

# Queen's University Biological Station

## Annual Report and newsletter 2007



Director: Dr. Bruce Tufts

Manager: Frank Phelan

Assistant Manager: Floyd Connor



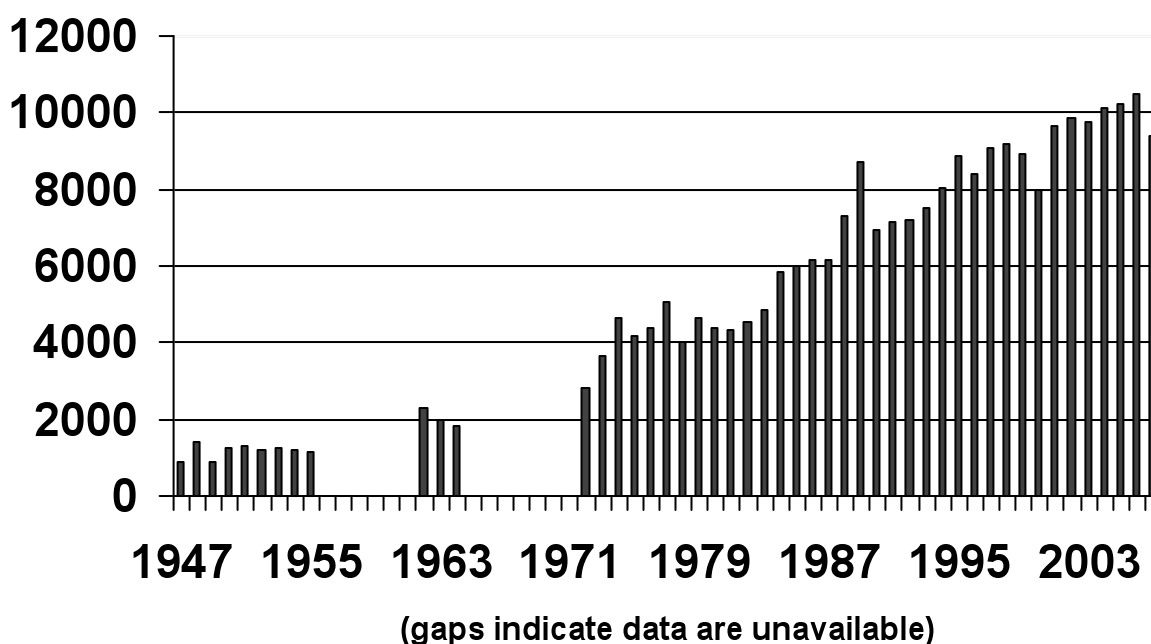
## Introduction

A year past the 60<sup>th</sup> anniversary celebrations and life at QUBS seemed a bit less feverish than it has been in recent years. The respite allowed completion of a number of smaller maintenance projects and significant progress on the addition of a new cabin which we are calling Cedar Cottage (more on this later).

In 2007, use of the field station dropped somewhat from the very high levels experienced in the previous year. In 2007, user-days totaled 9400 (user-day data are displayed in tabular form on pp. -). Use was down 10% over 2006.

On average, 49 researchers (professors, graduate students, honours students and assistants) were in residence through the summer (May through August). Abstracts of 2007 research projects and documentation of the personnel involved are to be found on pages xx through xx.

## User-Days at QUBS



In teaching activities, QUBS hosted 7 modules (12 weeks worth of modules) in the Ontario Universities Program in Field Biology (OUPFB). Four of these modules were presented by Queen's instructors and three by instructors from other institutions (one course was a collaborative effort between Queen's and Ottawa U.) Details of the OUPFB programme are found in Tables 1 and 2 (pp. -). Tim Demmons (a QUBS alumnus) brought his high school class from Opeongo High School (RR1 Douglas, Ontario) to QUBS for a few days in spring. Jim Ludden (a QUBS alumnus) brought a midsummer field course to QUBS from College of DuPage (Glen Ellyn, Illinois). In addition, an Ecological Land Classification Courses offered by Gartner Lee Associates and Ontario Ministry of Natural Resources was hosted by QUBS in fall.

In 2007, field trip and conference use of QUBS remained at high levels. A highlight of such use was the Society of Canadian Ornithologists Conference, co-hosted by QUBS and The Opinicon Hotel at Chaffey's Lock in fall. A summary of conference, meeting and field trip use of QUBS in 2007 appears later in this report (pp. -).

## Thousand Islands - Frontenac Arch Biosphere Reserve

QUBS continues involvement with the local Biosphere Reserve. QUBS properties contribute to education, research and conservation programs within the Biosphere Reserve. The Biosphere Reserve recognizes the attributes of the Frontenac Arch and promotes wise land use and sustainability within its borders.

## MAJOR GIFTS

### Baillie Family Chair in Conservation Biology

#### Message from the Incoming Baillie Family Chair in Conservation Biology

I am very excited to be the incoming Baillie Family Chair in Conservation Biology, with an opportunity to return to QUBS for my upcoming teaching and research programs. As many of you know, I worked at QUBS for 4 years during my undergrad at Queen's (1991-1994) and have the fondest memories of the station and the incredible opportunities that it provides.

Since beginning the position in July of 2007, my wife (Fran Bonier, adjunct professor at Queen's) and I have moved to Chaffey's Lock and are planning research for the 2008 spring and summer seasons. Fran will be continuing her behavioural ecology and physiology work on birds, this time collaborating with Raleigh Robertson on his study population of Tree Swallows. I too will be collaborating with Raleigh, continuing his decade-long research into Golden-winged Warblers (in collaboration with Rachel Vallender), and on community ecology of birds at Opinicon, including the declining Cerulean Warbler. This summer, my group will set up permanent long-term study plots that will encompass all of the major tracts of land held by Queen's. On these plots, we will begin new studies of behavioural interactions and patterns of coexistence in *Dendroica* wood warblers. We are also presently pursuing funding for the construction of aviary facilities at the biology station, where (if our grant is successful), we will be able to conduct breeding and mate choice experiments to explore the mechanisms of population differentiation and speciation in birds. All in all, I'm thrilled to be back at the biology station, and I'm looking forward to seeing most of you this coming field season.

Paul Martin

### William C. Brown Research Endowment Fund

Details?

### The Queen's Land Trust

The Queen's Land Trust has now exceeded a capital balance of \$200,000. While still far short of the ultimate goal of an endowed fund of \$1,000,000, the current fund does offer assurance that if a parcel of land that is integral to QUBS should be opened for potential development, QUBS would hopefully be in a position to act. In addition, the income from the land trust helps to cover costs of maintaining the extensive land base at QUBS

### Dr. Allen Keast

Dr. Allen Keast, a user of the field station for 40+ years, continues to be a major supporter of the field station by direct and indirect means.

In 2006, Dr. Keast established a fellowship entitled "**The J. Allen Keast Lake Opinicon Undergraduate Research Fellowship**". This fellowship was established in October 2006 to enable a keen student to carry out a one-summer study in an original area free of the constraints of a granting body.

In March of 2007, Dr. Keast established "**The J. Allen Keast Field Biology International Exchange Fund**". This fund is to encourage Australian, New Zealand and other biologists from the southern hemisphere to visit Queen's University and Queen's University biologists to visit internationally, and to enhance the programs and

facilities of the QUBS that make such in-depth study of organisms in their natural environments both enlightening and rewarding.

Thank you, Allen, for your continued generosity.

## **NSERC and Other Support**

2007 was the 24<sup>th</sup> year that QUBS has held a Major Facilities Access Grant (MFA) from NSERC (Natural Sciences and Engineering Research Council) (including the years of MFA's precursor, the Infrastructure Grant).

This grant pays the salary of QUBS Assistant Manager (Floyd Connor) and half of the Maintenance Assistant (Roger Green) salary and benefits. The Assistant Managers' benefits are paid by Queen's. In addition to salary and benefits, the MFA contributes to the cost of shared services (eg. electricity) and infrastructure.

Recognizing the need for more staff at QUBS, especially in the face of increasing regulations with respect to animal care, field and lab safety, chemical concerns etc, we have started discussions to use the increase in MFA funding for a new position. The Faculty of Arts and Science and the Department of Biology have promised matching funds to provide full funding. We hired Rashpal Dhillon for the period May through August 2007. Rush has moved back to British Columbia, finalizing his PhD thesis submission to Queen's (Tufts Lab).

The MFA award recognizes the productivity and excellence of a multi-university initiative. With researchers at QUBS coming from many Canadian, American and International universities, a collaborative atmosphere of inquiry and interaction is created at QUBS, enhancing the experience for everyone involved. This atmosphere leads to creative interaction and discussion, which, in turn, sparks users to be innovative in carrying out quality research.

## **Dean's Equipment Fund**

Changes in regulations by Transport Canada have now defined QUBS boats as commercial vessels. To comply with these changes, we have purchased two identical pontoon boats (24') thanks to the Dean of Arts and Science. The two boats were in the water for the summer and fall of 2007 and proved their utility for field courses and especially for the Limnology fall field trips.

Some unfortunate repairs were necessitated in fall because of muskrats chewing the wiring and control cabling on both boats – pesky critters!

Thanks you to the Dean of Arts and Science and to the Dean's Equipment Fund for funding these new boats. They will permit us to continue to provide hands-on field experience while complying with the new regulations.

## **Warner Lake Ecological Observatory (WLEO)**

The equipment donated by Lotek continues to provide detailed positional data on tagged animals in Warner Lake. Current studies focus still on Largemouth Bass ecology and physiology, but there is interest in expanding the focus to include other species of fish and even turtles (Snapping and/or Painted Turtles). Data on Largemouth Bass are used by the research teams of Dave Philipp (Illinois Natural History Survey), Steven Cooke (Carleton University) and Bruce Tufts (Queen's University). Particulars of their research based on data from WLEO may be found in their research summaries later in this report.

Expenses for the ongoing costs of operation of the observatory (electricity costs - provided by wiring into Joe Costa's house nearby; communication costs - one telephone line to the observatory; repair costs of electronic equipment and cabling) are split evenly between the three research groups. Muskrat chewing on cabling is an issue which needs to be addressed. Their activities have caused several hydrophones in the small basin to cease functioning, reducing the quality of information available for the small basin.

Some of the damaged cabling near the observatory building was repaired and sheathed in new conduit for mechanical protection. A barrier was also installed at the shoreline to prevent unwanted snowmobile traffic from crushing the conduit and cables. The old, antiquated computer was replaced with a more powerful one in late summer.

## SCHOLARSHIPS AND BURSARIES

There are a number of awards available to QUBS researchers. Among these are :

- Wes and Dorletta Curran Memorial Award
- Karen Huntley Memorial Award
- Alexander and Cora Munn Summer Research Award
- J. Allen Keast Lake Opinicon Undergraduate Research Fellowship Endowment Fund

Details of these awards and application procedures are available through Queen's Registrar  
<http://www.queensu.ca/registrar/awards/toolbox/ArtsSciAwards.htm>

In addition to the awards above specifically tailored to QUBS, the following is a partial listing of awards available to biologists at Queen's:

- Allen and Mary Lou West Memorial Award
- Fran and Tom McClung Scholarship in Biology
- Wallace Near Prize in Biology
- Ann Eliza Stafford Prize in Biology
- The Gray Family Student Initiatives Fund
- Pearl E. Williams and Llewellyn Hillis Fund
- NSERC Summer Undergraduate Research Awards

## QUBS Outreach Programs

### Seminars

2007 was the 175<sup>th</sup> anniversary of the Rideau Canal, so we invited several speakers to enable a bit of a focus on the Rideau. Dr. Brian Osborne, always an entertaining speaker provided a geographical/historical retrospective on the canal, its construction and changing uses over time. Don Ross provided an overview of the Thousand Islands Frontenac Arch Biosphere Reserve and the role of the Canal within the reserve. Finally, Jonathan Moore provided a fascinating look at the history of the canal through underwater archaeology work.

Dr. Bridget Stutchbury (York U), a QUBS alumna, provided a feature presentation and an eye-opening talk on the dwindling populations of migratory songbirds.

Thanks to all who participated in providing talks in the series. As always, there were a great many local residents and visitors that we welcomed to the talks.

### Open House

The 37<sup>th</sup> annual Open House was held on July 1, 2005. Approximately 350 visitors attended. QUBS regulars offered tours of the station and displays of current research projects.

The 2007 version of the Community Newsletter (25<sup>th</sup> edition) was distributed to some 1100 households and cottages in the Chaffey's Lock, Elgin, Perth Road, Massasauga Road and Hutchings Road area. This annual circular serves much the same purpose as the Open House, providing information to those interested but unable to attend the Open House itself.

Outreach activities have become a part of the mandate of QUBS, providing educational and research opportunities and information to a wide audience. Outreach activities are an important part of the continuing success of the field station. By way of outreach activities, interested neighbours become stakeholders in the field station itself. The contacts developed are instrumental in maintaining close relations with the local public and in enlisting broad-based support of the field station and its activities. Without the continuing support of the local community, opportunities at QUBS would become somewhat restricted.

## **QUBS Logistical Support**

### **GIS/GPS and SWEP**

The summer of 2007 saw the introduction of two new Geographic Information Systems (GIS) and Global Positioning Systems (GPS) technicians. Nicole Willie and Amanda Mathys kicked off the year with the addition of Cedar Cottage and its driveway to the Queen's Point map. Next they were recruited to help Lonnie Aarssen and Paul Grogan's deer exclusion crew in selecting and mapping the ten plots needed for their experiment. Due to previous experience in plant identification, Niki and Amanda found themselves helping to identify the various plant species found within each of the plots. This initial help led to (1) An ongoing process of drying plant specimens and putting together an introductory guide to QUBS forest plants, and (2) Further aid in making the deer exclusion fences. The QUBS open house newsletter and poster were created in partnership with the deer enclosure crew who also helped to make display posters (addressing such issues as declining song bird species, and the 175<sup>th</sup> anniversary of the Rideau Canal) in addition to individual project posters.

Black-capped Chickadee nests, American Redstart, and Golden-winged Warbler nests were once again mapped out, allowing comparisons among years to be made. Fish nests were also mapped for Large-mouth Bass and Bluegill Sunfish on Long Lake, also adding another year's worth of data.

Skycroft and Queen's trails were updated, colour-coded, intersection labels corrected, and missing trails added, thus generally improving the readability of the Quickmap series for QUBS users. An updated QUBS properties wall map (including the Boston Wildlands not on the previous version) was produced to display in the lower level of the Operations Centre, as well as smaller versions that were put together for a presentation by Raleigh Robertson. Miscellaneous maps were produced for researchers when quickmaps did not provide enough detail; this interaction allowed increased exposure of the GIS/GPS crew to the research taking place at QUBS. In turn, the needs of the QUBS users were more easily understood.

Additional information layers were added to the GIS database by way of geological, aerial photographic, and remote sensing layers (a coarse soil layer was also added, with the ability to refine it as information becomes available or necessary). Land use history/cultural information was also added (again, many details remain to be added as they become available).

Help files were made and built upon for future SWEP students in this position. A presentation was also done in August for the fisheries field course on GPS/GIS in general, and more specifically bathymetry and its use in fisheries. This presentation provided an opportunity to learn bathymetry, and practice presentation skills.

Overall, Niki and Amanda undertook a number of tasks over the summer, and were able to learn a multitude of new skills (for which they are very grateful). Although, not all tasks had to do with GPS/GIS directly, the overall effect was a greater appreciation for the role GPS/GIS plays (and could play) in biological research.

### **Acknowledgements**

QUBS has become a very busy field station with a multifaceted role to play in research, education, conservation and outreach. A lot of the success of the station is due to the dedication of our staff in core roles, especially general maintenance and foodservice. Thanks to Roger (Rod) Green, our Maintenance Assistant, our Food Service Staff - Marg Phelan, Stuart Davison, Jacqueline Coldrey, James Parry and our Cleaning Staff, Michelle Phelan and Lisa Burt (Mallen). Thank you also to kitchen helpers/dishwashers Stephanie Davison and Elizabeth Franklin who helped at especially busy times.

## **QUBS Properties**

### **Hughson Farm**

In 2007, the Hughson Farm was used for studies of Tree Swallows, American Redstarts, Golden-winged Warblers, American Goldfinch, Black Rat Snakes, Map Turtles, Spring Peepers, damselflies, dragonflies, mosquitoes, water mites, Largemouth Bass, Smallmouth Bass, Bluegill, Mudminnow, bats, plant competition, old field succession, plant growth and reproduction, soil heterogeneity, the possible effects of bismuth on forests and wetlands, the isotopic composition of precipitation and surface waters and nitrogen and carbon cycling.

The various bird box grids were again used by Dr. Raleigh Robertson and his students for 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 and a large plot in the center of the Cemetery Field were intensively used for plant competition studies.

Haying of the open fields was done by Bob Butterill and Ken Young in 2007.

### **Bonwill Tract**

The Bonwill Tract was used for studies of American Redstarts, Golden-winged Warblers, Black Rat Snakes, Map Turtles, Spring Peepers, damselflies, water mites, Largemouth Bass, bats, carbon/nitrogen cycles and the isotopic composition of precipitation and surface waters in 2007.

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

Haying of the open fields was done by Bob Butterill and Ken Young in 2007.

### **John M. Cape - Charles Sauriol Environmental Studies Area**

The Cape-Sauriol Tract was used for studies of Black Rat Snakes, Map Turtles, Largemouth Bass, Smallmouth Bass, Bluegill, Pumpkinseed, Mudminnow, bats and water mites in 2007.

In conjunction with the Chaffey's Lock and Area Heritage Society, Frank Phelan, Neil Patterson and Bruce Teepell led tours into the mine site near the Mill Pond (Pothole Lake) in late summer.

### **Hilda and John B. Pangman Conservation Reserve**

In 2007, the Pangman Reserve was used in studies of American Redstarts, Golden-winged Warblers, the genetic diversity of birds, Black Rat Snakes, Largemouth Bass, Northern Pike, Bluegill, Mudminnow, bats, damselflies, water mites, zooplankton communities and plant growth and competition.

In Warner Lake, the Lotek Ecological Observatory was used to monitor the movements of Largemouth Bass. Transmitters implanted in bass enable 3D locations along with pressure (depth) and temperature data.

In Lindsay and Poole Lakes, Northern Pike were implanted with PIT (Passive Integrated Transponder) tags as part of a long-term study on growth, behaviour and movements of pike.



West of the Lindsay Lake Road, five deer exclosures were built in summer to enable study of the impact of deer browsing on local vegetation. This will be a long-term study with monitoring required over a series of years.

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 an important site for studies of Golden-winged Warblers, Tree Swallows and Song Sparrows, American Goldfinch and Spring Peepers in 2007.

In fall, the property was intensively used by students from Geology 221 (Geological Field Methods). Doug Archibald and his students lay out baselines and pickets. With regular sampling, the students determine the stratigraphy of surficial sediments (lacustrine clay and/or sand over till for the most part) using soil augers. In addition, a magnetometer survey determined the location of the buried contact line 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 the Matthews Mine, a very successful iron (magnetite) mine.

Maurice and Wayne Hutchings were permitted to graze cattle on this tract in exchange for keeping an eye on the property. Ecologically, the cattle will help to keep some of the property in early successional stages. The Hutchings have been very cooperative, keeping cattle out of research areas until studies are over for the year.

## **Moores Tract**

In 2007, the Moores Tract was used in studies of Black-capped Chickadees, Black Rat Snakes Spring Peepers and water mites.

## **Crabbe Property**

The Crabbe House has again been a base of operations for study of Song Sparrows in 2007.

A neighbour, Jim Hales, has been engaged to cut the grass on a regular basis.

## **Massassauga Tract**

The Massassauga property was used in studies of Barn Swallows, Golden-winged Warblers and invasive species in 2007. Plots with deer fencing were set up in the Quonset field and an adjacent field to study the invasiveness of *Silene*.

Ken Young uses the barn for cattle and hay. The open fields were hayed by Ken in 2007.

Camp Outlook made use of the property for hiking and camping in fall and winter.

## **Boston Wildlands**

More visits to the Boston Tract were made in 2007, to increase familiarity with the property and its flora and fauna.

A start was made on investigating the "mystery road" which apparently runs/used to run through the property.

The Boston family will continue to monitor the property and, by agreement, have limited use of the property for maple syrup, wood cutting and recreation.

## Queen's Point

In 2007, the islands and mainland property of Queen's Point were used for studies of Black-capped Chickadees, Tree Swallows, Barn Swallows, American Goldfinch (aviaries), communication networks in birds, Black Rat Snakes, Map Turtles, bats, Largemouth Bass, Smallmouth Bass, Northern Pike, sunfish, moths, katydids, mosquitoes, water mites and aquatic invertebrates (in artificial ponds).

Some necessary repairs were made to the boardwalk to Cow Island. We are close to completing the groundwork for an interpretive trail to Cow Island.

## Animal Care, Safety and Training

### Animal Care

In November of 2001, a specific policy on animal care was put into place for QUBS. The 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>).

As ethical field researchers and educators, animal care issues are of paramount importance and the welfare of any animal which is the subject of either field or lab study must be foremost in planning and procedures.

Summary of requirements and procedures (get the full policy at website above):

- All activities involving vertebrates must obtain UACC approval
- Activities include: collecting, capturing, tagging, marking, handling, biosampling and housing
- Housing is short-term (less than thirty days)
- Non-Queen's researchers must provide a copy of approved protocol(s) from the home institution along with Animal Use Data Form (AUDF) to Queen's UACC for review.
- Copies of all protocols will be kept with UACC and at QUBS
- Copies of permits should be filed with UACC and QUBS

Dr. Bonnie Beresford is Queen's University Veterinarian and Director of University Animal Care. She is available for discussion of animal care issues at [beresfor@queensu.ca](mailto:beresfor@queensu.ca). UACC communications can also be accessed/delivered at [UACC@queensu.ca](mailto:UACC@queensu.ca) or via Natalie Kolomeitz Douglas, Secretary UACC

### Off-Campus Activity Safety Policy

As of September 2004, Queen's University has adopted a new Off-Campus Safety Policy (OCASP) which supersedes the previous Field Safety Policy. Under the new policy, QUBS is considered to be off-campus, so all of the provisions of the new policy apply to activities at QUBS. The policy document and supporting material can be accessed at <http://www.safety.queensu.ca/policy/activity>.

All Queen's Principal Investigators are required to complete safety planning records in advance of arrival at QUBS, which include risk assessment and risk management. Further, PIs must conduct information sessions with their field and/or lab workers and establish principles and procedures for safety in the field and/or lab. Non-Queen's PIs should undertake a similar process using the materials provided by OCASP as a guideline.

### Workplace Hazardous Materials Information System

Queen's University has made it mandatory for all employees to have current training and certification under WHMIS. Under new regulations, all lab workers must have training and must renew this training each year. Even office workers and others not directly working in labs must have exposure to WHMIS training. If a lab uses any chemicals at all at QUBS, it is imperative that all lab workers have WHMIS training. Please arrange for this well before arriving at QUBS.

QUBS is not an appropriate place for extensive chemical usage. Each PI must supply a list of chemicals brought to QUBS when application is made for space. All chemicals brought to QUBS must be accompanied by current MSDS (Material Safety Data Sheets). These sheets must not be more than 3 years old. Place MSDS sheets in the binders at the entrance to your lab.

Bring only small amounts of chemicals to QUBS. Discuss appropriate safe storage, handling and proper disposal with QUBS safety officer, Manager Frank Phelan.

## **Watercraft Safety**

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

Particular care must be taken when operating QUBS boats, both for safety reasons and because of visibility. Our boats and personnel are easily identified. Therefore, operation of these vessels must be beyond reproach.

Regulations are currently changing. Under new legislation, all QUBS vessels will be considered as commercial vessels. Transport Canada will soon recognize only two classes of vessel - either pleasure craft or commercial craft. Inspection and certification of all QUBS boats will need to be done by Transport Canada. Our two new pontoon boats (DMH II and DMH III) have arrived and are ready for use. These vessels must be piloted by a captain with MED A3 training and are limited to 11 persons (10 passengers and the captain). A session for MED A3 training was held in May, instruction by Navtex (Ray Throop – Kingston Coast Guard Captain). Depending upon interest and need, we can arrange further courses for this training through Captain Ray.

## **All-Terrain Vehicle Safety**

All-terrain vehicles are considered research tools at QUBS. While ATVs are useful tools, especially when equipment must be carried into remote areas, ATVs are also expensive and potentially dangerous. All operators must take a training program before operating ATVs. Proof of training from an established authority is acceptable. For those requiring on-site training, QUBS uses the program developed by 4-H Clubs. Study of safety material and passing a written test, followed by a practical test aboard an ATV is required.

## **Drinking Water Safety**

In the aftermath of Walkerton, stringent regulations were put into place for all water systems in Ontario. QUBS has complied with these as a small, non-municipal drinking water system with a well supply.

To obtain compliance, the following has been done:

- Inspection by a professional engineer (March 2002)
- UV units installed to treat all incoming well water
- Certification of QUBS staff in operation of small drinking water systems (June 2002)
- Weekly water testing for microbiological parameters (Accutest - Kingston)
- Multiparameter test of chemicals, minerals, pesticides and radionuclides (June 2002) - next test in June 2007 – done – all OK
- Weekly check of water treatment equipment
- Replacement of main septic field as suggested in Engineer's report (fall 2003)
- Annual report filed with Ministry of Environment (May 2004)
- Application to halve the frequency of sampling (May 2005) - we sample water for microbiological parameters every two weeks when small numbers of people are present at QUBS

We are fortunate that our well provides a good quantity of quality water. Nevertheless, QUBS is in full compliance with current regulations and staff make every effort to ensure the continuing safety of our drinking water.

## **Fire Safety**

QUBS users are probably unaware that monthly fire and general safety inspections are undertaken by QUBS staff at the first of each month. All fire extinguishers, alarms, monitors, first aid kits, eyewash stations etc.

are checked in all labs and accommodations. In the process, a check for any and all safety hazards is made across the station. The portable fire pump is also tested and emergency procedures reviewed. When possible, familiarization tours with the local volunteer fire department are conducted so that they can appreciate the requirements of QUBS before arriving during an emergency.

QUBS staff is committed to providing a safe environment at QUBS.

## **Renovations and Additions**

### **Cedar Cottage**

This large project occupied a lot of time in late summer, through fall and into winter. Once the excavation had dried out and we had mucked it out by hand for the third time, we were able to get Rob Young (Seeley's Bay) to pour a concrete foundation. From there, it was our project. The framing went quickly and we got Rush (Dhillon) into the swing of things along with Rod, Floyd and Frank (and a few other volunteers). Plans were vetted by Habitat Concepts (Kingston – John Johnson). Floor joists and roof trusses were supplied by Locke Truss (Brockville). Windows were purchased from The Window Centre (Kingston). Heating system was by Foley Mountain Mechanical. The building is overinsulated, with R30 walls (6" Roxul plus 1" foil-faced IKO polyisocyanurate foam sheets) and R50 ceiling. Reitzel Brothers (Wolfe Island) supplied blown-in cellulose insulation for the attic. By year's end, we had the building framed, wired, plumbed, insulated and drywalled. Interior finishing will be done over the winter and early spring of 2008, ready by April or May.



Basement – showing split level floor and support beam – looking SE

The cabin is a split-level with ten-foot high ceilings in the part facing the lake (living room/dining room/kitchen). There are three bedrooms on the upper (rear) level and a bathroom. Access to the basement is via a Bilco basement door on the north side. We elected to install a steel roof. To protect the entrances, projecting roofs were fashioned. It turns out that this was an excellent idea since the winter was extremely snowy. The roof extensions made entry and exit a breeze. Although we did our own wiring, Wainick Electric (Elgin) did the panel and power connections and checked our work.

The only item remaining on the exterior of the cottage is the soffit under the front and rear roof overhangs. Come spring, we will need to have a well drilled to complete the utilities.

Funds for this project came from QUBS Trust, Department of Biology (\$20K) and the Faculty of Arts and Science (\$25K). Thanks to the generosity of the Department and Faculty, we will add much-needed space for senior researchers via this new cottage.





Rear walls framed up, starting on front walls



Cedar Cottage - Exterior complete for winter – seen from driveway to cottage



Cedar Cottage - Exterior complete for winter – Lake View

### Cottages

With the entrance portico in place, we completely reroofed Curran Cottage in fall. The old cottage fairly groaned with relief as we stripped off many layers of shingles – up to an inch thick on the main roof. The new steel roofing is much lighter, is appropriate for the low-slope section facing the lake and should not need attention again for a long time.

We added septic tank access hatches to the top of the septic tanks at both Keast Cottage and the Assistant Manager's House.

### Operations Centre

Only seven years old, the Operations Centre badly needed restraining of the board and batten woodwork walls. Linda's Painting (Westport) undertook the work in fall, but was interrupted by rain and cold weather before completion. The remainder is to be completed in early summer 2008.

Several of the windows in the lodge, especially those directly facing south, were fogging inside the thermopanes, so these were replaced with new windows.

### Cabins

In late summer, we laid the foundation slabs and blockwork for a new Cabin 11. We have chosen to elevate this cabin to give it a view out over the lake and to allow it to catch cooling breezes off the lake. We will build the new cabin on the medium-sized new cabin plan next summer.

The porcupines had been chewing away at the lower walls of the Long lake Cabin. We added sheets of steel roofing on the lower walls to inhibit these rodents before their chewing does serious structural damage. **Right:** A snap of the front of the Long lake Cabin showing the porcupine damage.

### Road

In fall, we added gravel and crushed limestone to the access road to the station. French's Trucking (Terry French) provided and spread the material for us. Soon we will need to undertake a more





serious road repair to address loss of material and to provide better drainage during periods of wet weather.

#### Network and Wireless Systems

New gateways and switches were purchased and installed for the WiFi links. The communications tower was built higher and braced more strongly. A new dish was installed by WTC Communications ( Westport – Kevin Christie) along with replacement cabling from the tower dish to the Manager's House. To provide a more reliable link, new, more powerful boosters were also purchased and installed at the same time.

#### Old Boats and Equipment

To defray the cost of purchase of a new pontoon trailer for the new pontoon boats, some of our older boats and the old barge was offered for sale in summer. Many of our older, deeper hulled outboard motor boats had not been used for some time, researchers mostly preferring the newer flat-bottomed jon boats. Along with these, the old barge and the old doors of the workshop and some miscellaneous paints, all was sold, excepting the big old barge, The Rappinicon. Proceeds were used to purchase a scissor-lift pontoon trailer (Brown's Marina) for the two new pontoon boats. This acquisition makes it very easy for us to launch and take out as needed.

#### Refrigeration Equipment

The compressors for the walk-in cooler and walk-in freezer in the kitchen of the Operations centre needed replacement in early summer. What bad luck that both of these needed replacement at virtually the same moment! This expensive undertaking was done by R H Henderson (Kingston).

#### Composter

The varmints had pretty much eaten up our old composter (wildlife feeder?), so we built a new one. At the same time, we elected to move it away from the road. The new, more robust composter was installed flanking the fence in the aviary field.

#### Mattresses

In an effort to provide quality bedding, we replaced 8 more single mattresses and 2 double mattresses this year (Elgin Home Furnishings). If we do this on a regular basis, we should be able to keep up with wear and tear.

#### Boardwalk

It seems that the Boardwalk (initially built in 1984) to Cow Island needs a bit of work each year to keep it functional. We replaced some of the top planking this year, and devised a means of using through-bolts to replace many of the crossbraces for the planking.



New pontoon boats in action during Limnology weekends – Fall 2007

**Table 1: Summary of enrolments in the Ontario Universities Program in Field Biology in 2007 (QUBS courses highlighted)**

Course	Instructor	Affiliation	Module	Location	B	C	G	L	M	O	Q	To	Tr	Wa	We	Wi	WLU	Y	TOTAL
1	Handford & Bowles	Western	Introduction to Desert Ecology	Arizona, USA	1		1								5	1	1	3	12
2	Duthie, Allen & Witt	Waterloo	Costa Rica: Rainforest and Reef	Costa Rica		1	2		2	3	2		1	5					16
3	Walsh	Carleton	Tropical Research in Cuba	Cuba	1	4	3		2	1		1		1	1				14
4	Darling and Barrett	Toronto	Biodiversity and Ecology in Southeast Asia	Vietnam			2					8			2		1		13
5	Pieman	Ottawa	Reproductive Tactics of Marsh-Nesting Birds	Delta Marsh, Manitoba			1		1	1				1	3				7
6	Robertson	Queen's	Behavioural Ecology/Conservation Biology Birds	QUBS		1			1	2	3		1			2		2	12
7	Lougheed & Blouin-Demers	Queen's / Ottawa	Ecology of Amphibians&Reptiles	QUBS		1	1		2	2	2	1		1	2				12
8	White, Wang & Yang	Trent	Dolphin and Whale Biology in Tropical Asia	Taiwan			5				5		2	1			1	1	15
9	Wang and Murray	Queen's / North BC	Human Development & Aquatic Environment	China	1		3			1	4	1							10
10	Dickinson & Eckenwalder	Toronto	Field Botany	Koffler / Jaker's Hill	1	1			1	1		10			1			1	16
11	Drouillard	Windsor	Great Lakes Field Biology	GLIER			1			1		1			3	8	1		15
12	Sager and Smith	Trent	Ecology of the Kewarwas	Oliver Centre, Pigeon Lake	1		1			1	1	1	3		2				10
13	Badzinski and Petrie	Western	Wetland and Waterbird Ecology	Ontario (Lake Erie)		1	5								6			5	17
14	Kotanen & Havelka	Toronto	Arctic Ecosystems	Churchill Manitoba		1	1			1	2	9	1		1			2	18
15	Kolasa & Evans	McMaster	Tropical Ecology	Tanzania		1	2		1	2					1				7
16	Hebert	Guelph	Arctic Ecology	Manitoba		1	15		1	1				1					19
17	Richardson & Tattersall	Brock	Behavioural Energetics	Algonquin Park					1			1			2		1		6
19	Runtz	Carleton	Nat. Hist. - Great Lakes-St. Lawrence Ecoregion	Algonquin Park		6	2			5	1				1			1	16
21	Tufts	Queen's	Applied Fisheries Biology	QUBS		1				2	3	1				1	1		9
22	Danylchuk	Carleton	Tropical Island Ecosystems: Ecol & Conservation	Cape Eleuthera, Bahamas			8			1	3	1							13
23	Blouin-Demers & Bulte	Ottawa	Applied Wildlife Ecology	QUBS			2			3	4				2			1	12
24	Fryxell	Guelph	Experimental Field Ecology	Ontario (Algonquin Park)			19		1						1			1	22
26	Crawford	Guelph	Marine Biology & Oceanography	Huntsman			13		1										14
29	Millar & Sinclair	Western	Alpine Ecology	Brockville		1	1			1	5				7	1			16
30	Ramsay	Wilfrid Laurier	Field Ecology of Southern Ontario	QUBS			1			1	3			1	2		2		10
31	Eric Sager	Trent	Life on the edge: wetland and littoral ecosystems	Oliver Centre, Pigeon Lake								1	4		3	1			9
32	Quinlan	York	Limnology and Aquatic Ecology	QUBS							2			1	1				4
33	Owen	Western	Experimental Studies in Marine Biology	Huntsman						2	3	2			4				11
36*	Snetsinger and Griffin	Queen's	Forest and Ecosystems Assessment	QUBS			2		1	1	2			2	1			1	10
37	Arnott	Queen's	Limnology-Stressed & Recovering Ecosystems	Killarney Park, Ontario					1	1	3	1	2	1	1				10
38	Gunn & Morgan	Laurentian	Methods in Aquatic Biodiversity Assessment	Sudbury & Killarney Park		2	1	2			6	1	1	2					15
39	Walsh & Kolasa	Carleton	Tropical Research in Jamaica	Discovery Bay, Jamaica		4	3		2		6	1							16
40	Dudley Williams	Toronto	Tropical Marine Biology	Barbados, West Indies			1			1	1	11						1	15
41	Mernill and Doucet	Windsor	Tropical Ecology of Costa Rica	Costa Rica			3			2	3					6			14

\* one week module

# of students	5	26	100	2	18	37	64	52	15	17	52	20	8	19	435
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# student-weeks	10	52	198	4	35	73	126	104	30	32	103	40	16	37	860
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B=Brock C=Carleton G=Guelph L=Laurentian M=McMaster O=Ottawa Q=Queen's To=Toronto Tr=Trent Wa=Waterloo We=Western Wi=Windsor WLU=Wilfrid Laurier Y=York



**Table 2: Summary of credits earned in the Ontario Universities Program in Field Biology in 2007**

	Brock	Carleton	Guelph	Laurentian	McMaster	Ottawa	Queen's	Toronto	Trent	Waterloo	Western	Windsor	WLU	York	Total Student-Weeks	Total Half-Course Credits
Total Student-Weeks																
Not at QUBS	10	46	188	2	28	47	90	100	28	24	88	34	10	30	725	362.5
Total Student-Weeks at QUBS	0	6	10	0	7	26	36	4	2	8	15	6	6	7	133	67.5
Total Student-Weeks in Field Modules	10	52	198	4	35	73	126	104	30	32	103	40	16	37	860	
Total Half-Course Equivalents in Field Modules	5	26	99	2	17.5	36.5	63	52	15	16	51.5	20	8	18.5		430

15.7% of credits in entire program earned at QUBS in 2007

28.6% of Queen's credits earned at QUBS in 2007

**Dr. Lonnie W. Aarssen, Department of Biology, Queen's University**

**“Plant Ecology and Evolution”**

Research in this lab focuses on the interpretation of adaptive strategies for growth, survival and reproduction in plants along environmental gradients and how these strategies help to explain patterns in the abundance, distribution and diversity of organisms, taxa, biomass and productivity within and between habitats.

**Lonnie Aarssen and Paul Grogan (Queen's University)**

**“Permanent deer exclosures”**

Five permanent deer exclosure plots were installed in a woodland site near the entrance to Lindsay Lake Road off of Opinicon Lake Road during the summer months of 2007. Each plot measures 10 x 10 m and is enclosed with wire fencing (9 feet high to the top running wire above the fence) attached to four steel corner posts embedded in concrete. Five ‘control’ plots (no fence) were also staked out with steel corner posts installed. Plots were surveyed to obtain an initial botanical inventory and their locations were mapped using GIS. These plots will be used by the Aarssen and Grogan labs in long-term studies of the impact of deer browsing on community and ecosystem structure and function. They should also be of value to other researchers and for teaching at QUBS. As well, we anticipate that these permanent plots will serve as a show-and-tell natural history display for the public and school field trips.

**Assistants:** Catherine Gieysztor, Alexandra Howard, Floyd Connor, Roger Green, Nicole, Willie, Amanda Mathys, and Thea Whitman.

**Acknowledgements:** Funded by NSERC discovery grants to Lonnie Aarssen and Paul Grogan and funded by Queen's SWEP to Catherine Gieysztor and Alexandra Howard.

**Thea Whitman – “Between-species patterns of covariation in plant size, leaf size, and meristem production in herbaceous angiosperms” – B.Sc. Thesis**

Why do some plants have such large leaves while others have tiny leaves? Most past explanations for this basic ecological question have considered leaf size to be directly adaptive, based on factors such as gas exchange, photosynthetic rates, and temperature and humidity gradients. Smaller leaves are typically regarded as adaptive under conditions associated with cooler, drier, and/or low-nutrient environments, which have probably been the most common habitat types throughout the evolutionary history of plants. This is reflected in the skewed distribution of leaf sizes – i.e. a greater number of species with relatively small leaves. However, this does not explain why leaf size often varies widely even within a single habitat. In this study, an alternative interpretation is explored: Because each leaf is associated with an axillary

meristem, having a high leafing intensity (number of leaves per unit plant mass) is equivalent to having a greater number of meristems per unit plant mass – i.e., a higher “meristem bank”. Since each meristem can produce a new shoot or a reproductive structure, high leafing intensity should confer greater architectural and reproductive plasticity for the plant. Thus, it is plausible that for some species, having a relatively small leaf size, rather than being directly adaptive, may simply be a trade-off associated with the adaptive advantage of having a relatively large meristem bank (corresponding to a high leafing intensity). This advantage should be especially important for smaller species, since they are likely to suffer from greater obstruction of growth and reproduction.

**Acknowledgements:** Funded by NSERC discovery grant to LWA and by NSERC Summer Research Fellowship to Thea Whitman.

**Theses** (involving work done at QUBS):

Piggot, G. 2007. Effects of density and light use efficiency on plant community invisibility. BSc.(Hons.) Thesis, Queen’s.

Thompson, E. 2007. Quantifying the effect of diversity and time-since-disturbance on plant-induced heterogeneity in an old field. BSc.(Hons.) Thesis, Queen’s.

Schamp, B.S. 2007. Competition, species size, and the assembly of plant communities. PhD. Thesis, Queen’s.

**Publications** – last two years (involving work done at QUBS):

Kleiman D. and Aarssen, L.W. (2007) The leaf size / number trade-off in trees. *Journal of Ecology* 95: 376-382.

Schamp, B.S., Schurer, M. and Aarssen, L.W. (2007) Testing hypotheses for stem bending in tree saplings *International Journal of Plant Sciences* (in press).

Schamp, B.S., Chau, J. and Aarssen, L.W. (2008) Dispersion of traits related to competitive ability in an old-field plant community. *Journal of Ecology* 96: 204-212.

**Dr. Shelley Arnott, Department of Biology, Queen’s University**

### **“Aquatic Community Ecology”**

The Arnott lab executed three studies investigating different aspects of aquatic community ecology at QUBS in the summer of 2007. The largest of these was a master's project designed to test a hypothesized interaction between dispersal rates and regional heterogeneity on biodiversity.

**Michael Pedruski - The effects of habitat connectivity and regional heterogeneity on artificial pond metacommunities – MSc Thesis**

This experiment was executed in an array of 72 artificial pond mesocosms grouped into 18 regions that varied in levels of habitat connectivity and regional heterogeneity. The ponds were stocked with a hyperdiverse aquatic invertebrate community, and sampled after 12 weeks to determine the effects of both factors on invertebrate species richness, Simpson diversity, and functional diversity. Further research on dispersal in aquatic communities involved a study designed to investigate ambient dispersal of freshwater invertebrates, especially zooplankton. To accomplish this, Janine Lee (an NSERC USRA student) set up an array of water-bearing containers covered by filters of different mesh sizes. The specific objective was to determine colonization rates of zooplankton in the area, as well as to determine which dispersal vectors were important to colonization (as different vectors would be limited by different mesh sizes). Finally, the Arnott lab also ran a project examining trophic interactions of zooplankton from Opinicon lake. This experiment consisted of 'petri-dish' predation experiments designed to determine whether given predators consumed specific prey taxa, and if so at what rate. This project was also executed by an NSERC USRA student, Steve Hawrylshyn

**Assistants:** Janine Lee, Steve Hawrylshyn

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

**"Behavioural and physiological ecology of reptiles"**

Our long-term research objective is to decipher how behaviour and phenotype, modulated by physiological constraints, affect whole-organism performance and, thus, fitness-related life-history traits. We use a functional evolutionary approach and most of our work integrates controlled laboratory experiments with field observations.

Because reptiles are, proportionally, the most threatened vertebrate group in Canada (according to COSEWIC listings), another long-term objective in our laboratory is to contribute to their conservation. While we use funding other than NSERC to conduct applied conservation projects on reptiles at risk (e.g., descriptions of habitat use and movement patterns), we are also interested in fundamental conservation questions, such as the implications of demographic synchrony and of anthropogenic mortality.

In spring 2007, we continued our long-term demographic monitoring of the ratsnake population.

**Assistants:** Ariane and Félix Blouin, Grégory Bulté, Véronique Juneau, Gabriel Picard, Karine Savard, Catherine Verreault

**Grégory Bulté - “Causes and consequences of sexual size dimorphism in the common map turtle (*Graptemys geographica*)” - PhD Thesis**

Map turtles (*Graptemys*) are among the most size dimorphic reptiles. Females can be twice the length of males and up to ten times the mass. In the common map turtle, diet dimorphism in size and type of prey consumed is also present. For my PhD, I am interested in the following questions:

- 1-How do growth rates and timing of maturation differ between the sexes?
- 2-How does variation in growth rates between the sexes influences investment in thermoregulation and vice-versa?
- 3-Is body size sexually selected in males and females?
- 4-Is there a functional link between diet dimorphism and size dimorphism? Is allometric head size enlargement and foraging specialization in females necessary to achieve larger body size?

To answer these questions, I integrate physiology, ecology and behaviour. I use physiological telemetry, molecular markers, stable isotopes analysis, and mark-recapture techniques to gather my data. In spring 2007, I wrapped up the field component of my study by continuing the mark-recapture program and removing radio-transmitters previously placed on turtles.

**Assistants:** Véronique Juneau, Karine Savard

**Publications resulting from QUBS work (2006 and thereafter):**

Row JR & G Blouin-Demers. 2006. Thermal quality influences effectiveness of thermoregulation, habitat use, and behaviour in milk snakes. *Oecologia* 148: 1-11.

Row JR & G Blouin-Demers. 2006. An effective and durable funnel trap for sampling terrestrial herpetofauna. *Herpetological Review* 37: 183-185.

Bulté G & G Blouin-Demers. 2006. Cautionary notes on the descriptive analysis of performance curves in reptiles. *Journal of Thermal Biology* 31: 287-291.

Row JR & G Blouin-Demers. 2006. Thermal quality influences habitat selection at multiple spatial scales in milksnakes. *Écoscience* 13: 443-450.

Row JR & G Blouin-Demers. 2006. Kernels are not accurate estimators of home-range size for herpetofauna. *Copeia* 2006: 797-802.

Bulté G, C Verly & G Blouin-Demers. 2006. An improved blood sampling technique for hatchling emydid turtles. *Herpetological Review* 37: 318-319.

Quirt KC, G Blouin-Demers, BJ Howes & SC Loughheed. 2006. Microhabitat selection of five-line skinks in northern peripheral populations. *Journal of Herpetology* 40: 335-342.

Gibbs HL, SJ Corey, G Blouin-Demers, KA Prior & PJ Weatherhead. 2006. Hybridization between mtDNA-defined phylogeographic lineages of black ratsnakes (*Pantherophis* sp.). *Molecular Ecology* 15: 3755-3767.

Row JR, G Blouin-Demers & PJ Weatherhead. 2007. Demographic effects of road mortality in black ratsnakes (*Elaphe obsoleta*). *Biological Conservation* 137: 117-124.

Edwards AL & G Blouin-Demers. 2007. Thermoregulation as a function of thermal quality in a northern population of painted turtles, *Chrysemys picta*. *Canadian Journal of Zoology* 85: 526-535.

Blouin-Demers G & PJ Weatherhead. 2007. Allocation of offspring size and sex by female black ratsnakes. *Oikos* 116: 1759-1767.

Blouin-Demers G, LP Bjorgan\* & PJ Weatherhead. 2007. Changes in habitat use and movement patterns with body size in black ratsnakes (*Elaphe obsoleta*). *Herpetologica* 63: 421-429.

Bulté G & G Blouin-Demers. 2008. Northern map turtles (*Graptemys geographica*) derive energy from the pelagic pathway through predation on zebra mussels (*Dreissena polymorpha*). *Freshwater Biology* 53: 497-508. (cover photo)

Ben-Ezra E, G Bulté & G Blouin-Demers. 2008. Are locomotor performances co-adapted to preferred basking temperature in the northern map turtle (*Graptemys geographica*)? *Journal of Herpetology*, in press.

### **Theses resulting from QUBS work (2006 and thereafter):**

Ben-Ezra E. 2006. A test of the thermal coadaptation hypothesis in the common map turtle (*Graptemys geographica*). BSc Thesis, Department of Biology, University of Ottawa.

Gravel MA. 2006. Sexual size dimorphism and diet specialization in the common map turtle (*Graptemys geographica*). BSc Thesis, Department of Biology, University of Ottawa.

Verly C. 2006. Does multiple paternity increase with female body size in the common map turtle (*Graptemys geographica*)? BSc Thesis, Department of Biology, University of Ottawa.

Elgee KE. 2007. Sexual size dimorphism in garter snakes (*Thamnophis sirtalis*), water snakes (*Nerodia sipedon*), and black ratsnakes (*Elaphe obsoleta*). BSc Thesis, Department of Biology, University of Ottawa.

Patterson LD. 2007. The effect of constant vs. fluctuating incubation temperatures on the phenotype and fitness of black rat snake (*Elaphe obsoleta*) hatchlings. BSc Thesis, Department of Biology, University of Ottawa.

**Dr. Andrew J. Bohonak, Associate Professor, San Diego State University Department of Biology**

**“Coevolution of mosquitoes with their water mite parasites”**

Water mites are an ecologically and evolutionarily diverse group. Because their larvae parasitize freshwater insects, they provide a model system for studying the evolution of parasitism. Building on previous work, I collected *Coquilletidia* mosquitoes and their mite ectoparasites (*Arrenurus* spp.) from locations at the northern and southern end of the mosquito's range. These collections took place during sabbatic travels to Florida (hosted by Dr. David Jenkins, Univ. Central Florida), and Queen's University Biology Station in Ontario, Canada (hosted by Dr. Bruce Smith, Ithaca College, New York). I collected data on abundance patterns for mite and host, and have preserved the specimens for future genetic work. The analysis of these samples will make an excellent student research project in 2008 (possibly undergraduate), and the results of this pilot study will provide the basis for a future graduate student thesis.

**Dr. Frances Bonier, Adjunct Assistant Professor, Queen's Biology**

**“Reproductive Ecology of Tree Swallows”**

I am broadly interested in understanding how animals cope with challenges in their environment. I investigate how animals respond to environmental challenges both in the short term, through behavioural and physiological responses, and in the long term, through demographic and evolutionary responses. To address my research questions, I draw on tools from numerous disciplines, including endocrinology, hematology, population genetics, and field biology techniques. I am also interested in understanding local adaptation, and its impacts on population divergence.

During the spring/summer of 2007 I began work on tree swallows at QUBS; most notably we conducted a pilot study looking at the relationship between stress hormone (corticosteroid) levels and reproductive success. Our results show a strong negative correlation between fitness

and hormone levels at one point during the incubation stage, but the correlation disappeared when hormone measures were taken later during incubation from the same individuals. In 2008 we hope to replicate this study and expand into other areas of field endocrine work at QUBS.

**Assistants:** Hannah Munro and Kira Delmore

**Dr. Linda Campbell, School of Environmental Studies & Department of Biology, Queen's University, Kingston, Ontario.**

### **“Evaluation of Metal Contamination within the Rideau River Waterway”**

Created in 1832, the Rideau River canal links Ottawa and Kingston and is characterized by a lock system connecting cities as well as rural areas. Development and industry along a waterway such as this one has the potential to release metals into the watershed, which is of concern as metals can be toxic and can accumulate in living organisms. The geochemical and biological effects of metals on waterways, in particular, are of great concern as these metals can be taken up by aquatic plants as well as by aquatic organisms. Biomagnification, the process by which certain contaminants can increase in concentration up trophic levels, is also an issue because humans and wildlife consume fish and seafood from potentially polluted waters.

In 2006, a preliminary honours thesis project evaluated metal concentrations, grain size and organic content in the surface water, depth water and sediment of nine lakes south of Smith Falls. Within the two lakes with the highest metal concentrations, Pb was found to exceed CCME Sediment Guidelines, while Co and Zn were found to exceed CCME Freshwater Guidelines. Elevated concentrations of Cu, Co, Ni, Zn and Rb (0.003 to 0.073 ppm) in waters were found.

In 2007, a MSc thesis research project was initiated. The project objectives were threefold: firstly, to identify the areas of impact within both Upper Rideau and Indian Lake; secondly, to identify potential metal inputs within each of the lakes and thirdly, to examine the rate of mercury biomagnifications in sport fish from the Rideau River Waterway. A total of 14 surface and depth water samples and a total of 28 surface sediment grab samples were collected from Upper Rideau and Indian Lakes, along with nearly 300 fish collected from Upper Rideau, Indian and Newborough Lakes.

Samples are currently being analyzed. The data will be used to develop a field plan for the summer of 2008.

Masters graduate thesis: **Shannon LeBlond** (2007-2009)

Honours Biology undergraduate thesis: **Kathleen Hamilton** (2006-07)



**Dr. Steven J. Cooke, Fish Ecology and Conservation Physiology Laboratory, Department of Biology and Institute of Environmental Science, Carleton University, Ottawa, Canada.**

**“Fish ecology and conservation physiology”**

Our laboratory maintains broad interests in all aspects of aquatic ecology, conservation biology, physiological ecology, animal behaviour and environmental science. Much of our research programme is based at QUBS where freshwater fishes are used as research models for experiments conducted in laboratory tanks, enclosures, and experimental lakes. Specific interests are (1) determining the energetic, fitness, and potential evolutionary consequences of a variety of natural (e.g., winter, reproduction) and anthropogenic (e.g., angling, environmental pollution) stressors and, (2) understanding the diversity of energetic, physiological, and behavioural responses of fish to stress at the individual, population, and species level. We then apply the fundamental knowledge derived from these basic research activities to aid in the conservation and management of aquatic resources. Of late, we have been involved with defining the new discipline of “conservation physiology” – a field dedicated to understanding the mechanisms underlying conservation problems. Because our work is heavily based in the field, we rely on technologies including underwater videography and telemetry to monitor free-swimming fish in the wild. Specific research projects currently underway at QUBS include evaluating the sublethal consequences of catch-and-release angling, exploring the physiological correlates of reproduction and fitness in centrarchids (our NSERC-funded research programme), and understanding the factors influencing the spatial ecology of fish.

The Cooke Lab was in residence at QUBS from early May through late June. However, members of the Cooke Lab continued to use QUBS for day trips in mid summer and early fall.

**QUBS Collaborators:** Dr. Cory Suski, Dr. George Niezgoda, Dr. Jason Schreer, Dr. Robert Arlinghaus, Dr. Bruce Tufts, Dr. Patrick Weatherhead, Dr. Roly Tinline, Dr. David Philipp, Julie Claussen, Dr. George Iwama, Dr. Katie Gilmour, David Peterson, Dr. Patrice Couture.

**Kyle Hanson – “The morphological and nutritional correlates of mate choice in smallmouth bass (*Micropterus dolomieu*)” - Ph.D Thesis**

This was the second year of the Ph.D. research programme for Kyle Hanson. The focus of the research this year was to elucidate the relationships between female mate choice and variation in male morphology and nutritional status of smallmouth bass. A total of 88 nesting male smallmouth bass were sampled on Charleston Lake. The sampling process included

capture of individuals, digital photography for later morphometric analysis, and blood sampling for analysis of biochemical indicators of lipid and mineral stores.

**Assistants:** Michelle Caputo, Mike Donaldson, Caleb Hasler, Sean Landsman, Constance O'Connor, Amanda O'Toole, Rana Sunder, Steven Cooke

**Marie-Ange Gravel – “Influence of nest predator burden on the behaviour, physiology and energy status of fish providing parental care” – M.Sc. Thesis**

This project involved testing how nest predator burden affected smallmouth bass parental care behaviour, physiology and energy status. Data collection for this project occurred at seven lakes in the vicinity of the biology station. Predator burden was assessed when males were present and absent (after experimental removal) from the nest and lakes were then ranked according to these metrics. We monitored smallmouth bass behaviour through snorkeling observations and sampled individuals for blood and muscle across the parental care period in order to assess physiological condition and energy status. These data will be used to test if males in high predator lakes behave differently, have lower nutritional status, exhibit greater secondary stress response, use more energy stores and have greater anaerobic and aerobic capacity than males in low predator lakes.

**Assistants:** Michelle Caputo, Andrew Gingerich, Connie O'Connor, Amanda O'Toole, Tara Redpath, Rana Sunder, Steven Cooke

**Constance O'Connor – “Consequences of stress in largemouth bass: Interactions between physiology, behaviour, life history, and reproductive success” – M.Sc. Thesis**

Connie's M.Sc. research investigates how life history can influence the effects of stress on the physiology, behaviour, survival, and reproductive success in individuals, and how stress can potentially impact population-level processes. In particular, she is looking at how stress affects wild largemouth bass during parental care (the first study on stress during parental care in fish), and whether these effects differ from a stress applied during non-reproductive periods. A significant component of this work made use of the Warner Lake Ecological Observatory, where fine-scale remote biotelemetry allowed Connie to compare the over-wintering behaviour of stressed individuals to control individuals. Connie's research was conducted entirely on populations of largemouth bass in Long Lake and Warner Lake, two private research lakes managed by QUBS. The use of private research lakes allowed Connie to conduct studies using the first field application of stress hormone manipulation in fish. This research sets a precedent for the use of centrarchids as a model to test stress and life history theory.

**Assistants:** Michelle Caputo, Alison Coletelo, Mike Donaldson, Andrew Gingerich, Marie-Ange Gravel, Kyle Hanson, Caleb Hasler, Sean Landsman, Amos Mapleston, William Nalley, Vivian Nguyen, Amanda O'Toole, Dave Peterson, Chris Pullen, Tobias Rapp, Tara Redpath, Rana Sunder, Lisa Thompson, Steven Cooke

**Michelle Caputo – “Long-term physiological and nutritional consequences of internal and external telemetry devices on wild largemouth bass” – B.Sc. Thesis in Environmental Science**

Telemetry tagging is a research method that is used on a variety of fish to track movement and identify critical habitat. Michelle conducted a study on the physiological and nutritional consequences of surgically implanted transmitters on a population of wild largemouth bass in order to validate or reject research that uses this technique. This study was conducted on Warner Lake (owned by QUBS) which is equipped with a code division multiple access technology (CDMA)-based acoustic telemetry array. Since 2003, 119 largemouth bass have been implanted with transmitters and PIT tags are used to identify individuals (both with and without transmitters). Over several years, including June – October 2007, both tagged and untagged fish were caught, the total length was taken, and they were blood sampled. From these samples, nutrition and growth rates were compared for transmitter and control fish.

**Assistants:** Connie O'Connor, Mike Donaldson, Marie-Ange Gravel, Kyle Hanson, Tara Redpath, Amanda O'Toole, Rana Sunder, Caleb Hasler, Amos Mapleston, Tobias Rapp, Allison Colotelo, Vivian Nguyen, Lisa Thompson, Andrew Gingerich

## **Publications with QUBS Content or Relevance (2007 and 2008)**

### **In Press**

Thompson, L.A., M.R. Donaldson, K.C. Hanson, R. Arlinghaus, and S. J. Cooke. In Press. Physiology, behavior and survival of angled and air exposed largemouth bass. North American Journal of Fisheries Management. 00:000-000.

Donaldson, M.R., R. Arlinghaus, K.C. Hanson, and S.J. Cooke. In Press. Enhancing catch-and-release science with biotelemetry. Fish and Fisheries. 00:000-000.

Graham, A., and S.J. Cooke. In press. The effects of noise disturbance from various recreational boating activities common to inland waters on the cardiac physiology of a freshwater fish, the largemouth bass (*Micropterus salmoides*). Aquatic Conservation: Marine and Freshwater Ecosystems. 00:000-000.

Hanson, K.C., M.A. Gravel, A. Graham, A. Shoji, and S.J. Cooke. In press. Intersexual variation in fisheries research and management: When does sex matter? *Reviews in Fisheries Science* 00: 000-000.

## **2008**

Arlinghaus, R., T. Klefoth, A. Kobler and S.J. Cooke. 2008. Size-selectivity, capture efficiency, injury, handling time and initial hooking mortality of angled northern pike (*Esox lucius*) in Germany and Canada: the influence of bait size and type. *North American Journal of Fisheries Management* 28: 123-134.

Cooke, S.J. 2008. Biotelemetry and biologging in endangered species research and animal conservation: relevance to regional, national, and IUCN Red List threat assessments. *Endangered Species Research* 4:165-185.

White, A.J., J.F. Schreer, and S.J. Cooke. 2008. Behavioral and physiological responses of the congeneric largemouth (*Micropterus salmoides*) and smallmouth bass (*M. dolomieu*) to various exercise and air exposure durations. *Fisheries Research*. 89:9-16.

## **2007**

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### **Principal Investigators:**

**Dr. Suzie Currie**, Dept. of Biology, Mount Allison University, Sackville, NB

**Dr. Patricia Wright**, Dept. of Integrative Biology, University of Guelph, Guelph, ON

**Dr. Bruce Tufts**, Dept. of Biology, Queen's University, Kingston, ON

**Dr. Brian Bagatto**, Dept. of Biology, University of Akron, Akron, Ohio

**“Ecophysiology of the central mudminnow (*Umbra limi*) a freshwater, air-breathing fish”**

**Students:**

Danielle Leblanc, MSc candidate, University of Guelph

Matt DeMille, MSc candidate, Queen's University

Chris Marks, PhD candidate, University of Akron

Aubre Learner, BSc Honours student, University of Akron

Nicole Templeman, BSc Honours student, Mount Allison University

**Students Involved with project at home institutions:**

Lauren Stryker, BSc student, University of Guelph; Thesis Title: "Tissue ammonia and urea concentration in the central mudminnow, *Umbra limi*, in response to environmental perturbation"

Jennie Parker, BSc Honours student, Mount Allison University; Thesis Title: "The heat shock response in the central mudminnow, *Umbra limi*, an air-breathing fish"

**Research Summary:**

This year marked the second year of a collaborative research project investigating the unique ecological and physiological strategies of the central mudminnow, a freshwater, air-breathing fish native to southeastern Ontario. Our team combined lab-based physiology with field measurements to develop an environmentally relevant physiological profile of this fish in changing environments.

Field Biology: To understand diurnal changes in the fish's environment, we made field measurements of temperature, pH, ammonia and dissolved oxygen at several sites where mudminnows were captured. (DeMille, Templeman)

Physiology: We exposed fish to different environmental conditions informed by our field measurements: 1) high and low temperature, 2) aquatic hypoxia, 3) air exposure, 4) high ammonia. In all conditions, we measured metabolic rate (Leblanc, Bagatto, Marks, Learner), nitrogen excretion (Wright), blood glucose and lactate (Currie). We also sampled liver, muscle and gill tissue (frozen and fixed) for analysis of tissue ammonia, gill histology (Wright, Leblanc, Stryker) heat shock proteins (Currie, Parker).

**Publications:**

Marks, C.M., Learner, A.D., Wright, P.A., Currie, S., and Bagatto, B. 2008. Metabolism in the Mudminnow (*Umbra limi*): Effects of temperature, hypoxia and ammonia. *Integrative and Comparative Biology*. Jan 2008.

**Dr. John M. Epifanio – Aquatic Biology Section, Illinois Natural History Survey**

**“Nest-site fidelity in male bluegill sunfish”**

**Field Assistants:** Jennifer Bartlett, Sean Landsman, and Julie Weatherhead

This past summer was the culmination of a four-year study examining nest-site fidelity of male bluegill sunfish (*Lepomis macrochirus*) in Long Lake. During the bluegill breeding season (late May to early July), males group together in colonies to build nests and court females. Females deposit their eggs in males' nests and the males, termed parentals, provide parental care for their eggs and hatched fry until they leave the nest. Each season approximately one-third of bluegill nest two or more times to raise clutches, and approximately 15% of males renest the following year. Our objectives during this study were to determine if parentals repeatedly return to nest sites and to examine mechanisms relating fidelity to reproductive success. This year we conducted a full lake mark-and-recapture study of all nesting parentals capturing 497 fish from 93 colonies. Of these males, we recaptured 63 fish from previous breeding seasons and 161 fish from earlier nesting bouts in 2007. Looking at coarse-scale fidelity to delineated lake quadrants, males returned to the same areas of the lake 94% of the time to renest. On a smaller scale, combining GPS distance data with colony spawn dates, we determined that 79% of renesting males choose new colony sites that were as close as possible to their previous nests. These numbers strongly suggest that males are not randomly choosing nest sites, but rather are evaluating the sites and preferentially choosing them. We hypothesized that sites where males successfully nest are preferred over random sites. By experimentally predated nests and removing fry, we compared successful nesters to non-successful nesters. We measured renest rates, distances to new nest sites, and egg scores expecting treatment fish to renest at a lower rate, further from their original nest site, and have lower egg scores. Contrary to our expectations, control and treatment males displayed no differences between any of our measured variables. These results suggest that bluegill do not choose renesting sites based solely on assessed reproductive success and that habitat quality or social structure and interactions may be more important variables for choosing nest site locations.

**Dr. Mark Forbes, Department of Biology, Carleton University, Ottawa**

**"Ecological Parasitology and Barcoding"**

## **Mark R Forbes – “Barcoding and inter-annual variation in parasitism & host resistance”**

In 2007, I had two projects. The first was to collect odonates for DNA barcoding initiatives in collaboration with PDN Hebert. The second was to continue work initiated by Dr. Tonia Robb on long-term patterns of parasitism and host defence for a damselfly-parasitic water mite association, *Lestes disjunctus*-*Arrenurus pollictus* found at Barb's Marsh. We now have 40 or so species with barcodes completed. For the second project, we were interested in whether patterns of parasitism varied both within and between years and whether host defences were related to parasitism and/or weather. Initial analyses suggest that there were greater rates of parasitism and greater expression of host defences against parasitism in later, compared to earlier, years of study. This past year we had lower mite numbers but resistance was still relatively common suggesting mite numbers alone do not dictate resistance expression.

### **Theses:**

Robb, Tonia 2006 Causes and consequences of variation in immunity within insect populations. Ph.D. Thesis, Carleton University.

### **Publications:**

Forbes, MR. On sex differences in optimal immunity. Trends Ecol Evol, in press

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- Koprivnikar J, Forbes MR, Baker RL. 2006. Effects of atrazine on cercarial longevity, activity, and infectivity. *Journal of Parasitology* 92:306-311.

**Dr. James Fullard, Department of Biology, University of Toronto at Mississauga, Mississauga.**

## **“Sensory ecology of bats and insects”**

**Kit E. Muma - Biology Department - Ithaca College - Ithaca, NY**

### **"Moth anti-bat flight behaviours"**

I continued a study of the evolution of sensory adaptations in insects and in particular, the evolution of ultrasonic hearing in moths in response to predation by bats. The precise flight movements of moths when exposed to ultrasound has not been extensively studied. I used a high-speed, infra-red sensitive video camera to examine the timing of auditory evoked flight responses to bat-like sounds of different intensities. My goal was to test some of the models previously put forward for explaining the neural control of defensive flight in noctuid moths.

**Andrew Furfaro - Biology Department - Ithaca College - Ithaca, NY - Undergraduate Dana Summer Research Internship**

### **“Clear and present danger: moths avoiding ultrasonic bat calls”**

During the summer of 2007 I worked on several projects. Using the "Moths of Canada" website ([http://www.cbif.gc.ca/spp\\_pages/misc\\_moths/phps/mothindex\\_e.php](http://www.cbif.gc.ca/spp_pages/misc_moths/phps/mothindex_e.php)), I constructed a pictorial list of moths that were target species for the summer research in our lab and for Dr's Dawson and Yack at Carleton University. This allowed easy identification and familiarization with the species. These moths were used for many different experiments: some were dissected, others used in the over-water flight trials and the ultrasound experiments as described below. I examined the potential danger that a moth experiences, from fish, when landing on the surface of a lake. Live moths were released from the dock over the water at dusk and were subjected to an ultrasonic blast. I recorded whether moths reacted by diving into the water and if they were consumed by fish. In the other experiment I attempted to determine if moths would avoid ultrasound. A moth was placed in a cage and ultrasound controlled via a computer was emitted from the speakers alternating from one side of the cage to the other. This simulated the ultrasound that would normally be produced by a distant bat in pursuit of the moth. We predicted that the moth would avoid the side of the cage from which the ultrasound was emitted.

**Dr. John Ratcliffe - Department of Neurobiology and Behavior, Cornell University**

### **“Sensoribehavioural flexibility in bats and bat-specific warning signals in moths.”**

During the summer of 2007, my colleagues and I continued our on-going investigation of the sensory ecology and foraging behavior of insectivorous bats and the impact these predators

have on the evolution of warning signals in toxic tiger moths. First, with respect to the bats, we have now introduced individuals from each of the 5 residential species of bat found in Ontario to situations demanding two different hunting strategies. All 5 species have now been observed to readily capture airborne insects on the wing in a large outdoor flight room. And, with the sole exception of *Pipistrellus subflavus*, all species have now been documented to take prey from terrestrial surfaces there as well. That all species aerial hawk their prey comes as no surprise; that 4 of these same 5 species also glean prey changes our concept of the 'gleaning bat' and suggests that this 'rare' strategy is far more common than bats' wing and echolocation call designs would lead us to believe. Second, with respect to tiger moths, these insects, like their butterfly cousins, are often unpalatable to vertebrates, taking in toxins from their host plants as caterpillars or producing them themselves from more basic components. Many of these same insects advertise their toxicity through bright colouration and/or high frequency clicks. We have recently shown that which of these signals (one, both, or none) a particular species possesses is largely predicted by which predators are about when it emerges (in the early summer bats are less active, a trend that is not reflected in the foraging activity of birds) and when it is active (despite the image the name conjures in the mind, many tiger moths are highly diurnal). We found that toxic tiger moths that are flying when birds are hunting tend to brightly coloured but silent and those flying at night, when bats are out in full force, tend to be visual inconspicuous but produce sounds.

**Jeffrey Tribblehorn<sup>1</sup>, Hannah ter Hofstede<sup>2</sup>, Reese Arh<sup>2</sup>, and James Fullard<sup>2</sup>**

**<sup>1</sup>Department of Biology, University of Missouri**

**<sup>2</sup>Department of Biology, University of Toronto at Mississauga**

### **"Can insects detect the wind generated by a gleaning bat?"**

Most bats detect flying insects using echolocation and capture them in flight, but some species glean prey, meaning they capture insects off surfaces. Gleaning bats appear to rely on the sounds insects make to locate them. Using a large outdoor flight room at QUBS, we have found that a local gleaning bat, *Myotis septentrionalis*, can locate and capture singing male katydids, *Neoconocephalus ensiger*, on surfaces. We tested the hypothesis that these insects can detect the wind generated by a gleaning bat and take evasive action to avoid capture. Wind speed and acceleration were measured using a hot-wire anemometer placed behind a cage containing a singing (but deaf) katydid. In the lab, katydids were subjected to puffs of air to determine the threshold wind speed and acceleration required to pause and cease singing. We did not observe evasive behaviours by the katydids (such as dropping or song cessation) in response to the bat attacks in the flight room. The wind generated by bats during gleaning attacks was much lower in velocity (<100 cm/s) and acceleration (usually <1000 cm/s/s) than wind thresholds for song pausing (velocity = 394 cm/s, acceleration = 10222 cm/s/s) and cessation (velocity = 788 cm/s, acceleration = 20444 cm/s/s) observed from katydids in the lab. Katydids appear incapable of using wind as a predator cue and likely rely solely on hearing to detect gleaning bats.

**Hannah ter Hofstede<sup>1</sup> (Ph.D. Thesis), John Ratcliffe<sup>2</sup>, and James Fullard<sup>1</sup>**

**<sup>1</sup>University of Toronto at Mississauga, Mississauga, Ontario, L5L 1C6, Canada**

**<sup>2</sup>University of Southern Denmark, 5230 Odense M, Denmark**

**“Nocturnal activity positively correlated with auditory sensitivity in noctuid moths”**

We investigated the relationship between predator detection threshold and antipredator behaviour in noctuid moths. Moths with ears sensitive to the echolocation calls of insectivorous bats use avoidance manoeuvres in flight to evade these predators. Earless moths generally fly less than eared species as a primary defence against predation by bats. For eared moths, however, there is inter-specific variation in auditory sensitivity. At the species-level, and when controlling for shared evolutionary history, nocturnal flight time and auditory sensitivity were positively correlated in moths, a relationship that likely reflects selection pressure from aerial hawking bats. We suggest that species-specific differences in detection of predator cues are an important but often overlooked factor in the evolution and maintenance of antipredator behaviour.

**Reese Arh - “Foraging ecology of a bat community”- M.Sc. Thesis**

This past summer I completed a study of the ecomorphology of the five residential bat species found in Ontario (*M. lucifugus*, *M. septentrionalis*, *Myotis leibii*, *Eptesicus fuscus*, *Pipistrellus subflavus*). The first two species have echolocation and wing data already completed so the summer was spent concentrating on the other three species. Bats were captured and digital measurements were taken of wing morphology for each individual. We performed gleaning and aerial hawking trials to record echolocation data when capturing moths, though only one bat (*E. fuscus*) gleaned. We used the signal characteristics and wing morphology to predict differences in foraging habitat and behaviour. We found differences in both echolocation and wing structure that was indicative to the foraging habitat predicted by the literature, showing a relationship between the ecomorphology, echolocation, and wing design. Acoustic surveys were also performed throughout the summer where microphones were set up in various fields and forests to record bat calls. This will allow a description of which bat species are foraging where and at what times. By pairing this up with the echolocation and wing data we can then start answering key question about each species.

**Assistant:** Hannah Munro

**Matt Jackson – “Auditory system of notodontid moths” – M.Sc. Thesis**

Eared moths have the advantage of hearing the echolocation calls of their most deadly predator, nocturnal bats, as they approaching. This summer I had the opportunity to get a head start on my master’s candidacy, an investigation of the simplest ear on the planet. I spent my night’s blacklighting for notodontid moths and my days identifying them. With the moths identified and catalogued, I practiced neural dissections, exposing and recording from the

tympanic nerve. Moths were presented tones from 5 kHz to 100 kHz to determine their auditory thresholds. Spike patterns were recorded, and are being analyzed, not only for the presence of non-spontaneous activity tympanic nerve activity, as a threshold determinate, but also for more information that may be encoded therein. This information is valuable due to the simple nature of the notodontid ear. With only one receptor cell it is as straightforward as they come, and information yielded can be applied to other auditory receptor cells.

**Navdeep Asi – “Changes to auditory tuning in noctuid moths” - NSERC Undergraduate Summer Research Assistant**

This summer at the Queen's University Biology Station I worked under the supervision of Dr. James Fullard. As a summer USRA student, I worked on an independent project based on research in a recently published paper. My goal was to examine the effects of high amplitude sounds on the frequency response of the moth ear. For my project I used the noctuid, *Noctua pronuba* collected from areas around QUBS. Originally a European species, it has recently migrated to North America where it has the potential of becoming an agricultural pest. To examine the effects of high amplitude sounds, I micro-dissected the moth and exposed its auditory nerve. Once exposed, the auditory nerve was hooked onto an extracellular recording electrode. Measurements of the nerves response to various sound stimuli were recorded in order to analyze the effects of high amplitude sounds on its ear. I am currently analyzing this data and plan to submit my findings for publication this year. My experiences at QUBS have been very rewarding and enjoyable.

**Publications:**

ter Hofstede, H.M., Ratcliffe, J.M., Fullard, J.H. (in press) Nocturnal activity positively correlated with ultrasound sensitivity in noctuid moths. *Biology Letters*

J.M. Ratcliffe, A.R. Soutar, K.E. Muma, C. Guignon and J. H. Fullard. (in press) Reduced anti-bat flight activity in sound-producing versus silent moths. *Canadian Journal of Zoology*

Fullard, J.H., Ratcliffe, J.M. and Christie, C. 2007. Adaptive significance of acoustic feature discrimination in the dogbane tiger moth *Cycnia tenera*. *Journal of Experimental Biology* 210: 2481-2488.

**Dr. Paul Grogan - Department of Biology, Queen's University**

**"Controls on carbon and nitrogen cycling in the terrestrial ecosystems of S.E. Ontario"**

Our overall goal is to understand the factors that control carbon and nitrogen cycling and pool sizes in the forests and low intensity agricultural ecosystems of southeastern Ontario. At present, there are three major projects. First, we are investigating the influence of soil type and time on patterns of soil carbon accumulation and nitrogen mineralisation as shrublands and

forests regenerate on abandoned agricultural lands across the region. Second, we are investigating the influence of microbial community, substrate availability (carbon and nitrogen additions) and snowdepth on the soil processes of nitrification and denitrification (i.e. the production of dinitrogen gas and nitrous oxide – a greenhouse gas). We aim to characterise temporal and spatial variability in these processes at Stokes Field on the QUBS property. Third, we wish to investigate the influence of deer browsing on plant community structure, tree seedling regeneration, soil communities and biogeochemical processes. Five large replicate deer exclosures and associated control plots were established over the summer of 2007 in collaboration with Dr. Aarssen, and the assistance of Floyd Connor.

**Kate Buckeridge – “Microbial and environmental controls over nitrogen cycling in seasonally snow-covered ecosystems” - Ph.D Thesis**

Research at Stokes field on Lake Opinicon road was part of a pilot project for my thesis. This is the third winter that I have maintained snow depth and nitrogen-addition treatments, in addition to constantly monitoring soil temperature. The purpose of these treatments is to mimic climate change (more snow, and therefore reduced freeze-thaw cycles) and increased nitrogen deposition, and to monitor changes in the soil microbial community and soil microbial activity as a result of these disturbances. I collected soil samples last winter and spring for biogeochemical, microbial community and soil gas analysis. I am still running analysis, but preliminary results suggest that deeper snow does not have a very important biological impact on soil processes in this system. The Grogan lab intends to continue to add low levels of nitrogen to these plots, to monitor the long-term effects of nitrogen deposition on soil biogeochemistry and microbial activity.

**Robyn Foote – “Carbon and nitrogen dynamics in abandoned agricultural soils of Southeastern Ontario” – M.Sc. thesis**

This project is aimed at investigating if total soil carbon and nitrogen change over time on abandoned agricultural land and how these changes are different amongst the major soil types in the region. Robyn spent the summer of 2007 analysing her soil samples, and writing up her data.

**Assistants:** Catherine Gieysztor, Alexandra Howard, various members of the Grogan lab.

**Dr. Simone Immler – Department of Biology, University of Sheffield, Sheffield UK**

**“Sperm Competition”**

During my stay at QUBS in May and June of 2007, I undertook two projects:

- 1) For a comparative study investigating the impact of sperm competition on the evolution of sperm design in Passerine birds, I collected sperm samples from Passerines (mainly New World warblers or Parulidae). To do so, I strolled through the forests with a mist net, used

tape luring to attract males singing on their territories into the net and then collected a sperm sample and subsequently released the bird back into the wild.

- 2) The second project was in collaboration with Dr. John Epifanio (Illinois Natural History Survey) looking at the importance of conspecific sperm precedence for reproductive isolation between bluegill and pumpkinseed sunfish. To do this, we captured male and female sunfish from all over Lake Opinicon. We brought the fish back to the lab where we collected sperm and eggs from sacrificed males and females for in vitro experiments. Competition crosses were made wherein sperm of the two species was mixed and combined with eggs of females of either of the two species. The fertilized eggs were kept until hatching, which meant regular water changes (every four hours, day and night).

**Assistant:** Susie Crowe

## **Dr. Stephen Lougheed - Department of Biology, Queen's University**

### **“Diversification of vertebrates”**

Our lab is interested in the forces that shape biodiversity from the level of local adaptation and limiting gene flow in single landscapes, through the genetics of whole species' ranges, to understanding the causes of diversification of entire clades. Our research spans the Americas, with particular emphasis on phylogeography and phylogenetics of select anurans, snakes, lizards and birds.

We use a range of high-resolution molecular markers and morphometrics, and increasingly sonographic and colour analyses, to map variation across the ranges of organisms, and combine these with experimental approaches, GIS and automated climate measurement to understand the causes and consequences of diversity across geographical and temporal scales.

At QUBS over the last few years I have been developing a research program focused on how gene flow, habitat heterogeneity and potentially varying selection regimes at fine geographic scales might interact to influence local adaptation (e.g. spring emergence, morphology and growth rates in tadpoles) in the spring peeper, *Pseudacris crucifer*. The work includes (or will include): 1. Mapping microclimatic, hydrological and biotic differences among the myriad wetland types that spring peepers breed in at QUBS and environs. 2. Assessing variation among wetland types in spring emergence and calling and breeding phenology of this and other frog species. And 3. Quantifying the scale at which gene flow unites breeding assemblages, and thus at what scale local adaptation would be possible.

My research is embedded in a much larger geographic and temporal context, including at the largest scale, a continental phylogeography of the entire species (Austin et al. 2004. Mol. Phylogenet. Evol 32: 799-816), and also work by new Ph.D. student Kathryn Stewart on the importance of secondary contact zones in the diversification of *Pseudacris crucifer* (including both phonotaxis and hybridization work).

## **Dr. Daniel J. Mennill - University of Windsor - Department of Biological Sciences**

The Mennill Lab's QUBS-based field research in 2007 was the third year of a very productive collaborative project between myself and graduate student Lauren Reed, and Dr. Laurene Ratcliffe and graduate student Jennifer Foote (Queen's University). We continued to operate a sixteen-microphone Acoustic Location System capable of passively triangulating the position of free-living animals based on the sounds they produce. This project has given rise to a number of publications out of our research group concerning the behavioural ecology of black-capped chickadees, with more to follow. Importantly, our high-technology approach to studying the vocal behavior of chickadees provides some of the most compelling empirical support for the communication network model to date. Our data convincingly demonstrate that wild bird populations can be understood as a dynamic network of territorial males and discriminating females.

In early 2007, Oxford University Press published a landmark book, "Ecology and Behavior of Chickadees and Titmice" edited by Dr. Ken Otter (University of Northern British Columbia), which featured numerous chapters that highlighted two decades of chickadee research at QUBS including research out of the Ratcliffe Lab at Queen's University and the Mennill Lab at University of Windsor.

### **Publications:**

**Mennill DJ** and Otter KA (2007) Status signaling and communication networks in black-capped chickadees: Complex communication with a simple song. In: Ecology and Behavior of Chickadees and Titmice (Otter KA, ed) 215-233.

**Mennill DJ**, Burg TM, Curry BL, Martin K, Norris AR, Ratcliffe LM, Reudink MW, Rossano LM, Shubert KA (2007) Parid Reproductive Behaviour. In: Ecology and Behavior of Chickadees and Titmice (Otter KA, ed) 147-150.

Ratcliffe LM, **Mennill DJ**, & Schubert KA (2007) Dominance in black-capped chickadees. In: Ecology and Behavior of Chickadees and Titmice (Otter KA, ed) 131-146.

Freeberg TM, Baker MC, Bloomfield LL, Charrier I, Gammon DE, Hailman JP, Lee TT-Y, Lucas JR, **Mennill DJ**, & Sturdy CB (2007) Complexities in Vocal Communication. In: Ecology and Behavior of Chickadees and Titmice (Otter KA, ed) 235-240. [PDF]

Schubert KA, **Mennill DJ**, Ramsay SM, Otter KA, Boag PT & Ratcliffe LM (2007) Variation in social rank acquisition influences lifetime reproductive success in black-capped chickadees. **Biological Journal of the Linnean Society** 90:85-95.

Schubert KA, **Mennill DJ**, Ramsay SM, Otter KA, Boag PT, Ratcliffe LM, and Kraus KC (2008) Between-year survival and rank transitions in male black-capped chickadees: a multi-strata modelling approach. **Auk** in press.

**Lauren Reed** - "Countersinging interactions in black-capped chickadee neighbourhoods: Graded Aggressive Signals and Communication Networks" - MSc Thesis



Songbirds frequently engage in countersinging interactions, wherein they vary the type and timing of songs during interactions to convey information about their status and intent. I studied frequency matching, overlapping, and movement behaviour during 100 naturally-occurring song contests among male black-capped chickadees (*Poecile atricapillus*) using a 16-microphone Acoustic Location System. Matching was associated with song overlapping and approach, and my results support the idea that chickadees use graded signals of aggression during countersinging interactions. I used stereo playback to simulate two types of song contests that differed in song patterning and timing. I recorded all males surrounding the playback apparatus, which was positioned in undefended space between territorial males. Males responded more intensely to the aggressive treatments than the submissive treatments. My results reveal that male chickadees eavesdrop on and respond to contests occurring outside of their territory boundaries, and provide important empirical support for the communication network model.

**Assistants:** Holly Hennin, Anneka Osmun

**Publications:**

**Reed LP**, Foote JR, Ratcliffe LM, and **Mennill DJ** (2008) Frequency matching, overlapping, and movement behaviour in diurnal countersinging interactions of black-capped chickadees. **Animal Behaviour** in press.

**Reed LP**, Foote JR, Ratcliffe LM, and **Mennill DJ** (in revision) Eavesdropping and communication networks revealed through stereo playback and an Acoustic Location System. **Behavioral Ecology**.

**Dr. Robert Montgomerie – Queen’s University – Department of Biology**

**“Mate choice and sperm competition”**

In 2007, two Post-Docs, Troy Murphy and Simone Immler collaborated with me on different aspects of this topic. Summaries of their work appear elsewhere in this report. Susie Crowe worked on several invertebrate species.

**Susie Crowe**

In 2007, I was a field assistant for Simone Immler (in June) as well as Troy Murphy (in July). My summer at QUBS was funded by the J Allen Keast Lake Opinicon Undergraduate Research fellowship. My own research consisted of three projects;

- 1) I observed and described squash bug (*Anasa tristis*) courtship and copulation behavior
- 2) I conducted an experiment to investigate how antennal communication was related to successful copulation in soldier beetles (*Chauliognathus pennsylvanicus*)
- 3) I examined the colour, number of prey items and stabilimentum length of banded garden spiders (*Argiope trifasciata*) which will become the subject of my Master’s research.

**Kit E. Muma - - Biology Department - Ithaca College - Ithaca, NY**

**"Moth anti-bat flight behaviours"**

I continued a study of the evolution of sensory adaptations in insects and in particular, the evolution of ultrasonic hearing in moths in response to predation by bats. The precise flight movements of moths when exposed to ultrasound has not been extensively studied. I used a high-speed, infra-red sensitive video camera to examine the timing of auditory evoked flight responses to bat-like sounds of different intensities. My goal was to test some of the models previously put forward for explaining the neural control of defensive flight in noctuid moths.

**Andrew Furfaro** - Ithaca College, Biology - Class of 2007 - Undergraduate Dana Summer Research Internship

During the summer of 2007 I worked on several projects. Using the "Moths of Canada" website ([http://www.cbif.gc.ca/spp\\_pages/misc\\_moths/phps/mothindex\\_e.php](http://www.cbif.gc.ca/spp_pages/misc_moths/phps/mothindex_e.php)), I constructed a pictorial list of moths that were target species for the summer research in our lab and for Dr's Dawson and Yack at Carleton University. This allowed easy identification and familiarization with the species. These moths were used for many different experiments: some were dissected, others used in the over-water flight trials and the ultrasound experiments as described below.

I examined the potential danger that a moth experiences, from fish, when landing on the surface of a lake. Live moths were released from the dock over the water at dusk and were subjected to an ultrasonic blast. I recorded whether moths reacted by diving into the water and if they were consumed by fish. In the other experiment I attempted to determine if moths would avoid ultrasound. A moth was placed in a cage and ultrasound controlled via a computer was emitted from the speakers alternating from one side of the cage to the other. This simulated the ultrasound that would normally be produced by a distant bat in pursuit of the moth. We predicted that the moth would avoid the side of the cage from which the ultrasound was emitted.

**Publications:**

Weatherhead, P.J., **K.E. Muma**, J.D. Maddox, J.M. Knox, and K.W. Dufour. 2007. Morphology versus molecules: sexing Red-winged Blackbird nestlings. *Journal of Field Ornithology*: 78(4): 428-435

J.M. Ratcliffe, A.R. Soutar, **K.E. Muma**, C. Guignon and J. H. Fullard. Reduced anti-bat flight activity in sound-producing versus silent moths. Accepted to *Canadian Journal of Zoology*

**Funding:**

Summer Research Grant from the Provost of Ithaca College to KEM

Dana Summer Research Internship Program at Ithaca College and the Bernard Research Fund to AF

**Dr. Troy G. Murphy, Principal Investigator, Postdoctoral Fellow, Queen's University;**

**Dr. Keith A. Tarvin, Co-Principal Investigator, Associate Professor of Biology, Oberlin College**

**“Male preference for female bill color in American goldfinches”**

Although male sexual ornaments have been the focus of many evolutionary studies, little attention has been devoted to understanding the adaptive function of elaborate characters in females. Female ornaments may function as signals to attract males by revealing female genetic or parental quality (intersexual sexual selection), or they may function as status signals that allow competitors to assess each other's dominance (intrasexual sexual selection). American goldfinches are sexually dimorphic songbirds, yet both males and females change bill color from grey-brown to bright orange during the breeding season. We investigated whether the orange female bill signals quality to potential male mates. To test this hypothesis, we conducted an aviary-based experiment to test whether male goldfinches preferentially court females with more colorful bills. Specifically, we tested whether males prefer to court females with experimentally brightened bills over those with experimentally dulled bills. The data from the mate choice trial have yet to be analyzed, but tantalizing preliminary results indicate that female bill color is dynamic and changes rapidly while the birds are in captivity, which may indicate that males can use female bill color to assess a females real-time condition (i.e., whether she currently has parasites, or is experiencing other forms of stress). Future work at QUBS will investigate whether female bill coloration plays a signaling role in dominance interactions between females as they compete for access to food.

**Assistants:** Malcolm Rosenthal, Undergraduate, Oberlin College; Susie Crowe, Undergraduate, Queen's University.

**Dr. Bryan D. Neff - Department of Biology, University of Western Ontario, London, Ontario**

**"Mating Systems in Fish"**

My lab works on fish mating systems. During the summer of 2007, I continued my collaboration with Dr. Rosemary Knapp, University of Oklahoma, to investigate the endocrinology of parental care in bluegill sunfish (*Lepomis macrochirus*). My graduate student, Tim Hain, conducted an additional project on kin recognition in bluegill. Kristin Ambacher (University of Western Ontario) provided valuable field assistance.

**Tim Hain – “The evolution of kin recognition in promiscuous fish species” – PhD thesis**

I have previously shown that bluegill larvae sired by highly promiscuous ‘cuckolder’ males have a lower average relatedness index than larvae sired by nest-tending ‘parental’ males. Furthermore, these cuckolder-sired larvae use a direct recognition mechanism to recognize and preferentially associate with relatives, whereas parental-sired larvae do not discriminate on the basis of relatedness. In the summer of 2007, I conducted experiments to determine the benefits

to bluegill larvae of living in a kin group versus living in a mixed-kin group. Specifically, I measured the anti-predator response of larvae living in kin groups versus mixed-family groups. I found that larvae in groups of full-siblings shoaled more tightly than groups of mixed relatedness. This experiment was part of a larger study investigating the evolution of kin recognition in bluegill sunfish.

#### **Recent publications:**

- Cargnelli LM and BD Neff. 2006. Condition-dependent nesting in bluegill sunfish *Lepomis macrochirus*. *Journal of Animal Ecology* 75:627-633.
- Hain, TJA and BD Neff. 2006. Promiscuity drives self-referent kin recognition. *Current Biology*. 16: 1807-1811.
- Lister JS and BD Neff. 2006. Paternal genetic effects on foraging decision-making under the risk of predation. *Ethology* 112:963-970.
- Magee SE, BD Neff, and R Knapp. 2006. Circulating concentrations of androgens and cortisol in relation to breeding behavior in parental male bluegill sunfish, *Lepomis macrochirus*. *Hormones and Behavior* 49:598-609.
- Magee SE and BD Neff. 2006. Temporal variation in decisions about parental care in bluegill, *Lepomis macrochirus*. *Ethology* 112:1000-1007.
- Neff BD and JA Stoltz (equal contributors). 2006. Sperm competition in a fish with external fertilization: the contribution of sperm number, speed, and length. *Journal of Evolutionary Biology* 19:1873-1881.
- Stoltz JA and BD Neff. 2006. Male size and mating tactic influence proximity to females during sperm competition in bluegill sunfish. *Behavioral Ecology and Sociobiology* 59:811-818.
- Knapp R and BD Neff. 2007. Steroid hormones in bluegill, a species with alternative reproductive tactics including female mimicry. *Biology Letters*. 3: 628-631.
- Neff BD and JS Lister. 2007. Genetic life history effects on juvenile survival in bluegill. *Journal of Evolutionary Biology* 20:517-525.

**Dr. Elizabeth MacDougall-Shackleton - Department of Biology, University of Western Ontario**

**Dr. Scott MacDougall-Shackleton - Department of Psychology, University of Western Ontario**

#### **“Breeding Biology and Singing Behaviour of Song Sparrows (*Melospiza melodia*)”**

Our research program focuses on the interplay between mating behaviour and gene flow within and among wild populations. One long term goal is to understand how mating signals and strategies, and the distribution of genetic variation within and among populations, interact to shape the ability of songbirds to produce healthy offspring. A second long term goal is to explore

the adaptive significance of female preferences for complex male songs. To accomplish these goals, our research team combines extensive, long term field studies on a colour-banded population of song sparrows *Melospiza melodia*, breeding at QUBS' Bracken Property, with genetic, immunological and physiological analyses.

**Dominique Potvin** (MSc candidate, UWO)

**“Paternal attractiveness, parental investment and offspring performance in song sparrows”**

Parental investment theory predicts that females mated to attractive males should (1) overproduce sons relative to daughters and (2) invest more heavily in offspring than the mates of less attractive males. I tested these predictions in our focal population of song sparrows, where males vary greatly in song complexity and mated pairs vary in their degree of genetic dissimilarity ('compatibility'). Song sparrows do not appear to adaptively manipulate offspring sex ratios, as sex ratios were unrelated to paternal song complexity and to parental compatibility. However, nestlings fathered by complex singers, and nestlings produced by genetically compatible pairs, showed the highest growth rates. In 2008, I will investigate the potential mechanism(s) for this pattern.

**Field assistant:** Kathryn Stewart

**Erica Tennenhouse** (BSc candidate, UWO)

**“Song complexity and vocal output in song sparrows: do good singers flaunt what they've got or rest on their laurels?”**

Birdsong is rich in information, conveying for example information about current condition and motivation, past condition (during the time of song learning) and ability to withstand early-life stressors, and population of origin. I investigated the relationship between song complexity (thought to reflect condition during early development) and song output (which reflects current adult condition). Contrary to my initial prediction that song output should be greatest among males with small song repertoires (ie that such males use increased song output to compensate for less complex song), I found instead that song complexity and output were strongly positively correlated. Good singers may have more to gain than from advertising their singing ability than do their less talented rivals.

**Alexandra Hernandez** (PhD candidate, UWO)

**“Song learning and geographic song preferences”**

Female songbirds have been shown to prefer the songs of their local geographic area. In many cases this has been assumed to be a result of learning, but it is also possible that females have inherited preferences for local song variants. I hand-reared nestling song sparrows from QUBS and from London, Ont. and tutored these birds with songs from QUBS, London, or no song in a fully counterbalanced design. When sexually mature the song preferences were

assessed by measuring approach to a speaker playing songs from either location or song of another species. The results clearly indicated that learning early in life, not genetics, influence song preferences in this species.

**Amy Newman** – PhD Thesis

**Laura Morton** – BSc Thesis

### **“Developmental stress and birdsong”**

Male songbirds learn their songs early in life a time of developmental challenges. Thus, adult song may reflect the early developmental conditions of a bird. We are testing whether features of male song sparrow song is correlated to other indicators of early stress including functioning of the hormonal stress response and asymmetry of the skeleton. As well, we are testing whether stress hormones have negative impacts on the brain regions important for song learning and song production.

### **Theses:**

Hernandez, Alexandra. 2007. Development and neural basis of geographic song preferences. Ph.D. Thesis, University of Western Ontario

Morton, Laura. 2007. The effect of developmental stress on song complexity in the song sparrow, *Melospiza melodia*. B.Sc. Thesis, University of Western Ontario.

Stewart, Kathryn. 2007. Song complexity and correspondence in eastern song sparrows. M.Sc. Thesis, University of Western Ontario.

Singh, Vishalla. 2007. Variation at neutral (microsatellite) and naturally selected (MHC class IIB) loci, heterozygote advantage and mate choice in the song sparrow *Melospiza melodia*. M.Sc. Thesis, University of Western Ontario.

### **Publications:**

Hernandez, A.M., L.S. Phillmore & S.A. MacDougall-Shackleton (2008) Effects of learning on song preferences and Zenk expression in female songbirds. *Behavioural Processes*. 77: 278-284.

Pfaff, J.A., L. Zann, S.A. MacDougall-Shackleton & E.A. MacDougall-Shackleton (2007). Song repertoire size varies with HVC volume and is indicative of male quality in song sparrows (*Melospiza melodia*). *Proceedings of the Royal Society B* 274: 2035-2040. [Featured in *The Guardian*, *Science Shorts* and other news outlets]

Stewart, K.A. & E.A. MacDougall-Shackleton (2008). Local song elements indicate local genotypes and predict physiological condition in song sparrows *Melospiza melodia*. *Biology Letters*, FirstCite Online. [Featured in *The Toronto Star*]

## **Dr. David P. Philipp - Illinois Natural History Survey at the University of Illinois**

### **“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.

*Project Team Members:* David Philipp, Brandon Barthel, Niels Carlson, Julie Claussen, Andrew Gingrich, Sean Landsman

**Brandon Barthel** - PhD student, Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign

### **“Reproductive ecology and seasonal movement of smallmouth bass in the Mississippi River watershed”**

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. 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 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.

*Project Team Members:* David Philipp, Brandon Barthel, Niels Carlson, Julie Claussen, Andrew Gingrich, Jim Ludden, Sean Landsman

### **“Growth, survival, and movement of Northern Pike”**

We have conducted long-term, continuous mark and recapture efforts on the northern pike population in both Lindsay and Poole Lakes over the past ten years. We are capturing these pike repeatedly using hook-and-line angling techniques. Once captured, the fish are measured, sexed, given a pit tag, and released. The data are providing measurements of growth and survival, as well as territoriality among these fish. Data analysis is indicating a high level of

within and among year fidelity to small summer home ranges by almost all of the pike in this population, with more movement observed between seasons.

Project Team Members: David Philipp, Niels Carlson, Andrew Gingrich, Jim Ludden, Sean Landsman

### **Publications:**

Hanson, K.C., S.J. Cooke, C.D. Suski and D.P. Philipp. 2007. Effects of different angling practices on post-release behaviour of nest guarding male black bass, *Micropterus* spp. Fisheries Management and Ecology. 14:141-148.

Siepkner, M.J., K.G. Ostrand, S.J. Cooke, D.H. Wahl, and D.P. Philipp. 2007. A review of black bass (*Micropterus* spp) catch-and-release angling effects: implications for conservation and management. Fisheries Management and Ecology. 14:91-101

Hasler, C.T., K.C. Hanson, S.J. Cooke, R. Tinline, C.D. Suski, G. Niezgoda, F.J.S. Phelan, and D.P. Philipp. 2007. Frequency, composition, and stability of associations among individual largemouth bass (*Micropterus salmoides*) at diel, daily, and seasonal scales. Ecology of Freshwater Fish. 16: 417-424.

Hanson, K.C., Cooke, S.J., Suski, C.D., Niezgoda, G., Phelan, F.J.S., Tinline, R., Philipp, D.P. 2007. Assessment of largemouth bass (*Micropterus salmoides*) behaviour and activity at multiple spatial and temporal scales utilizing a whole-lake telemetry array. Hydrobiologia, 582: 243-256

**Dr. Laurene Ratcliffe – Department of Biology, Queen's University and**

**Dr. Peter Marra – Smithsonian Migratory Bird Center, National Zoological Park, Washington, DC**

**"Seasonal Interactions, Population Ecology, and Sexual Selection in a Long-distance Migratory Songbird, the American Redstart (*Setophaga ruticilla*)"**

**Raleigh J. Robertson, Department of Biology, Queen's University**

**"Behavioural Ecology and Conservation Biology of Birds"**

With the handover of the Baillie Chair to Paul Martin and my downscaling to a 50% position on 1 July 2007, all part of my impending retirement, the most recent group of RJR Bird Lab grad and honours students who have been doing research at QUBS have now completed their programs. Looking forward, with the prospect that **Dr. Fran Bonier** plans to conduct research on the **Tree Swallows**, **Kira Delmore** & **Hannah Munro** worked with Fran on some pilot studies on corticosterone in female TRES.

Kira and Hannah also, with help from **Natalie Paquin**, provided continuity for our studies of **Golden-winged Warblers**. Given the 10 year history of colour marking and breeding



studies on this very successful GWWA population, there are good possibilities for future studies to be based at QUBS.

In collaboration with **Dr. Jan T. Lifjeld, Professor, NCB - National Centre for Biosystematics, Natural History Museum, University of Oslo, Norway**, we worked to facilitate sampling of a diversity of QUBS area passerines for studies on sperm competition.

#### **Project details:**

**Golden-winged Warbler Project** – building on the earlier studies of grad students **Tim Demmons** and **Rachel Vallender**, and 2006 honours student, **Natalie Paquin**, we continued studies on return rates and survival of male Golden-wings. With some field help from **Natalie, Kira Delmore** and **Hannah Munro** were able to obtain identities of some 40 returning and new males, as well as get GIS data for territory locations.

Continuation of long-term studies (> 30 Years) on **Tree Swallows** as part of the "Golondrinas of the Americas" project.

Pilot study on **Tree Swallows** with **Adjunct Assistant Professor, Dr. Francis Bonier**, to examine corticosterone levels as a possible indication of stress on females in relation to the thermal environment of the nest. Fran is planning to continue Tree Swallow studies to examine various aspects of 'cort' as an indicator of stress for birds, and to explore implications for using this metabolic hormone as a metric for conservation issues such as habitat quality.

Field study in collaboration with **Prof. Jan Lifjeld**, University of Oslo, Norway. Post-docs **Oddmund Kleven, Frode Fossoy** and **Lars Erik Johannessen**, PhD student **Terje Laskemoen**, and Lab Manager, **Trond Oigarden**, University of Oslo, continued sampling for the "Museum Project" from the past few years. In two-weeks of intensive mist-netting, they obtained samples from 273 individuals of 49 species for comparative studies on sperm morphology and motility of passerines at QUBS.

#### **Publications, 2006 & 2007**

Kleven, O., F. Jacobsen, R. Izadnegahdar, R.J. Robertson and J. Lifjeld. 2006. Male tail streamer length predicts fertilization success in the North American barn swallow (*Hirundo rustica erythrogaster*). *Behavioral Ecology and Sociobiology* 59(3): 412-418. (published online 12 October 2005)

Male, S.K., J. Jones, and R.J. Robertson. 2006. Effects of nest-box density on the behavior of Tree Swallows during nest building. *Journal of Field Ornithology* 77(1): 61-66.

Kleven, O., F. Jacobsen, R. Izadnegahdar, R.J. Robertson, and J.T. Lifjeld. 2006. No evidence of paternal genetic contribution to nestling cell-mediated immunity in the North American barn swallow. *Animal Behaviour* 71: 839-845.

Barg, J.J., J. Jones, M.K. Girvan, and R.J. Robertson. 2006. Within-pair interactions and parental behavior of Cerulean Warblers breeding in eastern Ontario. *Wilson Journal of Ornithology* 118(3): 316-325.

- Barg, J.J., D.M. Aiama, J. Jones and R.J. Robertson. 2006. Within the territory: habitat use and microhabitat selection by male Cerulean Warblers. *Auk* 123(3): 795-806
- Stapleton, M.K. and R.J. Robertson. 2006. Female Tree Swallow home range movements during their fertile period revealed by radio-tracking. *Wilson Journal of Ornithology* 118(4): 502-507.
- Vallender, R., R. J. Robertson, V. L. Friesen, and I. J. Lovette. 2007. Complex hybridization dynamics between golden-winged and blue-winged warblers (*Vermivora chrysoptera* and *V. pinus*) revealed by AFLP, microsatellite, intron and mtDNA markers. *Molecular Ecology* 16(10): 2017-2029. (Published article online: 2-Mar-2007 doi: 10.1111/j.1365-294X.2007.03282.x)
- Stapleton, M.K., O. Kleven, J.T. Lifjeld and R.J. Robertson. 2007. Female tree swallows increase offspring heterozygosity through extrapair mating. *Behavioral Ecology and Sociobiology* 61(11): 1725-1733. (doi 10.1007/s00265-007-0404-4 May 2007)
- Vallender, R., V.L. Friesen and R.J. Robertson. 2007. Paternity and performance of Golden-winged Warblers (*Vermivora chrysoptera*) and Golden-winged X Blue-winged Warbler (*V. pinus*) hybrids at the leading edge of a hybrid zone. *Behavioral Ecology and Sociobiology* 61: 1797-1807. (published on-line May 2007: doi 10.1007/s00265-007-0413-3).
- Reed, L., R. Vallender and R.J. Robertson. 2007. Provisioning rates by Golden-winged Warblers. *Wilson Journal of Ornithology* 119(3): 350 – 355.
- Barber, C. and R.J. Robertson. 2007. Timing of copulations and the pattern of paternity in relation to laying order in tree swallows. *Journal of Avian Biology* 38: 249-254.
- Girvan, M. K., J. Jones, D. R. Norris, J. J. Barg, T. K. Kyser, and R. J. Robertson. 2007. Long-distance dispersal patterns of male Cerulean Warblers (*Dendroica cerulea*) measured by stable-hydrogen isotopes. *Avian Conservation and Ecology* 2 (2): 3. [online] URL: <http://www.ace-eco.org/vol2/iss2/art3/>
- Kleven, O., T. Laskemoen, F. Fossoy and R.J. Robertson, and J.T. Lifjeld. 2007. Intraspecific variation in sperm length is negatively related to sperm competition in passerine birds. *Evolution (OnlineEarly Articles)*. doi:10.1111/j.1558-5646.2007.00287.x
- McKinnon, E.A. and R.J. Robertson. In press. The signal function of a melanin-based plumage rnement in the Golden-winged Warbler. *Wilson Journal of Ornithology* (accepted 07/09/22, to be published June 2008).
- Buehler, D.A., J.J. Giocomo, J. Jones, P.B. Hamel, C.M. Rogers, T.A. Beachy, D.W. Varble, C.P. Nicholson, K.L. Roth, J. Barg, R.J. Robertson, J.R. Robb and K. Islam. In press. Cerulean Warbler rangewide demographic population analysis to model source/sink relationships. *Journal of Wildlife Management* (23 pp, plus. 2 figures & 3 tables). (to appear summer 2008).

Fraser, K.C., T.K. Kyser, R.J. Robertson and L.M. Ratcliffe. In press. Seasonal patterns in hydrogen isotopes of claws from breeding wood-warblers (Parulidae): utility for estimating migratory origins. *Avian Conservation and Ecology* (accepted 5 February 2008 MS #2008-218).

**Dr. Ryan Norris, Assistant Professor, Department of Integrative Biology, University of Guelph**

Research in my lab seeks to understand the evolution of life-histories and the dynamics of migratory populations by integrating behavioural and demographic field research, landscape ecology, modeling, and biogeochemistry.

**Megan Sellick**, MSc. Candidate, Department of Integrative Biology, University of Guelph

**“Geographic variation in stable-strontium and -hydrogen isotopes in known-origin avian tissues: implications for tracking continental migration.”**

This research examines the distribution of stable-strontium and -hydrogen isotopes across North America to investigate the value of combining these two markers to track migratory passerines. We approached this question by comparing the isotopic compositions of feathers from Tree Swallows (*Tachycineta bicolor*) sampled at 18 breeding sites (QUBS included). Results from this research may provide evidence that the combination of these two markers increases our estimates of a migrant's origin. This information, in turn, is valuable for studies investigating the ecology and evolution of life-history strategies in small-bodied passerines.

**Publications:**

Martin, TM, Chades, I, Arcese, P, Marra, PP, Possingham, HP & Norris DR. 2007. Optimal conservation of migratory birds. *Public Library of Science*, ONE 2(8): e751.

Norris, DR & Marra, PP. 2007. Seasonal interactions, habitat quality and population dynamics in migratory birds. *The Condor* 109: 535-547.

Taylor, CM & Norris, DR. 2007. Predicting conditions for migration: effects of density-dependence and habitat quality. *Biology Letters*, Royal Society, London 3: 280-283.

Langin, KM, Reudink, MW, Marra, PP, Norris, DR, Kyser, TK & Ratcliffe, LM. 2007. Hydrogen isotopic composition of known-origin migratory birds: implications for geographic assignment *Oecologia* 152: 449-457.

Norris, DR, Marra, PP, Ratcliffe, LM, Kyser, TK & Montgomerie, R. 2007. Continent-wide variation in feather colour of a migratory songbird in relation to body condition and moulting locality. *Biology Letters*, Royal Society, London 3: 16-19.

Marra, PP, Norris, DR, Haig, SM, Webster, MS & Royle, JA. 2006. Migratory connectivity. Pages 157-183 *In: Connectivity Conservation* (Eds. KR Crooks & M Sanjayan), Cambridge University Press, New York.

- Boulet, M & Norris, DR. 2006. The present and past of migratory connectivity. *Ornithological Monographs* 61: 1-13. (doi:10.1642/0078-6594(2006)61[1:tpapom]2.0.co;2)
- Norris, DR, Wunder, MB & Boulet, M. 2006. Perspectives on migratory connectivity. *Ornithological Monographs* 61: 79-88. (doi:10.1642/0078-6594(2006)61[79:pomc]2.0.co;2)
- Norris, DR, Marra, PP, Bowen, GJ, Ratcliffe, LM, Royle, JA & Kyser, TK. 2006. Migratory connectivity of a widely distributed Nearctic-Neotropical songbird, the American redstart (*Setophaga ruticilla*). *Ornithological Monographs* 61: 14-28.
- Langin, KM, Norris, DR, Kyser, TK, Marra, PP & Ratcliffe, LM. 2006. Capital versus income breeding in a migratory passerine bird: evidence from stable isotopes. *Canadian Journal of Zoology* 84:947-953. (doi:10.1139/Zo6-080)
- Norris, DR & Taylor, CM. 2006. Predicting the consequences of carry-over effects in migratory animals. *Biology Letters, Royal Society, London* 2: 148-151.

**Dr. Thomas N. Sherratt<sup>1</sup>**      Principal Investigator

**Dr. Hans van Gossom<sup>2</sup>**      Principal Investigator

**Janice J. Ting<sup>1</sup>**      PhD Candidate

**Jessica Bots<sup>2</sup>**      MSc Candidate

**Felipe Pérez Jvostov<sup>1</sup>**      Research Assistant

<sup>1</sup>Department of Biology, Carleton University, Ottawa, Canada

<sup>2</sup>Evolutionary Ecology Group, University of Antwerp, Antwerp, Belgium.

Two main research projects were carried out at QUBS in 2007, both investigating the evolution and maintenance of female-limited polymorphism in the sedge sprite *Nehalennia irene* (Odonata : Zygoptera). This damselfly has two female forms – the andromorph (which looks rather like a male) and the gynomorph. Intriguingly, *N. irene* populations typically comprise 5-50% andromorphs at QUBS, yet in British Columbia andromorphs comprise 90-95% of the female population.

Our research fell into two broad categories: a quantitative comparison of male mate preference in Ontario with male mate preference in British Columbia, and a continuing survey of female morph frequencies at a variety of sites in Ontario. Both of these studies were aimed at understanding why the polymorphism has been selected for, how it is maintained, and why morph frequency varies so much between populations. Our experimental work at QUBS centred on Barb's Marsh, Jacks's Marsh and Otter Marsh.

In short, our research work strongly suggests that a combination of the two leading theories for female-limited polymorphism (male-mimicry and learned male recognition) best explain the dramatic variation in male mate preference observed. Furthermore, our survey work continues to suggest that male density plays a role in mediating female morph frequency, although it is becoming increasingly clear other factors may also play a role.

Full technical abstracts are given below, along with full papers (the male mate preference work by Ting *et al.* is at an advanced stage of preparation; the morph frequency analysis Iserbyt *et al.* is a first draft only)

**“Geographical variation in male mate preference in a polymorphic damselfly among populations with contrasting female morph frequencies”**

Janice J. Ting<sup>1</sup>, Jessica Bots<sup>2</sup>, Felipe Pérez Jvostov<sup>1</sup>, Hans Van Gossum<sup>2</sup>, Thomas N. Sherratt<sup>1</sup>

<sup>1</sup>Department of Biology, Carleton University, Ottawa, Canada

<sup>2</sup>Evolutionary Ecology Group, University of Antwerp, Antwerp, Belgium.

Several theories have been proposed to explain the evolution and maintenance of multiple coexisting female colour morphs in damselflies (Odonata: Zygoptera). Two of the leading theories have been broadly classed as the learned mate recognition (LMR) and the male mimicry (MM) hypotheses. We designed a study that would allow us to discriminate among these hypotheses, by capitalising on the extreme cline (<10% to >90%) in female morph frequency present for the damselfly, *Nehalennia irene* across Canada. If the LMR were valid, then we predicted *N. irene* males should less frequently attempt to mate with gynomorphs on encounter in those populations where andromorphs are common, due to the relative rarity of these female morphs. The MM makes no such prediction. Likewise if the MM were valid, then we predicted that *N. irene* males should more readily attempt to mate with other males as the frequency of andromorphs to males increased, due to the increased ratio of mimics to models. The LMR makes no such prediction. On repeatedly presenting live specimens (andromorph, gynomorph, and male) to focal males in five different populations across Canada, we observed that the proportion of mating attempts on males increased, and the proportion of mating attempts on gynomorphs decreased, as andromorph frequency increased supporting predictions of both models. Although typically presented as competing hypotheses, our data suggest a combination of the two hypotheses may help to explain polymorphism in damselflies.

**“Multi-annual variation in female morph frequencies of the polymorphic damselfly, *Nehalennia irene* at continental and regional scales.”**

A. Iserbyt<sup>1</sup>, J. Bots<sup>1</sup>, J. Ting<sup>2</sup>, F. Pérez Jvostov<sup>2</sup>, M.R. Forbes<sup>2</sup>, T.N. Sherratt<sup>2</sup>, H. Van Gossum<sup>1</sup>

<sup>1</sup> Evolutionary Ecology Group, University of Antwerp, Groenenborgerlaan 171, B-2020 Antwerp, Belgium

<sup>2</sup> Department of Biology, Carleton University, 1125 Colonel by Drive, Ottawa, Ontario, K1S 5B6, Canada

Female-limited polymorphism occurs in different animal taxa but is particularly abundant among species of damselflies (Insecta: Odonata). Recent work on the damselfly *Nehalennia irene* indicated spatial variation in morph frequencies to be limited for nearby populations (i.e. regional scale), but large at a continental scale. Some of this observed variation may be understood based on correlated inter-population variation in the estimated degree of male harassment on female morphs (i.e. male density and operational sex ratio). Here, we elaborated on this work and asked how variable morph frequencies are over multiple years at both regional (data of 8 populations for three years) and continental scales (data of 33 populations for two years). Further, we asked whether any spatial and temporal variation in morph frequency related with variations in the estimated degree of male harassment. At the regional scale our data suggest temporal variation in morph frequencies, while at the continental scale multi-annual variation appears limited. At both geographic scales, male density and operational sex ratio was highly variable across years. The estimated degree of male harassment correlated with variation in morph frequency in some regions, but not all. Together, the observed natural variation in female morph frequencies may be partly understood based on explanations of male harassment, but it appears a complete understanding will require considering the role of other environmental factors.

**Dr. Bruce P. Smith - Biology Dept., Ithaca College, Ithaca, NY 14850.**

### **"Water mite parasitism of Aquatic Insects"**

The focus of our effort in Summer 2007 was a continuation of research on the photopositive response of water mites and zooplankton, and how to exploit this behavior for sampling organisms in littoral habitats. The standard method of sampling by net is very laborious and time consumptive, plus there was substantially more variation between net samples taken by different individuals than there was among concurrent light trap samples. Previous tests demonstrated that traps based on a 50 watt halogen bulb are by far the brightest, but collect hundreds of mites per hour, while traps based on cyalume glowsticks collect up to 4000 mites in an evening. In 2007 we developed a trap based upon LED flashlights. There is considerable waste generated when using cyalume glowsticks, the intensity and duration is determined by water temperature, and the intensity has a negative exponential relationship with time - whereas LED flashlights with rechargeable batteries provide consistent long-term lighting with no waste, and reasonable price (ca. \$30 / trap). In parallel testing, the LED flashlights attract more mites than glowstick traps.

Elyse worked primarily on the spectral sensitivity of the water mite *Hydrodroma despiciens*, which is extremely photosensitive and represents better than 95% of the mites collected by light traps in open water habitats. Mites of this species apparently shift from being photonegative during the day to photopositive at night - but there was no detectable circadian rhythm under laboratory conditions. The only way to elicit a consistent photopositive response was to collect mites at 11 pm or later and use them immediately for experiments. This species is apparently sensitive to low light intensities: significant response to white light was obtained with 1 :Mol/m<sup>2</sup>/s, maximal response at 10 :Mol/m<sup>2</sup>/s, with no apparent increase in response at higher intensities (note: sunlight at noon on a clear day is approximately 2,000 :Mol/m<sup>2</sup>/s).

At 70  $\mu\text{mol}/\text{m}^2/\text{s}$  of 10 nm bandwidth illumination, *H. despiciens* responded approximately equally across the spectral range of 450 - 697 nm. With narrow bandwidth and only 0.05  $\mu\text{mol}/\text{m}^2/\text{s}$  illumination, this species still showed significant responses at 697 nm and had consistent maximal response across the 450 - 650 nm range. Response to light in the red (650 - 697 nm) end of the spectrum is rare among arthropods and has not been reported previously in any arachnid group. The plateau in response both to changes in intensity and across the spectrum is completely different from Will Brogan's results with the mite *Arrenurus manubriator*: the latter species has consistently stronger response as light increases (tested up to 10,000  $\mu\text{mol}/\text{m}^2/\text{s}$ ), responds progressively more strongly as the wavelength is shifted to the blue end of the spectrum (tested to a minimum of 450 nm), and is essentially blind to red light (tested at 650 and 697 nm).

This research was supported in part by an Ithaca College Provost's Summer Grant to Bruce Smith, and from the IC Biology Dept. Ford Fund and Bernard Fund for Elyse Honikel.

**Assistant:** Elyse Honikel

**Dr. Cory Suski - University of Illinois at Urbana-Champaign, Department of Natural Resources and Environmental Sciences**

**“ Ecological physiology of centrarchid fishes.”**

Our lab is broadly interested in understanding how individuals and populations respond to different biotic and anthropogenic stressors. Ultimately, we would like to understand how these stressors can influence the abundance and distribution of organisms, and how we can design conservation strategies to protect biological systems. At QUBS, our research is focused on two areas: (1) understanding how different stressors can influence the reproductive success of centrarchid fishes, primarily using largemouth bass and smallmouth bass as model species and (2) quantifying the physiological impact of angling-related stressors on smallmouth bass and largemouth bass.

**Publications:**

Gingerich, A., K. C. Hanson, C. D. Suski and S. J. Cooke. 2007. Evaluation of the interactive effects of air exposure duration and water temperature on the condition and survival of angled and released fish. *Fisheries Research* 86:169-178.

Hasler C. T., K. C. Hanson, S. J. Cooke, R. Tinline, C. D. Suski, G. Niezgoda, F. J. S. Phelan, and D. P. Philipp. 2007. Frequency, composition, and stability of associations among individual largemouth bass (*Micropterus salmoides*) at diel, daily, and seasonal scales. *Ecology of Freshwater Fish* 16:417-424.

Hanson, K. C., S. J. Cooke, C. D. Suski, G. Niezgoda, F. J. S. Phelan, R. Tinline, C. T. Hasler and D. P. Philipp. 2007. Assessment of largemouth bass (*Micropterus salmoides*)

behaviour and activity at multiple spatial and temporal scales utilizing a whole-lake telemetry array. *Hydrobiologia* 582:243-256.

Suski, C. D., J. D. Kieffer, S. S. Killen and B. L. Tufts. 2007. Sub-lethal ammonia toxicity in largemouth bass. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology* 146:381-389.

Suski, C. D., S. S. Killen, J. D. Kieffer and B. L. Tufts. 2006. The influence of environmental temperature and oxygen concentration on the recovery of largemouth bass from exercise: implications for live-release angling tournaments. *Journal of Fish Biology* 68:120-136.

**Dr. Bruce Tufts – Department of Biology, Queen’s University**

**“Physiology and Physiological Ecology of Fish”**

**Dr. Patrick J. Weatherhead - Program in Ecology, Evolution and Conservation Biology, University of Illinois**

**"Long-term studies of snakes and birds"**

The long-term study of black ratsnakes continued in 2007. 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 previous studies of red-winged blackbirds is ongoing.

**Publications:**

Blouin-Demers, G., L.P.G. Bjorgan and P.J. Weatherhead. 2007. Changes in habitat use and movement patterns with body size in black ratsnakes (*Elaphe obsoleta*). *Herpetologica* 63: 421-429.

Blouin-Demers, G. and P.J. Weatherhead. 2007. Allocation of offspring size and sex by female black ratsnakes. *Oikos* 10: 1759-1767.

Cooke S.J., D.P. Philipp, D.H. Wahl & P.J. Weatherhead. 2006. Energetics of parental care in six syntopic centrarchid fishes. *Oecologia* 148: 235-249.

Gibbs H.L., S.J. Coreyl, G. Blouin-Demers, K.A. Prior and P.J. Weatherhead. 2006. Hybridization between mtDNA-defined phylogeographic lineages of ratsnakes (*Pantherophis* sp.). *Molecular Ecology* 15: 3755-3767.

Row, J.R., G. Blouin-Demers and P.J. Weatherhead. 2007. Demographic effects of road mortality in black ratsnakes (*Elaphe obsoleta*). *Biological Conservation* 137: 117-124.

Weatherhead, P.J., K.J. Kissner and S.J. Sommerer. 2006. Prenatal sex ratios and expression of sexually dimorphic traits in three snake species. *Journal of Experimental Zoology* 305A: 603-609.



Weatherhead, P.J., K.E. Muma, J.D. Maddox, J.M. Knox and K.W. Dufour. 2007. Morphology vs. molecules: sexing red-winged blackbird nestlings. *Journal of Field Ornithology* 78: 441-448.

**Dr. Lorne M. Wolfe, Dept. of Biology, Georgia Southern University, Statesboro, GA. 30460. USA and**

**Dr. Douglas R. Taylor, Dept. of Biology, University of Virginia, Charlottesville, VA. USA.**

### **"The Ecological Genetics of Invasiveness in *Silene latifolia*"**

Biological invasions represent one of the greatest threats to the preservation of biodiversity. In addition, the economic costs to the USA resulting from damage and control of alien organisms (e.g. zebra mussel, kudzu) amounts to more than \$100 billion annually. Surprisingly, very little is known about why species that are normally benign, suddenly become noxious pests following their introduction to another country or continent. While the emphasis of previous research in the literature has been on ecological forces, the goal of this research is to explore the role that genetic changes play in the invasion process.

Taylor and Wolfe are studying the genetics and origin of invasiveness using a combination of approaches in *Silene latifolia*, a plant that was introduced to North America from Europe. There are three goals to this research. 1) To examine the history of the invasion process, and clarify the genetic consequences of the invasion process in terms of the amount and distribution of genetic variation. 2) To experimentally test for unique environmental patterns in North America that might promote the success of weedy species. 3) To use replicated experimental populations to test whether North American populations are genetically more invasive and the extent that natural enemies limit invasiveness in Europe. This research will have broad significance in terms of understanding the origin of invasiveness as well as providing opportunities for the career development of undergraduate students, graduate students and post-docs.

Two large-scale experiments were established over an extended period in 2005-06 on the Massasauga property using plants from approximately 30 populations from both N. America and Europe. 2007 represented the first year that we were able to census the plants to determine the strength of natural selection on the evolution of invasive phenotypes.

#### Students

PhD student: **Dexter Sowell** (University of Virginia)

MS student: **Brandy Penna** (graduated from Georgia Southern University)

Postdoctoral student: **Dr. Maurine Neiman** (University of Iowa)

MISSING: Reports from Montgomerie, Tufts, Ratcliffe

### Summary of Conference, Meeting and Field Trip Use of QUBS in 2007

Organizer	Function	Numbers	Duration
Cathy Marrocco (Amherstview Public School)	Counselling and Skills Development Class Winter Field Trip	13	Jan 24 - 26
Jennifer Holub (Queen's)	QPID Retreat - Queen's Program in International Development	25	Jan 27 - 28
Kathy Hoover (Queen's - Geography)	Snow Studies - Geography Field Trip	8	Feb 8
Dr. Paul Grogan (Queen's - Biology)	Bio 416 Field Trip	15	March 3 - 4
Dr. Paul Alexandre (Queen's - Geology)	Geology 465 Field Trip	5	March 10
Dr. Raleigh Robertson (Queen's - Biology)	Bio 526 Field Trip and Group Presentations	13	March 24 - 25
Dr. Virginia Walker (Queen's - Biology)	Bio 423 Field Trip and Collections	7	March 31
U. Rasa (Queen's - Engineering)	Science Quest Retreat	12	Mar 31 - Apr 1
Tim Demmons (Opengo High School)	OSPREY - Field Trip	20	April 23 - 25
Jim Ludden (College of DuPage, Illinois)	General Ecology Field Course	15	May 21 - 26
Cpt Ray Throop Navtex/Canada Coast Guard	MED A3 Training Course	20	May 25
Dr. Kelly Shoemaker (Queen's - Biology)	Biology Alumni Field Trip and Revisit to QUBS	86	June 2
Christine Waugh (OFN)	Ottawa Field Naturalists Field Trip and Picnic	26	June 9
Natalie Kolomeitz (Queen's - UACC)	University Animal Care Committee Facilities Tour and Inspection	6	June 14
Dr. Mel Robertson	Departmental Picnic	102	June 21

### Summary of Conference, Meeting and Field Trip Use of QUBS in 2007

(Queen's - Biology)			
Niel Patterson	Chaffey's Lock and Area Heritage	30	July 18
(CLAHS)	Society Mine Tour		
Bob Crandall	Retirees Association of Queen's	21	July 25
(Queen's - RAQ)	Field Trip and Picnic		
Niel Patterson	Chaffey's Lock and Area Heritage	24	August 15
(CLAHS)	Society Mine Tour		
Dr. Yuxiang Wang	Chinese Delegation	12	Aug 27 - 29
(Queen's - Biology)	(Fudan U, Tongji U, East China Normal U		
	and China Sci/Tech Commission, Shanghai)		
Diane Lawrence	Environmental Education	41	Sept 7 - 9
(Queen's - Education)	Field Trip and Workshops		
Ted Thomas	North Park Collegiate	33	Sept 12 - 14
(N Park Collegiate, Brantford)	Field Trip and Ecology Course		
Dr. Gary Bell	NCC Easement Workshop	10	Sept 15 - 16
(Nature Conservancy Canada)			
Suzanne Gitto	Ecological Land Classification	24	Sept 16 - 21
(Gartner Lee Assoc - Markham)	Course		
Brenda Schamehorn	Bio 302 - General Ecology	114	Sept 22 - 23
(Queen's - Biology)	Field Trip Weekend		
Dr. Bruce Pauli	CARCNET Field Trip	30	Sept 24
(Canadian Wildlife Service)			
Joe Nocera	Society of Canadian Ornithologists	59	Sept 27 - 30
(Queen's - Biology)	Conference		
Brenda Schamehorn	Bio 302 - General Ecology	122	Sept 29 - 30
(Queen's - Biology)	Field Trip Weekend		
Dr. Brian Cumming	Bio 335 - Limnology	36	Sept 29 -30
(Queen's - Biology)	Field Trips		
Doug Archibald	Geol 221/211 - Geological Field	20	Oct 3
(Queen's - Geology)	Methods Field Trip		

### Summary of Conference, Meeting and Field Trip Use of QUBS in 2007

Doug Archibald	Geol 221/211 - Geological Field	20	Oct 4
(Queen's - Geology)	Methods Field Trip		
Tim Gray	Soils Workshop	25	Oct 12
(Trees Ontario)			
Scott Taylor	Graduate Students Weekend	28	Oct 20 - 21
(Queen's - Biology)			
Dr. Raleigh Robertson	Bio 526 Field Trip	15	Oct 26 - 27
(Queen's - Biology)			
Angela Strecker	<i>Bythotrephes</i> Meeting and	12	Nov 14 - 15
(Queen's - Biology)	Workshop		
Susie Crowe	Kingston Junior Field Naturalists	15	Nov 24
(Queen's - Biology)	Field Trip		

## **Seminars 2007**

Seminars are normally held at 7:30 pm in the Conference Room, Lower level of QUBS Operations Centre

Wednesday, May 30

Dr. Paul Martin - The New Baillie Family Chair in Conservation Biology at Queen's Biology Department

"Latitudinal Variation in Diversity"

Wednesday, June 13

Dr. Simone Immler - Department of Biology, University of Sheffield, U.K.

"Sperm in Competition: The evolution of sperm design"

Wednesday, June 20

Dr. Susan Bertram - Department of Biology, Carleton University, Ottawa, Ont

"Understanding Variation in a Sexually-selected Trait"

Wednesday, June 27

Dr. Brian Osborne - Emeritus - Department of Geography, Queen's University

"Approaching the Rideau: Past, present, future"

Thursday, July 5

Dr. Bridget Stutchbury - Department of Biology, York University, Toronto, Ont

"Neotropical Migratory Songbirds: Going down the drain?"

Wednesday, July 11

Dr. Shelley Arnott - Department of Biology, Queen's University

"Local and Regional Factors Influencing Zooplankton Community Structure"

Wednesday, July 18

Dr. Paul Grogan - Department of Environmental Studies, Queen's University

"The Earth Matters: Some underground tales"

Wednesday, July 25

Dr. Briar Howes (Parks Canada) and Greg Bulte (University of Ottawa)

"Conservation and status of Ontario Reptiles"

Wednesday, Aug 1

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

"Parasite Design: Manipulation, distortion and indiscrimination"

Wednesday, Aug 8

Don Ross (Executive Director, Frontenac Arch Biosphere Reserve)

"Biodiversity of the Rideau and the Biosphere Reserve"

## **Seminars 2007 (cont'd)**

Wednesday, Aug 15

Dr. Deborah MacLatchy (Wilfrid Laurier University)

“Endocrine Disruption in Fish: A Canadian Perspective on a Global Phenomenon”

Thursday, August 23

Jonathan Moore – Parks Canada – Underwater Archaeology Service

“Underwater Archaeology of the Rideau Canal”

## *Fee Schedule for 2008*

### **University Research and Teaching Rates**

#### Board Charges - Meals only

\$630/month/person	-no obligation for chores
\$445/month/person	-includes obligation for chores on a rotating schedule

#### Accommodation Charges - Housing only - no linen service

\$48/month/person	-dormitory (White House or Curran Cottage)
\$96/month	-small cabin (Cabins 1, 4, 5, 6, 7, 11 and shaker)
\$190/month	-medium cabin (Cabins 2, 3, 8, 9, 10, 13, 14)
\$260/month	-large cabin (Cabins 12, 15 and White House Apartment)
\$400/month	-Cottage (Keast, Earl, Sumac or Maplewood)

#### Room and Board Rates for Field Courses - no linen service

\$350/person	-weekly R&B for OUPFB field courses
\$385/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

\$44/day/person	-24 hr. room and board
\$6.50	-breakfast or lunch only
\$13.00	-dinner only
\$21.50	-overnight accommodation

#### Bench Fees

##### Basic\* 1 (MFA co-applicants and Queen's Biology researchers)

\$1.26/day	principal investigator/graduate student/lab coordinator
\$0.63/day	assistant

##### Special Requirements\*\* 1 (MFA co-applicants/Queen's Biology)

\$3.14/day	principal investigator/graduate student/lab coordinator
\$1.26/day	assistant

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

\$3.14/day	principal investigator/graduate student/lab coordinator
\$1.26/day	assistant

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

\$6.30/day	principal investigator/graduate student/lab coordinator
\$3.14/day	assistant

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

\$6.30/day	principal investigator/graduate student/lab coordinator
\$3.14/day	assistant

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

\$12.60/day	principal investigator/graduate student/lab coordinator
\$6.30/day	assistant

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

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



### ***Fee Schedule for 2007 (continued)***

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

#### **Electronic Equipment Charges**

Local Area Network Connection /Internet      \$12.50 per person per month

#### **GPS/GIS Equipment**

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

#### **Boat Rental**

\$360/month, \$150/week - includes maintenance from normal use - gas and oil not included  
\$81.00/day - includes gas and oil for one day rental

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

**All QUBS boat users will require Operator Proficiency cards to rent a boat  
MEDA3 Training and certification required to operate pontoon boats**

### **Conference and Group Rates**

\$6.50/person/day	facility day use fee - no meals
\$65.00/person/day	24 hr R&B and day use - summer season (April 30 - September 10)
\$16.50/person/day	linen service (must be pre-arranged for groups)

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 to 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.*