Creek Watershed via water quality and habitat assessment, Fund for Lake Michigan/City of Racine Health Department
- Sam Myers Park Restoration, Fund for Lake Michigan/City of Racine Health Department
- An Integrative Biodiversity Assessment of Wisconsin's Riverine Dragonflies, John J. Brander and Christine E. Rundblad Research Fellowship, Milwaukee Public Museum
- Great Water Alliance – Root River Monitoring, City of Waukesha

# Mark R. Servos

Professor and Tier I Canada Research Chair in Water Quality Protection,  
Department of Biology, University of Waterloo

## Contact

mservos@uwaterloo.ca - 519-888-4567 x 36034

## Bio and Research Interests

Dr. Mark Servos' research group is exploring a variety of issues related to predicting and managing the risk of human activities in aquatic ecosystems. The objective of his research is to build predictive relationships to better model how contaminant exposure leads to effects in fish at various levels of biological organization (from gene expression to populations) and how natural gradients within watersheds modify these responses. He works within a risk assessment framework to define exposure and effects and formulate innovative technologies and solutions to minimize risk to the environment. Research outcomes support the development of more effective risk assessments, monitoring programs and implementation of remedial actions in watersheds.

## CRI History

Dr. Servos joined CRI as a Science Director in 2011.

## Background

- Scientific Director of the Canadian Water Network (2003-2011)
- Project Chief, National Water Research Institute, Environment Canada (1996 - 2003)
- Research Scientist, Great Lakes Laboratory for Fisheries and Aquatic Sciences, Department of Fisheries and Oceans Canada (1990-1996)
- Research Scientist, Lakes Research Branch, Environment Canada (1988-1996)
- PhD, University of Manitoba, Canada
- MSc, University of Guelph, Canada
- BSc, University of Guelph, Canada



## Students

Maricor Arlos  
Michael Dunning  
Meghan Fuzzen  
Keegan Hicks  
Patricija Marjan  
Katie McCann

## Research Staff

Leslie Bragg

## 2016-2017 Research Highlights

- Hicks, K. and M. Servos. 2017. Site fidelity and movement of a small-bodied fish species, the rainbow darter (*Etheostoma caeruleum*): Implications for environmental effects assessment. *River Research and Applications* 33(7): 1016-1025.
- Hicks, K., M. L. M. Fuzzen, E. K. McCann, M. Arlos, L. Bragg, S. Kleywegt, G. R. Tetreault, M. E. McMaster, and M. Servos. 2017. Reduction of intersex in wild fish population in response to major municipal wastewater treatment plant upgrades. *Environ Sci Technol* 51(3): 1811-1819.
- Hicks, K., H. A. Loomer, M. Fuzzen, S. Kleywegt, G. R. Tetreault, M. E. McMaster, and M. Servos. 2017.  $\delta^{15}\text{N}$  tracks changes in the assimilation of sewage-derived nutrients into a riverine food web before and after major process alterations at two municipal wastewater treatment plants. *Ecological Indicators* 72: 747-758.
- Marjan, P., C. J. Martyniuk, M. Fuzzen, D. L. MacLatchy, M. E. McMaster, and M. Servos. 2017. Returning to normal? Assessing transcriptome recovery over time in male rainbow darter (*Etheostoma caeruleum*) liver in response to wastewater treatment plant upgrades. *Environ Toxicol Chem* 26(8): 2108-2122.
- Fuzzen, M., L. Bragg, G. R. Tetreault, P. Bahamonde, R. N. Tanna, C. J. Bennett, M. E. McMaster, and M. Servos. 2016. An Assessment of the Spatial and Temporal Variability of Biological Responses to Municipal Wastewater Effluent in Rainbow Darter (*Etheostoma caeruleum*) Collected along an Urban Gradient

# André St-Hilaire

Professor, Hydrology, National Institute of Scientific Research (INRS), Université du Québec

## Contact

andre.st-hilaire@ete.inrs.ca - (418) 654-3113

## Bio and Research Interests

Dr. André St-Hilaire is a member of the Hydroclimatic Statistics Research Group at the Université du Québec and a member of CIRSA (Inter-university Research Center on Atlantic salmon). His current research focuses on environmental hydrology, with an emphasis on hydrological extremes, and modelling of hydrology, habitat, and water quality, with recent development in water temperature and river sediment.

## CRI History

Dr. St-Hilaire joined CRI as a Science Director in 2005.

## Background

- PhD Sciences de l'eau, Institut national de la recherche scientifique (INRS-Eau), Canada
- M.A.Sc., Université de Moncton, Canada
- BSc Physics and oceanography, Royal Roads Military College, Canada

## Students

Joannie Beaupre  
Gaetano Cecerre  
Samah Larabi  
Sebastien Ouellet-Proulx  
Alida Thiombano

## Associates

Dr. Anik Daigle  
Dr. Normand Bergeron  
Dr. Olivier Chimi-Chiadjeu  
Dr. Daniel Caissie

## 2016-2017 Research Highlights

- Appointed to the National Advisory Panel for protecting Canada's land and freshwater
- Appointed as the Canadian lead of the IJC Review Panel on the Lake Champlain & Richelieu River watershed study
- Ouellet-Proulx S\*., Boucher M.-A., O. Chimi-Chiadjeu, St-Hilaire A. 2017. Assimilation of water temperature and



- Sirabahenda\*, Z., A. St-Hilaire, M. Van den Heuvel, S.C. Courtenay, A. Alberto. 2017. A modelling approach for estimating suspended sediment concentrations for multiple rivers influenced by agriculture. *Hydrological Sciences Journal* 62(13):2209-2221.
- Masselot\*, P., F. Chebana, D. Bélanger, A. St-Hilaire, B. Abdous, P. Gosselin. 2018. EMD-regression with application to weather-related cardiovascular mortality. *Science of the Total Environment* 612: 1018-1029.
- Kwak\*, J., A. St-Hilaire, F. Chebana, G. Kim. 2017. Summer season water temperature modeling under climate change: case study for Fourchue River, Quebec, Canada. Publié en ligne dans *Water*, DOI 10.3390/w9050346.
- Ouellet-Proulx S\*., St-Hilaire A., Boucher M.-A., 2017. Water temperature ensemble forecasts in the context of river cooling: Implementation of the CEQUEAU model on the Nechako River (Canada) *Water* 9, 457; doi:10.3390/w9070457.
- Thiombiano, A.\*, S. El-Adlouni, A. St-Hilaire, N. El-Jabi. 2017. Nonstationary frequency analysis of extreme daily precipitation amounts in Southeastern Canada using a peaks-over-threshold approach *Theoretical and Applied Climatology* 129:413–426. doi:10.1007/s00704-016-1789-7.
- El-Adlouni, S., G. Salaou\*, A. St-Hilaire. 2017. Regularized Bayesian Quantile Regression. Publié en ligne *Communications in Statistics - Simulation and Computation*. 24 janv. doi.org/10.1080/03610918.2017.1280830
- Dugdale, S., A. St-Hilaire, R.A. Curry. 2017. Automating drainage direction and physiographic inputs to the CEQUEAU hydrological model: sensitivity testing on the lower Saint John River watershed, Canada. *Journal of Hydroinformatics*. 19 (3) 469-492; DOI: 10.2166/hydro.2017.051.
- Jeong, D.I., A. St-Hilaire, Y. Gratton, C. Bélanger, C. Saad. 2017. A guideline to select an estimation model of daily global solar radiation between geostatistical interpolation and stochastic simulation approaches. *Renewable Energy*. 103: 70-80.
- Laanaya\*, F., A. St-Hilaire, E. Gloaguen. 2017. Modeling the water temperature: comparison of the generalized additive model, logistic and residuals regression models. *Hydrological Sciences Journal* 7. Publié en ligne, 31 mars. DOI: dx.doi.org/10.1080/0262667.2016.1246799.
- Alberto\*, A., S.C. Courtenay, A. St-Hilaire, M. Van den Heuvel. 2017. Factors Influencing Brook Trout (*Salvelinus fontinalis*) Egg Survival and Development in Streams Influenced by Agriculture. Publié en ligne à *Journal of Fisheries Science.com*. 18 fév.
- Kwak, J.\*, A. St-Hilaire, F. Chebana. 2017. A comparative study for water temperature modelling in a small basin, the Fourchue River, Quebec, Canada. *Hydrological Sciences Journal* 62(1): 64-75 doi: 10.1080/02626667.2016.1174334

# Michael Van den Heuvel

Professor, Department of Biology and Department of Biomedical Sciences (Atlantic Veterinary College), and former Tier II Canada Research Chair in Watershed Ecological Integrity, University of Prince Edward Island

## Contact

mheuvel@upei.ca - (902) 388-0895

## Bio and Research Interests

Dr. Michael Van den Heuvel studies in the effect of environmental contaminants on fish health, impacts of land use on estuarine biodiversity, and the movement of freshwater and coastal fishes. His toxicology focus is the endocrine responses, immunotoxicology, population health of fishes exposed to agricultural and petrogenic compounds. Dr. van den Heuvel is working to develop methods and solutions to advance cumulative impacts assessment in eastern Canada.

## CRI History

Dr. Van den Heuvel joined CRI as a Science Director in 2005, and is currently the Institute Director.

## Background

- Aquatic Ecotoxicology Program Leader, New Zealand Forest Research Institute Limited, New Zealand (1998-2005)
- Research Associate and Adjunct Assistant Professor, University of Waterloo, Canada (1995-1998)
- PhD, University of Waterloo, Canada
- BSc, University of Waterloo, Canada

## Students

Colin Arens	Scott Roloson
Michael Coffin	Kate Rundie
Jesse	Bradley Scott
Hitchcock	Laura Taylor
Travis James	Carissa Grove
Kyle Knysh	Courtney McRorie
Sean Landsman	Jessica Cormier

## Research Staff

Christina Pater  
Mahmoud Sharaf



## Associates

Dr. Kamunde Collins - Atlantic Veterinary College  
Dr. Donna Giberson - University of Prince Edward Island  
Dr. Spencer Greenwood - Atlantic Veterinary College  
Dr. Pierre Daoust - Atlantic Veterinary College  
Dr. Brian Wagner - University of Prince Edward Island  
Dr. Brendan Hicks - University of Waikato

Dr. Yefang Jiang  
Dr. Todd Dupuis  
Dr. Zhang Weidong

## 2016-2017 Research Highlights

- Alberto, A., S.C. Courtenay, A. St-Hilaire, and M.R. van den Heuvel. 2017. Factors influencing brook trout (*Salvelinus fontinalis*) egg survival and development in streams influenced by agriculture. *Journal of Fisheries Sciences.com*. 11: 9-20.
- Arens, C.J., J.C. Arens, N.S. Hogan, R.J. Kavanagh, F. Berrue, G.J. Van Der Kraak, and M.R. van den Heuvel. 2017. Population impacts in White Sucker (*Catostomus commersonii*) exposed to oil sands-derived contaminants in the Athabasca River. *Environmental Toxicology and Chemistry*. 36: 2058-2067.
- Coffin, M.R.S. C.C. Pater, E.F. Theriault, S.C. Courtenay, and M.R. van den Heuvel. 2017. Floating vegetative mats mitigate the impacts of water column anoxia on epifaunal invertebrates. *PeerJ*. 5:e3080.
- Hitchcock, J.K., S.C. Courtenay, M.R.S. Coffin, C.C. Pater, and M.R. van den Heuvel. 2017. Eelgrass biomass and physiological responses to natural and anthropogenic gradients in estuaries of the Southern Gulf of St. Lawrence. *Estuaries and Coasts*. 40: 1653-1665.
- Landsman, S, and M.R. van den Heuvel. 2017. Fish passage requirements for rainbow smelt (*Osmerus mordax*) and gaspereau (*alewife Alosa pseudoharengus*) and blueback herring (*A. aestivalis*) at fishways and culverts: current knowledge, research gaps, and recommendations. *Canadian Technical Report of Fisheries and Aquatic Sciences*. 3210
- Landsman, S.J., A.D.M. Wilson, S.J. Cooke, and M.R. van den Heuvel. 2017. Fishway passage success for migratory rainbow smelt *Osmerus mordax* is not associated with personality. *River Research and Applications*. 33: 1257-1267.
- Martel, P.H., B.I. O'Connor, T.G. Kovacs, J.L. Parrott, M.E. McMaster, D.L. Maclatchy, G.J. Van Der Kraak, M.R. van den Heuvel, and L.M. Hewitt. 2017. The relationship between organic loading and effects on fish reproduction for pulp mill effluents across Canada. *Environmental Science & Technology*. 51: 3499-3507.
- Phalen, L.J., B. Köllner, N.S. Hogan, and M.R. van den Heuvel. 2017. Transcriptional response in rainbow trout (*Oncorhynchus mykiss*) immune cells following in vivo exposure to benzo[a]pyrene. *Environmental Toxicology and Pharmacology*. 53: 212-218.
- Sirabahenda, Z., A. St-Hilaire, S.C. Courtenay, A. Alberto, and M.R. van den Heuvel. 2017. A modelling approach for estimating suspended sediment concentrations for multiple rivers influenced by agriculture. *Hydrological Sciences Journal*. 62: 2209-2221.

# Steve Wiseman

**Associate Professor, Department of Biological Sciences, and  
Tier II Canada Research Chair in Aquatic and Mechanistic Toxicology, University  
of Lethbridge**

## Contact

steve.wiseman@uleth.ca - (403) 329-2320

## Bio and Research Interests

Dr. Steve Wiseman's research focuses on the molecular and biochemical mechanisms of both adaptive and maladaptive responses in aquatic organisms, particularly fishes, exposed acutely or chronically to natural and anthropogenic chemical stressors. One major research focus is the characterization of adverse effects of process-affected water generated in the oil sands mining industry in northern Alberta.

## CRI History

Dr. Wiseman joined CRI as a Science Director in 2017.

## Background

- PhD Biology, University of Waterloo, Canada
- MSc Biology, University of Waterloo, Canada
- BSc Biology, Mount Allison University, Canada

## Students

Christie Miller (MSc Candidate)  
Sean Everitt (MSc Candidate)



## 2016-2017 Research Highlights

- Tang, S., J.A. Doering, J.-X. Sun, S.C. Beitel, K. Shekh, S. Patterson, S. Crawford, J.P. Giesy, S.B. Wiseman and M. Hecker. 2016. Linking Oxidative Stress and Magnitude of Compensatory Responses with Life-Stage Specific Differences in Sensitivity of White Sturgeon (*Acipenser transmontanus*) to Copper or Cadmium. *Environ. Sci. Technol.* 50:9717-9726.
- Morandi, G., K. Zhang, S. Wiseman, A. Pereira, J.W. Martin and J.P. Giesy. 2016. Effect of Lipid Partitioning on Predictions of Acute Toxicity of Oil Sands Process Affected Water to Embryos of Fathead Minnow (*Pimephales promelas*). *Envir. Sci. Technol.* 50:8858-8
- Sun, J.-X., S. Tang, H. Peng, D.M.V. Saunders, J.A. Doering, M. Hecker, P.D. Jones, J. P. Giesy and S. Wiseman. 2016. Combined Transcriptomic and Proteomic Approach to Identify Toxicity Pathways in Early Life Stages of Japanese Medaka (*Oryzias latipes*) Exposed to 1,2,5,6-Tetrabromocyclooctane (TBCO). *Envir. Sci. Technol.* 50:7781-7790
- Peng, H., J.-X. Sun, D.M.V. Saunders, G. Codling, S. Wiseman, P.D. Jones, and J.P. Giesy. 2017. Hydroxylated 2-Ethylhexyl Tetrabromobenzoate Isomers in House Dust and Their Agonistic Potencies with Several Nuclear Receptors. *Environ. Pollut.* 227: 578-586.
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# Adam Yates

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## Bio & Research Interests

Dr. Adam Yates' research integrates aquatic and landscape sciences to generate the knowledge and tools to help solve critical issues threatening the health and sustainability of freshwater ecosystems. He is a leader in the study of the effect of agricultural land use and management practices on aquatic ecological condition and has on-going research projects in southern Ontario and the Red River Valley of Manitoba. Adam's interest in landscape-scale effects on stream ecosystems has led him to integrate a blend of observational and experimental field studies conducted at ecosystem scales as well as controlled mesocosm experiments to provide the knowledge and tools for improved watershed management. Several government agencies within Canada have implemented his widely cited, novel protocols.

## CRI History

Dr. Yates joined CRI as a Science Director in 2012 after a postdoctoral fellowship with Science Director Dr. Joseph Culp.

## Background

- PhD, University of Western Ontario, Canada
- MSc, University of Western Ontario, Canada
- BSc, University of Guelph, Canada



## 2016-2017 Research Highlights

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## Students

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*Photo by Nolan Pearce*

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