

Queen's Biology

Greetings from Biology

Welcome to another edition of the Biology Newsletter. Time sure flies. It seems like such a short time ago that I was putting the finishing touches on last year's edition.

The first thing I would like to do in this year's edition is to thank so many of you for the great support you have shown us during the past year. In addition to a lot of positive feedback about the newsletter, many alumni and friends have now been making donations to the different Funds that have recently been created within the Department and the Queen's University Biological Station (QUBS). I can't emphasize

enough how important these donations are to us right now. In the new financial reality we are facing these days, these donations have allowed us to continue to think creatively about ways to improve the educational experience that we offer undergraduates and graduate students. In another great example, donations from Alumni and friends have enabled us to start a summer Eco-Adventure Camp for 10-14 year olds at our new QUBS' Elbow Lake facility (see story inside). In the current financial climate, exciting new initiatives such as this would never get off the ground without outside financial support. On

behalf of our students, faculty and new Eco-Adventure campers, we would like to say "thank-you".

As you will see in the following stories, our faculty and students continue to shine both within and outside the university. We lost a couple of great people in 2011, but we will find a way to move forward. Despite cutbacks in Federal support for field stations, QUBS continues to thrive. In large part, this is due to the tremendous dedication of QUBS' staff and the hope now provided by private donations.

I hope you enjoy this year's newsletter.

Bruce Tufts



Queen's Biology students conducting studies on lake trout habitat use near Algonquin Park

Recent Headlines

BIOLOGY PROFESSOR HONoured FOR WORK WITH GRAD STUDENTS

Virginia Walker was a recipient of the 2011 Award for Excellence in Graduate Supervision. The award is presented by the School of Graduate Studies in recognition of achievements as a researcher and mentor to current and past graduate students. Dr Walker, who has taught at Queen's for 30 years, had no idea her current and former students had nominated her for the award. She says one of the most rewarding aspects of graduate supervision is building relationships with her students that last years after they graduate.



2011 Award for Excellence in Graduate Supervision winner Virginia Walker (front right) with some of her current graduate students.

AWARDS TO BIOLOGY GRAD STUDENTS

Two Biology graduate student's won awards at the 2011 Cooper Ornithological Society Meeting in Nebraska. **Vanya Rohwer** (supervisor Paul Martin) received the Brazier Howell Award for best student paper award and **Ann McKellar** (supervisor Laurene Ratcliffe) was awarded the Mewaldt-King Student Research Award.

Kyle Lauersen (supervisor Virginia Walker) won a prestigious (full) scholarship for a PhD position with the Cluster of Industrial Biotechnology at Bielefeld University in Germany. Kyle was

selected from a pool of 100 candidates for his project focussing on the genetic engineering of algae for biofuel production.

Katie Griffiths (supervisor John Smol) won the 2011 Lortie Prize as the best student poster presentation at the Canadian Quaternary Association meeting.

Two Biology graduate students received honours at the Plant Canada Meeting in Halifax in 2011. **Kyle Bender** (supervisor Wayne Snedden) won the award for best poster and Whitney Robinson (supervisor Bill Plaxton) won the award for best oral presentation.

Celia Symons (supervisor Shelley Arnott) received a prestigious Canadian

Northern Studies Trust Award to study the influence of dispersal on zooplankton response to climate change in sub-arctic tundra ponds.

Kristin Spong (supervisor Mel Robertson) won the Helen Battle Award for the best student poster at the 2011 Annual Meeting of the Canadian Society of Zoologists.

Roslyn Dakin, a PhD candidate with Bob Montgomerie, won an Emerging Science Journalists Award from the Canada Foundation for Innovation (CFI). In her winning article, Roslyn provided examples of research success stories from the CFI-Funded Queen's University Biological Station.

Farewell to Christoph Richter

At the end of June 2011 Christoph Richter left the Department to take up an appointment as a Teaching Professorship at the University of Toronto (Mississauga). He had been with the Department since 2002 starting as an Adjunct Lecturer and, after completing his PhD on sperm whales off Kaikoura (New Zealand), finishing as a Continuing Adjunct Associate Professor. During his time as a faculty member he contributed to the teaching of introductory biology (of cells and of organisms), diversity of life (I and II), data management and analysis, animal behaviour and vertebrate diversity and

evolution. Judging by the student evaluations of his course offerings, which were among the top 5 in Biology, and the fact that he won the Biology Department Student Council Award for Excellence in Teaching in 2006/07, many of our alumni will have very positive memories of Christoph as a teacher (he also has a very strong “hotness” rating on ratemyprofessors.com, for both his Queen's and UTM activities). Christoph was a valuable, and always cheerful, addition to our teaching staff for many years. We are sorry to see him go but wish him well and hope that he can still find time to pursue his



Christoph Richter (left) and Mel Robertson (right)

interests in the human impacts on whale behaviour.

Jonathan Jones Retires

Jonathan Jones, a stalwart of the Biology laboratories and long-time Queen's staff member, retired at the end of December 2011 having just completed his last animal physiology labs. Many alumni will remember Jonathan (JJ) from their Biology laboratory experiences, particularly in the comparative animal physiology and plant physiology courses, though some may remember him from earlier microscopy courses. He joined Queen's immediately after receiving his Biology BSc from Brock University in 1974 and was hired as a research technician in the Pathology Department at Hotel Dieu Hospital. He moved to the Biology Department

in 1980 when the Head, David Canvin, recruited him as a Laboratory Instructor. He remained with Biology for the next 32 years, being promoted to Senior Instructor in 1983, taking on the role of Safety Officer in Biology in 1987 and serving the Department under 5 different Heads (Canvin, Dennis, Morris, Boag and Robertson). Jonathan introduced many students to the joys of experimental biology (e.g. over the years around 4,000 students have been taught by JJ in the comparative animal physiology laboratories alone) and his expertise will be greatly missed. The Department wishes him a long and fulfilling retirement, which he says begins



Jonathan Jones (center), wife Marcia (left) and Joanne Surette (right)

with 3 months in Florida during the winter term when in previous years he would be battling winter and running the plant physiology laboratories – an enviable start.

Eco-Adventure Camp Gets Underway at Elbow Lake

This year we did something very different from the normal goings-on in a biology department – we created and ran an EcoAdventure day camp for 10-14 year olds. We started with nothing but an idea and hope, and from there negotiated the labyrinth of permits, safety policy, insurance, logistics, and programming to bring our vision to fruition. We found an incredible camp director in Queen's Con Ed student Kait Pasic and soon thereafter assembled a dynamic team of three counselors from a pool of Biology undergrad applicants. The camp ran for 5 weeks over July and August, with campers doing everything from dissecting owl pellets (the consensus - gross but cool) to learning how to right a capsized canoe. We had guests like Mark Conboy (aka Nature Guy but also the Outreach Coordinator at the Biological Station) and Samantha Klaus (M.Sc. candidate and frog lady – a super hero moniker if ever I have heard one) who brought their different incredible knowledge and passion of the natural world to the camp. We received nothing but glowing reviews from campers and parents alike. In 2012 we intend to expand the camp, adding one more week to our roster, adding a Leader in Training program, and fund raising to ensure that the camp can continue for the foreseeable future and that we can offer bursaries to students in economic need.

Stephen Lougheed, Director
Queen's University Biological Station



Eco-Adventure Campers

Editor's note: A new fund, the QUBS' Community Outreach Fund, has recently been established to support QUBS' public outreach initiatives such as the Eco-Adventure Camp



photos: Marketing and Communications

Understanding the Effects of Stressors on Lake Ecosystems

PROFILE ON SHELLEY ARNOTT'S LAB

Canada holds nearly 30% of the world's freshwater. In Ontario alone, a quarter of a million lakes cover 17% of the landscape. Canadians value this precious resource and, in a 2009 Nanos Research poll, we indicated that our freshwater resources are most important to Canada's future. Despite this, many freshwater ecosystems have been affected by human activities that often result in loss of biodiversity and ecosystem function. Examples include excessive nutrient loading from agricultural fertilizer, the spread of non-native species, climate change, and the deposition of industrial pollutants.

Shelley Arnott's research group is in-

terested in understanding the individual and combined effects of these stressors on lake ecosystems. "These stressors do not occur in isolation. More often than not, regions experience several types of environmental change, yet there have been few studies that have investigated their combined effects on biological communities," says Dr. Arnott.

Sudbury, ON is a world-renowned producer of nickel and has a long history of regional acid deposition that resulted in the acidification of lakes and streams, and ultimately the loss of fish, invertebrate, and plant populations in thousands of lakes. As a result of environmental legislation Sudbury smelters

have reduced the emissions of sulphur dioxide, one of the chemicals responsible for acid rain, by 90%. "With emission reduction, many of the lakes in the region have started to chemically recover," says Dr. Arnott. "In Killarney Provincial Park, located 50 km from Sudbury, all 45 of our study lakes have increased in pH from the period of peak acidification in the 1970s to 2011 when we did our most recent survey." However, recovery of the biota has been slower.

Bythotrephes longimanus, the spiny water flea, arrived in the Great Lakes in the mid-1980s, transported from Eurasia in ship ballast water. Since then, it has spread to over 170 inland lakes in



Members of the Arnott lab in the field

Profile on Shelley Arnott's Lab continued

Ontario, including lakes in Killarney Park. Shelley Arnott's students have shown that *Bythotrephes* reduces zooplankton richness, total abundance, and shifts community composition by preying selectively on cladoceran taxa. "Our field experiments indicate that *Bythotrephes* has stronger effects on recovered

lakes compared to acid-damaged lakes," says Dr. Arnott. Lakes invaded by *Bythotrephes* resemble acid-damaged lakes indicating that the spread of *Bythotrephes* may be a major impediment to regional recovery of the zooplankton communities.

Calcium concentration is declining

in lakes across the Canadian Shield as a result of acidification, forestry, and land use practices. Calcium is an essential element for biota, especially zooplankton with calcium-rich carapaces. Reduced calcium concentration in lakes that are recovering from acidification is likely preventing recovery of zooplankton, particularly *Daphnia* taxa that have high demands for calcium.

"One of the biggest challenges that we face is to conduct our research at relevant scales that enable us to tease apart the effects of these multiple regional-scale stressors", says Dr. Arnott. Research conducted by Shelley Arnott's team is aimed at multiple scales, including extensive regional surveys, field experiments, and laboratory studies. "We approach the problem from several angles, using survey data to evaluate patterns on the landscape and using controlled field experiments to isolate the effects of individual and combined stressors on plankton communities."

Given the importance of Canada's freshwater ecosystems, it is imperative to provide policy makers with sound scientific information about how multiple stressors impact ecosystem structure and function. Dr. Arnott's experimental and monitoring research will help provide information that will allow science-based decisions for conservation and the sustainable use of our natural resources into the future.



Shelley Arnott

An Evolutionary Battle of the Sexes

PROFILE ON ADAM CHIPPINDALE'S LAB

The existence of two sexes that differ in size, appearance, behavior, and other attributes is so commonplace in animals that many of us take it for granted. But this sexual dimorphism is evidence that the two sexes have evolved in response to different selective pressures, and this can generate conflict between females and males. The evolutionary battle of the sexes takes two forms: one is like an arms race, in which one sex evolves an adaptation to improve its reproductive success, but this comes at the expense of the other sex, precipitating defensive adaptations. Many examples of this are seen in species where males use coercion to

mate with females, yet females would be better off picking when and with whom they mate. The other form of conflict is more like a tug-of-war over the genome; each sex has a different best genotype and yet the genes are shared between them. The problem of one genome / two sexes means that females carry some genes that would be better suited to expression in a male, as well as the reverse.

Adam Chippindale's lab in the Biology Department at Queen's has been studying sexual conflict using the fruit fly, *Drosophila*. While notorious for its apparent spontaneous generation in kitchens around the world, this tiny

insect has been the darling of geneticists and biologists for over a hundred years. We know more about the biology and the genome of the fruit fly than we do about any other animal. Adam, who joined the department in 2002 after a PhD and postdoctoral research in the University of California system, uses flies to study the genetics and evolution of gender in several different ways; first, by changing the rules of inheritance and actually evolving the insect over dozens or hundreds of generations. In one experiment, Chippindale and his students used genetic tricks to allow the entire genome (as represented by sperm) to be transmitted to sons, harvested and passed down to their sons, and so on. For over 80 generations, thousands of males were allowed to grow up and compete for mates – allowing natural and sexual selection – but their genes were only passed down to sons. This experiment showed that when females are removed from the gene pool, males become fitter: more “masculine” in morphology, more attractive to females, and better in male-male competition. Critically, when these Super Males are experimentally allowed to produce daughters, the daughters are less fit than normal females. In other words, there are many genes in fly populations that reduce male fitness



Adam Chippindale

Profile on Adam Chippendale's Lab continued

because they increase female fitness, and the reverse. Chippendale's lab showed this another way, by measuring the Darwinian fitness of fathers and mothers and arranging matings in a kind of fruit fly dating game. The remarkable result was that successful males had unsuccessful daughters, and successful females had unsuccessful sons. In fact the least successful combination of parents was the fittest males with the fittest females, something Chippendale calls the Quarterback-Cheerleader Effect.

These kinds of results have now been found in studies of plants, birds, lizards,

mice, and other insects, suggesting the evolutionary tug-of-war over the genome is widespread in nature, as well as in the lab. Chippendale and others believe that sexual conflict is a key driver reproductive evolution, resulting in the origin of new species, and is implicated in a variety of genetic disorders. This research confirms what is so manifestly obvious in humans: that gender is not a switch thrown one way or the other, but a slider travelling continuously between two poles. The research group has also been focused on the unique genetics of sex chromosomes, like X and Y, the nature of mutations through-

out the genome, the genetics of ageing, and the biology of sperm. In the sperm research, the team has employed a technique developed in a collaborator's lab at Syracuse University that makes sperm fluoresce so they can be seen in the reproductive tract. They can make males produce red glowing sperm or green glowing sperm, and, if a female mates with each of these two males, visualize the competition between rival male ejaculates; it is a phenomenon known as sperm competition, and it is another area where Adam Chippendale's group sees sex as a battlefield.

Research finds new evidence of climate change

A study co-authored by Queen's Biologists and published in the journal *Proceedings of the National Academy of Science* in 2011 shows that storm surges in the Arctic can radically alter coastal ecosystems. Nearly all Arctic indigenous communities are coastal, and the damage from future surges could have significant social and economic impacts. The research concludes that changes in sea ice cover, sea levels and the frequency and intensity of storms will likely result in increased storm surge activity in the 21st century with obvious profound consequences for coastal peoples.

Members of the research team included Queen's Biology Professor, John

Smol, graduate student Joshua Thienpont and undergraduate Holly Nesbitt.

The *Association of American Geographers* presented the authors with the 2012 Cowles Award, as the best book or paper published in 2011 on biogeography.

Ongoing research at the Paleoenvironmental Assessment and Research Lab (PEARL), as well as other units in the biology department, provide key evidence that is needed to document the negative impacts of climate change and other environmental stressors. For example, **John Smol** (photo at right) was one of the four panellists in "The Great Canadian Climate Debate", held at Queen's University in 2010.



photo: Marketing and Communications



Alumni Profile

In our ongoing effort to highlight the interesting career paths that some of our Biology alumni have taken, we have asked **Robert Alvo**, BSc(Biology)'81, to tell his story this year...

The culture shock I felt when my family moved from Montreal to Greece when I was 10 years old lasted only a year. Seven years later, my return to Canada took me another 15 years to get used to! Bio 101 at Queen's had 800 students, compared to the three students that most of my courses had in my last year of high school at Thessaloniki International High School. I had graduated after 12th grade in that American-run school, whereas my peers at Queen's, most of whom were from Ontario, had completed Grade 13. Fortunately, Ralph Clench taught a special calculus course for young folk like me and brought us up to speed by the end of the year. He would draw up the entire exam schedule for Queen's when the computers failed.

I had trouble with Bio 101, which at 58% was my second worst mark in first year. Other folks might have switched majors, but the natural world was in my blood, so I persisted.

Second year biology was tough for me too, but I did reasonably well. Come third year, Ecology was offered, and that was when I started to catch on. I started taking one-quarter credit field modules, most of which were given at the Queen's University Biology Station (QUBS). They each lasted

a week, followed by one week for analysis and write-up. All the ones I took involved field work. I was finally starting to see a connection between the bird-watching I did in Greece, where I never met another birder and didn't even know there was such an activity as birding, and my Queen's Biology experience.

The Limnology and Aquatic Macrophyte modules, as well as courses in Limnology, Freshwater Algae, Invertebrate Biology, and Entomology, were very useful for my B.Sc. thesis work on the effects of human activity on loon breeding success. The latter prepared me beautifully for my M.Sc. thesis at Trent University, where I studied the effects of lake acidification on loon breeding success. That turned into a 25-year study, which I published two years ago and came full circle by presenting it at the PEARL Laboratory at Queen's and at QUBS, both in 2012. In the latter study I found out that loons, particularly the chicks, eat a variety of organisms, not just fish as the literature had implied, e.g. crayfish, dragonfly larvae, whirligig beetles, leeches, and aquatic macrophytes.

Dr. Raleigh Robertson had given me the opportunity to study loons through an "Experience '80" grant from the Ontario Ministry of Natural Resources. When I discovered that the loons at QUBS were often nesting in marshy back bays, and attributed this to their normally preferred islands having too much human traffic, Frank Phelan, the station's manager, suggested I write a "note"

for the Canadian Field-Naturalist – it became my first publication. Karen Brown, who had completed an M.Sc. on fish with Dr. Allen Keast, and was working for him at the station, also mentored me on that study and drew a much-needed figure for my thesis (no drawing software in those days). I fondly recall discussion-filled canoe trips with Dr. Keast, Frank, and Pat Weatherhead, then a grad student. Dr. Keast hired me to collect insects for one of his studies and to help one of his graduated students with fish-seining. One night, Frank and a few of us went to a haunted house to capture and re-locate a screech-owl that was preying on and threatening a colony of bats that a Ph.D. student was studying.

It felt great to finally find my way in the world of biology, to feel part of something, and to be blessed with great mentors at Queen's.

After Trent, I spent two winters in Toronto doing consulting, and two summers at Delta Waterfowl and Wetlands Research Station in Manitoba. The Nature Conservancy of Canada sent me to Quebec City to set up Canada's first Conservation Data Centre, (like Ontario's Natural Heritage Information Centre). Later I wrote, edited, and corrected translations of species accounts for Quebec's breeding bird atlas. My work on biodiversity issues and species-at-risk continued in Ottawa, where I consulted for various clients, and later worked for Parks Canada on their species-in-parks

Alumni Profile continued

database. The Conservancy hired me again, this time to protect and manage natural areas in the Outaouais Region of Quebec. Lately I have been working on a forthcoming

book entitled, Being a Bird in North America (www.babina.ca).

I have loved my career thus far, being able to do what I love. My experience with

Queen's Biology, and QUBS in particular, was a critical part of my career, and happened at a crucial time in my then young life.

Robert Alvo, BSc(Biology)'81



"Wow, the Ecuadorin jungle really does have exotic looking birds!"



Queen's University Biological Station

2011 was an eventful and fulfilling year for the Queen's University Biological Station. We hosted researchers from institutions across North America and around the world working on an incredible array of species and topics spanning ecology, evolution, and wildlife conservation and management. As is the case each year, we had popular undergraduate field courses run over the spring and summer on a wide array of topics including the ecology of amphibians and reptiles, insect classification, and applied ecology. As part of our commitment to internationalization, we once again welcomed undergraduate students from Fudan University (Shanghai), and Southwest University (Chongqing) in September and October to learn field techniques for quantifying biodiversity and environmental assessment. Our Wednesday night seminar series was a great success with 16 talks on a broad range of topics such as the building of the Rideau Canal, Guyana natural history, and the evolutionary history of downy woodpeckers.

School trips continue to be important to QUBS. Opeongo High School (near Renfrew) had a field excursion to the

Station in April led by teacher and Queen's Biology alumnus Tim Demmons. Our public workshop roster included Art in Nature with artist and educator Marta Scythes, and Fabulous Fall Fungi with naturalist Richard Aaron. The QUBS Open House (our 41st) in June had some 450 attendees who viewed research presentations and displays of local biodiversity including live beasts. We were visited by a busload of alumni during Queen's MiniU in May. We also hosted such diverse functions as a get-together by the Retirees Association of Queen's, the annual meeting of the Committee on the Status of Species at Risk in Ontario, and a College of DuPage Course for Instructors (Glen Ellyn, Illinois) among many other activities.

We were very excited to sign a new lease-to-own agreement with the Nature Conservancy of Canada to partner in managing a 400 hectare property southwest of the current Station land holdings. The new entity, the Elbow Lake Environmental Education Centre, is now the focus of our burgeoning outreach program. 2011 was the inaugural year for our Eco-Adventure Summer Camp, which was offered over 5 weeks

in July and August. The camp for young people aged 10 to 14 years afforded opportunities for swimming, hiking, canoeing and a host of activities geared toward augmenting outdoor experience, and learning about the natural environment in fun ways.

I would be remiss if I did not mention our ever-expanding electronic resources including a blog (<http://opinicon.wordpress.com/>), data repository (<http://www.qubsdata.org/>), Facebook page, and website with many archived digital documents (<http://www.queensu.ca/qubs/>). I hope you explore them and come to visit us soon!

Stephen Loughheed, Director

Supporting Biology and QUBS

As you have read in this newsletter, the Department of Biology is accomplishing exciting things and working hard to provide an excellent learning environment. With the current economic climate this has become much harder than usual and we rely heavily on the support of our alumni and donors to stay competitive and to ensure that the quality of the education we provide to our students doesn't suffer. We hope that you consider supporting one or more of the funding initiatives that enable us to continue the important work that we do.

You can make your gift by filling out the enclosed form, by visiting us online at www.givetoqueens.ca/biology or by calling Carrie Miles at 1-800-267-7837.



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