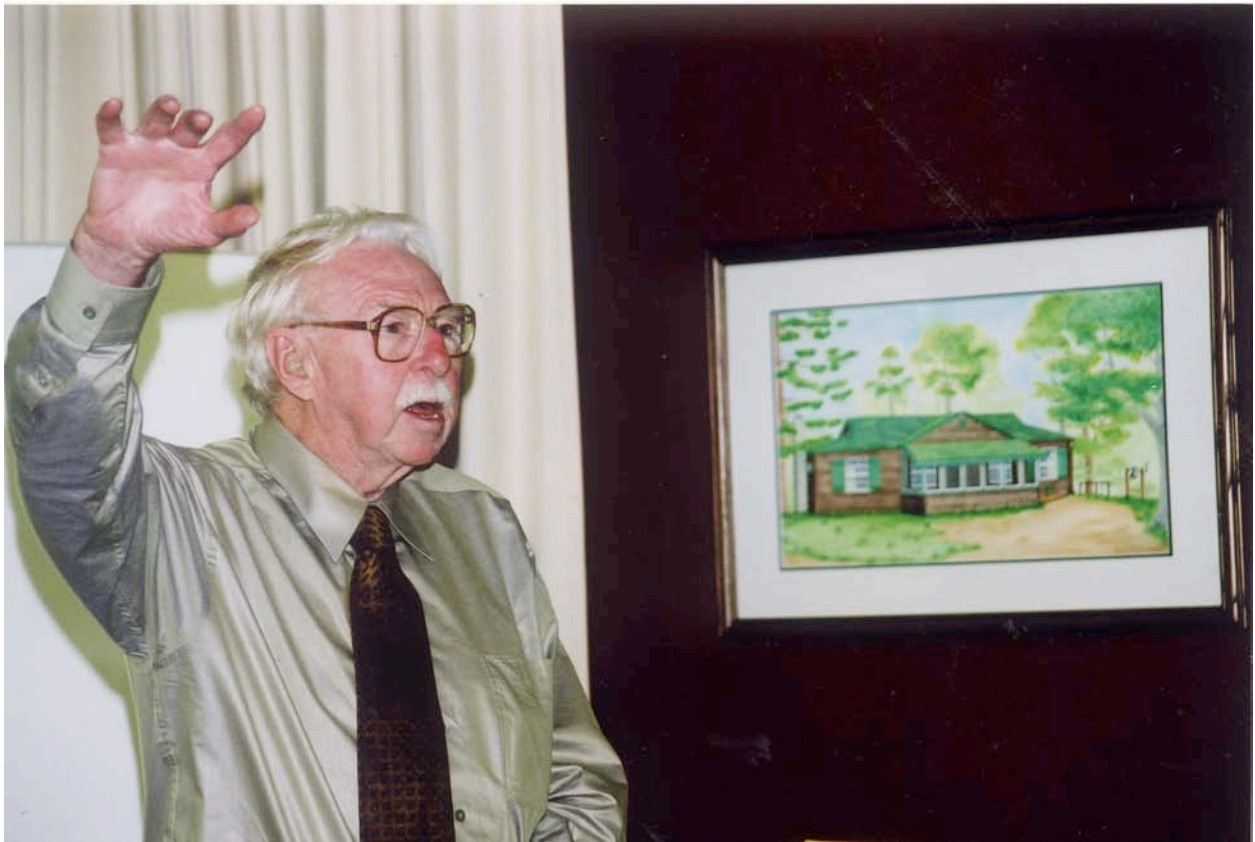


Queen's University Biological Station Annual Report and Newsletter – 2003



*Dr. Allen Keast
Speaking at the Celebration held in His Honour
QUBS, 21 June 2003*

*Director: Raleigh Robertson Manager: Frank Phelan
Assistant Manager: Floyd Connor*

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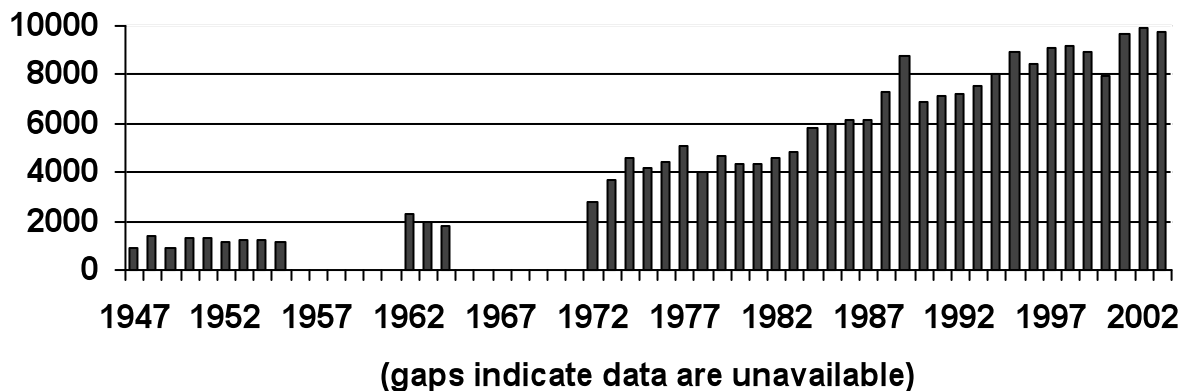
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Introduction

Projections were that 2003 would be the busiest year ever, topping the 10,000 user-day level. However, total user-days have once again fallen just short of that mark. Some 9,755 user-days were logged in 2003 (user-day data are displayed in tabular form on pp. 83 and 84). Use was down by 1% from 2002. Cancellation of planned teaching modules and programs was a major contributor to user-day totals lower than projected. Indeed, four courses under the OUPFB field course program were cancelled, as well as two field courses planned by another university and a college. For a variety of reasons, several short-term field trips and workshops were also cancelled. Had some of these not been cancelled, user-days would have easily crested the elusive 10,000 user-day level.

On average, 47 researchers (professors, graduate students, honours students and assistants) were in residence through the summer. Abstracts of 2003 research projects and the personnel involved are contained in the following pages (pp. 43 - 75).

User-Days at QUBS



In teaching activities, QUBS hosted 4 modules (7 weeks worth of modules) in the Ontario Universities Program in Field Biology (OUPFB). Two of these modules were presented by Queen's instructors and two by instructors from other institutions. Titles and enrolments for the OUPFB programme are found in Tables 1 and 2 (pp. 41 - 42). In addition to the OUPFB modules, Dr. Ed Kott (Wilfrid Laurier University) brought his field course for senior undergraduates for two weeks in late summer. This is the 16th (and last) year that Dr. Kott has brought the WLU field course to QUBS. After this year, Ed will no longer co-ordinate the course, having handed this responsibility to Dr. Scott Ramsay (see photo p. 36).

In 2003, field trip and conference use of QUBS dropped somewhat from the high levels of 2002. Again, a number of cancellations contributed to this decline. A summary of conference, meeting and field trip use of QUBS in 2003 appears later in this report (pp. 78-80).

A highlight of 2003 was the celebration in honour of Dr. J. Allen Keast, Queen's Professor Emeritus and long-time QUBS user. Allen is well-known around the world for his life-

long studies on birds, fish and biogeography. In June, some of his past students helped organize a special Keast Day - more on this later in this report.

In 2003, Dr. Raleigh Robertson announced his plans to retire as Director of QUBS in July 2005. Raleigh has been Director since 1972. Under his direction, the field station has become a renowned, world-class facility. Congratulations, Raleigh, on a job well done. There is, at present, no word on who will become the new Director. Raleigh will continue at Queen's as professor until July 2006 at which time he will retire completely. Raleigh was honoured by his peers in ornithology with the awarding of the Doris Heustis Speirs Award by the Society of Canadian Ornithologists in 2003. Details appear on page 4.

Celebrating the Contribution of Dr. Allen Keast to the Queen's University Biological Station

By Jennifer Harker, M.Sc. '76

Allen is a noted world expert in biogeography, and the natural history, ecology and evolution of birds and fishes. He came to Queens in 1962 and developed an instant bond with QUBS. In over 40 years of scientific research there he has, with his students and colleagues, published definitive papers in freshwater biology. He is also the author of a number of books. On June 21, 2003, many old and new friends of Allen Keast descended on the QUBS to join with him for a day of reminiscing, conversation and a BBQ dinner. Past graduate students Jennifer Harker (Queens M. SC. '76) and Deborah Turnbull (Queen's, B.Sc., '75), along with the very able help of Floyd Connor, QUBS Assistant Manager, organized the get-together. Its purpose was to celebrate Allen's life and contribution to QUBS, as well as to our understanding, through his eyes, of the natural world. What was expected to be a small informal gathering grew to a major social function attended by over 100 people. It was a testimonial to Allen's wide-reaching influence and enormous circle of friends. It was also wonderful to have in attendance Allen's sister Janet Baker, who flew in from Washington State for the event.

In addition to Allen's many friends and students, several Queen's faculty members (some retired) were also present, including Drs. Peter Boag and Laurene Ratcliffe, Dr. Ted Brown, Dr. Dave Canvin, Dr. Dolf Harmsen, Dr. Raleigh Roberston (Station Director), Dr. Bob Stewart, and Dr. Gerry Wyatt as well as the late Dr. Ed Crossman, Professor Emeritus at the University of Toronto.

We enjoyed a wonderful BBQ dinner, supervised by Marg and Frank Phelan and the station kitchen staff, followed by a slide presentation by Jennifer Harker. Allen responded with a lively speech, where he reflected on his own work and the enjoyment he has had from a life of scientific research. Gifts were presented by Jennifer Harker, Marg Phelan and Naz MacDonald to commemorate the occasion..



Keast Celebration 2003



QUBS Director Honoured by Society of Canadian Ornithologist's Award

QUBS Director, Raleigh J. Robertson, was the winner of the 2003 Doris Huestis Speirs Award from the Society of Canadian Ornithologists. As indicated in the citation below, the award recognizes the important role that QUBS plays in ornithological and other field research.

"The Doris Huestis Speirs Award is the most prestigious award of the Society of Canadian Ornithologists. For his outstanding lifetime contributions to ornithology in Canada, the SCO/SOC has chosen Dr. Raleigh J. Robertson as the recipient of the Doris Huestis Speirs Award for 2003.

Dr. Robertson is a professor in the Department of Biology at Queen's University, Kingston, Ontario, where he holds the Baillie Family Chair in Conservation Biology. He is also the director of the Queen's University Biological Station at Lake Opinicon, Ontario. We honour Dr. Robertson for his contributions to ornithology in Canada over his 30+ year career. He has excelled as a researcher, teacher, and supervisor of graduate students. His research focuses on reproductive behaviour, population dynamics and conservation biology of birds. He has published over 150 scientific papers on subjects ranging from optimal niche space in blackbirds to allocation of parental care, from sexual selection to the evolution of clutch size, from male and female reproductive strategies to bird communities in shade coffee plantations. His early work, conducted mostly in southern Ontario, focused on reproductive behaviour and strategies in passerines and he was on the forefront of using paternity analysis to derive true fitness costs of various reproductive strategies. More recently he has expanded his scope to conservation, supervising projects on ecology and behaviour of the rare Cerulean Warbler and habitat relationships of passerines in agro-forestry areas in Mexico. In addition to his direct contributions to ornithology, Dr. Robertson has established two important legacies that will contribute both to ornithology and to conservation more broadly well into the future. First, Dr. Robertson has supervised 43 graduate students who now contribute independently through their employment at universities, research institutes, national parks, Canadian Wildlife Service, Canadian Forest Service and NGO's such as Bird Studies Canada. Second, as Director of the Queen's University Biological Station since 1972, Dr. Robertson has expanded the facilities of that institution to make it a world class centre for teaching and field studies. Central to that expansion has been the acquisition of extensive land holdings (in excess of 2000 ha) that protects important wildlife habitat while providing sites for ornithological and other field research. Through Dr. Robertson's efforts, research and teaching activity at the Queen's University Biological Station has more than tripled since he became its Director. For these contributions, the SCO is pleased to present the 2003 Doris Huestis Speirs Award to Dr. Robertson."

A Short Tribute to Edwin J. Crossman (21 September 1929 - 21 December 2003)

- excerpted from the CCFFR website (Canadian Conference for Fisheries Research, 1/26/2004 - URL by Oceanography Department, Dalhousie University).

"To their shock, many Canadians interested in fish learned of Ed Crossman's sudden death at home on Sunday morning, 21 December 2003.

Dr. E.J. (Ed) Crossman, PhD, was born in Niagara Falls, Ontario and received his early education there. He went to Queen's University, Kingston, Ontario where he received a BA in 1952. From there he went on to graduate work with F.E.J. Fry at the University of Toronto and received his MA in 1954. Ed completed his PhD in 1957 at the University of British Columbia with Peter Larkin. He then immediately joined the University of Toronto in 1957 as Assistant Curator in the Department of Ichthyology and Herpetology at the Royal Ontario Museum (ROM). Dr. Crossman worked mainly with freshwater fishes and particularly the group that includes the pike and muskellunge. His studies included the relationships and evolutionary history of the group, their distribution, and the biology of individual species. He was actively involved in a study of the biodiversity of the fishes of the Great Lakes, and had a special interest in the phenomenon of introduced fishes. He carried out expeditions and studies in various parts of Canada, the United States, Europe, Cuba, Malawi, and Far Eastern Russia. Dr. Crossman served as scientific advisor to a number of Provincial, Federal, Angler and international organizations, in Canada, the United States, England, and Germany. Up until the time of his death Ed was Curator Emeritus of Ichthyology at the ROM Centre for Biodiversity and Conservation Biology and Professor Emeritus, Department of Zoology, University of Toronto. Although officially retired, he regularly occupied his office at the ROM where he continued his studies and involvement in the curation of the important reference collection of fishes housed there.

Ed is the author or coauthor of approximately 180 publications, both scientific and interpretive, including "the" major text published in 1973 and co-authored with W.B. (Bev) Scott, entitled *Freshwater Fishes of Canada*. This comprehensive book continues to be one of the most important and informative works on freshwater fishes in Canada. The concept of the book had its birth in 1960 in Newfoundland where Ed and Bev spent the summer there making the first formal collection of the freshwater fishes of Newfoundland. According to Bev, they had many nights that summer to discuss the concept of the book and argue the many points of interest. In the end it was the synergy that developed between them, Ed's knowledge of the west, Bev's knowledge of the east, their combined new knowledge of Newfoundland and their mutual willingness to learn about the prairies that eventually led to the book that has had two editions. Ideas for a 3rd edition had been evolving between Ed and Bev over recent years, but the future of those ideas is now unclear.

Ed will be sorely missed."

Ed was a great friend of the station, having been introduced to the place as an undergraduate student during the very early years of QUBS. Ed has returned to QUBS many times since, with a most recent trip during the celebration held this year for Allen Keast. We at QUBS feel a great sense of loss and offer our condolences to Ed's family.



Nigel Lester, Ed Crossman and Jen Harker at Keast Celebration at QUBS, June 2003

Thousand Islands - Frontenac Arch Biosphere Reserve

Dr. Raleigh Robertson participated in the Opening Ceremony for the UNESCO designated "Thousand Islands - Frontenac Arch Biosphere Reserve" on 7 June 2003 at Mallorytown. Along with Charleston Lake Provincial Park and St. Lawrence Islands National Park, the extensive lands of the Queen's University Biological Station provide opportunities for education, research and conservation programs that promote sustainable land-use practices within this new Biosphere Reserve that encompasses the large triangular area with its base extending from Gananoque to Brockville in the south and its tip at Westport in the north.

Wildlife Habitat Canada Presents National Forest Stewardship Recognition Award to Outstanding Recipient

At a ceremony held on June 7, 2003, at the Watershed in Ivy Lea, celebrating the official opening of the UNESCO Man and the Biosphere (MAB) *Canadian Thousand Islands/Frontenac Arch Biosphere Reserve*, Wildlife Habitat Canada (WHC) presented a Forest Stewardship Recognition Program (FSRP) award to Peter M. Murray, Chairman of the Gananoque Forestry Advisory Committee. Mr. Murray is a 1952 graduate in forestry from the University of New Brunswick, Fredericton.

The goal of the FSRP is to stimulate awareness of, and appreciation for, stewardship, sustainable practices, and biodiversity conservation efforts in Canada's forests. The program aims to identify those who have shown leadership in forest stewardship and biodiversity conservation through on-the-ground, practical actions. Peter Murray was recognized for his leadership in promoting sustainable forestry in smaller communities across eastern Ontario. He is also an outspoken advocate of the need for proper forest inventories and management plans and has created a community tree nursery to make native, indigenous trees available to Gananoque and small communities in eastern Ontario. He has readily shared his experience, and encouraged citizens and municipal councils to better understand, and appreciate, community forests.

Recipients are awarded a limited- edition reproduction of a work of art by BC artist Don Li-Leger, as well as a Certificate of appreciation from the Governor General of Canada, the official Patron of the Program.

Dr. Raleigh J. Robertson, Director of QUBS, and his wife Lois attended the event representing Queen's University, one of the partners in the establishment of the *Canadian Thousand Islands/ Frontenac Arch Biosphere Reserve*. In discussion with Dr. Robertson following the ceremony, Mr. Murray revealed that he worked during the summer of 1951 as an undergraduate, and in 1952 as a graduate student, at QUBS under Dr. Harold Good, where he did research on the pathology of disease in sugar maple and its effects on the cellular structure of the wood. He co-authored a paper with Dr. Good on the identification of living cells in infected maple, and the cellular mortality as disease progressed. Peter reminisced that Dr. Wes Curran was director, and Dr. Ted Brown was a graduate student. The station was considerably more primitive in those days, with outside privies and kitchen duty for everyone.

After a working life in the forest industry, Peter retired to Gananoque, where in addition to his urban forest work, he is a director of the Canadian Thousand Island Heritage Conservancy, the Gananoque Historical Society, and is active with the Rideau Trail Association (he maintains a section of trail on QUBS property).

Parks Canada - Rideau Canal

Thanks to Doug Stewart (Superintendent - Rideau Canal) for arranging complimentary lockage passes for our two pontoon boats, or as we sometimes refer to them, our floating classrooms. These lockage passes open up a variety of lakes to study, a boon to work in

comparative limnology. In these times of fiscal constraint, the generosity of Parks Canada - Rideau Canal is gratefully acknowledged.

MAJOR GIFTS

Baillie Family Chair in Conservation Biology

The Baillie Family Chair in Conservation Biology is an endowed chair, linked permanently with the Queen's University Biological Station (QUBS). The purpose of the Baillie family's generous gift to establish the chair is to strengthen research in conservation and biodiversity and to augment and reinforce teaching programs at the graduate and undergraduate levels in the Department of Biology.

Dr. Raleigh J. Robertson was appointed to hold the chair, effective 1 July 2002. In a message from the chair-holder, Dr. Robertson states, "I am a strong advocate of field courses to improve our understanding of issues in conservation biology and of field research to provide solutions for conservation problems. Consequently, as holder of the Baillie Family Chair in Conservation Biology and as Director of the Queen's University Biological Station (QUBS), I work hard to ensure that through the Biological Station, Queen's University can provide first-hand experience to students in the context of small, intensive field modules, and at the same time offer first-rate facilities and logistical support to researchers.

The Baillie Family Chair in Conservation Biology has been very beneficial in raising the profile of our programs in this very important discipline. We at Queen's, especially those of us who teach and study at QUBS, want to express our gratitude to the Baillie Family for their generous gift that sponsors the Chair, and our respect for their very farsighted and sincere commitment to conservation and to Queen's."

Massassaugua Property

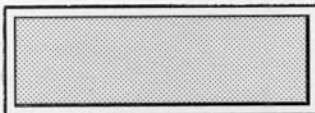
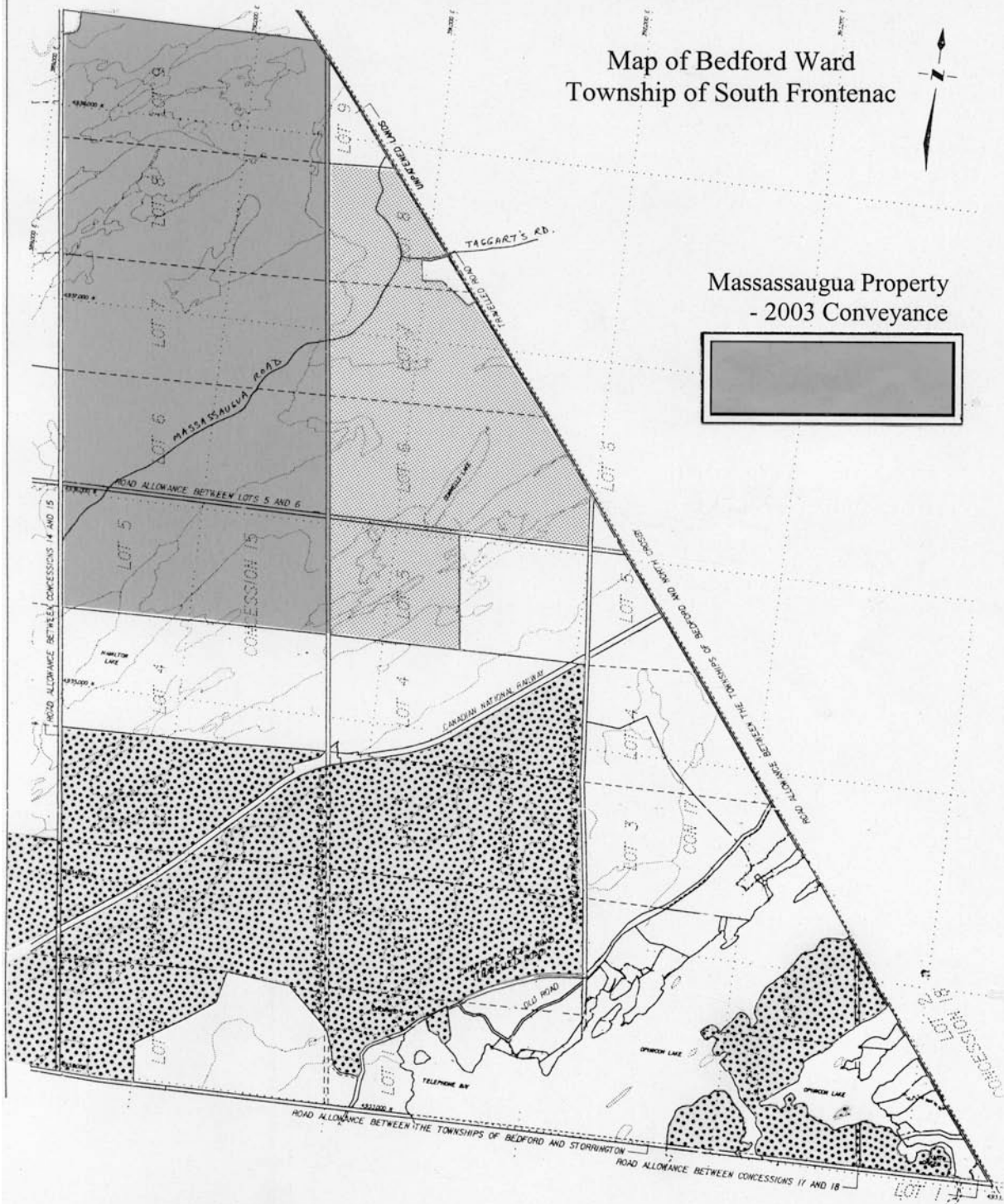
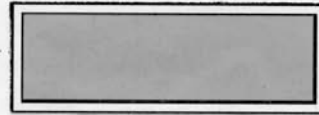
In December of 2003, a third parcel of property along the Massassaugua Road was conveyed to Queen's from an anonymous donor. This third parcel, comprising some 400 hectares (987 acres) lies in Concession 15 (Lots 5, 6, 7, 8 and Part of Lot 9) of the District of Bedford, Township of South Frontenac (see Maps, pp 9 and 10). This parcel is bisected by the Massassaugua Road and contains waterfrontage on the Massassaugua Creek in the north and on the north end of Hamilton Lake in the south. In addition, there are two buildings on the property; an old schoolhouse on the Massassaugua Road and a quonset hut situated west of the road and north of the schoolhouse.

The property represents a mixture of habitat, ranging from beaver ponds and pothole lakes in the north, through farm fields and woodlands in the central section to mixed forest and wetlands in the south. The southern part of the property falls in the Hamilton Lake Area of Natural and Scientific Interest (ANSI) (cf. David White. 1993. Life Science Areas of Natural and Scientific Interest in Site District 6-10. Ontario Ministry of Natural Resources, Kemptville, Ontario. 122 pp. [OFER SR9401]). Because of the extent of the property, its varied habitat and location in part within the ANSI, the entire property has been certified as ecologically sensitive by Environment Canada and has qualified for the EcoGifts Program.

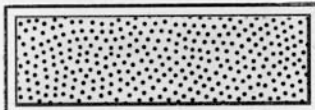
Map of Bedford Ward Township of South Frontenac



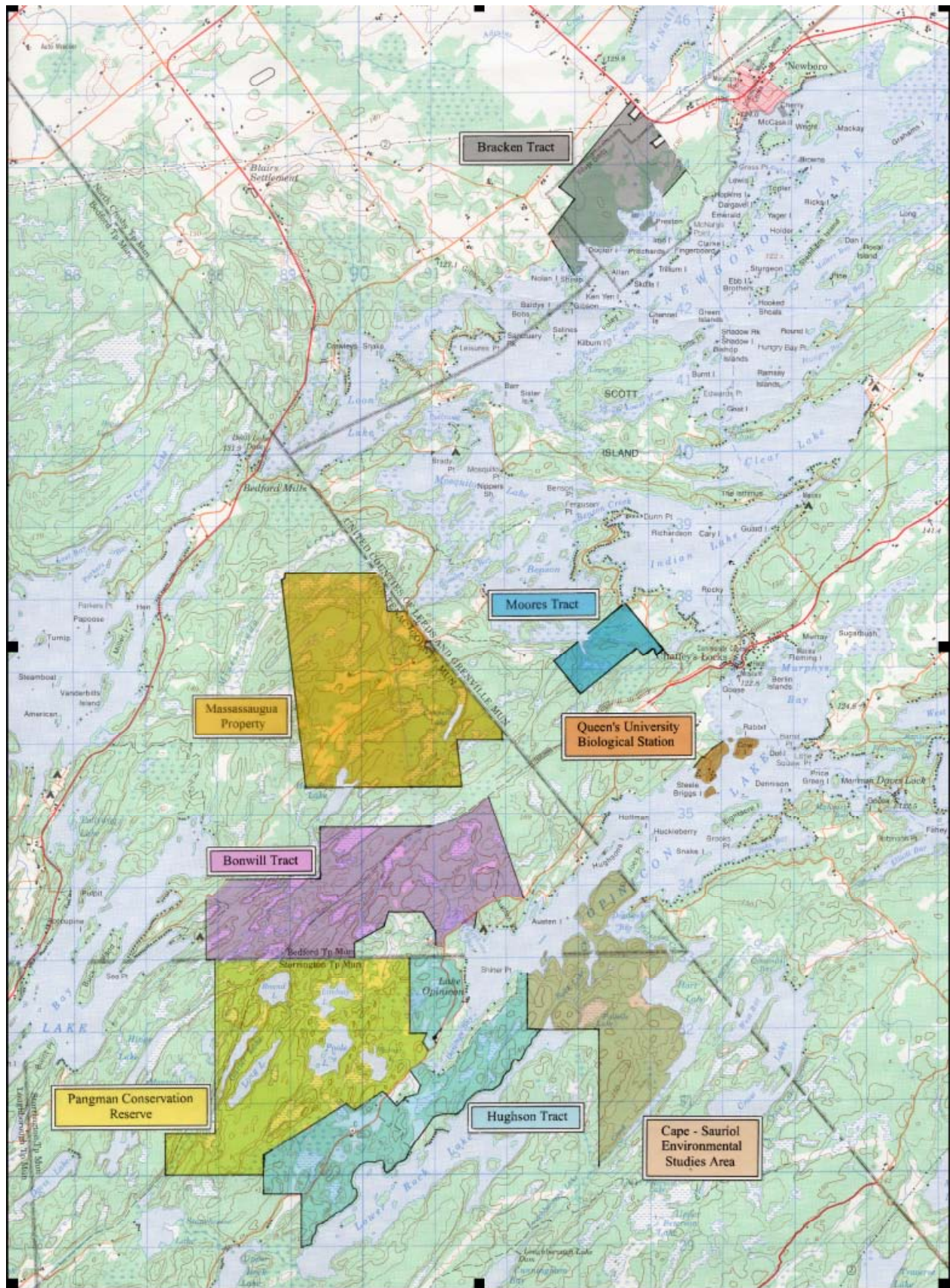
Massassaigua Property
- 2003 Conveyance



Massassaigua Property - 2001/2002 Conveyances



Other Queen's Properties in Bedford Ward



The generous donations of the anonymous donor have totalled some 593 hectares (1,465 acres):

2001 - First parcel - 29 hectares (72 acres) including house and barn.

2002 - Second parcel - 164 hectares (406 acres) - including Connell's Lake

2003 - Third parcel - 400 hectares (987 acres)

The three parcels comprise a significant tract of land with features not found on other properties already owned by QUBS. QUBS landholdings now total some 2,666 hectares (6,585 acres).

Lotek Ecological Observatory

Early in the year, Lotek Wireless Inc., a Canadian company that manufactures technological equipment for use in wildlife study, broached the idea of establishing an ecological observatory. Through the observatory, Lotek would obtain field tests of its products and technical data which would allow refinements of the products (including software). A successful installation would be an achievement which would augment their position as a producer of quality equipment and software. The initial approach to Queen's by Peter Anson and George Niezgoda of Lotek was through Dr. Roly Tinline of the Queen's GIS Lab (Geography Department). His interest was piqued by the possibility of working with the spatial data and developing means of handling high volumes of said data. An important avenue for the GIS Lab would be the development of a means to make real data available as a teaching tool through a web-based window on the observatory. With mutually beneficial goals in mind, a site for the observatory and a suite of researchers to collaborate in the enterprise had to be found. Initial contact with QUBS, through Manager, Frank Phelan, was positive. This could be a very interesting avenue for the field station and its researchers.

The ecological observatory was to consist of an array of hydrophones spread across the lake basin, feeding data via cabling to an outpost building on the lakeshore. This building was to be provided with power to run the equipment and a telephone link to provide immediate contact, data transmission and system monitoring via modem. Lotek was willing to donate the technical equipment and software to enable the functioning of the observatory. The equipment and software exceeded \$200,000.00 in value (13 hydrophones, cabling array, 30 transmitters, 2 receivers, computer and software). Queen's Office of Research Services (Sandra Crocker) indicated that Queen's was willing to accept the donation, subject to a memorandum of understanding concerning ownership of intellectual property and general terms of agreement of the operation of the observatory. The Office of Research Services committed \$10,000.00 to startup funds to cover the trial period of the observatory (first two years).

The equipment is designed for in-water studies, so search for a suitable lake was undertaken. Fortunately, QUBS has many candidate lakes. The ideal lake would be small in size, not exceeding 2.5 km in its longest dimension. It should have limited or controlled access, yet be reasonably accessible for supply of services, for researchers and monitoring activities and should have several species available for study. The first lake considered was Lindsay Lake. Although a good prospect, it proved too large for effective coverage. Its location also presented difficulties with power supply and communications. Thus, the search focussed in on Warner

Lake, on the Hughson Farm, a small lake closer to the main road and close to electrical supply and telephone grids.

With a workable site in mind, a consortium of researchers who might utilize the observatory was sought. An initial meeting was set up at QUBS, May 29-30, 2003 to demonstrate the equipment, present the possibilities and gauge interest among researchers. The meeting included representatives of Lotek, Queen's and QUBS researchers and QUBS staff. A complete list of attendees and affiliations is as follows:

Lotek

George Niezgoda - Director of Research
Peter Anson - Vice-President of Technology
Richard Booth - Science Advisor
Djordje Lekovic - Technologist

Queen's

Dr. Roly Tinline - GIS Lab
Dr. Greg Ross - Physiology
Dr. Shelley Arnott - Biology
Cory Suski - PhD student with Dr. Tufts - Biology
Dr. Yuxiang Wang - Biology
Dr. Laurene Ratcliffe - Biology
Rob Harrap - Geology and GIS Lab
Peg Hauschildt - GIS Lab
David Ball - GIS Lab
Dr. Raleigh Robertson - Biology and QUBS
Frank Phelan - QUBS
Floyd Connor - QUBS

Non-Queen's

Dr. Patrick Weatherhead - University of Illinois
Dr. David Philipp - Illinois Natural History Survey
Dr. Bryan Neff - University of Western Ontario
Sarah Magee - MSc student with Dr. Neff - University of Western Ontario
Dr. Gabriel Blouin-Demers - University of Ottawa
Dr. Dennis Murray - Trent University

Sufficient interest was shown at the meeting to proceed with the process toward development of the observatory. The equipment was subsequently donated to Queen's. Our summer SWEP students Alex and Lysa did a hydrographic survey of the lake, mapping the depth profiles of the two basins. A map of this appears on p. 25. It was now up to the consortium to provide the basic services to the site, build an outpost to house the technical equipment and design projects to utilize the observatory. In late summer and early fall, Staff from QUBS built a small, heavily-insulated outpost building at the shore of the lake, beside the access lane to the lake on the south side. An arrangement was made with Joe Gallipeau to provide electrical

connection through his electrical service nearby. A telephone connection was also installed in fall.



Once all the fundamentals were in place, Lotek staff arrived to begin the installation of the array and to connect the system. This work was completed in early November. Eight hydrophones were installed in the larger, deeper basin and five hydrophones were installed in the smaller, shallower basin. Soon after installation was complete, 22 largemouth bass were implanted with acoustic tags which provide positional data as well as temperature and pressure.

Dave Philipp, Steve Cooke, Cory Suski, Kevin Esseltine, Brandon Barthel, Kyle Hanson and Frank Phelan caught and implanted the fish (Steve Cooke as head surgeon).

With hydrophones and target subjects in the water, Lotek staff showed QUBS staff (Floyd and Frank) how to operate the system and retrieve, transport and store data. Only a short time into full operation, a lightning strike nearby fried major components of the system. Both receivers were heavily damaged, as was the small computer and nine of the thirteen hydrophones. The system was temporarily restored to operation, though in a limited fashion. With a replacement computer and one receiver, data were gathered through the winter from the four hydrophones which still functioned. In the meantime, steps were taken to repair the system. An agreement was made by which Queen's self-insurance (c/o Bob Weisnagel) would pay for repairs which would be made by Lotek at their cost.

In late February and early March of 2004, repair and replacement of the damaged hydrophones was undertaken. Divers ventured under the ice of Warner Lake to bring up the hydrophones needing attention. Many thanks to Bob Willis and his crew who undertook the ice diving. With QUBS staff (Floyd and Rod), Lotek staff came and repaired or replaced the damaged hydrophones. At the time of this writing (March 10, 2004), the hydrophones are back in place. Testing of the new electronics and cabling will be done shortly and the repaired receivers reinstalled. Hopefully, the system will be fully functional once again before ice-out. Discussions have started on effective lightning protection, which will be installed as soon as possible.





Data are available for analysis, even with the damage wrought by lightning. George Niezgoda has worked some of the data and has shown some of the technical means of filtering data. Biologically, some interesting results are beginning to emerge. To make the system really work, a Memorandum of Understanding needs to be worked out between Lotek and the consortium of researchers, the GIS Lab needs to begin to address the handling of huge blocks of data and to begin to develop the virtual laboratory. After the initial two-year startup period, the consortium of users will need to develop long-term arrangements for operation and funding of the observatory.

Queen's Land Trust

In 2001, an endowed fund, the Queen's Land Trust, was established with the goal of raising \$1,000,000 for use in acquisition of key properties and in stewardship of existing land for the QUBS. Ideally, once the \$1 million goal is reached, the interest from that endowed fund will support the purchase and/or appraisals of land acquisitions as they become available, as well as provide seasonal salary support for staff in this endeavour. Stewardship of nearly 7,000 acres of land, involving provision of access to students, natural history interpretative programs, mapping, and habitat management will involve ongoing investment of time and money.

In 2003, with the help of supporters such as the Garfield Weston Foundation, the Land Trust account now exceeds \$177,000.

Acquisition: There are 3 properties adjacent to QUBS that will likely become available for purchase within the next ten years, and it is crucial that QUBS be in a position to acquire these properties. Income from the land trust will provide funding necessary to move quickly in acquisition of these properties, and to then repay the costs of acquisition over time.

Programs & Stewardship - Stewardship of nearly 7,000 acres of land, which involves provision of access to students, natural history interpretative programs, mapping, and habitat management, requires personnel. Income from the Queen's Land Trust will provide seasonal salary support for staff in this endeavour.

Dr. Allen Keast

Dr. Allen Keast continues to be a generous supporter of the field station. In 2003, two gifts to QUBS came because of Allen's association with QUBS. After the Keast celebration in June, nearly \$1,000, the proceeds of the event, were donated in Allen's name to the Queen's Land Trust. Later in the year, Allen himself made a generous donation to QUBS, as he has done for the last several years. Continuing support like this from a long-time friend of the station is greatly appreciated. Thank you Allen.

William C. Brown Research Endowment Fund

The William C. Brown Research Endowment Fund was established through a bequest from the estate of William C. Brown, B.A. 1930. The fund was established to provide annual investment income to be used by the Queen's University Biological Station for research in the environment, and to build on existing strength by supporting research in ecology and conservation biology. The funds are to be used for research programs, facilities or equipment at QUBS, for QUBS based research activities of the Director of QUBS, and for teaching programs at QUBS that have a research component.

In 2003, funds were used to cover the board and room of the SWEP GIS students, and toward expenses of visiting research scientist Dr. Clive Bealey (Open University and English Nature, UK), working on the Cerulean Warbler project.

We at QUBS are grateful to Mr. Brown for the generous bequest to establish this endowment, and to Mr. Dale Canfield, executor of the Estate of William C. Brown, for his assistance in establishing the terms for the fund.

Estate Planning

It is very gratifying to know that some alumni have included QUBS in their will to create an endowment for a named bursary to provide board and room for students conducting field

research at the station. Such a program has two main benefits, benefiting many students over the long term and benefiting the station by allowing it to host students who might not otherwise have the opportunity to work at QUBS. Once such an award is established, it raises both the profile of field biology in general and QUBS itself, by having a named award (bursary) that will be announced to students. The award will also be a meaningful and lasting tribute to the donor.

The continuing support of QUBS friends and alumni is important to ensure future programs. Including QUBS in estate planning is a good way to ensure that the quality experience we cherish from our own involvement at the field station will be available for future generations of field biologists.

Campaign for Queen's

In working with Lili Harriss, Ed Pearce, Doug Puffer and others in the Development Office of the Campaign for Queen's, we have been very successful in funding QUBS. We hope to move forward toward reaching our goal for our current priority project, the Queen's Land Trust. This trust provides an ideal means of supporting Conservation Biology, education and research, Queen's and QUBS. Anyone wanting more information, or to make a donation, is encouraged to call the Development Office in the Faculty of Arts and Science at 613-533-6000, ext 77901 and speak to the Faculty Project Assistant, Myrna Horton.

NSERC and Other Support

NSERC MFA Grant

2003 was the 20th year that QUBS has received a Major Facilities Access (MFA) Grant from NSERC (Natural Sciences and Engineering Research Council) (including the years of tenure of MFA's precursor, the Infrastructure Grant). 2003 was the first year of the new three-year award.

The grant pays the salary of QUBS Assistant Manager (Floyd Connor) and half of the Maintenance Assistant (Roger Green) salary and benefits. In 2003, the Assistant Manager's benefits were paid by Queen's, freeing up some MFA funds for other purposes. In addition to salary and benefits, the grant also contributes to the cost of shared services (eg. electricity) and infrastructure.

The MFA award is an acknowledgement of the productivity and excellence of the facility and its multi-university program of research and training. The presence of users from many universities is key to a successful application and the award further enables interaction among multi-university users. The atmosphere created by this interaction leads to creative discussion among users which ultimately benefits all users and challenges them in terms of innovation of approach, quality of research and application of competing theories to their work.

CFI Grant to Smol and Cumming

Lawson Building Services (RR#1 Elgin) was contracted to build a 32' x 60' storage building. The project is funded by a CFI grant to Drs. Smol and Cumming, a contribution from



Environmental Studies and contributions from the Biology Department and Biological Station. In spring of 2003, the multiuse storage facility was constructed. The building boasts a cement slab, frame walls clad with steel, four overhead doors, a full-length storage loft and steel roof with skylight panels. Building construction was completed in July.

The process of planning and coordinating the project by QUBS staff began in 2002. QUBS staff prepared the site in fall and winter of 2002, and provided electrical service to the building and landscaping of access road and pad in 2003. In fall, contending with the constant rain and consequent mud, a serviceable access was provided. Next year will see final touches to the road and access pad.

In late fall, Environmental Studies built a cage demarcating their section of the building, at the same time defining the space allocated to Smol/Cumming. At present, four overhead doors define four storage bays on the main level. In addition, a fifth bay is accessed by a personnel door at the south end of the building. Smol/Cumming have been allocated the two north end storage bays and Environmental Studies the central storage bay. The remaining two bays at the south end are general Departmental/QUBS storage. The upper level loft will be for containerized storage from a variety of users.

Since completion was late in the year, only minor amounts of gear have so far been stored in the building. Already it has made a huge difference in available lab space, since extraneous gear at QUBS can now be removed from labs, making more space available for a variety of users and uses.

Renovations and Alterations Funding

QUBS was successful in its application to the Vice-Principal's Fund for Renovation and Alterations in 2003. The submission proposed to complete the renovation of the main QUBS septic system. The old system was 25 years old and was showing the first signs of failure. With growing concerns about the provision of safe drinking water and the increased use of water associated with the construction of the new Operations Centre in 2001, there was some urgency to the request. During construction of the Operations Centre, it was intended to enlarge the septic field, but funding permitted only the replacement of the main septic tanks, leaving the pump chamber and the septic field unaltered. With funds from R&A, removal and replacement of the sewage pump and chamber, new sewage line up to the field and replacement and enlargement of the field itself were undertaken, in accordance with the engineering study performed by McIntosh Hill Engineering (Carp, Ontario - Jim McIntosh/Tom Jones) in 1999, during planning for the Operations Centre.

Bids were requested and the job subsequently awarded to Robb McManus Construction (Portland, Ontario). In fall, QUBS staff removed encroaching trees, enlarging the open area to permit a mowed border around the field. The old cowbird trap was removed and the water line to the fish pools relocated. The real work began in November of 2003 and was completed by early December. With a wet fall and early winter, the topsoil could not be spread before freezeup, so topsoil and seeding (part of the contract) will await spring thaw.

In all, the Vice-Principal of Operations and Finance's Renovations and Alterations Fund provided some \$27,017.00 for the work. This award covered the cost of the Engineer's Report pursuant to Drinking Water Protection Regulations (McIntosh Perry - John D. Bishop), the septic field work, a new sewage pump and chamber and associated landscaping.

We thank the Vice-Principal for access to and the award of Renovations and Alterations Funding. These funds will continue to be important to QUBS in the face of tight fiscal policies as an aid to addressing the issue of aging infrastructure at the field station.

Scholarships and Bursaries

Wes and Dorletta Curran Scholarship

The Curran Scholarship was established in memory of the Founding Director of QUBS, Dr. Wes Curran and his wife, Dorletta. The award is given to an undergraduate student at Queen's who is working at the Biological Station. Projects on aquatic habitats and species are given priority in the selection process.

This scholarship was not awarded in 2003, since no applications were received.

Alexander and Cora Munn Summer Research Award

In 2001, Alexander and Cora Munn made a gift to Queen's, which has been used to establish an endowed fund from which summer research awards may be made. Third-year or fourth-year undergraduates in Conservation Biology, working in full-time summer positions in a research environment at QUBS are eligible. The award will be made to students who aspire to pursue studies in conservation biology and/or environmental preservation. Preference will be given to students in woodlot management and/or wildlife conservation.

Mr. and Mrs. Munn have made a generous gift, which will provide opportunities for future conservation biologists into the future. For this, we thank them heartily.

This award was not made in 2003, since no applications were received. It is anticipated that the first Munn award will be made in 2004.

Pearl E. Williams and Llewellyn Hillis Fund

This fund, established in 1991 by Llewellya Hillis (Arts '52) to honour her parents, is to promote the careers and scholarship of women scientists, especially biologists, at all stages of their professional development, and secondly to promote performances by artists who are women. Having studied at QUBS as an undergrad, Llewellya also hoped this fund would promote involvement by women in programs - both scientific and artistic – at QUBS. In 2003, two awards were made, one to host Monica Kidd at QUBS and a second to Jennifer Schum to assist with her M.Sc. work at Queen's.

Monica Kidd – Journalist/Artist-in-Residence at QUBS



Monica's Background

Monica Kidd completed her undergraduate studies in Biology at University of Calgary, where she also did some volunteer journalism and filled in as a host for a women's issues show and a world music show on campus radio CJSW.

Many people at Queen's remember Monica as a student in Dr. Vicki Friesen's lab, studying population genetics and evolution of seabirds. During that time, she also volunteered at the campus radio station (CFRC) where she hosted a variety of weekly shows on local arts and

international development. In 1996 and part of 1997, she was able to work with the Canadian Wildlife Service on the Gannet Islands of Labrador. She graduated with her M.Sc. degree in 1997, but stayed on in Kingston for a year to work with CUSO for whom she co-hosted 18 half-hour radio documentaries. She also continued to develop her interest and involvement in environmental issues, initially explored during her undergraduate years at University of Calgary, and helped to found the Society for Conservation Biology Kingston Chapter. During this time, she helped to bring in internationally-renowned conservationist Anne Ehrlich to give a public address at Queen's for which she was given some support from the Williams and Hillis Fund. In 1997, she also published two poems in the Kingston-based literary magazine Quarry. In the years to come, these were followed by publications in a dozen other journals across the country. She then moved to Newfoundland and started freelancing for CBC radio, and was based in St. John's.

In 1999, only two years after getting her M.Sc. degree and a year after being media consultant with CUSO in Kingston, she was awarded the Atlantic Journalism Awards "Gold Award" for continuing coverage of a story on chlorination by-products in the Newfoundland water supply. She was described as "a persistent tenacious journalist working in the face of government attempts to keep her story from being aired."

Her journalism and publishing career really began to take off in 2000. In that year alone, she was given the Atlantic Journalism Honourable Mention for a feature (a documentary about the life of a rural family doctor), the Atlantic Journalism Silver Award for Continuing Coverage (a story about occupational asthma among crab plant workers) and the Atlantic Journalism Gold Award for Spot News. For this latter award, she was glowingly characterized as being given the award "for her satellite phone report from a plane flying over a leaking supertanker. Vivid and descriptive writing, calm and professional delivery conveyed the drama and excitement at the scene, and a real sense of danger and distress at sea." The story was about a disabled tanker on the 200-mile territorial limit which threatened the Grand Banks with an oil spill larger than that from the Exxon Valdez. In 2000 her writing was also published in a poetry anthology and other literary publications.

In 2001, she won the New York Festivals Finalist Award for drama (a radio play about the death of Dr. Frederick Banting in the Newfoundland wilderness) and continued to publish her poetry. She also published "Beatrice", a novel about the destruction of Alberta grain elevators and a struggle to hang onto a part of the Western Canadian heritage (Turnstone Press).

In 2002, she continued to reap journalism awards and nominations, while publishing more poetry. She received the RTNDA Honorable Mention for Investigative Reporting for a story involving church sexual abuse against Innu children of Labrador. For work completed in that year, she was a finalist for two Atlantic Journalism awards (Continuing Coverage, and Entertainment). In addition, she had a photographic exhibition called "Inventions: Pinholes and Polaroid Transfers" at The Rogue Gallery in St. John's.

In January of 2003 she was given the position of "National Science Reporter" for CBC. Some selections from among Monica's radio reports in early 2003 include the following:

04/05 Gros Morne National Park to regulate snowmobile use

04/04 Structural genomics centre in Toronto to be among world's largest

04/01 Northern contaminants program ends

03/11 U.S. scientists feel chill from biosecurity rules

03/07 Canadian fishermen worry about effects of Spanish oil tanker disaster

As she visited her family in Alberta in May, just before her visit to QUBS, she broke the CBC's coverage of the discovery of BSE (bovine spongiform encephalopathy) in Alberta. The

effects of that single case of BSE continue to reverberate through the Canadian economy and society.

Monica's Visit to QUBS

Monica arrived at the Queen's University Biological Station on Sunday, 25 May 2003. In her very friendly and approachable way, she began immediately to chat with residents, to discuss shared interests, and to plan times when she could accompany them on their field studies.

On Monday, 26 May, she hosted an informal discussion in the screen porch of the QUBS Operations Centre, focussing on the "Intersection of Science and Art" but touching on many topics.

On Tuesday, residents and friends of QUBS gathered in the main dining room were treated to readings from and discussions of some of her writings. These included her recently-published novel "Beatrice", her new novel "The Momentum of Red" due out in April 2004, and some of her poems.

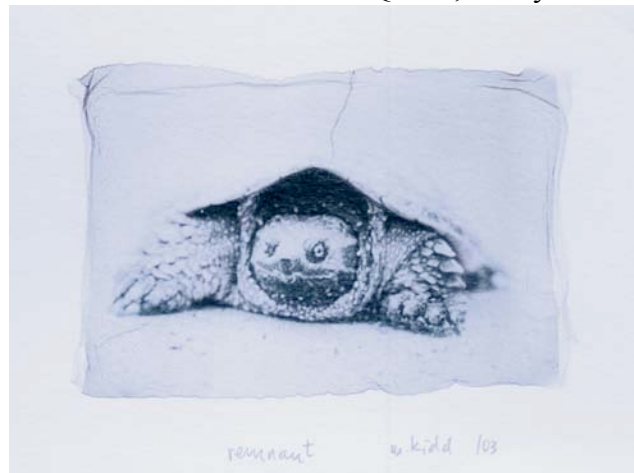
On Wednesday, Monica led a journalism workshop and discussion for QUBS residents and friends in the Operations Centre lecture room. The topic was "The Intersection of Journalism and Science".

The week's planned activities concluded with an informal social gathering on Friday evening.

Throughout the week, Monica continued to chat with residents and to accompany them on their field studies on Cerulean Warblers, Black Rat Snakes, Large-mouth Bass, Painted Turtles, and other species found on QUBS property. Her talks, chats, and accessibility were much appreciated and elicited responses such as "...the best talk I've heard at QUBS" and "Of course I'm going to attend her talk. She's doing exactly what I want to do!" Monica also found some time while at QUBS to walk on her own, to observe, and to photograph.

A few weeks after she had returned to her journalistic base in Newfoundland, Monica sent us four specially-processed, mounted and framed photographs that she had taken at QUBS, and a set of nine poems she had written while here. Each of four of the poems is related to one of the photographs: an example follows. In a short accompanying note addressed to "Dearest Station Grunts", Monica says "... you might like to know the process. They're called Polaroid emulsion transfers. I made them from 35mm colour and B/W slides exposed to colour Polaroid film. I boiled off the positive emulsion and transferred it to watercolour paper. It's fun. Thanks again for everything back in May. It was good for my writing and my heart. Keep in touch."

From those of us at QUBS, a very heartfelt "Thank you, Monica!"



remnant

*the devil was a snake,
back in the day when
all it took was a forked tongue
and a curious woman.*

*now he's old as the hills,
eyes blind with becoming,
the world galloped on ahead.*

*watch..
he turns to stone.*

©Monica Kidd 2003

In October 2003, the National Science Reporter position at CBC disappeared due to financial considerations but Monica continues to work for the CBC. Into early 2004, she hosted a provincial show in Newfoundland on Saturdays and Sundays called "The Weekend Arts Magazine". In November 2003, the Canadian Council of University Biology Chairs honoured Monica with their Distinguished Public Education Award. In early December 2003, she opened another Polaroid transfer exhibit in The Rogue Gallery in St. John's, this one entitled "The Cracks in His Skin: Polaroid transfer images of a changing rural landscape." It is based on images from rural Alberta.

As we prepare to take this Annual Report to press (March 2004), we have just received an exciting bit of news from Monica. She writes "I'm now working on a pilot project through Quirks & Quarks to provide science programming for CBC's local afternoon radio programs. I'm doing that from St. John's." We wish her the best of luck and much success in her new projects!

Jennifer E. Schum – M.Sc. Candidate, Dr. Katherine Wynne-Edwards' lab

Jennifer writes:

"I wish to extend my sincerest thanks to the Pearl E. Williams and Llewellyn Hillis Fund for the monies awarded to me this fall, which have greatly helped in the pursuit of my graduate studies.

Progress on my Master's thesis had slowed during the fall of 2002 due to multiple hospitalizations for pregnancy-induced renal colic which in turn caused pre-term contractions. My son was born 6 weeks premature while I was still a student at Queen's University. Following his two-week stay in the NICU, Mason and I moved to Toronto so that our family could be reunited (Mason's father had moved to Toronto during the pregnancy, in pursuit of work).

The funds awarded me have primarily gone towards the cost of childcare while I am in Kingston. This has permitted me to leave my son in a safe environment while freeing me time to work on my thesis. The fund has also helped to alleviate the travel costs incurred through subsidy of the cost of fuel.

The financial assistance provided by the Williams and Hillis Fund has helped me to make significant progress in the pursuit of my graduate studies. Thank you for affording me that opportunity."

QUBS Outreach Programs

Seminars

The seminar program was organized with the able help of Shannon McCorquodale. Frank, Shannon and Floyd had an early planning session to bandy about ideas. Once the schedule was planned, Shannon, along with Sue MacLatchie and Kathy Wirsig helped to advertise the seminar series to the local community. Many thanks, Shannon, Sue and Kathy for your able assistance. The full list of speakers and topics for 2003 appears later in this report (pp. 81 and 82).

Early on in the summer, the program is dominated by research activities of QUBS regulars and visitors. These seminars stimulate interaction between QUBS regulars and lead to

intense discussions and create opportunities for the exchange of ideas. As the summer progressed, topics shift to appeal to a wider audience of friends and neighbours, visitors to the area and the Friends of Opinicon. The seminar series has thus become a major means of outreach for QUBS. The seminar room is always full, a testament to the success of the program and the interest exhibited by the "locals" in biological topics.

Suggestions for speakers and topics are always welcome.

Open House

The annual Open House was held on June 29 in 2003. Some 350 visitors attended to tour the facilities and sample the activities at the field station and the research projects carried out at QUBS. Rain during the last hour of the event curtailed numbers from past years, but those who did attend made very favourable comments on their experience. The Open House is a significant outreach effort of QUBS, made successful only through the efforts of our regulars who take the time to prepare displays and man the displays, giving a series of presentations, answering questions and serving as effective ambassadors of QUBS itself. Thank you all for your efforts!

The 2003 version of the Community Newsletter was distributed to some 850 households and cottages in the Chaffey's Lock, Elgin and Perth Road area. This annual circular serves much the same purpose as the Open House, maintaining contact with the activities under way at QUBS and providing a means of outreach for those unable to attend the Open House itself.

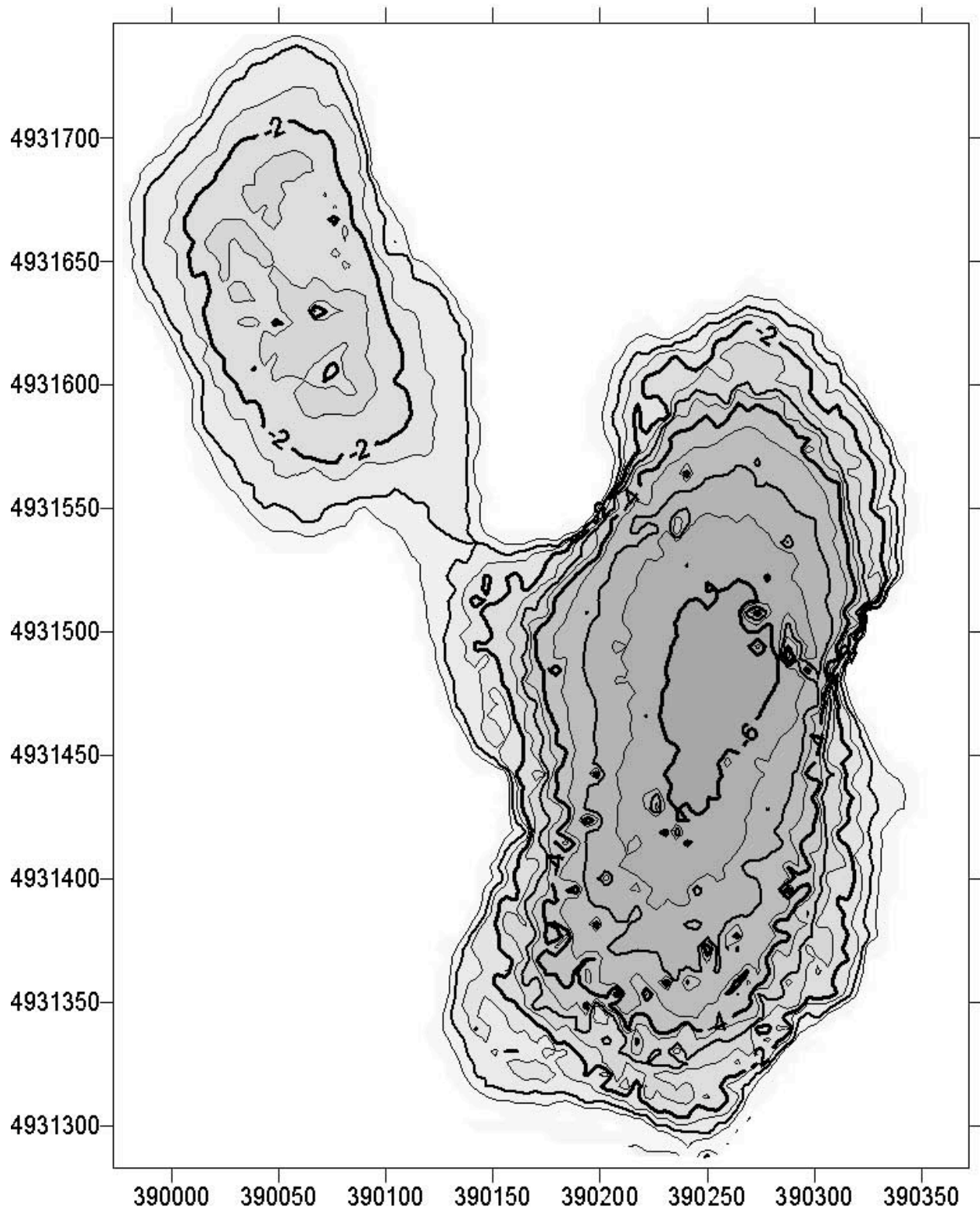
Outreach activities are part of the mandate of QUBS to provide educational and research opportunities for a broad base of users. Outreach initiatives are key to the continued success of the field station. Close and friendly contact with neighbours enables many projects, especially when research or teaching activities extend beyond QUBS landholdings. Without the support of the local community, opportunities at QUBS would become much more restricted.

QUBS Logistical Support

GIS/GPS AND SWEP

Alexandra Hewitt and Lysa Irvine were the Geographical Information Systems (GIS) and Global Positioning Systems (GPS) assistants at QUBS in 2003, jointly sponsored by the Queen's Summer Work Experience Program (SWEP) and QUBS. They were involved in both fieldwork and computer analysis. One of the first goals for the summer was to map certain landscape features that were missing from the QUBS database. The features that were completed for 2003 include Coldspring Swamp, Upper and Lower Dowsley Lake, Horseshoe Marsh and the major fields and buildings on Massassaqua Property. Another major GPS project was the collection of bathymetric information for two major lakes (Warner Lake and Lindsay Lake) that are frequently used for fish research. A GPS Trimble TSC1 unit and an echo depth sounder were used to record position and depth information, which was then inputted into GIS software to produce contour maps. The bathymetric data of Warner Lake were particularly useful to Lotek, a biological monitoring company, who will utilize the information to place their new technology in the best location for fish monitoring purposes. In addition, researchers using the QUBS facilities needed mapping done for their own projects. Alex and Lysa were involved in mapping nest sites for several researchers as well as mapping reference markers for others.

Contour Map of Warner Lake using Linear Interpolation



Another important aspect of GIS is computer analysis and data entry. The GIS team of 2003 was involved in upgrading QUBS software to ArcGIS 8.1. This new software has a greater capacity to create visually pleasing maps with attribute information attached to each layer. A major computer project for the summer involved transferring all previous files into the new software and ensuring that all the data was compatible and edited. Quick maps were created allowing users to easily access selected areas of Queens Property for research and recreational purposes. Data entry was then completed to link attribute information to the landscape features on the map (i.e. lengths of roads, dimensions of buildings). With the introduction of the new software, Help Files were created to ensure that future students have the ability to work efficiently with the programs.

Over the course of the summer months, Alex and Lysa were involved in several community projects. During the Open House on July 29, a poster station was set-up to provide residents with information on ongoing GIS projects. In addition, the GIS team was involved with Science Discovery (a Queen's science camp) and presented a short information session and hands-on trial to acquaint the students with GIS technology.

QUBS Properties

Hughson Farm

In 2003, the Hughson Farm was used for studies of Tree Swallows, Golden-winged Warblers, Blue-winged Warblers, Cerulean Warblers, Black Rat Snakes, Eastern Milksnakes, Painted Turtles, Dragonflies, Damselflies, Burying Beetles, Blowflies, Syrphid Flies, Moths, Water Mites, Spider Mites, Plant Competition and Co-occurrence and the possible effects of bismuth on forests and wetlands.

The various bird box grids were again used by Dr. Raleigh Robertson and his students in work on Tree Swallows.

Rotation plots in the Lane Sargent Field were used by Dr. Aarssen's lab for a variety of projects. The fenced plot in the New Barn Field was roto-tilled in fall.

Haying of the open fields was done by Bob Butterill in 2003.

In fall, all gaps leading into fields were fitted with distinctive chains (black and white) to clearly mark QUBS property entrances and to indicate that access is restricted.

In fall, the boundary between QUBS property and Watson's was marked out with wooden stakes. Mel Watson was asked to remove his equipment from the Chapman Field and onto his own property.

Bonwill Tract

The Bonwill Tract was used in studies of American Redstarts, Golden-winged Warblers, Blue-winged Warblers, Cerulean Warblers, Black Rat Snakes, Eastern Milksnakes, Painted Turtles, Dragonflies, Damselflies, Burying Beetles, Syrphid Flies, Moths, Water Mites, Spider Mites and the testing of an interceptor barrier for PCB studies in 2003.

The Ontario Ministry of Natural Resources (Eric Boysen - Kemptville) maintains several growth and yield plots flanking the Bedford Road. Forest Bird inventory plots are located within the Bonwill Tract, north and east of the Wire Fence Field.

Haying of the open fields was done by Bob Butterill in 2003.

Distinctive chains were fitted across field entrances, as for the Hughson Farm.

John M. Cape-Charles Sauriol Environmental Studies Area

The Cape-Sauriol Tract was used for studies of Eastern Kingbirds, Black Rat Snakes, Eastern Milksnakes, Painted Turtles, Largemouth Bass and Bluegill Sunfish in 2003.

Hilda and John B. Pangman Conservation Reserve

In 2003, the Pangman Reserve was used in studies of Cerulean Warblers, Golden-winged Warblers, Blue-winged Warblers, Black Rat Snakes, Eastern Milksnakes, Painted Turtles, Largemouth Bass, Northern Pike, Dragonflies, Damselflies, Burying Beetles, Syrphid Flies, Aquatic Invertebrates and Water mites.

A major installation on Warner Lake, the Lotek Ecological Observatory was built and installed in fall of 2003 (see pp. 11 to 15).

Warner Lake has both PIT-tagged Largemouth Bass and currently has 22 Largemouths with acoustic tags which feed data into the hydroacoustic array of the Ecological Observatory. In spring, some White Suckers will be equipped with acoustic tags as part of a study on heavy metal effects on fish physiology and behaviour carried out by Dr. Greg Ross.

Northern Pike in Lindsay and Poole Lakes have been implanted with PIT tags as part of a study on movements and population biology of pike.

Largemouth Bass in Long Lake have been implanted with PIT tags as part of an ongoing study of nesting behaviour and recruitment in bass. The outpost cabin on Long Lake greatly facilitates lake work.

The Lindsay Lake Road continues to be a popular place for nature hikes and local history walks by various groups.

Bracken Tract

The Bracken Tract was used for studies of Tree Swallows and Brown-headed Cowbirds in 2003.

In fall, the property was intensively used by students from Geology 221 (Geological Field Methods). Doug Archibald had the students lay out baselines and pickets and, working in groups, paced and compassed on perpendicular lines. The purpose of the field work was to determine the stratigraphy of the surficial sediments (lacustrine clay and/or sand over till in most places) on the property using soil augers. In addition, a magnetometer survey was done on the baselines to determine the location of the buried contact between the gneiss and the very magnetic gabbro that hosts the magnetite. This work is of interest since the area used to be the site of a very successful iron (magnetite) mine.

Maurice and Wayne Hutchings are permitted to graze cattle on this tract in exchange for keeping an eye on the property. They try to manage the cattle so as to not interfere with ongoing research efforts. For the most part, this has been successful.

In fall, some of the open fields were cut to help control weed growth.

Moores Tract

In 2003, the Moores Tract was used in studies of Black Rat Snakes, Spring Peepers and Water Mites.

Crabbe Property

The Crabbe House was effectively used as a site to temporarily house Brown-headed Cowbirds in 2003. Dr. D. Sherry spent some time collecting Brown-headed Cowbirds for behavioural and physiological studies.

An arrangement was made with Jim Hales, who lives nearby to cut the grass around the house on a regular basis.

In spring, the skylight over the stairs was removed since it was leaking badly.

Massassaugua Property

In 2003, some time was spent in exploratory forays of the property and habitats available. Given the size and variability of the property, it will take some time to become familiar with it. Alex and Lysa, our summer SWEP students started to map some of the main features of the property using GPS (Global Positioning System) gear.

The big barn was used for studies of Barn Swallows.

An arrangement was made with Michelle Cummings and Ken Young to use the barn and the pastures surrounding it for keeping horses and cattle. The open fields were hayed by Ken Young in 2003.

In fall, Vicki Friesen's field course on Conservation of Biodiversity used the property as a site to develop broadscale plans for preserving biodiversity.

In winter, Camp Outlook used the property for winter hiking and camping.

Queen's Point

The property immediately surrounding the buildings of the station, including Sheep and Cow Islands is often overlooked as a site for research. Its proximity to amenities makes it an important part of educational trips, especially as part of the fall program for various undergraduate courses. The more remote areas such as the islands, Cow Island Marsh and surrounding woodlands offer sites of biological interest. The open fields are used for aviary studies and exercises in sampling methods. Easy access to typical shorelines and bays allows a variety of aquatic studies.

In 2003, Queen's Point was used in studies of Black-capped Chickadees, Barn Swallows, Black Rat Snakes, Eastern Milk Snakes, Bats, Bluegill Sunfish, Largemouth Bass, Smallmouth Bass, Dragonflies, Damselflies, Syrphid Flies, Burying Beetles and Moths.

Several small aviaries were removed in 2003, making way for a larger aviary on site. This aviary figured prominently in studies of Black-capped Chickadees this year and will be used intensively in future.

Animal Care, Safety and Training

Animal Care

In November of 2001, a specific policy on animal care for QUBS was put into place. This policy meshes animal care at the field station with University Animal Care Committee (UACC) protocols and approvals. All QUBS users must adhere to the QUBS policy guidelines (<http://biology.queensu.ca/~qubs/AnimalCare.pdf>).

To QUBS users as ethical field researchers and educators, animal care issues should be of paramount importance and the welfare of an animal which is the subject of either field or lab study should be of foremost concern.

Dr. Bonnie Beresford (University Veterinarian and Director of University Animal Care) came to QUBS on May 21, 2003 to tour the station facilities and present an information and training session on animal care to QUBS regulars and a few students from Environmental Studies, who made the trip out to QUBS specifically for the animal care session. In all, the session had 35 participants.

Dr. Beresford is available for discussion of animal care issues (beresfor@post.queensu.ca). UACC communications can also be accessed/delivered at UACC@post.queensu.ca or via Laurel Amey, Secretary UACC (ameyl@post.queensu.ca).

Principal Investigators should be aware that the Canadian Council of Animal Care has adopted a new set of guidelines on the care and use of wildlife in 2003 (ISBN: 0-919087-39-6). PI's should acquaint themselves with this document and adhere to the guidelines therein.

Field Safety Policy

Queen's University has developed a comprehensive field safety policy as well as guidelines for safety in field research. QUBS users are expected to fully adhere to the principles and established guidelines. The policy document is accessed at: (<http://www.safety.queensu.ca/safety/policy/fieldpol.htm>).

During the animal care session on May 21, 2003, Drs. Bonnie Beresford and Kathy Wynne-Edwards introduced the topic of field safety at QUBS. Each lab group must undertake a risk evaluation and risk management session during which careful planning of field activities is undertaken, with due attention to anticipation of hazards, keeping contact with members of the groups in the field and effective response to emergencies. Each lab group must develop a plan whereby specific risks are assessed, procedures developed to minimize identified risks and procedures for dealing with worst-case scenarios. All members of the group should sign off on the plan and a copy could be filed with QUBS management. PI's could use the field research planning record as a guide to developing a group-specific awareness of and approach to field safety: (<http://www.safety.queensu.ca/safety/policy/field/app2.pdf>).

Watercraft Safety

In compliance with current legislation, all users of motorboats at QUBS must have proof of operator competency. There are a variety of means of obtaining proof of competency, via local courses or web-based training. A good place to start looking for information is the Canadian Coast Guard (<http://www.ccg-gcc.gc.ca/>).

With great interest shown from biologists on site, Frank arranged a QUBS course on June 16 in the conference room of the Operations Centre. The instructor was George Hiles (tel 613-453-5253) of Lakeland Safe Boating (lakeland@safeboating.ca). 18 biologists received training and proof of competency during the session.

QUBS users who plan to use motorboats must show proof of competency before using station boats. This means that PI's should plan ahead and arrange for appropriate training for themselves, graduate students or field assistants before arrival at QUBS. During the summer, if sufficient interest is shown, an on-site course for future users could be arranged.

ATV Safety

All-terrain vehicles are considered research tools at QUBS. ATV's are expensive and potentially dangerous tools, so QUBS insists on all users having taken a training program. Proof of training from any established authority is acceptable. For those requiring on-site training, QUBS uses the training program developed by the 4-H Club. Study of safety material and passing a written test, followed by a practical test aboard an ATV is required before using any ATV on QUBS property.

Drinking Water Safety

QUBS has complied with all of the regulations for providing safe drinking water in the aftermath of Walkerton. Under regulation 170, QUBS is considered a small, non-municipal drinking water system with a well supply. The designated water system number for QUBS is 260029458. A series of requirements have been met to comply with this regulation:

- 1) Both Frank and Floyd have become "trained persons" under the Act
- 2) Our UV treatment system and the water system in general must be inspected at least once a week by a "trained person"
- 3) Replacement parts must be kept on hand in case of breakdown
- 4) Samples of treated water must be tested at an accredited lab once a week for Total Coliforms, *E. coli* and heterotrophic bacteria (plate count)
- 5) Samples of untreated water must be tested at an accredited lab once a month for Total Coliforms, *E. coli* and background bacteria
- 6) Multiparameter testing (elements, metals, radionuclides, hydrocarbons, PCBs, pesticides etc.) must be done every 60 months at an accredited lab. This was done in June 2002, with some extra parameters tested in summer of 2003. All parameters fall within the guidelines under the Act.
- 7) Lab results must be kept on file for inspection
- 8) There is a complex set of reporting requirements mandated in the event of an adverse test result
- 9) An annual report must be filed outlining the water system itself, procedures for providing safe water and the results of all tests done on water. QUBS must file its first annual report under Reg.170 in May of 2004.

As part of our ongoing effort to ensure safe drinking water, the septic system was replaced and enlarged in fall of 2003 - details may be found in the Renovations and Alterations Fund section elsewhere in this report.

Overall, we are supplying safe drinking water to QUBS and are making every effort to ensure that this continues.

Renovations and Additions

White House Kitchen

The kitchen in the White House was the original, installed during construction in 1968. It was never designed for group use, and was certainly showing its age. The original fixtures, cupboards and flooring were removed, stripping all down to bare floors and ceiling. The wall between the dining room and kitchen was partially removed, opening the kitchen to the dining

room by a wide archway. Underlay was applied to the floor and new vinyl flooring laid down. The refrigerator was moved back against the wall and new cabinetry was installed around it. A new sink base was added and all work surfaces were tiled and epoxy grouted. A new exhaust hood over the stove was installed. After drywall work, painting and wood trim, the kitchen was new again. The new layout and opening to the dining room works very well for groups.

Earl Cottage

Continuing the renovation of Earl Cottage, a small deck was installed on the lake side. A step-out from the patio doors and a keyhole around the tree make it a great addition to the cottage. In summer, the siding was stained and the fascia painted. All that remains to complete the renovation is some staining of window frames on the interior.

Cabin 12 - Condo

A new roof was put on this cabin. The old shingles were removed and replaced. In so doing, new plexiglas skylites, upper vents and fascia were also installed.

Boardwalk to Cow Island

Some reasonably major repairs were undertaken to replace rotted posts, walkway supports and walkway planking in summer.

Crabbe House

The skylight over the stairs was leaking badly. In spring, it was removed and steel roofing installed over the gap.

Rappinicon

To complete the change in mode of propulsion, a second outboard (30 hp) was obtained and installed. The two outboards (20 hp and 30hp) were slaved together for steering. It is unfortunate that matching outboard motors could not be found, but the beast will never go fast, so tuning power plants is not required. The new arrangement works well. In summer, the pontoons were spot sandblasted and touched up.

Operations Centre - Deck

Lawson Building Services (RR#1 Elgin) built a deck on the front of the building in fall. With input from the original architect (Tom Blood) and local landscape architect Brad Johnson, a plan was formulated which will allow a meeting place out front with access from the front porches of the Operations Centre. The deck is cedar, with wide steps descending to the lawn out front. A secondary deck extends down toward the hill between the Brown Lab and Library. Board and batten "fences" screen the undersides of the screened porches and flank the new deck. A design feature incorporates a metal screen into the deck near the building which allows runoff from the roof to fall through, rather than onto the deck. To finish the project, the "fences" will need staining to match the Op Ctr siding and some handrails will need to be installed.

Operations Centre Wood Stairs

In summer, a start was made on refinishing the Douglas Fir steps between levels of the Op Ctr. These massive treads are made of soft wood and rapidly show signs of wear (they have only seen 4 years of use). Four of the sixteen steps were removed to the shop. They were

stripped of varnish, planed as necessary, cracks in upper surfaces were filled and they were subsequently sealed and varnished. The remaining steps will receive the same treatment in the near future.

Operations Centre Doors

The entrance doors had become worn with use and exposure to the elements. These were stripped of varnish, sealed and revarnished. At the same time, the window were sealed with silicone caulking to keep water from getting into the woodwork.

Operations Centre - Kitchen and Dish Room Sinks

To avoid the inevitable splash of water behind the sinks, stainless steel flashings were made and installed atop these sinks.

Operations Centre - Utility Room

To increase the versatility of the utility room, especially with respect to the chest freezer, new electrical outlets were added. Wainick Electric (Crosby) did the work.

New Septic System

With funds from Queen's University's Renovations and Alterations Fund, a new septic system was installed by Robb McManus (Portland) in late fall. The original septic field was installed some 25 years ago. During recent work related to the construction of the Operations Centre and spurred by the Walkerton incident, the septic field was showing signs of failure. The new septic field is larger, matched to current use and designed for proper dosing by the sewage pump. A new pump chamber and dosing pump were also installed, completing the septic system overhaul (new tanks were installed during the building of the Op Ctr in 1999-2000). Some tree removal was required to enable the larger footprint. The old bird trap at the back of the old field was removed. The supply line to the fish pool complex was rerouted to avoid damage. During the work, it was discovered that only a portion of the old field was functioning and that it was being dosed improperly.

The fall was very wet, so spreading of topsoil and seeding will have to wait until spring. Some fill is also required to complete the coverage of the pump chamber.

After the main construction, access hatches of pressure-treated materials were fabricated and installed atop the pump chamber.

CFI Storage Building

Lawson Building Services (RR#1 Elgin) was contracted to build a 32' x 60' storage building. The project is funded by a CFI grant to Drs. Smol and Cumming, a contribution from Environmental Studies and contributions from the Department and Biological Station. As a result, a multiuse storage facility was constructed. The building boasts a cement slab, frame walls clad with steel, four overhead doors, a full-length storage loft and steel roof with skylight panels. Building construction was completed in July.

Besides planning and coordinating the project, QUBS staff prepared the site, provided electrical service to the building and landscaping of access road and pad. The electrical supply originates in the workshop and runs underground (under the roadway) to the south end of the building. Inside, two separate circuits have been provided, one for simple lighting and one for outlets. Because of the building's location, considerable quantities of fill were required in front

of the building to provide an entrance pad. In fall, contending with the constant rain and consequent mud, a serviceable access was provided. Next year will see final touches to the road and access pad.

In late fall, Environmental Studies built a cage demarcating their section of the building, at the same time defining the space allocated to Smol/Cumming. At present, four overhead doors define four storage bays on the main level. In addition, a fifth bay is accessed by a personnel door at the south end of the building. Smol/Cumming have been allocated the two north end storage bays and Environmental Studies the central storage bay. The remaining two bays at the south end are general Departmental/QUBS storage. The upper level loft will be for containerized storage from a variety of users.

Landscaping - Parking area

With improved storage, the need for Frank's "temporary garage" in the parking area was obviated. In fall, this was removed and relocated to the Vinkle's in Hartington. This has resulted in more parking space and a more open feel to the approach to the lodge.

Aviary

With funding from research grants to Raleigh Robertson and Laurene Ratcliffe, a new aviary was built in the Aviary Field. To make way for this huge construction, three of the old, smaller aviaries were first removed. With time of the essence, QUBS staff (primarily Roger Green) built the framework in sections in the workshop. These panels were then covered with wire screen, transported to the site and erected section by section by a work party of researchers and QUBS staff.

The new aviary is 30' x 30' overall and 10' high, with a central row of three 10' x 10' cells flanked by two flyways of 10' x 30' each.

Trilab

A recurrent leak in the roof and general signs of age in the Trilab prompted an ambitious set of renovations in the fall. The asphalt roofing was stripped off and replaced. The low-slope section above Room #4 (currently herptile rearing room) received careful attention. Several rotting boards were replaced. Wideide flashings were then installed along the sides and the top.. Low-slope Bakor self-sealing roofing was applied. The rest of the roof was stripped and re-shingled. Fascia were replaced as required.

The lake side and west sides of the building were scraped and painted. Some rotten and carpenter ant-eaten boards were replaced. A primer was applied and a top coat of paint added. Windows and sills received special attention. The lake side windows and sills were in tough shape and required considerable work to repair. As winter overtook the project, the windows need to be painted and a couple more window sills need attention. This will be completed in spring. Before summer is out, the rest of the building will be similarly treated.

This was a major job for QUBS staff - about 350 man-hours so far. It is amazing how much work can be collapsed into a few sentences and how much time is required to care for some of our older buildings.

Aquarium Water System

Instantaneous demand for water to the aquarium varies with the intensity of research activity. Often there is no need for the huge pumps to run. When they do, with low water

requirements for the aquarium, it is often necessary to let a large amount of water run down the drain just to avoid constant on-off switching of the big pumps. To avoid this situation and to provide an alternative water supply during periods of low demand, a large captive air pressure tank was installed on the backup system. This 80 gallon tank provides a considerable quantity of water between cycles of the smaller pump. This system worked so well that the huge pumps were not even started in 2003!

White House Basement

Since the main water supply system passes through the utilities room of the White House basement, there is often a lot of condensation and humidity generated there. The installation of a dehumidifier in the room, emptying directly into the floor drain has greatly reduced the amount of condensation and humidity.

Lower Brown Lab Air Conditioner

The shared lab space in the Lower Brown Lab often experiences periods of high inside temperatures. The technical gear and the press of bodies seems to be the source of this heat. To make the working space more comfortable, the researchers chipped in to purchase an air conditioner. This was installed mid-summer in a central window.

Lower Brown Lab Incubators

Doing his level best to contribute to increasing lab temperatures, Mark Forbes moved two climate-controlled growth chambers into the Lower Brown Lab. This necessitated some new high-voltage outlets. These were installed in early summer.

Field Entrances

Along the Opinicon Road, all entrances to property owned by QUBS have been fitted with steel gateposts (painted brown). Between these, a distinctive black and silver chain has been stretched across the opening. These chains can be locked if non-conforming uses become a problem. The chains also have red stop signs with reflective tape markings.

Cataraqui Trail Gate

In an effort to curtail wholesale access to QUBS properties flanking the trail, QUBS paid for a gate to be installed just off the Maple Leaf Road in front of Van Wyngaarden's farm. Without the gate, many have been driving trucks to gain access to the remote property and lakes, especially Garter and Round Lakes. To boot, a flurry of Marijuana cultivation has been abetted by this ease of access. In late summer, the new gate was installed by the Cataraqui Trail Committee. Hopefully, it will help stop this unauthorized access and abuse.

Property Boundaries

The edge of the old Randall property (now Watson) in the Chapman Field was surveyed in summer of 2002 by George Bracken and Son (Smiths Falls). A new peg was placed by the road at the extreme SW limit of the property. In fall of 2003, QUBS staff placed temporary intervening posts across the field preparatory to construction of a fence in spring/summer of 2004.

Docks

Patching of breaks and cracks in the concrete docks was carried out to reduce trip hazards and to stabilize the docks until a longer-term solution can be found.

Curran Cottage - Shower Room

Water had been accumulating on the floor in this room. After sealing the flooring and baseboard, a through-floor drain was installed to deal with excess water.

Laptop and Data Projector

At the beginning of the summer season, Departmental funds were made available to purchase a data projector (NEC LT 260) and laptop computer (IBM Thinkpad Type 2656) to be used for presentations at QUBS. At the same time, a projector cart was purchased to provide mobility and ease of storage when not in use.

Fax Machine

The old Fax machine was getting very balky and uncooperative, so a new Fax machine (HP 1010) was purchased. The new unit is very compact and leaves more usable desk space in the outer office.

New Truck

In spring, our small pickup truck failed its annual safety check because of frame problems. While repairs could be made, the cost of the repairs was likely to be greater than the value of the truck (11 years old). The decision was made to retire it. With a contribution from the Biology Department, a new 2003 S15 pickup was purchased from Condie Pontiac-Buick in Kingston.

Work Truck

The clutch in our old work truck was getting bad and with winter snowplowing imminent, a new clutch and throwout bearing were installed in fall. The work was done at Haskin's Ford (Crosby).

Acknowledgements

The operation of a facility like QUBS is impossible without capable, dedicated staff. Our staff deserves a large vote of thanks for their work. Thanks to Roger (Rod) Green (Maintenance Assistant) and our Food Service Staff - Marg Phelan, Cheryl MacDonald, Veronika Jaspers-Fayer and Karen Smith. Thanks also to Emma Jaspers-Fayer for her help with housekeeping and other tasks. Your efforts are appreciated by all QUBS users.

Thank you to Amy Cameron who helped put this report together as part of a student work placement project.

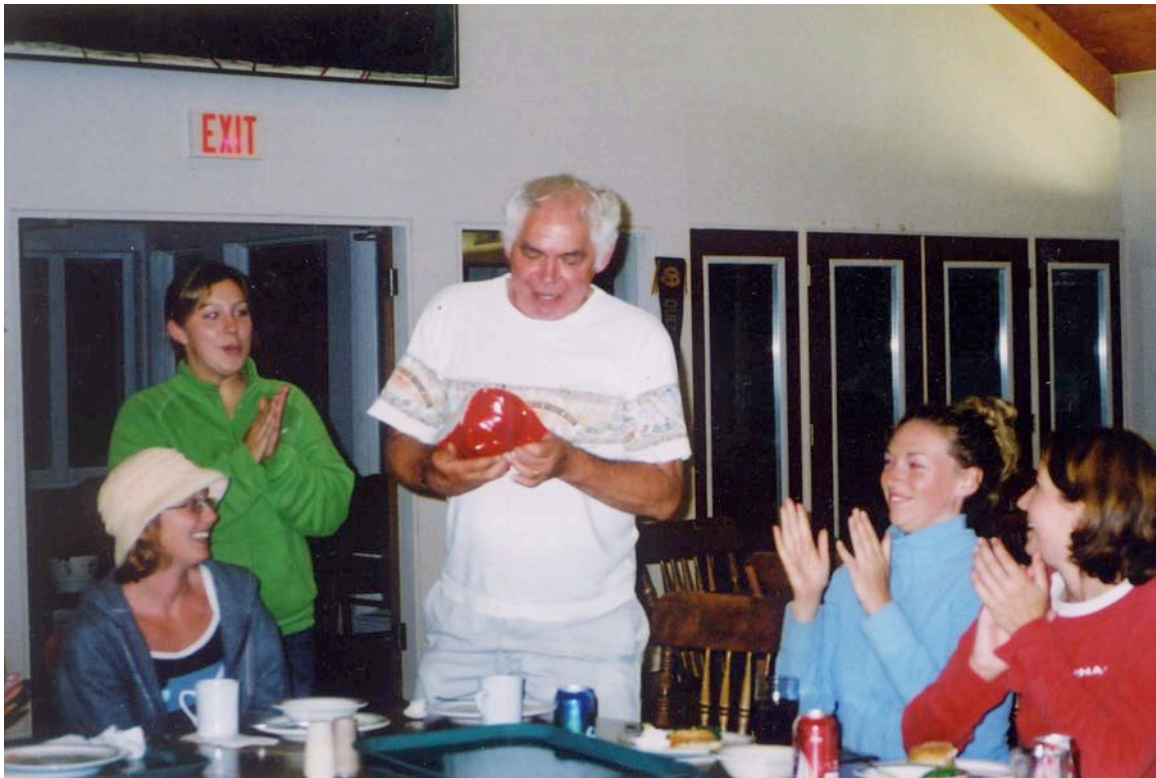
A special "Thank you!" to Lois Robertson for providing several photographs for this report, and for helping with many aspects of the Director's role at QUBS.

**Invasive Species Workshop
Queen's University Biological Station (QUBS) and
Eastern Ontario Model Forest (EOMF)**

Early in 2003, discussions arising at a meeting of “The Watershed Nature and History Network” of the newly-sanctioned “Canadian Thousand Islands/Frontenac Axis Biosphere Reserve” of UNESCO suggested an interest in and a need for a local workshop on Invasive Species. Following those conversations between Brian Barkley of EOMF and Floyd Connor of QUBS, Mark Richardson (Project Forester of EOMF) and Floyd began developing the details of a workshop to be held at QUBS in June.

On Saturday, 14 June 2003, 23 participants from a wide variety of backgrounds registered for the “Aliens In Your Environment” workshop at QUBS. After receiving an 85-page manual, each participant enjoyed a morning of presentations by Peter Neave of Neave Resource Management and by Mark Richardson in the Operations Centre lecture room. After a lunch in the QUBS Operations Centre, all those who could afford the time joined an Invasive Species field trip around QUBS grounds and in the vicinity of Chaffeys Lock. This very informative part of the workshop was ably led by Dale Kristensen (Queen's Phytotron Manager) with assistance from Brandon Schamp (Queen's PhD student). Dale also produced and provided a very useful handout on Invasive Species in Ontario. Our sincere thanks to both!

The workshop was very enthusiastically received, suggesting that something similar might be desirable and possible in the future.



Laurier students present Ed Kott with a memento during his last field course, Fall 2003

The Weather Report 2003

Weather Station and Data Characteristics

Many of the characteristics described herein have remained unchanged for some years. It may be useful, however, to summarize them here to put the current report into context, especially for new users. Some features are unique to 2003.

The Queen's University Biological Station Weather Station is located on a headland of Queen's Point on the shores of Opinicon Lake. The headland slopes down abruptly in a southwesterly direction to the water through a tangle of low brush and small trees. When fully functional, the Weather Station has 11 electronic sensors which sample a variety of weather variables as described below. The data are collected and temporarily stored by a Campbell Scientific 21X micrologger and are then automatically uploaded every 3 hours to a continuously-running computer in the "Brown Lab", via a dedicated underground cable. From time to time, the accumulating weather data files from that computer are copied to disc and a copy is produced on the drive of the Assistant Manager's computer in the Director's Office of the Operations Centre. It is here that summaries are produced and sent upon demand to Biological Station users and other interested persons.

The micrologger is in its own weather-tight housing next to the rain guage. It is powered by a battery which is kept charged by a solar panel mounted on the top of the micrologger housing. Sensors are in 4 main groups, all within a few tens of meters of each other. Some are at approximately 1.5 meters above the ground (standard for measuring human environment), a couple are on the ground, some are immersed in Opinicon Lake, and some are mounted on horizontal arms extending out from a 3-legged steel television tower constructed there for that purpose. The sensors in 2003 were as follows:

- 1) Air Temperature – in a Stevenson Screen, 1.5m above ground
- 2) Relative Humidity – part of the Air Temperature probe; some unexplained variability
- 3) Rain – "tipping bucket" rain guage, 1.75m above ground
- 4) Soil Temperature – a few meters from the Stevenson Screen, 0.15m depth
- 5) Wind Speed – a cup anemometer 11.7m above ground on the TV tower
- 6) Wind Direction – a wind vane 13.5m above ground on the TV tower
- 7) Sky and Solar Radiation – a pyranometer 14.5m above ground on the tower
- 8) Water temperatures – downhill from the other probes, in Opinicon Lake at
 - i) 0.2m depth – unreliable in 2003. Some blocks of data collected.
 - ii) 1.2m depth – out of service in 2003. No useful data collected.
 - iii) 3.3m depth – functioned reliably throughout 2003
- 9) Black Globe temperature probe – out of service in 2003.

The micrologger is currently programmed to scan each sensor once every 5 seconds, and from the values so collected it calculates and stores data summaries at user-defined intervals. In 2003, the summary intervals used were 1 hour and 24 hours. The micrologger has been additionally programmed with instructions to record data summaries from selected sensors at 5-minute and 10-minute intervals, if so requested by a single function-key command from the computer; in 2003 neither of these short summarization intervals was used. Interested persons can, within reason, request customized summaries that pool existing intervals to give, for example, weekly or longer summarization intervals. The contact for this is Assistant Manager Floyd Connor.

Highlights and Comparisons of 2003 Weather

Perhaps the most outstanding feature of QUBS weather in recent years has been its variability, both within and among years. The table of ice dates for Lake Opinicon and the temperature and rainfall chart in this report illustrate this point in some detail.

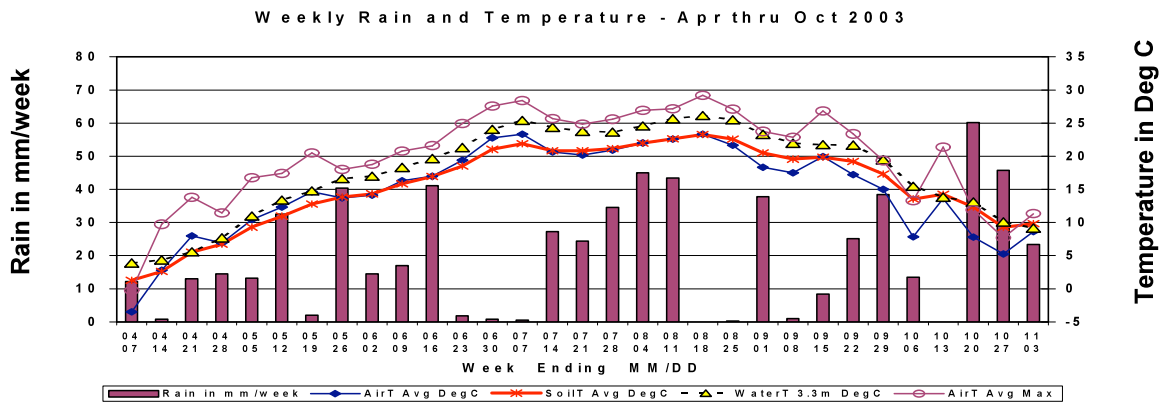
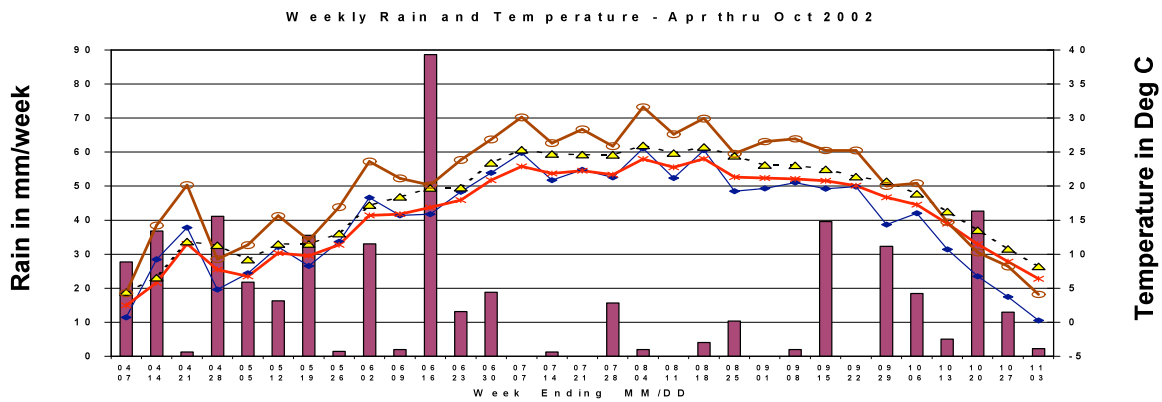
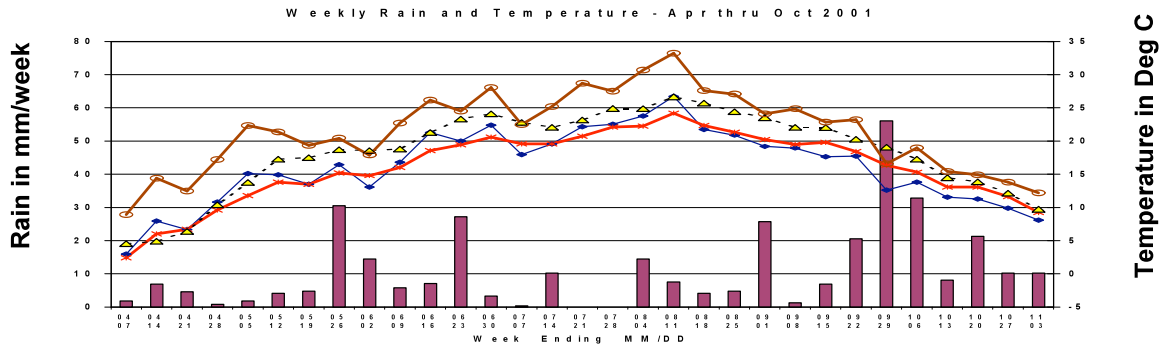
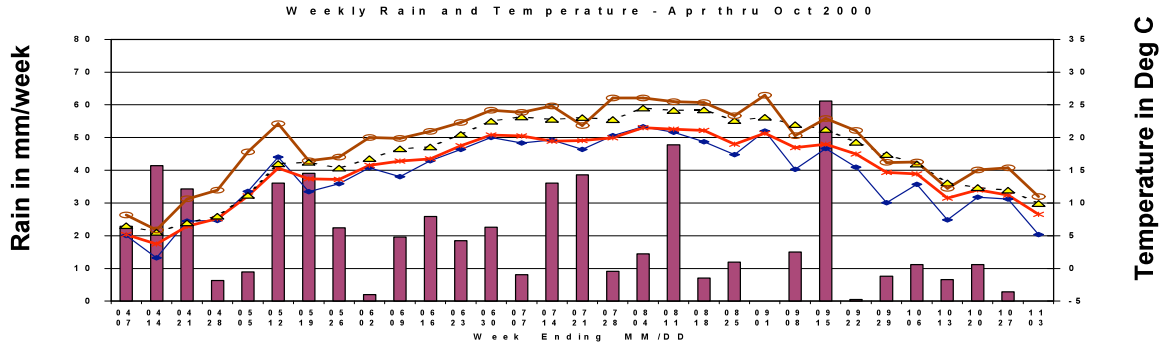
Formation of ice cover on Lake Opinicon was complete for the winter of 2002-2003 by 03 December 2002. Conditions after that time were not, however, particularly “wintry” and by 01 January 2003 Lake Opinicon ice was snow free and Upper Rock Lake was still 80% to 90% open water. That, however, was not enough to deter the ice fishermen who made their way out almost to the edge of the Upper Rock Lake ice near the mouth of Stonehouse Creek and proceeded to fish through the newly-formed ice.

On 02 January 2003, the Opinicon countryside was still brown and snow-free except for some very small traces in shaded low areas on the lee side of some forest patches. This, coupled with ice on swamps, created an opportunity for John Cunningham of the Aarssen lab at Queen’s to do some GPS mapping of swamp edges.

Most of the snowy part of winter was below freezing, and for the first time in a few years snow tended to accumulate in relatively soft and insulative layers. The first persistent snow of winter began to fall on 03 January 2003, with an accumulation of about 12 cm. The first rain of 2003 fell on 04 February, and was steady and moderately intense for most of the morning. Other than this, very little rain or melting occurred between 03 January 2003 and 14 March 2003, at which time the settled snow depth measured 56cm. 15 March 2003 was the first day significantly above zero for the year, and 16 March was the first day of significant melting and pools of water. There were lots of American Robins and Starlings to be seen along roadways, and there were reports of 2 Eastern Bluebirds nearby. On 18 March, Rod Green helped drill 2 holes in the Lake Opinicon ice offshore from Earl Cottage; one well out from shore had an ice depth of 60cm, and one near the probable outer edge of the littoral zone had an ice depth of 58cm. On 25 March 2003, the first Blue-Spotted Salamander of the season was seen on the Biological Station road; there was still a lot of snow cover and this turned out to be an early individual, but 3 more were seen on 28 March. Two Eastern Phoebe and a Brown-headed Cowbird were seen and heard singing at QUBS on 26 March, and on 27 March 2003 the Red-shouldered Hawks were calling. An Osprey was spotted at Chaffeys Lock on 30 March.

Early April marked a bit of a return to winter, with 15cm of snow falling on 2 and 3 April and temperatures being quite chilly. On 4 and 5 April, freezing rain and snow and ice pellets forced the cancellation of a hundred or more flights at Pearson International Airport, and at QUBS on 5 April Frank, and Ron Vinkle, were forced to put the sander back on the Biological Station truck and sand the road due to freezing rain and snow. Warming began again on 9 April, by 18 April a Common Loon called, and surprisingly by 19 April ice was out on Lake Opinicon.

April through October 2003 had some notable periods of frequent rain, and a couple of periods of 2 or 3 weeks with almost no rain at all. There was heavy rain on 28 November, followed by the first significant snowfall of autumn 2003 (about 6cm). Another 5cm fell on 2 December, and the rather chilly weather resulted in “Ice On” at Warner Lake on this date. Through 7 December, cold temperatures formed ice in Lake Opinicon bays but large areas were kept ice-free by strong northerly winds. Temperatures at 3.3m depth dropped to just above 1 degree Celsius. On the night of 7 – 8 December, winds dropped and suddenly Lake Opinicon had a complete ice cover. On 10 and 11 December temperatures warmed and a total of 44.5mm of rain fell. By this time, the snow was completely gone. A cold front on the night of 14



December 2003 deposited 13cm of snow, and gave us our first day of plowing, blowing, and shoveling for this season. Upper Rock Lake developed a complete ice cover around 16 December, according to observations generously shared with us by our good neighbours Elva and Stirling Danby. Between then and the end of the month, there was very little snow and generally warm temperatures, with a need for 2 bouts of sanding of the Biological Station road. Friday and Saturday, 2 and 3 January 2004, were very warm and the countryside was almost totally brown. On Sunday, 4 January 2004, temperatures dropped and snow began again, with what turned out to be “real winter” this time.

The included spreadsheet summarizes Ice ON/OFF dates for Lake Opinicon for the years 2000 through 2003. The reader is referred to the QUBS Annual Report 2001 for a summary of years 1995 through 2001. The charts of “Weekly Rain and Temperature – April through October” included here summarize those variables for the same period. The somewhat unusual variable “AirT Avg Max” is the average of the 7 daily air temperature maxima over the course of the week in question. Weather data are summarized beginning 01 April in each year, so the first week ends on “04 07”.

Ice ON/OFF Dates for Lake Opinicon, 2000 through 2003.

	2000	2001	2002	2003
Ice Off (“Ice Out”)	26 Mar	17 Apr	06 Apr	19 Apr
Final “Ice On” (Complete)	08 Dec	27 Dec	03 Dec	08 Dec



QUBS F₁: Catherine Verreault and Ariane, Jana Svec and Liam – baby shower, summer 2003

Table 1: Summary of enrolments in the Ontario Universities Program in Field Biology in 2003 (QUBS courses highlighted)

Course	Instructor	Affiliation	Module	Location	B	C	G	M	O	Q	To	Tr	Wa	We	Wi	Y	Other	TOTAL
1	Duthie	Waterloo	Costa Rica Rainforest & Reef	Costa Rica	1	1	3	2	0	2	0	2	4	0	1	0		16
2	Handford	Western	Desert Ecology	Arizona	0	0	1	2	0	4	0	0	0	5	0	0		12
3	Arnason	Ottawa	Tropical Ecosystems	Costa Rica	0	0	0	1	7	2	0	1	0	2	0	0		15
4	Lougheed/Blouin-Demers	Que/Ottawa	Amphibians & Reptiles	QUBS	0	1	1	0	4	3	1	1	0	1	0	0		12
5	Robertson	Queen's	Behav Ecol/Conserv Biol Birds	QUBS	1	0	0	1	1	6	0	2	0	0	0	0		12
6	Stutchbury	York	Forest Songbird Ecology	Pennsylvania	0	0	1	0	0	0	0	0	0	1	0	5		7
7	Rising	Toronto	Field Ornithology	HMSC	2	0	1	0	1	2	13	2	1	0	0	2		24
9	Hutchinson	Trent	Ecology of The Kawarthas	Pigeon Lake	0	0	0	1	0	0	1	5	1	2	0	1		11
10	Drouillard	Windsor	Great Lakes Field Biology	Windsor	0	0	0	1	1	3	1	0	0	4	1	0		10
13	Conlan	Carleton	Marine Invertebrates	HMSC	0	0	2	1	0	1	3	0	0	0	0	0	2	9
16	Hansell	Toronto	Arctic Ecosystems	Churchill, Man	0	1	1	1	0	3	6	1	1	0	0	0		14
18	Runtz	Carleton	St. Lawrence River Ecoregion	Dorset	0	6	0	0	0	0	2	2	1	1	0	0		12
19	Schreer	Waterloo	Marine Mammals & Seabirds	HMSC	0	0	4	1	1	3	3	1	0	2	0	1	1	17
20	Mable	Guelph	Ecology of Iceland	Iceland	0	0	13	0	0	2	0	0	0	0	0	0		15
21	Brooks	Guelph	Field Ecology	Algonquin Park	1	0	22	1	1	0	1	0	0	0	0	0		26
24	Gunderman	McMaster	Insect Taxonomy/Ecology	QUBS	0	0	1	4	0	2	0	2	0	0	0	3		12
26	Friesen	Queen's	Conservation of Biodiversity	QUBS	0	1	1	1	1	4	0	1	0	0	0	0		9
27	Francis	Queen's	Bird Migration and Ecology	LPBO	0	0	1	0	1	1	1	0	3	0	0	0		7
29	Staples	Western	Exptl Studies in Marine Biology	HMSC	0	0	3	0	0	3	3	0	1	3	0	0		13
30	Ferris	Toronto	Biogeochemical Processes	Deep River	0	0	0	0	0	0	5	0	0	0	0	0		5
32	Smith/Hawthorn	Waterloo	Terrestrial/Aquatic Biology	Algonquin Park	1	0	1	3	0	2	1	1	4	0	0	0		13
35	Sager	Trent	Wetland/Littoral Ecosystems	Pigeon Lake	0	0	1	1	0	2	1	4	0	0	0	1		10
36	Arnott	Queen's	Limnology of Stressed Ecoststs	Killarney Park	0	0	1	1	0	6	1	0	1	0	0	1		11
37	Thorn	Western	Flora of Algonquin Park	Algonquin Park	1	0	1	0	0	4	0	1	0	6	0	0		13
37a	Harmsen	Queen's	Siberian Ecosystems	Siberia	0	0	0	0	0	1	3	0	0	1	0	0		5
38	Kolasa	McMaster	Tropical Ecology	Jamaica	0	0	3	6	0	2	1	0	1	2	0	0		15
39	Williams	Toronto	Tropical Marine Biology	Barbados	0	0	3	0	1	1	10	0	0	0	0	0		15
				# of students	7	10	65	28	19	59	57	26	18	30	2	14	3	340
				# student-weeks	14	20	125	52	37	115	99	50	36	59	4	20	6	637

B=Brock C=Carleton G=Guelph M=McMaster O=Ottawa Q=Queen's To=Toronto Tr=Trent Wa=Waterloo We=Western Wi=Windsor Y=York

Table 2: Summary of credits earned in the Ontario Universities Program in Field Biology in 2003

	Brock	Carleton	Guelph	McMaster	Ottawa	Queen's	Toronto	Trent	Waterloo	Western	Windsor	York	Other	Total Student-Weeks	Total Half-Course Credits
Total Student-Weeks															
Not at QUBS	12	16	120	44	25	87	97	40	36	57	4	17	6	561	280.5
Total Student-Weeks															
at QUBS	2	4	5	8	12	28	2	10	0	2	0	3	0	76	38
Total Student-Weeks															
in Field Modules	14	20	125	52	37	115	99	50	36	59	4	20	6	637	
Total Half-Course															
Equivalents in Field Modules	7	10	62.5	26	18.5	57.5	49.5	25	18	29.5	2	10	3		318.5

11.9% of credits in entire program earned at QUBS in 2003 (13.5% in 2002; 14% in 2001; 24% in 2000; 13% in 1999)

21.3% of Queen's credits earned at QUBS in 2003 (41% in 2002; 30% in 2001; 47 % in 2000; 26% in 1999;)

Research Conducted by Queen's University Personnel in 2003

Dr. Lonnie W. Aarssen - Department of Biology

“Plant Ecology and Evolution”

Joyce Chau – “Size Asymmetry and Plant Co-occurrence” – B.Sc. Thesis

This project addresses the question of whether pairs of plant species may be spatially organized at different scales according to their size asymmetry. In an ‘old-field’ in the Lane Sargeant field at Queen’s University Biology Station, this question was addressed by considering a number of vegetation plots of variable size (10x10cm; 30x30cm; 50x50cm), to determine whether a given pair of species were more or less commonly associated than one would expect by chance organization in relation to the size asymmetry of that pair.

Assistants: John Cunningham, Bila Nagirner, Brandon Schamp, Andrew Stevens,
Jennifer Waugh

Acknowledgements: Funded by NSERC discovery grant to LWA

John Cunningham – “Mean-Variance Relationships in Plant Species Size” – B.Sc. Thesis

This project set out to determine the nature of the relationship between mean and variance in plant species size in vegetation plots of different sizes. The expectation, should interspecific competition be size driven, is that the mean-variance relationship should be significantly different than they would be if species organization is determined by chance processes. In the ‘old field’ portion of the Lane Sargeant field at Queen’s University Biology Station, flexible vegetation plots, measured in number of species per 50, 100, and 500 ramets rather than per unit of space, were used to address this question.

Assistants: Joyce Chau, Bila Nagirner, Brandon Schamp, Andrew Stevens, Jennifer
Waugh

Acknowledgements: Funded by NSERC discovery grant to LWA

Publications:

Laird, R., Pither, J. and Aarssen, L.W. 2003. Species evenness, not richness has a consistent relationship with productivity in old-field vegetation. *Community Ecology* 4: 21-28.

Paquin, V. and Aarssen, L.W. Allometric gender allocation shows adaptive plasticity in *Ambrosia artemisiifolia* (Asteraceae). *American Journal of Botany* (in press).

Thesis:

Schurer, M. (2003) Investigation of potential causes of stem bending in under-story tree saplings. BSc Honours Thesis, Queen’s University.

Dr. Shelley Arnott - Department of Biology

"Aquatic Ecology"

We are interested in the factors that determine community structure and function in lakes. Local factors include species interactions such as predation and competition. Regional factors primarily deal with dispersal, either from nearby lakes or from resting stages that were historically deposited in the lake sediments.

Alison Jackson – "Influence of *Graphoderus liberus* on *Daphnia* Behaviour and Life History Traits" – M.Sc. Thesis

Predators sometimes induce phenotypically plastic responses in their prey, which result in lower predation rates. *Daphnia* are known to respond to pelagic invertebrate predators such as *Chaoborus*, by growing 'neck teeth', increasing their helmet size, reproducing at larger sizes, and vertically migrating in the water column. Less is known about the response of *Daphnia* to other kinds of predators such as predaceous water beetle larvae (*G. liberus*). We exposed *Daphnia* to water which had contained *G. liberus* (predator cue) to determine if *Daphnia* would exhibit any phenotypically plastic traits in response to the predator. Several life history traits (e.g., age and size at reproduction, clutch size) morphological characteristics (e.g., body length, helmet length) were measured in treatment and controls (no *G. liberus* exposure). In addition, horizontal migration patterns were monitored, with and without predator cue.

Assistants: Jessica Forrest

Acknowledgements: NSERC PGS-A, NSERC Discovery Grant to SEA

Amanda Duffus – "A Comparison of Resting Egg Densities and Hatching Success in Acid and Reference Lakes" – B.Sc. Thesis

Thousands of lakes in Ontario were acidified because of high sulphur dioxide emissions from mining and smelting activities in Sudbury, ON. Strong emission controls have resulted in chemical recovery of many lakes. However, biological recovery has lagged. One possible explanation is that there are few colonists available to re-build communities. Many zooplankton taxa produce resting eggs as part of their life cycle. These eggs accumulate in lake sediments and can survive for decades to hundreds of years, making them possible sources of colonists in recovering lakes. We collected resting eggs from historically acidic (from Sudbury) and neutral lakes (from QUBS) to compare egg densities, hatching success, and species diversity in the egg bank. We hypothesize that egg densities, hatching success, and egg diversity will be lower in the historically acidic lakes. This could have important implications for biological recovery, if resting eggs are not available for re-colonization of chemically recovering lakes.

Acknowledgements: NSERC Discovery grant to SEA, Jessie Binks for helping set up protocol

Dr. Troy Day (Department of Mathematics and Statistics/Biology) and **Dr. Karen D. McCoy** (Post-Doctoral Research Associate, Dept. of Biology)

"Parasite Dispersal Strategies and Host Life Histories: Population Structure of the Two-Spotted Spider Mite *Tetranychus* sp."

Parasites are thought to trade off reproduction (associated with their level of virulence) for increased transmission to new host individuals. This project investigates this potential trade-off by examining virulence and dispersal rates of a polyphagous parasite, the spider mite *Tetranychus* sp. (Acari: Tetranychidae), in natural plant host populations.

This work was initiated in the summer of 2003. During this first field season, our goals were to 1) determine the prevalence and relative abundance of the mite on different plant hosts, 2) establish a workable protocol for population monitoring and estimating levels of parasite virulence (i.e., damage to the plant), and 3) collect mite samples at several spatial and temporal scales to later examine levels of population structuring using molecular markers.

These goals were largely achieved. We determined that, although occasionally found on other host plants, *Tetranychus* sp. was regularly present on *Aralia nudicaulis* (Araliaceae). We then established six semi-permanent plots around the station property to monitor the population dynamics and virulence of this mite throughout the growing season. Finally, we sampled parasite populations at numerous spatial scales and at three time intervals. These samples are currently being analysed at five microsatellite markers. Results from population monitoring and genetic analyses will be combined to determine whether the ecology of the host plant population affects the reproductive strategy adopted by the mite.

Assistants: Karen Choo and Erin Cameron

Acknowledgements: This research was supported by grants from NSERC, CFI, OIT to Troy Day. Financial support for Karen McCoy was provided by a NSERC Post-doctoral Research Award.

Dr. Dolf Harmsen (Department of Biology, Queen's University) and **Dr. Suzanne Blatt** (Department of Biology, Acadia University)

"Patterns in Ecological Succession in Old-Field Communities"

This long-term project was started in 1975, studying the overall community structure and successional changes in two abandoned hay fields. For the first 25 years intense sampling was carried out for both the vegetation, invertebrate population densities, soils, climate and effects of vertebrate grazers. On the basis of the resulting data set, various analyses have been conducted, and new theoretical approaches have been designed. Now that the vegetation has mostly grown beyond the grass and forb stage, sampling has been reduced to every three or four years. The year 2003 was a dormant year in the field. The year 2004 will see a re-sampling of all individual woody plants, a one-shot vegetation survey, and one or two quantitative insect collections.

Publications:

Blatt, S.E., J.A. Janmaat and R.Harmsen. 2003. Quantifying secondary succession: A measure for all sites? *Community Ecology* 4: 141-156.

Jim D. Karagatzides (Department of Geography, Queen's University), **Dr. Len J. S. Tsuji** (Environmental Science, University of Waterloo) and **Dr. Kurt Kyser** (Department of Geology, Queen's University)

“Effects of Bismuth Shotshell Pellets on Southern Ontario Sugar Maple Forests and Wetlands”

Lead is detrimental to the health of people and our ecosystems and has been banned for use in shotshell for hunting migratory birds but its use continues for hunting upland birds and mammals. Bismuth pellets are proposed as a non-toxic alternative yet there is scant information for the effects on bismuth on ecosystems. To examine the potential effects of bismuth pellets on southern Ontario ecosystems, we established parallel long-term monitoring plots in a sugar maple forest and sedge marsh at QUBS in 1999. The results will provide information for policy formulation to maintain sustainable environments.

Lisamarie Akeson – “Effects of Bismuth Shotshell and Simulated Acid Rain on Sugar Maple Tree-Ring Chemistry” – B.Sc. Thesis with Dr. Kyser, Queen’s University

A 5m x 5m plot was marked around 24 mature trees that were then randomly assigned to one of four treatments: bismuth, acidifying agent (ammonium sulphate pellets applied annually), bismuth plus acidifying agent, or control. In 1999, bismuth pellets were applied at 50 pellets m⁻², the average published rates of lead pellets for upland forests. Two questions are asked:

- (1) Does simulated acid rain increase soil acidity and increase the dissolution of Bi pellets in hardwood forest soils?
- (2) Is there a concomitant increase of Bi in tree-rings?

Nathan Fahey – “Effects and Fate of Bismuth Shotshell and Simulated Acid Rain on Southern Ontario Wetlands” - M.Sc. Student with Dr. Tsuji, University of Waterloo

Twenty-four circular plots (2 m diameter) were randomly assigned to one of four treatments: bismuth, acidifying agent (ammonium sulphate pellets applied annually), bismuth plus acidifying agent, or control. Bismuth pellets were applied in November 1999 at average published rates of 200 pellets m⁻² for wetlands. Two questions are asked:

- (1) Does simulated acid rain increase soil acidity and increase the dissolution of Bi pellets in marsh soils?
- (2) What is the effect of Bi and acid rain on the growth (biomass and shoot density) and nutrition of *Carex aquatilis*, the dominant plant species in the marsh?

Dr. Robert Montgomerie - Department of Biology

"Sperm Competition"

In 2003 we continued our research on sperm competition at QUBS, with two different projects, described below. Our ongoing studies of sperm competition continue to reveal some interesting patterns that are helping us to understand what influences the evolution of sperm morphology and behaviour. In bluegill sunfish, we measured some of the physiological influences on sperm behaviour and how females influence the fertilization success of different males by inhibiting or promoting sperm motility. In frogs we began to look at the distribution of sperm sizes and morphologies within and among species.

Gary Burness, Albrecht Schulte-Hostedde, Stephen Casselman – "Sperm Energetics of Parental and Sneaker Bluegill"

Due to the intense sperm competition faced by sneaker males, we expected that they might compensate by producing a superior ejaculate. We previously had some evidence (Leach and Montgomerie 2000 Behav Ecol Sociobiol 49:31-37) that sneaker sperm swam faster than parental male sperm so we sought to try to find out why. Our work in 2003 showed that sneakers have slightly longer sperm than parentals but, most important, that they also have higher ATP levels per spermatozoa and thus more energy available when they start swimming. This should give them a slight competitive advantage during spawning, everything else being equal and we are currently working on both a model to explain this and some tests to determine whether the model predicts relative fertilization success.

Leanne Youngman – "Sperm Competition and Sperm Evolution in Anurans" – B.Sc. Thesis

A recent study showed that interspecific variation in sperm length in Australian frogs was correlated with the intensity of sperm competition, with species experiencing higher levels having longer sperm and bigger testes, as has been found in some, but not all, other taxa. We set out to see whether a similar relation held for North American species and to that end measured sperm and testis characteristics in 18 species (some of which are at QUBS). As for Australian anurans, North American species that have more intense sperm competition have relatively longer sperm, on average but some apparent exceptions to this rule are puzzling and currently being investigated. We also looked at variation within spring peepers (*Hyla crucifer*) among ponds across southern Ontario and found a surprising amount of variation that remains unexplained though we are looking into possible effects of density, inbreeding and pollution.

Publications:

Burness G, Schulte-Hostedde A, Casselman S, Moyes C, Montgomerie R. 2004. Sperm morphology, motility and energy stores differ between reproductive tactics in male bluegill (*Lepomis macrochirus*). Behavioral Ecology & Sociobiology (in press)

Casselman S, Montgomerie R. 2004. Sperm traits in relation to male age and phenotype in colonial spawning bluegill, *Lepomis macrochirus*. Journal of Fish Biology (in press)

MacDougall AK, Montgomerie R, 2003. Assortative mating by carotenoid-based plumage colour: a quality indicator in American goldfinches, *Carduelis tristis*. Naturwissenschaften 90:464-467.

Mennill DJ, Doucet SM, Montgomerie R, Ratcliffe LM, 2003. Achromatic color variation in black-capped chickadees, *Poecile atricapilla*: black and white signals of sex and rank. Behavioral Ecology and Sociobiology 53:350-357.

Thesis:

MacDougall A, 2003 Reproductive correlates of plumage coloration in American goldfinches (*Carduelis tristis*). MSc Thesis, Queen's University

Dr. John Poland - Analytical Services Unit, Department of Environmental Studies

“An Interceptor Barrier for PCB Studies”

An interceptor barrier is being designed by the ASU to trap PCBs carried in water and on particles. The barrier is composed of a series of filters that would trap fine particles and absorb PCBs. We conducted a trial at QUBS using a wooden prototype to investigate how the barrier would perform under spring run off conditions. A suitable stream was located and the barrier installed by Dr John Poland and Dr John Page in early spring. The barrier was left in place during the runoff for approximately two months. Dr. John Poland then returned with two summer students (who are now both doing their masters at the ASU on this project), and they inspected and removed the barrier. The prototype barrier and an improved stainless steel version of the barrier were installed at Resolution Island, Nunavut this summer.

Dr. Laurene Ratcliffe - Department of Biology

“Communication and Mate Choice in Birds” and, with Dr. Peter Marra
(Smithsonian Environmental Research Institute)

"Linking Events of the Annual Cycle in a Long-Distance Migratory Bird Using Stable Isotopes"

Last year, 2003, marked a transitional year for our long-term studies of sexual selection in Black-capped Chickadees at QUBS, with defence of two theses on communication networks and life history (see below). Fieldwork monitored chickadee survival and breeding activity to provide baseline information for new communication experiments planned in 2004. In comparison, the field season measuring American Redstart breeding success in relation to past winter habitat occupancy was both intense and highly successful.

Assistants: William McLeish, Erik Coleman

Katie Langin – "Examining the Breeding Strategy of Female American Redstarts *Setophaga ruticilla* Using Stable Carbon Isotopes" – B.Sc. Thesis

Birds produce their eggs from recently ingested nutrients ("income breeders") or from body reserves ("capital breeders"). I used stable carbon isotopes to identify the breeding strategy used by a long-distance migratory bird, the American Redstart (*Setophaga ruticilla*). In 2002 and 2003, 160 eggs were collected from redstart nests in the Old Bedford Mills Road study plots. Stable carbon isotope analysis of the egg components were carried out in fall 2003 in Queen's Facility for Isotope Research (QFIR, PI Dr. Kurt Kyser, Geology). Within females, the isotope ratios of eggs from first clutches differ from those of subsequent clutches, with first clutch signatures more representative of over-winter habitats.

Assistants: Derek White, Melanie Ball, Rob MacIver

Acknowledgements: NSERC (L.M. Ratcliffe), NSERC UGSA (K. Langin)

Daniel Mennill – "The Song System and Mating Systems of the Black-Capped Chickadee: Communication Networks and Female Choice" - Ph.D. Thesis

Daniel Mennill's thesis was successfully defended in April 2003. The following is a summary of his research conducted during the previous year.

I tested how territorial male Chickadees respond to opponents who differ only in their relative contribution to song contests. Male Chickadees discriminated between loudspeakers broadcasting overlapping and overlapped songs, responding more aggressively to overlapping opponents. Further, males of high and low dominance status showed rank-related differences in their responses to intruders.

Following the publication of my research on female eavesdropping on male song contests in May 2002, many news agencies reported on our Chickadee research at QUBS including Nature, U.S.A. Today, The National Post, The Ottawa Citizen, The Kingston Whig-Standard, Birder's World magazine, New Scientist magazine, Season's magazine, The Discovery Channel, CNN, CBC's Quirks & Quarks, BBC radio, and National Public Radio. You can read more about chickadee research at QUBS on the internet (<http://www.biology.queensu.ca/~mennilld>).

Ryan Norris – "Linking Events of the Annual Cycle in a Long-Distance Migratory Bird Using Stable Isotopes"- Ph.D Thesis

We are using stable-isotopes to examine seasonal interactions in long-distance migratory bird, the American Redstart (*Setophaga ruticilla*). Individuals sampled upon arrival on the breeding grounds carry an isotopic fingerprint of the habitat used the previous season on the tropical wintering grounds. We use this system to explore two questions: 1) Does winter habitat quality in the tropics carry-over to influence the reproductive success of males and females on the breeding grounds? 2) How do breeding events, such as timing of nest initiation and nest failure influence the ability to acquire high quality habitat the following winter?

Assistants: Derek White, Melanie Ball, Rob MacIver

Acknowledgements: NSERC (L.M. Ratcliffe), National Science Foundation (P.P. Marra, T.W. Sherry), grants and scholarships to D. R. Norris from Wilson Ornithological Society, Cooper Ornithological Society, American Museum of Natural History, NSERC, Ontario government, and the Smithsonian Institute.

Kristin Schubert – “Lifespan, Social Rank and Lifetime Reproductive Success in Black-Capped Chickadees” (NB All fieldwork was completed in 2002) - M.Sc. Thesis

Kristin Schubert’s thesis was successfully defended in summer 2003. The following is a summary of her research conducted during the previous year.

This project examined the process of winter rank acquisition and its fitness consequences for male chickadees breeding at QUBS over 1992-2002. The data set used 22,000 dominance interactions observed in 155 flocks, and breeding data from 536 pairings. Among same-aged birds, rates of rank advancement varied individually, with some males attaining alpha status in their first year. Rank reversals among flock-mates were rare, and change (increase) in social rank was associated with change in flock membership. Alpha males were significantly leaner than same-aged but lower-ranked flockmates. Social rank predicted male survival better than age. Although average lifetime reproductive success was best predicted by life expectancy, male rank history also explained a significant portion of variation in realized reproductive success. The results show that social factors play an important role in the life history of this short-lived avian species.

Acknowledgements: NSERC (L.M. Ratcliffe)

Lisa Woodcock – “Is Black-Capped Chickadee Mate Choice Really Black and White? A Study of Achromatic Plumage Variation and Female Mate Choice” – B.Sc. Thesis

Recent studies using spectrometry reveal sex and individual variation in reflectance of achromatic (black and white) plumage of black-capped chickadees. To investigate whether this variation serves as a sexual signal, female mate choice trials (20 min duration) were carried out in an outdoor aviary during fall and early winter, when chickadees form pairs. A pilot study, which offered experienced females the choice of associating with their original mate versus a younger, unfamiliar male, housed in separate, adjacent compartments, showed females discriminated quickly in favour of their mate. The main study then used the same set-up to offer 14 mature but inexperienced females a choice between two age-matched, unfamiliar males. Females preferred males (1) with brighter plumage intensity and UV chroma, and (2) that achieved higher dominance rank in trials carried out after the mate choice study. These results demonstrate that female chickadees can assess male quality accurately without observing dominance interactions, and that achromatic plumage variation may play an important role in mate assessment.

Publications:

Christie, P. J., Mennill, D. J. and L. M. Ratcliffe. 2004. Chickadee song structure is individually distinctive over long broadcast distances. Behaviour: in press

- Christie, P. J., Mennill, D. J. and L.M. Ratcliffe. 2004. Pitch shifts and song structure indicate male quality in the dawn chorus of black-capped chickadees. *Behavioral Ecology and Sociobiology*: in press.
- Kasumovic, M.M., Ratcliffe, L.M. and P. T. Boag. Song structure may differ between male and female Least Flycatchers. *Wilson Bulletin* (accepted 23 July 2003)
- Kasumovic, M.M., Ratcliffe, L. M. and P. T. Boag. 2004. A method to improve confidence in paternity assignment in an open mating system. *Canadian Journal of Zoology*: in press.
- Mennill, D. J., Boag, P. T. and L. M. Ratcliffe. 2004. The reproductive choices of eavesdropping female black-capped chickadees, *Poecile atricapilla*. *Naturwissenschaften*: in press.
- Mennill, D.J., Doucet, S.M., Montgomerie, R. and L.M. Ratcliffe. 2003. Achromatic color variation in black-capped chickadees, *Poecile atricapilla*: black and white signals of sex and rank. *Behavioral Ecology and Sociobiology* 53: 350-357
- Mennill, D. J., Ramsay, S. M., Boag, P. T. and L. M. Ratcliffe. 2004 Patterns of extra-pair mating in relation to male dominance status and female nest placement in black-capped chickadees. *Behavioral Ecology*: in press.
- Mennill, D.J. and L.M. Ratcliffe. Overlapping and matching in the song contests of black-capped chickadees. *Animal Behaviour*: in press (accepted 11 Feb 2003)
- Mennill, D.J. and L. M. Ratcliffe . 2004. Do male black-capped chickadees eavesdrop on song contests? A multi-speaker playback experiment. *Behaviour*: in press.
- Norris, D.R., Marra, P.P., Kyser, T.K., Sherry, T.W. and L. M. Ratcliffe. 2003. Tropical winter habitat limits reproductive success on the temperate breeding grounds in a migratory bird. *Proceedings of the Royal Society B (London)*: in press.
- Otter, K. and L. Ratcliffe. 2004. Enlightened decisions: female assessment and communication networks. In McGregor, P.K. (ed) *Communication Networks*. Cambridge University Press (in press)
- Ramsay, S.M., Mennill, D.J., Otter, K.A., Ratcliffe, L. M. and P. T. Boag. 2003. Sex allocation in black-capped chickadees *Poecile atricapilla*. *Journal of Avian Biology* 34: 134-139
- Ramsay, S.M. and L. M. Ratcliffe. 2003. Determinants of social rank in female black-capped chickadees (*Poecile atricapilla*). *Canadian Journal of Zoology* 81: 117-121

Theses:

- Mennill, D. J. 2003. The song system and mating system of black-capped chickadees: eavesdropping and female choice. Ph.D. Thesis, Queen's University, pp xi + 156

Schubert, K. A. 2003. Lifespan, social rank and lifetime reproductive success in black-capped chickadees. M.Sc. Thesis, Queen's University, pp xii + 142

Dr. Raleigh J. Robertson - Department of Biology

“Behavioural Ecology and Conservation Biology of Birds”

Our field program in 2003 continued with on-going studies of Tree Swallows (Catherine Dale and Sherilee Harper, with supervision from Mary Stapleton), Cerulean Warblers (Kate Girvan with Visiting Scientist Clive Bealey) and Golden-winged Warblers (Rachel Fraser, Bill McLeish, Kate Neville and Kevin Fraser). We also made modest efforts to continue studies on Black-and-white Warblers, based on Melinda Collins' M.Sc. work, as part of the spring field course on Behavioural Ecology and Conservation Biology of birds taught by myself with Mary Stapleton as TA.

With Bill McLeish having finished his field studies on Eastern Kingbirds in 2002, no field work was done on EAKI's in 2003, and that study was in the analysis stage with Bill defending his thesis in February 2004.

Dr. Clive Bealey, a landscape ecologist from the UK, worked with Kate Girvan on the Cerulean Warbler project for the period 1 - 14 June 2003, to explore new avenues for doing landscape level work with our local Cerulean populations.

Catherine Dale - "Does Nest Composition Affect Blowfly Infestation?" - B.Sc. Thesis

Over the summer, Sherilee Harper and I monitored tree swallows nesting in the QUBS boxes. We captured and banded adults as well as nestlings. I also carried out an experiment to determine if nest composition affected the infestation of nests by parasitic blowflies. Nests from the North East Sanctuary (a wetland grid), composed mainly of pine needles, were switched with grass nests from terrestrial habitats. After nestlings had fledged, nests were sorted and blowfly larvae and pupal cases were counted.

Rachel Fraser – “Examining the Genetic Architecture of a Newly Formed Hybrid Zone Between Golden-winged and Blue-winged Warblers” – Ph.D. Thesis

During the summer of 2003 Rachel worked with Kate Neville and Bill McLeish studying Golden-winged Warblers at QUBS. Fieldwork involved finding, capturing and banding adult birds, locating nests, as well as collecting blood samples from adult birds and nestlings, and mapping nests sites using the GPS. Blood samples collected were used in paternity analyses that examined whether female Golden-winged Warblers engage in extra-pair copulations (EPCs), and whether EPC's are ever sought from heterospecific males (i.e. Blue-winged Warblers and hybrids). In addition, the samples collected in 2003 were added to two previous years worth of samples and are currently being used in molecular genetic analyses that are examining the scale of hybridization in the QUBS population. It is our hope that these data will ultimately help explain the affects of widespread hybridization between Golden-winged and Blue-winged Warblers on Golden-winged Warblers breeding throughout Canada and the north-eastern United States.

In addition, in early spring Rachel, Kate and Bill worked in collaboration with Ryan Norris and his field assistants to build a large outdoor aviary on QUBS property. The aviary was used to examine mate-choice decisions by female Golden-winged Warblers in a controlled environment. Preliminary trials were conducted in 2003 and will form the basis for extensive aviary work to be carried out in 2004.

Assistants: Kate Neville & Bill McLeish

Chris Gibb – “A Study of Haematozoan Prevalence and Intensity in Cerulean Warblers (*Dendroica cerulea*) Across Their Breeding Range” – B.Sc. Thesis

Chris Gibb wrapped up a study of blood parasites in six Cerulean Warbler populations during the breeding season. She, along with co-authors Dr. Jason Jones, Kate Girvan, Jennifer Barg and Dr. Raleigh Robertson, submitted a manuscript to the Canadian Journal of Zoology entitled, "Range-wide variation in haematozoan prevalence and intensity in the cerulean warbler (*Dendroica cerulea*) during the breeding season."

Kate Girvan – “Examining dispersal and Migratory Connectivity in the Cerulean Warbler (*Dendroica cerulea*) Using Stable Isotope Analysis” – M.Sc. Thesis

The 2003 CERW field crew consisted of Kate Girvan, Kevin Fraser and Clive Bealey (visiting British researcher). We monitored Ceruleans on the Old Bedford Mills Road study plots for May and the first half of June and banded 21 new males, and 1 new female. 12 nests were found and monitored throughout the season. Kate Girvan spent the rest of the summer analyzing Cerulean feather samples in the Geology Isotope lab at Queen’s University, and writing up her thesis. She successfully defended her M.Sc. thesis at the end of September.

Assistants: Kevin Fraser and Clive Bealey

William McLeish – “Breeding Habitat Use, Selection and Nest Success Across Multiple Spatial Scales by Eastern Kingbirds (*Tyrannus tyrannus*)”- M.Sc. Thesis.

This investigation comprises two components: First, it is a study of the habitat use and selection of Eastern Kingbirds in small (<19.5 hectares in area) beaver ponds, wetlands and lakes embedded within a forest matrix. Secondly, it is an investigation into habitat choice and habitat selection by breeding Eastern Kingbirds across multiple spatial scales. The main questions of the thesis are broken down into two sets: 1) What is the minimum wetland area required for the presence of Kingbirds? Can this be accurately predicted, and if so what variables (e.g. patch area, nest substrate availability, isolation) are involved? 2) Which consistent nesting site preferences are observed across different macrohabitat types (comparing ephemeral wetlands, large lakes, and uplands)? Are these habitat factors related to nesting success? Data collection occurred in the spring and summer of 2001 and 2002. Factors monitored included settlement, nesting, clutch initiation, clutch size, hatching success, and fledging success. Data were also collected on habitat characteristics around nest sites (vegetation data from 1m radius to 100m radius), and within 'available' habitat.

Assistants: Kate Neville

Mary Stapleton – “Why do Female Tree Swallows (*Tachycineta bicolor*) Mate Multiply? Testing the Genetic Compatibility Hypothesis” – Ph.D. Thesis

During the summer of 2002, Mary and her field assistants, Catherine and Sherilee, monitored the reproductive efforts of Tree Swallows breeding in nest boxes located on QUBS property. All pairs of Tree Swallows nesting in boxes were monitored to determine clutch size, hatching success as well as fledging success. Blood samples were taken from adults and nestlings to be used in a genetic study examining the role of the genetic compatibility and relatedness in mate choice in this species. Mary is currently in her fourth year of the Ph.D. program at Queen's University.

Assistants: Catherine Dale and Sherilee Harper

Kate Neville – “Nestling Sex Ratios in Golden-winged Warblers (*Vermivora chrysoptera*): Is There Evidence of a Cost of Hybridization?” – B.Sc. Thesis

The 2003 summer field season proved an excellent starting point for my fourth year undergraduate thesis project on sex ratios of Golden-winged Warbler (*Vermivora chrysoptera*) nestlings. In collaboration with Rachel Fraser and Bill McLeish, 40 first nests and 8 renests were found for Golden-winged Warbler pairs, at study sites in the Bonwill, Hughson, Pangman, and Bracken reserves. Blood samples were collected for 105 nestlings from 21 broods. The blood samples were analyzed this fall, using molecular methods to determine the sex of each nestling. Results may indicate some of the selective pressures acting on hybridization that occurs between Golden-winged Warblers and Blue-winged Warblers (*V. pinus*).

Publications:

Demmons, T, W.J. McLeish, R.J. Robertson. The effects of edge linearity and edge profile on nest predation at forest-field edges. In review – The Condor.

Jones, J. 2003. Tree Swallows (*Tachycineta bicolor*): a new model organism? Auk 120: 591-593.

Jones, J., J. J. Barg, T. S. Sillett, M. L. Veit, and R. J. Robertson. in press. Minimum estimates of survival and population growth for Cerulean Warblers breeding in Ontario, Canada. Auk. (accepted 03/07/23).

Theses:

Collins, M.L. 2003. Area utilization, evidence of cooperative breeding, sex ratio bias and nest-site selection in Black-and-white Warblers (*Mniotilta varia*). M.Sc. Thesis. Queen's University. 86pp.

Dale, C. 2003. Factors affecting the infestation of Tree Swallow nests by parasitic blowflies (*Protocalliphora sialia*). B.Sc. Thesis, Queen's University. 47pp.

- Gibb, C. 2003. A study of haematozoan prevalence and intensity in Cerulean Warblers (*Dendroica cerulea*) across their breeding range. B.Sc. Thesis. Queen's University. 50pp.
- Girvan, M.K. 2003. Examining dispersal and migratory connectivity in Cerulean Warblers (*Dendroica cerulea*) using stable isotope analysis. M.Sc. Thesis. Queen's University. 86pp.
- Panczuk, J. 2003. Patterns in the size and blackness of throat and auricular patches among male Black-and-white Warblers (*Mniotilta varia*). B.Sc. Thesis. Queen's University. 51pp.

Dr. Bruce Tufts, (Department of Biology, Queen's University) and **Dr. Jim Kieffer** (Department of Biology, University of New Brunswick)

“Evaluating the Potential to Minimize Physiological Disturbance Associated with Live-Release Angling Tournaments for Largemouth Bass, Smallmouth Bass and Walleye”

The practice of releasing fish following angling (catch-and-release) has increased dramatically in the past few decades. The rise in popularity of catch-and-release has been partially due to the increasing popularity of live-release angling tournaments. While releasing fish following normal angling does not typically result in mortality, studies have documented that mortality of fish following tournaments can occur. Our lab has previously been interested in the physiological responses of largemouth bass, smallmouth bass and walleye to the challenges associated with catch-and-release angling. Recently, we have begun to examine the physiological disturbances that arise in largemouth bass, smallmouth bass and walleye during live-release angling tournaments. The goal of our research is to minimize the physiological disturbance associated with angling and angling tournaments, and to maximize the survival of fish caught during these events.

Cory Suski – “Quantification and Alleviation of Physiological Disturbances in Largemouth Bass (*Micropterus salmoides*) and Smallmouth Bass (*M. dolomieu*) during Competitive Angling Events” – Ph.D. Thesis

Live-release angling events present fish with a number of different challenges. During a tournament, largemouth bass are exposed to a number of situations where they may encounter sub-lethal concentrations of ammonia, the effects of which are largely unknown. Research at QUBS in the summer of 2003 focused on ammonia excretion rates, uptake of ammonia, and effects of ammonia on recovery from exercise in largemouth bass. In addition, valuable field assistance provided by professional angler ‘Big’ Jim McLaughlin allowed us to verify earlier angling tournament simulations by better replicating actual tournament conditions.

Assistants: Kevin Esseltine, ‘Big’ Jim McLaughlin

Publications:

Furimsky, M., S. J. Cooke, C. D. Suski, Y. Wang and B. L. Tufts. 2003. Respiratory and circulatory effects of hypoxia in largemouth bass and smallmouth bass: an application to “live-release” competitive angling events. Transactions of the American Fisheries Society 132:1065-1075.

Suski, C. D., S. S. Killen, M. Morrissey, S. G. Lund and B.L. Tufts. 2003. Physiological status of largemouth bass, *Micropterus salmoides*, following live-release angling tournaments. North American Journal of Fisheries Management 23:760-769.

Suski, C. D., S. S. Killen, S. J. Cooke, J. D. Kieffer, D. P. Philipp and B. L. Tufts. Physiological significance of the weigh-in during live-release angling tournaments for largemouth bass. Transactions of the American Fisheries Society (Provisionally Accepted.)



Dr. Allen Keast, Dr. Ted Brown and Dr. Raleigh Robertson at the start of Keast Celebration

Research Conducted by Non-Queen's Personnel in 2003

Dr. Gabriel Blouin-Demers (Department of Biology, University of Ottawa)

"Thermal Ecology of Reptiles"

The general goal of my research program is to understand how temperature affects the ecology of reptiles. Ecological effects of global warming have been reported in a number of taxa (e.g., earlier bird and butterfly migrations), but not in reptiles. Global warming should affect reptiles particularly because, as ectotherms, most aspects of their life history are temperature dependent. The first objective of my research program is to determine how reptiles at the northern extreme of their distribution will be affected by global warming. The cost-benefit model of thermoregulation predicts that thermoregulatory effort should be highest in habitats of high thermal quality because the cost of thermoregulating is low. My work on black rat snakes suggests the opposite, probably because the cost of not thermoregulating is high in habitats of low thermal quality. The second objective of my research program is to understand how the thermal quality of habitats influences thermoregulatory effort by reptiles.

Since 1996, I have also been involved in a long-term study of black ratsnakes with Patrick Weatherhead (University of Illinois). The current goals of this study are to document the effects of global warming on the demography of ratsnakes and to deploy artificial nests designed to decrease egg parasitism by the burying beetle *Nicrophorus pustulatus*. The fieldwork we conducted at QUBS in 2003 had several objectives relevant to the above goals. (1) Continue the long-term demographic study of the black ratsnake population. (2) Recapture some of the 1600 neonates marked and released since 1996. (3) Build, deploy, and monitor artificial nesting sites.

Assistants: Ariane Blouin, Grégory Bulté, Steve Stoddard, Catherine Verreault

Acknowledgements: OMNR, PC, NSERC, ESRF

Laura Bjorgan – "Ontogenetic Shifts in Habitat Use and Movement Patterns of Ratsnakes"

– M.Sc. Thesis (unofficially co-supervised by Patrick Weatherhead)

My work at the QUBS focuses on ontogenetic differences in the movement patterns and habitat use of the black ratsnake, which is included in the Canadian list of threatened species. The goals of this research are (1) to enhance our understanding of ontogenetic processes in terrestrial species and (2) to contribute to the design of conservation efforts for the black ratsnake through the identification of critical habitat for juveniles. My work during this past summer included following juvenile black ratsnake movements using radio telemetry and identifying habitat preferences through habitat characterization of snake locations.

Assistant: Grégory Bulté

Acknowledgements: OMNR, PC, NSERC

Alana Edwards - "Thermoregulation of Painted Turtles in Habitats Differing in Thermal Quality" – M.Sc. Thesis

I have been studying the thermal ecology of painted turtles, examining the different levels of thermoregulation between individuals in a lake or a marsh habitat. The data are collected with thermosensitive radiotelemetry. Individuals have a radio transmitter attached to the carapace, which allows the individuals to be located and their temperature and activity recorded every 48 hours. This information will then be analyzed to determine which environment results in higher levels of thermoregulation.

Assistant: Grégory Bulté

Acknowledgements: NSERC

Jeffrey Row – "Habitat Use in Milksnakes" – M.Sc. Thesis

In North America and especially in Canada little is known about habitat usage and life history of eastern milksnakes. This year at QUBS, we began the first major radio telemetry study of this species in North America. The goals of this research are to determine habitat use at multiple scales through radio-tracking and habitat analysis. We tracked a total of 13 milksnakes this summer and collected habitat data on over 200 individual snake locations. The results from this study should help provide useful information towards any conservation efforts for this or any other species of conservation concern.

Assistant: Grégory Bulté

Acknowledgements: NSERC

Grégory Bulté - "Reproductive Ecology of the Burying Beetle *Nicrophorus pustulatus*, an Ophidian Egg Parasitoid" – B.Sc. Thesis (UQTR)

Recently, the beetle *Nicrophorus pustulatus* was discovered to be a parasitoid of snake eggs, but nothing is known of its breeding ecology. I documented the breeding ecology of *Nicrophorus pustulatus* in the lab by filming pairs of adults breeding on both snake eggs and mice carcasses. The beetles used both substrates, but difficulty in getting large number of adults prevented a quantitative assessment of their preferences. Further studies are possible if we can find a better way to obtain the adults.

Assistants: Gabriel Blouin-Demers

Acknowledgements: ESRF

Publications:

Blouin-Demers, G. 2003. Precision and accuracy of body-size measurements in a constricting, large-bodied snake (*Elaphe obsoleta*). Herpetological Review, in press.

Blouin-Demers, G. & Gibbs, H. L. 2003. Isolation and characterization of microsatellite loci in the black rat snake (*Elaphe obsoleta*). Molecular Ecology Notes, 3, 98-99.

- Blouin-Demers, G., Prior, K. A. & Weatherhead, P. J. 2002. Comparative demography of black rat snakes (*Elaphe obsoleta*) in Ontario and Maryland. *Journal of Zoology*, 256, 1-10.
- Blouin-Demers, G. & Weatherhead, P. J. 2002. Habitat-specific behavioural thermoregulation by black rat snakes (*Elaphe obsoleta obsoleta*). *Oikos*, 97, 59-68.
- Blouin-Demers, G. & Weatherhead, P. J. 2002. Implications of movement patterns for gene flow in black rat snakes (*Elaphe obsoleta*). *Canadian Journal of Zoology*, 80, 1162-1172.
- Blouin-Demers, G., Weatherhead, P. J. & McCracken, H. A. 2003. A test of the thermal coadaptation hypothesis with black rat snakes (*Elaphe obsoleta*) and northern water snakes (*Nerodia sipedon*). *Journal of Thermal Biology*, 28, 331-340.
- Weatherhead, P. J., Blouin-Demers, G. & Cavey, K. M. 2003. Seasonal and prey-size dietary patterns of black ratsnakes (*Elaphe obsoleta obsoleta*). *American Midland Naturalist*, 150, 275-281.
- Weatherhead, P. J., Blouin-Demers, G. & Prior, K. A. 2002. Synchronous variation and long-term trends in two populations of black rat snakes. *Conservation Biology*, 16, 1602-1608.

Dr. John Epifanio (Illinois Natural History Survey and University of Illinois at Urbana-Champaign)

“Cooperative Breeding Behaviour in Bluegill: Genetic Analysis of Kin Selection”

Natasha A. Silich - "Relatedness and Kin Selection in Bluegill Colonies"– M.Sc. Thesis

The focus of my research is to determine whether or not bluegill within a breeding colony are related to one another and benefit from this behavior of kin selection. Data for specific, spawning bluegill colonies was collected at Lake Opinicon in May-June 1999 and 2002. The field collection in May-June 2003 was conducted at several study sites in Lake Opinicon, including Alistair's Bay, Brook's Bay Entrance, Lazy Loon Lodge, and Huffman Bay. During two separate spawning bouts at each location, the colonies present were mapped, then fin clips and scales were collected from the parental male attending the nest. On average the spawning colonies contained ~ 50 to 100 parental males. The DNA present in fin samples from 1999, 2002, and 2003 is currently being isolated to perform microsatellite analysis using five variable loci. Using this analysis in conjunction with scale aging will provide estimates of relatedness among the parental males of a colony. This study will provide important insights into the ultimate cause of cooperative breeding in bluegill sunfish, and contribute greatly to a deeper understanding of kin selection.

Assistants: John Epifanio, David Philipp, Julie Claussen, Brandon Barthel, Deanna Barthel, Anne Readel, Sara Terranova, and Kyle Hanson

Dr. Mark R. Forbes (Department of Biology, Carleton University)

"Ecological Entomology"

In 2003, a number of projects were initiated, whereas others were partially or wholly finished. All projects this year dealt with the ecology of damselflies and dragonflies, particularly in relation to season, weather-related temperature variation, parasitism by mites, and foraging behavior. The work on parasitism by mites includes ongoing collaborations with Drs. Bruce P. Smith (Ithaca College) and Robert Baker (University of Toronto at Mississauga). The work on how apparent aposematism in flies influences food choice by dragonflies was done in collaboration with Dr. Tom Sherratt and a jointly supervised doctoral student.

Tonia Robb – "Weather-Related Tolerance/Immunity in Damselflies" – Ph.D. Thesis

Tonia's research at QUBS in 2003 was multifaceted. She completed collection of data on weather-dependent temperature variation and immune expression. Those data indicate that bouts of cool weather are associated with reduced immune expression in damselflies from early and late-emerging cohorts. Such findings are important as the success of parasites on their hosts may well depend on the weather experienced by both. For example, reduced immunity with poor weather, could result in parasites having greater effects on damselfly fitness. Alternatively, insect immunity can be costly and result in reduced survival, if immune expression is followed by inclement weather, as recently shown for bumblebees. Often, the efficacy of biocontrols of pest species is weather dependent.

Arash Rashed – "The Evolution of Warning Colors in Syrphid Flies" – Ph.D. Thesis

Birds are thought to account for the evolution of warning coloration, such as black and yellow stripes indicative of wasps, on harmless insects such as Syrphid flies. Arash has argued that invertebrate predators are often more numerous and potentially exert stronger selection than endothermous vertebrates. Recent studies have shown that dragonflies also avoid warningly colored insects. However in those studies, warningly colored insects were also large and size-selective preference by dragonflies for smaller prey items was not excluded. In a series of experiments based on presentation of tethered live prey, Arash has shown that *Sympetrum* dragonflies and other dragonflies do not avoid medium-sized Syrphid flies that appear as wasp mimics, but they do avoid large prey items. Arash has also questioned earlier findings as the wasp mimics appear to come out earlier in the season than their supposed models.

Assistant: Chris Beatty

Marc Lajeunesse – "Local Adaptation Studies: Mites and Dragonflies" – Technician

In addition to assisting with other studies, Marc managed to finish writing up papers for publication while at QUBS. His main research interest was whether generalist versus specialist parasites differ in their likelihood of showing local adaptation (i.e. a parasite does better on local versus non-local population of hosts). He tested some of the suppositions of both verbal and mathematical models of local adaptation using *Limnochares americana* mites and two of their

host dragonflies. Marc first used a meta-analysis to show that generalist parasites are often not well adapted to local populations of given host species; he then demonstrated that mites on a less abundant host were less likely to engorge than were mites on a more abundant host. This research suggested local tracking of abundant host species by mites, similar to research from other study systems.

Assistant: Silvia Laimgruber

Publications:

Forbes MR, Muma KE, Smith BP. 2002. Diffuse coevolution: constraints on a generalist parasite favor use of a dead-end host. *Ecography* 25:345-351.

Forbes MR, McRuer DL, Rutherford PL. Natural history of three frog species and prevalence of *Aeromonas hydrophila*. Accepted. *Ecoscience*.

Forbes MR, Muma KE, Smith BP. Accepted. Recapture success of *Sympetrum* dragonflies in relation to size, symmetry and mite parasitism. Accepted. *Exp. Appl. Acarology*

Hecker KR, Forbes MR, Leonard NJ. 2002. Parasitism of *Enallagma boreale* damselflies by gregarines: sex biases and relations to adult survivorship. *Can. J. Zool.* 80:162-168

Lajeunesse MJ, Forbes MR, Smith BP. Species and sex biases in successful ectoparasitism of dragonflies by mites. Accepted. *Oikos*

Lajeunesse MJ, Forbes MR 2003. Variable reporting and quantitative reviews: a comparison of three meta-analytical techniques. *Ecology Letters* 6: 448-454.

Lajeunesse MJ, Forbes MR. 2003. A comparison of structural size and condition in two female morphs of the damselfly, *Nahalennia irene* (Hagen). In press. *Odonatologica*.

Lajeunesse MJ, Forbes MR. 2002. Host range and local parasite adaptation. *Proc. Roy. Soc. Lond. Series B* 269: 703-710.

Schalk G, Forbes MR, and Weatherhead PJ. 2002. Phenotypic plasticity in green frog (*Rana clamitans*) embryos and hatchlings: effects of a leech (*Macrobdella decora*) predator. *Copeia* 2:445-449.

Wong A, Smith ML, Forbes MR. 2003. Differentiation between subpopulations of a polychromatic damselfly with respect to morph frequencies, but not neutral genetic markers. In press. *Molecular Ecology*

Yourth CP, Forbes MR, Baker RL. 2002. Sex differences in melanotic encapsulation responses (immunocompetence) in the damselfly, *Lestes forcipatus* Rambur. *Can. J. Zool.* 80: 1568-1583.

Yourth CP, Forbes MR, Smith BP. 2002. Immune expression in a damselfly is related to time of season and not to fluctuating asymmetry or host size. *Ecological Entomology* 27:123-128.

Dr. James H. Fullard (Department of Zoology, University of Toronto at Mississauga)

"Sensory Ecology of Insects"

This summer's activities saw a tying up and submission of past projects on the defensive lifestyles of earless versus eared moths (Soutar), the changes to auditory defences in exclusively diurnal moths (Muma), the effects of nocturnal fish predation on moth flight (Guignion) as well as a new investigation of the acoustic startle response of tiger moths (Fullard) and a pilot project to see if we can quantify another anti-bat defense, directional avoidance flight. This year we also resurrected our colony of Dogbane tiger moths after a 3 year hiatus to use as a source for our winter work at UTM and for next summer's projects.

"Acoustic startle response of tiger moths to bat sounds"

Moths possess a remarkable variety of defences against the threat of predation by insectivorous bats. Bats emit ultrasonic (to human ears) navigational calls (echolocation) that provide them with information about the size, distance and possibly identity of their potential prey. In turn, moths listen for these calls and respond with flight behaviours appropriate to their perceived risk. It has been hypothesized that the two-celled ears of noctuid moths govern a bimodal defensive response with distant (i.e., faint) bats evoking controlled avoidance flight (i.e., far-bat response) while close (i.e., intense) bats evoke erratic, 'last-ditch' flight (i.e., near-bat response, acoustic startle response (ASR)). Certain species of tiger moths (Arctiidae) add to their ASR by producing ultrasonic clicks which apparently deter bats either by warning them of the noxious quality of the moth (aposematism) or by interfering with the echolocation processing of the bat (jamming). To support the theory of acoustic aposematism, it was proposed that arctiid moths do not exhibit the noctuid flight ASR since dropping from the sky would be maladaptive to an already-protected moth. Using our ASR measurement paradigm we have determined that arctiid moths do exhibit reduced flight ASR compared to noctuid moths but that this is not a function of their ability to produce sounds and may be more related to their increased diurnality.

Acknowledgements: I thank Raleigh Robertson, Frank Phelan, and Floyd Connor of Queen's University for permission to use their facilities and Cassandra Guignion and Kit Muma for their assistance in the field and in the lab. This study was funded by a research grant from the Natural Sciences and Engineering Research Council of Canada.

Amanda R. Soutar – "Nocturnal Anti-predator Adaptations in Nearctic Lepidoptera"
– M.Sc. Thesis

Nocturnal, flighted insects face the predatory threat of insectivorous bats while living in reduced light conditions. Most moths have evolved ultrasound sensitive ears to detect the

approach of bats; however, there are moths that have remained earless. We tested the hypothesis that throughout the night, earless moths fly less than eared moths, which our results confirmed. In this way, earless moths are likely concealed from foraging bats. The amount of nocturnal flight differs amongst moths, with most species flying during both day and night, and only some moths being exclusively nocturnal or diurnal. We tested the hypothesis that moths with greater nocturnality have larger eyes, and that earless moths possess larger eyes with which to see bats since they do not have the long-range detection defences of eared moths. We showed that the eyes of moths increase in size with the degree of nocturnality, but that there is no difference between eared and earless moths. Earless moths may have evolved large size to make themselves difficult targets for small bats. Although our results support this prediction using a database of moths collected in the same area as our study, the existence of many small earless moths combined with recent observations of bats eating large moths leaves this trait as a still questionable defence. The possession of ears also appears to have influenced the diversification of moths, as we found that earless moths are less species rich than eared moths.

Acknowledgements: I thank Raleigh Robertson, Frank Phelan, and Floyd Connor of Queen's University for permission to use their facilities and Cassandra Guignon, Kit Muma, John Ratcliffe, and Christine Belanger for their assistance in the field and in the lab. I also thank Jerry Brunner for his statistical help. This study was funded by a research grant from the Natural Sciences and Engineering Research Council of Canada.

Cassandra Guignon - "The Potential Cost of Responding to Bats in Moths Flying Over Water Surfaces" – B.Sc. Thesis

The evasive flight of eared moths to attacking bats has received much attention in the literature but relatively few studies have been made of the potential costs for this behaviour. Since bats and moths co-habit the airspace over lakes we examined the fate of moths that land upon the surface of a lake in simulation of an evasive power dive away from a bat. Of 102 different sized moths from 18 species that were dropped onto the surface of a lake in eastern Ontario, Canada, 61 percent were eaten by fish in an average of 31.3 seconds with no correlation of escape success and wing surface area. We tested for the possible survival benefit of wing scales by comparing the escape success of descaled gypsy moths (*Lymantria dispar*) to that of sham-operated individuals. All of the descaled individuals were consumed while 63% of the control individuals escaped suggesting a new function for lepidopteran scales. This study represents the first empirical report of nocturnal fish predation on moths and predicts that moths will avoid lake surfaces when reacting to bat attacks.

Acknowledgements: I thank Raleigh Robertson, Frank Phelan, and Floyd Connor of Queen's University for permission to use their facilities and Amanda Soutar, Kit Muma, and John Ratcliffe for their assistance in the field and in the lab. This study was funded by a research grant from the Natural Sciences and Engineering Research Council of Canada.

Kit Muma (Ithaca College) – "Auditory Constraints and Ultrasound Sensitivity in Moth Ears"

Many moths have ears sensitive to ultrasound produced by echolocating bats. Moths that can hear a foraging bat can evade capture. Larger moths require more sensitive ears since they present a larger target and would be detected at a greater distance. Some moths have avoided bat predation by altering their daily activity patterns so as not to overlap with bats. In a previous study we examined a small day-flying moth (Geometridae: *Trichodezia albobittata*; with large abdominal ears) and found that it reacted to ultrasound both physiologically and behaviorally even though it is no longer subject to bat predation (Muma and Fullard in prep.). Other studies on noctuid moths, a group with ears located on their thorax, have shown that ear size does not simply increase with body size (Surlykke et al. 1999). They suggested that ear size is constrained to match the range of ultrasound emitted by bats. During the summer of 2003 I studied a variety of factors influencing sensitivity to ultrasound in inchworm moths (geometrids): I predicted that, because they have been released from bat predation, 1) the diurnal moth should have smaller ears than other geometrids based on body size, 2) diurnal species and species that avoid activity when bats are calling will have more asymmetrical tympana.

Acknowledgements: I thank Amanda Soutar, Cassandra Guignon for assistance. This research supported by a 2003 Summer Research Grant from the Provost at Ithaca College.

Publications:

Fullard, J.H., Muma, K.E., and Dawson, J.W. 2003. Quantifying an anti-bat flight response in eared moths. *Canadian Journal of Zoology* 81, 395-399.

Ratcliffe, J. M. and Dawson, J. W. 2003. Behavioural flexibility: the little brown bat, *Myotis lucifugus*, and the northern long-eared bat, *M. septentrionalis*, both glean and hawk prey. *Animal Behaviour* 66: 847-856.

Theses:

Soutar, A. 2003. Effects of nocturnal lifestyle on the visual morphology and flight behaviour of Nearctic moths. M.Sc. Thesis, U. of Toronto, Mississauga, Ont.

Guignon, C. 2003. Effects of fish predation on the nocturnal defensive behaviour of Nearctic moths. B.Sc. Thesis, U. of Toronto, Mississauga, Ont.

Dr. Jim Kieffer (Centre for Fish Metabolism and Energetics, Department of Biology, University of New Brunswick)

“Physiological and Behavioural Aspects of Catch and Release Angling on Largemouth Bass”

In collaboration with Dr. Bruce Tufts (Queens) and his students (Cory Suski, Kevin Esseltine), the focus of this research project was to examine the impacts of tournament angling on the physiology, behaviour and survival of largemouth bass. QUBS served as the “research hub” for most of our experiments.

Dr. Jan T. Lifjeld (University of Oslo, Norway)**Oddmund Kleven, Frode Jacobsen** (both U. of Oslo), **Rasa Izadnegahdar and Dr. Raleigh J. Robertson** (both Queen's University)

“Paternity and Offspring Quality in the North American Barn Swallow (*Hirundo rustica erythrogaster*) ”

This study was part of the doctoral thesis project of Oddmund Kleven entitled “*The function of extra-pair fertilization in passerine birds*”. Kleven holds a doctoral fellowship from the Research Council of Norway together with Professor Jan T. Lifjeld as supervisor.

The principal objective of the doctoral project is to “*reveal to what extent female birds enhance offspring fitness through extra-pair fertilization*”. Usually, female birds seem to receive no direct benefits except sperm in extrapair copulation. It is therefore generally believed that females pursue extra-pair copulations to achieve some form of indirect genetic benefit, but very little empirical evidence for any such benefits exist. In one species, the bluethroat (*Luscinia svecica*), an immunocompetence benefit has been documented (Johnsen et al 2000, Nature 406, 296-299). Offspring sired by extra-pair males had a higher cellular immunocompetence than their maternal half-siblings sired by the resident male. Extra-pair young also had a higher immune response than their paternal half-sibs (i.e. offspring sired by the same male in his own nest). These results are consistent with a model of variable female preferences exerted in extra-pair mate choice for compatible genes rather than good genes per se. The doctoral project aims at examining the generality of these findings on a number of other passerine species.

One of the sub-goals, which applied to the barn swallow study at QUBS in 2003, was to “*test whether an immunocompetence benefit through good-genes mate choice applied to species with a directional female mating preference for phenotypic sexual traits in males*”. The barn swallow is one of several model species in behavioral ecology. It is well documented that the long tail streamers in males of this species is a sexually selected trait that has evolved through female mate choice. Males with long tail streamers are preferred in both social and sexual mate choice. Barn swallow females thus seem to have similar mating preferences, as opposed to the variable preferences documented for bluethroats. One would therefore expect males with long tail streamers to possess high quality viability genes, so that their offspring perform better than offspring of males with shorter streamers.

The field work took place in breeding colonies of barn swallows located in the district around QUBS during the period 29 April until 15 July.

Dr. Scott A. MacDougall-Shackleton (Departments of Psychology and Biology, University of Western Ontario)

“Integrative Studies of Birdsong”

Our research addresses the mechanistic bases of birdsong production and perception, as well as the reproductive and population-level effects of variation in singing behaviour.

Jeremy Pfaff – “Song Repertoire Size and Male Quality in the Song Sparrow (*Melospiza melodia*)” – M.Sc. Thesis

Male song sparrows sing from 5 to 13 different variants of their species-typical song (song repertoire). In captivity female song sparrows exhibit greater sexual responses to a playback of many song types than to playback of few song types. We are conducting a long-term study of song repertoires and male quality in a population of song sparrows breeding on the Bracken Tract. This involves i) recording the entire song repertoires of the local males, ii) locating nests and collecting DNA samples from males, females and nestlings, iii) collecting blood samples for parasite analyses, and iv) taking morphological measures to evaluate physical measures of quality. This research will allow us to determine if behavioural preference for large song repertoires seen in the lab actually lead to increased reproductive success in the field.

Assistant: Julia Panczuk

Thesis:

Pfaff, J.A. (2003) Song repertoire size and male quality in the song sparrow (*Melospiza melodia*). B.Sc. Thesis, University of Western Ontario

Dr. Bryan D. Neff (Department of Zoology, University of Western Ontario)

“Origins and Dynamics of Alternative Mating Tactics in Bluegill Sunfish”

My laboratory conducted two studies at the QUBS this summer. First, we investigated kin recognition systems of nest-tending parental male bluegill. Parentals are regularly cuckolded during spawning by specialized parasitic males. We were interested in testing whether parentals could differentiate their offspring from non-offspring within their nest. Parentals and females were collected from natural colonies in Lake Opinicon just prior to spawning and used to produce offspring of known parentage using *in vitro* fertilization techniques. After the eggs hatched, each parental was given two odour samples in a two-choice experimental set-up conducted in the aquatic facility at the station. One sample was scented with the male’s own offspring and the other with a foreign male’s. We found that parentals spent significantly more time associated with the scent of their own offspring. Because the parentals had never come into contact with the offspring prior to the experiment, the results strongly suggest that they were able to use their own odour as a referent template in kin recognition. This mechanism of recognition is receiving increasing support in the animal kingdom, and may be particularly important in systems where no other reliable cues of kinship exist. It has been termed “self-referencing” by Paul Sherman and euphemistically termed the “arm-pit effect” by Richard Dawkins.

We examined the risk sensitivity during foraging of offspring produced by parental males versus the parasitic cuckolded males. We again used *in vitro* fertilization to produce offspring of known parentage. The offspring were tested in two-choice trials where the fry could choose to forage in a risky or safe area. Any differences in foraging decisions between the offspring of

parentals versus cuckolders can be attributed to differences in genetic quality. These data will help to understand the origins of the alternative parental and cuckolder life histories.

We investigated parental care and sperm competition using high tech tracking equipment and video cameras.

Collaborators: Dr. Paul W. Sherman (Cornell)

Students: Joanna Lister, MSc Candidate; Sarah Magee, MSc candidate; Jeff Stoltz, MSc candidate

Assistants: Beth Clare (Western, summer NSERC)

Publications:

Neff, BD, P Fu and MR Gross. 2003. Alternative male mating tactics and sperm investment in bluegill sunfish. *Behavioural Ecology*, 14:634–641.

Neff, BD and PW Sherman. 2003. Nestling recognition via direct cues by parental male bluegill sunfish (*Lepomis macrochirus*). *Animal Cognition*, 6:87-92.

Neff, BD. 2003. Decisions about parental care in response to perceived paternity. *Nature*, 422:716-719.

Neff, BD. 2003. Paternity and condition affect cannibalistic behavior in nest-tending bluegill sunfish. *Behavioral Ecology and Sociobiology*, 54:377–384.

Dr. David P. Philipp (Illinois Natural History Survey and University of Illinois at Urbana-Champaign)

“Long-term Monitoring of Largemouth Bass and Smallmouth Bass Reproductive Success”

The impact of early variation in mating and reproductive success is not well understood for many species of fish, especially for species with long-term parental care. To address this issue in largemouth and smallmouth bass, we have been monitoring the reproductive activities at several sites within Lake Opinicon, including four islands and 2 km of mainland shoreline. These habitats have been surveyed annually during the spawning season by visual swims using a mask and snorkel. Data collected included the date of each individual spawn, location of the nest, depth, assessment of mating success (number of eggs laid), size of parental male, and duration of parental care for each male, as well as the occurrence of hookwounds from angling. Visual swims to determine number of Age-1 and Age-2 largemouth and smallmouth bass are also done to assess year class strength. By determining the success or failure of each male in raising a brood, we can then calculate total fry production for each site each year. These data can then be correlated with year class strength one and two years later.

Assistants: Julie Claussen, Brandon Barthel, Anne Readel, Jim Ludden, Jana Svec, Deanna Iwaniec, Natasha Silich, Sara Terranova, and Kyle Hanson

“Conservation Sanctuaries as Management Tools”

Sanctuaries or conservation zones have been proposed for use in protecting spawning areas of certain fish by many conservation agencies. Current regulations in Ontario prohibit angling for nesting bass while they are spawning and providing parental care for their young. Existing regulations do, however, allow angling for other game fish such as crappie and northern pike. As a result, it is possible to inadvertently hook a nesting bass while legally angling for another game fish. Our research has demonstrated that catching and releasing a male bass can lead to an increase in their nest abandonment and can affect reproductive success within a water body. One alternative management strategy that may prove more effective at preventing angling male bass out of season is legislating one or more no-fishing bass conservation zones within each key body of water. When properly enforced, these conservation zones can reduce the harmful effects of angling and can lead to an increase in nesting success. Current research is being conducted to assess the efficacy of conservation zones, as well as designing protocols to predict areas preferred by nesting bass. Once developed, this protocol would allow the OMNR to establish bass conservation zones using recognizable cues, such as littoral zone character, shoreline features, and bathymetric maps.

Assistants: Brandon Barthel, Anne Readel, Jana Svec, Steven Cooke, Jim Ludden, Deanna Iwaniec, Julie Claussen, and Frank Phelan

“The Physiological Ecology of Parental Care in Centrarchid Fishes”

We have been studying the energetics and cardiovascular performance of six species of paternal care providing centrarchid fishes that occur syntopically in Lake Opinicon, Ontario. The duration of parental care, activity patterns and energetic costs varied widely among species. Overall, the duration of care increased with increasing parental size. When energetics were adjusted for the species-specific differences in the duration of parental care, the cost of parental care increased with the size of the fish. Fish with extended parental care exhibited stage-specific patterns of activity and energy expenditure consistent with parental investment theory, whereas fish with short duration parental care tended to maintain high levels of activity throughout the entire parental care duration. Resting cardiovascular values were consistently higher for nesting fish when adjusted for variation in temperature. When exposed to exhaustive exercise, nesting fish took longer to exhaust but recovered more rapidly than non-nesting individuals. The maximal cardiac variables were usually slightly higher in nesting fish than non-nesting fish such that cardiac scope was maintained during the parental care period. Several cardiovascular variables were correlated with parental care metrics. Collectively, these data suggest that parental care providing fish possess adaptations that enhance their ability to provide protracted care at high intensities and reveal the important link between physiological performance and fitness. These data also reveal the extreme energetic consequences of parental care.

Assistants: Steven Cooke, David Philipp, and Patrick Weatherhead

Brandon Barthel – “Reproductive Ecology and Seasonal Movement of Smallmouth Bass in the Mississippi River Watershed” – M.Sc. Thesis

Our INHS research team has been studying the reproductive ecology of smallmouth bass in Millers Lake and the portion of the Mississippi River just upstream from it. These studies have focused on monitoring the reproductive success of individual nesting male smallmouth bass. The data gained from these ongoing projects continue to provide insight into recruitment mechanisms and nest-site fidelity, improving our ability to manage and conserve smallmouth bass populations. A three-year telemetry project concluded in the summer of 2002. Over 40 adult bass of both genders were located throughout each year, most frequently during the reproductive period. The study has resulted in detailed assessments of pre and post spawn movements and provided insight into habitat use and seasonal movements. It has also led to the hypothesis that multiple life history strategies may be present among the fish of the system. This comprehensive project will continue to improve the understanding of the ecology of smallmouth bass.

Assistants: David Philipp, Deanna Iwaniec, Jana Svec, Jim Ludden, Anne Readel, Sara Terranova, Kyle Hanson, Julie Claussen, and Frank Phelan

Kyle Hanson – “The Use of a Permanent Hydrophone Array to Assess the Impact of Angling on the Behaviour and Reproductive Success of Largemouth Bass” - M.Sc. Thesis

The specific objective of this study is to assess the impact of catch-and-release angling on the behavior of nesting male largemouth bass through the use of a hydrophone array deployed in Warner Lake (Lotek Ecological Observatory). The study began in October of 2003 with the implantation of acoustic transmitters into 14 male and 10 female largemouth bass. In mid-late spring of 2004, at the beginning of spawning season, snorkeling surveys will locate all bass nests along the shoreline. Fish implanted with transmitters will then be separated into a control group and two treatment groups. One treatment group will be subjected to simulated catch-and-release angling (hooking, capture, brief air exposure, and release within 5m of their nest in under 5 minutes), while the other treatment group will be subjected to simulated tournament angling (hooking, capture, livewell confinement for three hours, and release from a central location at least 500m from the majority of nest sites). Subsequent movement and behavior will be recorded not only by the array, but also by video cameras set up at selected nests. This study will gather detailed data on both basic largemouth bass behavior during spawning and also responses to catch-and-release and tournament practices.

Assistants: David Philipp, John Epifanio, Brandon Barthel, Deanna Iwaniec, Anne Readel, Sara Terranova, Frank Phelan

Publications:

Barthel, B.L., S.J. Cooke, C.D. Suski, and D.P. Philipp. 2003. Effects of landing net mesh type on injury and mortality in a freshwater recreational fishery. *Fisheries Research* 63: 275-282.

- Bunt, C.M., S.J. Cooke, and D.P. Philipp. 2002. A simple technique for obtaining radio signals from deep water. *North American Journal of Fisheries Management*. 23: 258-263.
- Cooke, S. J., K.M Dunmall, J. F. Schreer, D.P. Philipp. 2001. The Influence of terminal tackle on physical injury, mortality, handling time, and cardiac disturbance of rock bass. *North American Journal of Fisheries Management* 21:333-342.
- Cooke, S. J., R.S. McKinley, and D. P. Philipp. 2001. Physical activity and behavior of a centrarchid fish, *Micropterus salmoides*, during spawning. *Ecology of Freshwater Fish* 10: 227-237.
- Cooke, S.J., C.M. Bunt, J.F. Schreer, and D.P. Philipp. 2002. Attachment, validation, and preliminary deployments of ultrasonic heart rate transmitters on largemouth bass, *Micropterus salmoides*. *Aquatic Living Resources*. 15: 155-162.
- Cooke, S.J., D.P. Philipp and P.J. Weatherhead. 2002. Parental care patterns and energetics of smallmouth bass, *Micropterus dolomieu*, and largemouth bass, *M. salmoides*, monitored with activity transmitters. *Canadian Journal of Zoology*. 80:756-770.
- Cooke, S.J., J.F. Schreer, K. Dunmall, and D.P. Philipp. 2002. Quantifying the sublethal effects of marine catch-and-release angling – novel insights from freshwater applications. Pp 100- 135 in : American Fisheries Society Symposium on Catch and Release in Marine Recreational Fisheries.
- Cooke, S.J., J.F. Schreer, D.H. Wahl, D.P. Philipp, C.D. Suski, and B.L. Tufts. 2002. Interfacing cardiac physiology with fisheries management through studies of catch-and-release angling effects on Centrarchid fishes. Pages 27-31 in K. Gamperl, A.P. Farrell, and D. MacKinlay, eds. *Cardiovascular physiology of fish*. International Congress on the Biology of Fishes. Vancouver, BC.
- Cooke, S.J., J.F. Schreer, D.P. Philipp, and D.H. Wahl. 2002. Physiological impacts of catch-and-release angling practices on largemouth bass and smallmouth bass. Pp 489-512 in D.P. Philipp and M.S. Ridgway (editors) *Black Bass 2000: Ecology, conservation and management*. American Fisheries Society Symposium 31, Bethesda , MD.
- Cooke, S.J., C.D. Suski, B.L. Barthel, K.G. Ostrand, B.L. Tufts, , and D.P. Philipp. 2003. Injury and mortality induced by four hook types on bluegill and pumpkinseed. *North American Journal of Fisheries Management* 23: 883-893.
- Epifanio, J. M. and D. P. Philipp. 2001. Simulating the extinction of parental lineages from introgressive hybridization: the effects of fitness, initial proportions of parental taxa, and mate choice. *Reviews in Fish Biology and Fisheries* 10: 339-354.
- Kubacki, M, F. Phelan, J Claussen , and D.P. Philipp. 2002. How well does a closed season protect spawning bass in Ontario? Pp 371-378 in D.P. Philipp and M.S. Ridgway (editors) *Black Bass 2000: Ecology, conservation and management*. American Fisheries

Society Symposium 31, Bethesda , MD.

Schreer, J.F., S.J. Cooke, and D.P. Philipp. 2002. Are fish primarily stroke volume modulators?: not according to the centrarchids. Pages 79-85 in K. Gamperl, A.P. Farrell, and D. MacKinlay, eds. Cardiovascular physiology of fishes. International Congress on the Biology of Fishes. Vancouver, BC.

Suski, C.D., F. Phelan, M.F. Kubacki, and D.P. Philipp. 2002. The use of sanctuaries to protect nesting black bass from angling. Pp 371-378 in D.P. Philipp and M.S. Ridgway (editors) Black Bass 2000: Ecology, conservation and management. American Fisheries Society symposium 31, Bethesda , MD.

Suski, C. J.H. Svec, J.B. Ludden, F.J.S. Phelan, and D.P. Philipp. 2003. The impact of catch-and-release angling on the parental care behavior of male smallmouth bass. Transactions of the American Fisheries Society 132: 210-218.

Dr. Thomas N. Sherratt (Department of Biology, Carleton University)

“Evolution and Maintenance of Mimicry and Warning Signals in Insects”

After finishing a successful winter project in the lab, Arash Rashed (Ph.D. Student, Carleton) and Christopher Beatty (Ph.D. Student, Carleton) started the summer project at QUBS. One project was initiated and the other one successfully completed during the field season. These projects mainly investigated the evolution and maintenance of mimicry and warning signals in insects, and more particularly hoverflies and damselflies.

Arash Rashed – “The Evolution and Maintenance of Mimicry in Hoverflies” – Ph.D. Thesis

Vertebrate predators, particularly birds, are considered as the main selective agent in the evolution of Batesian mimicry. However, it is quite possible that predation by insects far exceeds avian predation. Arash’s research at QUBS in summer 2003 was conducted to investigate the implication of invertebrate predation for the evolution of mimicry, using dragonflies as a model visual predator. In this study a pair-wise presentation method was used in order to evaluate the response of dragonflies in the field to warningly-coloured and mimetic natural and artificial prey. Overall, dragonflies preferred small-size flies over large-size flies and lepidopterans. Most importantly, dragonflies did not show any tendency to avoid the imperfect wasp mimic *Toxomerus giminatus* (Diptera: Syrphidae) or small warningly-coloured artificial prey. The results of this study showed no evidence to support the contention that warning signals and mimicry protect small insect prey from attack by dragonflies.

Assistant: Christopher D. Beatty

Christopher D. Beatty – “The Evolution of Warning Signals in Coenagrionid Damselflies”
– Ph.D. Thesis

Chris' research was initiated, at QUBS in summer 2003, in order to investigate the evolution of warning signals in *Nehalennia irene* (Odonata: Coenagrionidae). While many of Coenagrionid species are sexually dimorphic, females of these damselflies often demonstrate a colour polymorphism; some individuals exhibit the predominant female colouration (heteromorphs) and behaviour, while a percentage of the female population look and behave more like males (andromorphs). This research has been conducted to explore the theory that this complex of colours has developed as a result of warning signaling between males, rather than through female mate choice. In this theory, males are brightly coloured as a means to signal their "maleness" to other males, and to thus deter other males from attempting to mate with them. Andromorphic females function as mimics, avoiding excessive male attention by mimicking the male signal. Unlike previous research, which has focused on female colouration and survivorship, this project will focus on male traits and the benefits imparted to them by their colouration. The data collection for this study will be completed in the next field season.

Assistant: Arash Rashed

Publications:

Sherratt, T.N., A. Rashed & C.D. Beatty (*in press*) The evolution of locomotory behaviour in profitable and unprofitable simulated prey. *Oecologia*.

Sherratt, T.N. & C.D. Beatty (*in press*) The evolution of warning signals as reliable indicators of prey defense. *American Naturalist*.

David F. Sherry (Department of Psychology, University of Western Ontario)

“Behavioural, Cognitive and Neuroanatomical Sex Differences in the Brown-headed Cowbird”

Our research examines sex differences in memory and cognition in brown-headed cowbirds. Cowbirds are brood parasites. Females search for host nests but males do not. Our previous research showed that the hippocampus – a part of the brain involved in memory and spatial ability – is larger in female cowbirds than in males. At QUBS we collected cowbirds to be trained on laboratory tasks that compare male and female spatial and non-spatial abilities. In this way we will be able to determine whether sex differences in ecology and the brain are correlated with sex differences in memory and cognition.

Sara B. Lattanzio – “Sex Differences in Memory and Cognition in Brown-headed Cowbirds” - Ph.D. Thesis

Male and female brown-headed cowbirds were trained to peck a computer touch screen to obtain food. The touch screen apparatus allows us to present a wide variety of visual stimuli

to the birds. In a typical task, coloured shapes appear on the screen and birds must discover by pecking which one produces food. After a delay, stimuli re-appear in an altered arrangement and birds must remember either the spatial location of the correct stimulus or its distinguishing features. Preliminary data show better performance by both males and females on spatial versions of the task.

Acknowledgments: This research is supported by NSERC and the University of Western Ontario Academic Development Fund. Special thanks to Scott MacDougall-Shackleton.

Publications

Hoshooley, J. S. and D. F. Sherry, D.F. in press. Seasonal stability in hippocampal neurogenesis, neuron number and volume in the food-storing black-capped chickadee (*Poecile atricapillus*). Behavioral Neuroscience.

Hoshooley, J. S. and D. F. Sherry. 2003. The role of caching experience in the survival of new neurons in the hippocampus of adult food-storing black-capped chickadees. Program No. 720.21 Society for Neuroscience Abstracts, 2003. 33rd Annual Meeting, New Orleans LA.

Lattanzio, S. B. and D. F. Sherry. 2003. Do sex differences in ecology and neuroanatomy predict sex differences in memory in the brood parasitic brown-headed cowbird (*Molothrus ater*)? Program No. 115.9 Society for Neuroscience Abstracts, 2003. 33rd Annual Meeting, New Orleans LA

MacDougall-Shackleton, S. A., D. F. Sherry, A. P. Clark, R. Pinkus and A. M. Hernandez. 2003. Photoperiodic regulation of food-storing and hippocampus volume in black-capped chickadees, *Poecile atricapilla*. Animal Behaviour 65: 805-812.

Sherry, D. F. in press. Brain and behaviour. In: J. J. Bolhuis, and L.-A. Giraldeau (Eds.) The Behaviour of Animals: Causation, Function and Evolution. Blackwell Publishers: Oxford UK.

Sherry, D. F. and J.B. Mitchell. in press. Neuroethology of foraging. In D.W. Stephens, R. C. Ydenberg, and J. S. Brown (Eds.) Foraging. University of Chicago Press: Chicago.

Thesis:

Szekeres, B. A. 2003. Spatial orientation and landmark use in black-capped chickadees (*Poecile atricapilla*). M.A. Thesis. Department of Psychology, University of Western Ontario, London ON Canada.

Dr. Bruce P. Smith (Biology Department, Ithaca College, Ithaca, NY)

"Water Mite Parasitism of Aquatic Insects"

Knee surgery meant that I had to revise my plans for summer 2003, so I spent much of my time writing papers. I finished off some work (and a manuscript) on pheromone communication in *Arrenurus* spp. water mites, demonstrating that often, there is pheromone cross-attractancy among co-occurrent species grouped within the same species complexes. Interspecific sex pheromone responsiveness can thus be used as another source of evidence for phylogenetic affinity among species. I also continued to gather material for testing pheromone communication and contact mate-guarding behaviour of virgin females by male *Arrenurus planus* water mites.

Publications:

Bohonak, A., B.P. Smith, and M.R. Thornton 2004? Distributional, morphological and genetic consequences of dispersal for temporary pool water mites (Acari: Arrenuridae: *Arrenurus*). *Freshwater Biology*, Accepted pending minor revision.

Forbes, M.R., K.E. Muma, and B.P. Smith 2002. Diffuse coevolution: constraints on a generalist parasite favor use of a dead-end host. *Ecography* 25: 345- 351.

Forbes, M.R., K.E. Muma, and B.P. Smith 2003?. Recapture of dragonflies at an emergence pond in relation to gender, phenology, wing length and symmetry, and parasitism by mites. *Experimental and Applied Acarology*. Accepted pending minor revisions; invited paper for a special Dec. issue.

Smith, B.P., and J. Hagman 2002. Experimental evidence for a female sex pheromone in *Arrenurus manubriator* (Acari: Hydrachnida; Arrenuridae). *Experimental and Applied Acarology* 27: 257-263.

Smith, B.P. 2003. Diversity of stylostome structure among parasitic larval water mites (Acari: Hydrachnida), pp 239-255 *in* From Yankee Springs to Wheeny Creek: An Acarological Tribute to David R. Cook, edited by I.M. Smith. Indira Publishing House.

Smith, B.P., and J. Florentino 2003?. Communication via sex pheromones within and among *Arrenurus* spp. mites (Acari: Hydrachnida; Arrenuridae). *Experimental and Applied Acarology*. Accepted pending minor revisions; invited paper for a special Dec. issue.

Dr. Patrick J. Weatherhead (Program in Ecology and Evolutionary Biology, University of Illinois at Champaign-Urbana)

"Long-term Studies of Snakes and Birds"

The long-term study of black ratsnakes continued in 2003. This study is being done collaboratively with Dr. Gabriel Blouin-Demers, who provides details of the study in his entry in this report. Analysis of data from studies of northern watersnakes and red-winged blackbirds is ongoing.

Publications:

Blouin-Demers, G, KA Prior & PJ Weatherhead. 2002. Comparative demography of black rat snakes (*Elaphe obsoleta*) in Ontario and Maryland. *Journal of Zoology* 256: 1-10.

Blouin-Demers, G & PJ Weatherhead. 2002. Habitat-specific behavioural thermoregulation by black rat snakes (*Elaphe o. obsoleta*). *Oikos* 97: 59-68.

Blouin-Demers, G & PJ Weatherhead. 2002. Implications of spatial and movement patterns for gene flow in black rat snakes (*Elaphe obsoleta*). *Canadian Journal of Zoology* 80: 1162-1172.

Blouin-Demers, G, PJ Weatherhead & HA McCracken. 2003. A test of the thermal coadaptation hypothesis with black rat snakes and northern water snakes. *Journal of Thermal Biology* 28: 331-340.

Blouin-Demers, G, PJ Weatherhead & JR Row. 2004. Phenotypic consequences of nest site selection in black ratsnakes (*Elaphe obsoleta*). *Canadian Journal of Zoology*, in press.

Brown, GP & PJ Weatherhead. 2004. Sexual abstinence and the cost of reproduction in adult male watersnakes, *Nerodia sipedon*. *Oikos* 104: 269-276.

Cooke SJ, JF Schreer, DP Philipp, & PJ Weatherhead. 2003. Nesting activity, parental care behaviour, and reproductive success of smallmouth bass, *Micropterus dolomieu*, in an unstable thermal environment. *Journal of Thermal Biology* 28: 445-456.

Weatherhead, PJ & G Blouin-Demers. 2004. Understanding avian nest predation: why ornithologists should study snakes. *Journal of Avian Biology*, in press.

Weatherhead, PJ & G Blouin-Demers. 2004. Long-term effects of radiotelemetry on black ratsnakes. *Wildlife Society Bulletin*, in press.

Weatherhead, PJ, G Blouin-Demers & KM Cavey. 2003. Seasonal and prey-size dietary patterns of black rat snakes (*Elaphe obsoleta obsoleta*). *American Midland Naturalist* 150: 275-281.

Weatherhead, PJ, G Blouin-Demers & KA Prior. 2002. Synchronous variation and long-term trends in two black rat snake (*Elaphe o. obsoleta*) populations. *Conservation Biology* 16: 1602-1608.

Wind Damage and Repair at “Loon Island”, Lake Opinicon

The following interesting account and photographs were received by Raleigh Robertson from Sherwood Wright of Toronto, who has a cottage on Lake Opinicon near “Loon Island” (the small island in Lot 14, Con X of South Crosby Ward of Rideau Lakes Twp, between “Snake Island” and the entrance to “Deadlock Bay”) and who was a previous owner of the “Cape-Sauriol Environmental Studies Area” of QUBS. The island has been home to an Osprey nest and a Common Loon nest for several years. Sherwood writes:

I thought you might find the enclosed snap shots interesting. They were taken by Cynthia Wright on the dates indicated. The August 16 picture was, of course, taken because of the ospreys and does not show much of the island in its pre-storm state. August 29 was the day of the micro blast that uprooted most of the trees on the island and several more on the mainland to the east. September 20 was shortly after Nick D’Angelo, Emmerson Baxter and John Gamble had done their remarkable work of putting most of the vegetation back in its proper position, but with the ospreys’ favourite high-rise, unavoidably, severely truncated.



16 August: Loon Island before the storm



29 August: After the micro blast



20 September: After the repair

Summary of Conference, Meeting and Field Trip Use of QUBS in 2003

Organizer	Function	Numbers	Duration
Claudia Kraft	Queen's Medical Outreach	32	Jan 24 - 26
(Queen's)	Retreat and Training		
Anne Robertson	Kingston Teen Naturalists	8	Feb 8
(Kingston Field Naturalists)	Winter Field Trip		
Natalie Buckup	Queen's Program in International	22	March 8 - 9
(Queen's)	Development Training		
Tracy Hardiman	Science Quest Retreat and	13	March 15 - 16
(Queen's)	Planning Weekend		
Dan Selbie	E=MC ² - Enrichment Mini-course	20	May 7
(Queen's - Biology)	in Limnology for high school		
	students		
Dan Selbie	E=MC ² - Enrichment Mini-course	18	May 14
(Queen's - Biology)	in Limnology for high school		
	students		
Ken Kingdon	Ontario Field Ornithologists	9	May 17
(OFO)	Field Trip		
Dr. Bonnie Beresford	Workshop on Animal Care, Ethics	40	May 21
(Queen's - Animal Care)	and Field Safety		
Brian Hutchison	Black Rat Snake Recovery Team	6	May 27
(Parks Canada)	Meeting		
Mark Millan	Canoe Trip and Station Tour	25	May 28
(Glenburnie Public School)			
Dr. Rollie Tinline	Ecological Observatory Workshop	12	May 29 - 30
(Queen's GIS Lab/Geography)	with Lotek Wireless Inc		
Mark Millan	Canoe Trip and Station Tour	22	May 28
(Glenburnie Public School)			
Sylvat Aziz	Art Students Field Trip	8	June 2
(Queen's - Art)			
Mark Richardson	Invasive Species Workshop	27	June 14 - 15
(E. Ontario Model Forest)			

Summary of Conference, Meeting and Field Trip Use of QUBS in 2003

George Hiles (Lakeland Safe Boating)	Boat Operator Safety Training Course and Operator Certification	18	June 16
Jen Potten (Royal Military College)	Field Work Training Session for Arctic Team Researchers	31	June 20
Jennifer Harker (MM Dillon Consultants)	Dr. Allen Keast Recognition Day and Roast	80	June 21 - 22
Bruce Ripley (Kingston Field Naturalists)	KFN Butterfly Field Trip	10	June 22
Bob Bell (Queen's Env Health & Safety)	Fire Safety Training Session	25	June 23
Hank Neff (Elgin VFD Fire Chief)	Elgin Volunteer Fire Department Familiarization Session	10	July 17
Bronwyn Keatley (Queen's - Biology)	Science Discovery Field Trip on Ecology of QUBS	30	July 23
Frank Phelan (QUBS)	Wedding of Robert Vinkle and Stepanie Shelley	80	August 9* - 10
Dr. Ed Kott (Wilfrid Laurier - Biology)	Senior Undergraduate Field Course in Biology	22	Aug 24 - 06-Sep
Frank Phelan (QUBS)	Wedding of Daniel Mennill and Stephanie Doucet	60	Sept 6* - 7
Sharon Walker (RWLT)	Rideau Waterway Land Trust Annual Meeting and Dinner	71	Sept 12
Sarah Cosh/Kelly Shoemaker (Queen's - Biology)	Bio 200 - (Organization for Life - the Organism) Field Trips	184 137	Sept 13 Sept 14
Diane Lawrence (Queen's - Education)	Environmental Education Workshops and Field Trip	39	Sept 13 - 14
Brenda Schamehorn (Queen's - Biology)	Bio 302 -(General Ecology) Field Trip	59	Sept 20 - 21
Brenda Schamehorn (Queen's - Biology)	Bio 302 -(General Ecology) Field Trip	60	Sept 27 - 28
Bronwyn Keatley	Bio 335 - (Limnology) Field Trips	44	Sept 27

Summary of Conference, Meeting and Field Trip Use of QUBS in 2003

(Queen's - Biology)		30	Sept 28
Richard Verbisky	International Model Forest Network	32	Sept 28
(E. Ontario Model Forest)	Field Trip and Station Tour		
Doug Archibald	Geol 221/211 - (Geological Field	40	Oct 1 - 2
(Queen's - Geology)	Methods) Field Trip		
Jill Hamilton	Graduate Student Orientation	26	Oct 4 - 5
(Queen's - Biology)	Weekend and Field Trip		
Tim Demmons	Biology Field Trip	24	Oct 17
(Opeongo High School)			
Gary Nielsen	Stewardship Workshop - Forest	60	Oct 18
(Leeds Stewardship Council)	Ecology and Management		
Tori Ingram	Queen's Program in International	16	Oct 24 - 25
(Queen's)	Development Training		
Drs. Remenda and Jamieson	Geol 443/485 - (Hydrogeology)	40	Oct 26
(Queen's - Geology, Env Scis)	Field Trip		
Lisa Douglas	BIOCAP Retreat and Long-Range	11	Nov 10
(Queen's - Biology)	Planning Session		

Seminars 2003

Wednesday May 21

Dr. Bonnie Beresford (Director, Queen's Animal Care) -
"Animal Care and Ethics"

Wednesday May 28

Monica Kidd (Hillis Fund Visitor 2003)
Workshop - "The intersection of science and journalism"

Tuesday June 3

Dr. Tony Goldberg (Dept of Veterinary Pathology, U. of Illinois)
"Fish 'n Chimps: Model systems for the evolutionary ecology of infectious disease"

Thursday June 5

Dr. Clive Bealey (Open University and English Nature, UK)
"How important is landscape? A British butterfly perspective"

Wednesday June 11

Mark Velland (PhD candidate in Ecology & Evolutionary Biology, Cornell)
"Species diversity and genetic diversity: parallel processes and correlated patterns."

Wednesday June 25

Kristin Schubert (Dept of Biology, Queen's University)
"Social Dynamics and Fitness in Black-capped Chickadees"

Thursday July 3

Dr. Brent Charland
"Burton, Speke and the great lakes of Africa: In the footsteps of Victorian Explorers"

Wednesday July 9

Christine Vance (Ontario Parks, Regional Office Kingston)
" Ontario Parks: The ideal study site - research needs and opportunities in the Southeastern zone"

Wednesday, July 16

Frank Phelan (QUBS)
"Phelan Odyssey: Ramblings in the Canadian Maritimes, American Southwest and Gulf Coast"

Seminars 2003 (continued)

Wednesday, July 23

Fullard Lab - Dr. James Fullard, Amanda Soutar and Cassie Guignon (Erindale College of University of Toronto, Mississauga, Ontario)

"The ecological and evolutionary contest between predator (bat) and prey (moth)"

Wednesday, July 30

Erin Koen (University of Ottawa)

"The Biology of Fishers in Eastern Ontario: Current Research"

Thursday, Aug 7

Dr. Peter Boxall (University of Alberta)

"Aspects of the behavioural ecology of *Homo sapiens* at rest and at play: The value of wildlife and wild places in Canada"

Wednesday, Aug 13

David Carlson (Indian Lake cottager)

"Wildlife around the world through the eyes of a Chaffey's family: How wildlife is viewed in various countries and cultures"

Tuesday, August 26

Kate Girvan (Queen's Biology)

"Examining dispersal and migratory connectivity in the Cerulean Warbler using stable isotopes"

Wednesday, Sept 3

Barbara and Col. Harvey (Spider) Miller (Dripping Springs, Texas and Lake Opinicon cottagers)

"Perspectives on the Congo"

Documentation of Research Use of QUBS in 2003 - User-Days

User	Affiliation	Principal Investigator	Post-Doc	Graduate Student	Honours Student	Assistant	Total
Aarssen	Queen's - Biology	-	2	43	91	8	144
Arnott	Queen's - Biology	2	-	16	2	12	32
Boag	Queen's - Biology	-	-	-	-	4	4
Day	Queen's - Math/Env Stud	5	20	13	4	6	48
Friesen	Queen's - Biology	-	-	1	-	-	1
Frost	Queen's - Psychology	-	-	-	-	2	2
Hodson	Queen's - Biology	-	-	1	-	2	3
Jelinski	Queen's - Envtl Studies	-	-	-	-	-	0
Karagatzides	Queen's - Biology	7	-	-	3	2	12
Keast	Queen's - Biology	75	-	-	-	-	75
Lougheed	Queen's - Biology	-	-	3	-	-	3
Montgomerie	Queen's - Biology	16	15	20	-	18	69
Poland	Queen's - Envtl Studies	8	-	2	-	4	14
Ratcliffe	Queen's - Biology	20	-	86	91	184	381
Robertson	Queen's - Biology	50	14	321	176	157	718
Tufts	Queen's - Biology	6	-	90		3	99
					Queen's	Subtotal	1605
Blouin-Demers	Ottawa U - Biology	83	-	470	-	184	737
Epifanio	Illinois Natural Hist Survey	8	-	29	-	-	37
Fenton	York U - Biology	-	-	2	-	2	4
Forbes	Carleton - Biology	26	-	205	-	-	231
Fullard	U of T - Erindale	60	-	179	-	72	311
Kieffer	U New Brunswick - Biology	18	-	-	-	-	18
Lifjeld	Natl Museum - U of Oslo	8	-	158	-	-	166
Marra	Smithsonian Envtl Res Ctr	-	-	45	-	250	295
Neff	U of W Ontario - Biology	57	-	173	62	8	300
Philipp	Illinois Natural Hist Survey	84	16	114	-	211	425
Shackleton	U of W Ontario - Psych	5	-	107	-	95	207
Sherratt	Carleton - Biology	3	-	74	-	-	77
Sherry	U of W Ontario - Psych	7	-	-	-	-	7
Smith	Ithaca College - Biology	63	-	-	-	-	63
Weatherhead	U Illinois - Nat Res/Envtl Sci	38	-	15	-	-	53
					Non-Queen's	Subtotal	2931
					RESEARCH	TOTAL	4536

Documentation of Use of QUBS in 2003 - User-Days

		Principal Investigator	Post-Doc	Graduate Student	Honours Student	Assistant	Total
Total Research User-Days		649	67	2167	429	1224	4536
	% Queen's	29	76	28	86	33	35
	% Non-Queen's	71	24	72	14	67	65
User-Days in Teaching Activities							2024
Conference and Field Trip Use							815
Other*							2380
Grand Total User - Days **							9755

* - QUBS staff, their families and visitors are not included

** - down 1% from 2002

Fee Schedule for 2004

University Research and Teaching Rates

Board Charges - Meals only

\$550/month/person	-no obligation for chores
\$390/month/person	-includes obligation for chores on a rotating schedule

Accommodation Charges - Housing only - no linen service

\$40/month/person	-dormitory (White House or Curran Cottage)
\$80/month	-small cabin (Cabins 1, 4, 5, 6, 7, 11 and shaker)
\$160/month	-medium cabin (Cabins 2, 3, 8, 9, 10, 13, 14)
\$215/month	-large cabin (Cabins 12, 15 and White House Apartment)
\$310/month	-Cottage (Keast, Earl, Sumac or Maplewood)

Room and Board Rates for Field Courses - no linen service

\$310/person	-weekly R&B for OUPFB field courses
\$345/person	-weekly R&B for other field courses - incl. facilities use fee

Room and Board Rates for Short-Term Users and Guests- no linen service

\$34/day/person	-24 hr. room and board
\$5.50	-breakfast or lunch only
\$11.00	-dinner only
\$17.00	-overnight accommodation

Bench Fees

Basic* 1 (MFA co-applicants)

\$1.10/day	principal investigator/graduate student/lab coordinator
\$0.55/day	assistant

Special Requirements** 1 (MFA co-applicants)

\$2.75/day	principal investigator/graduate student/lab coordinator
\$1.10/day	assistant

Basic* 2 (non-MFA Queen's researchers)

\$2.75/day	principal investigator/graduate student/lab coordinator
\$1.10/day	assistant

Special Requirements** 2 (non-MFA Queen's researchers)

\$5.50/day	principal investigator/graduate student/lab coordinator
\$2.75/day	assistant

Basic* 3 (non-MFA non-Queen's researchers)

\$5.50/day	principal investigator/graduate student/lab coordinator
\$2.75/day	assistant

Special Requirements** 3 (non-MFA non-Queen's researchers)

\$11.00/day	principal investigator/graduate student/lab coordinator
\$5.50/day	assistant

*Basic - desk/lab bench space only - electricity and/or water

**Special Requirements - tanks, pumps, heating, cooling, air, disposables, extra space

NOTE - If sufficient funds are not available, bench fees may be waived or reduced upon written application to the Director.

Fee Schedule for 2004 (continued)

Electronic Equipment Charges

Local Area Network Connection

Research Use: \$22/mo for each computer connected to the network

Internet Access

Individual Users: \$11.00/mo

GPS/GIS Equipment

Charges for maintenance of equipment and systems will be charged back to users based on intensity of use

Boat Rental

\$310/month, \$140/week - includes maintenance from normal use - gas and oil not included
\$70/day - includes gas and oil for one day rental

All QUBS boat users will require Operator Proficiency cards to rent a boat

NOTE - Fees for use of pontoon boats are negotiated directly with the Manager or Director

Conference and Group Rates

\$5.50/person/day	facility day use fee - no meals
\$50.00/person/day	24 hr R&B and day use - summer season (April 30 - September 10)
\$12.00/person/day	linen service

Rates for groups outside of summer season and for special requirements are negotiated directly with the Manager or Director

Rates are based on provision of basic services (dining hall meals, conference room use, dormitory style accommodation) - additional requirements will increase rates

50% booking deposit required (non-refundable if cancellation made less than two weeks prior to event)

Provincial Sales Tax

P.S.T. is applicable to non-Queen's users for oil used in boats, photocopies and Fax .

Goods and Services Tax

G.S.T. is applicable non-Queen's users for charges for boat rental, photocopies, direct sales (e.g. equipment) and all charges for room and board from casual users.

QUBS Management reserves the right to allocate space to maximize accessibility to all users of the facility. This may mean sharing space at times of intense use.