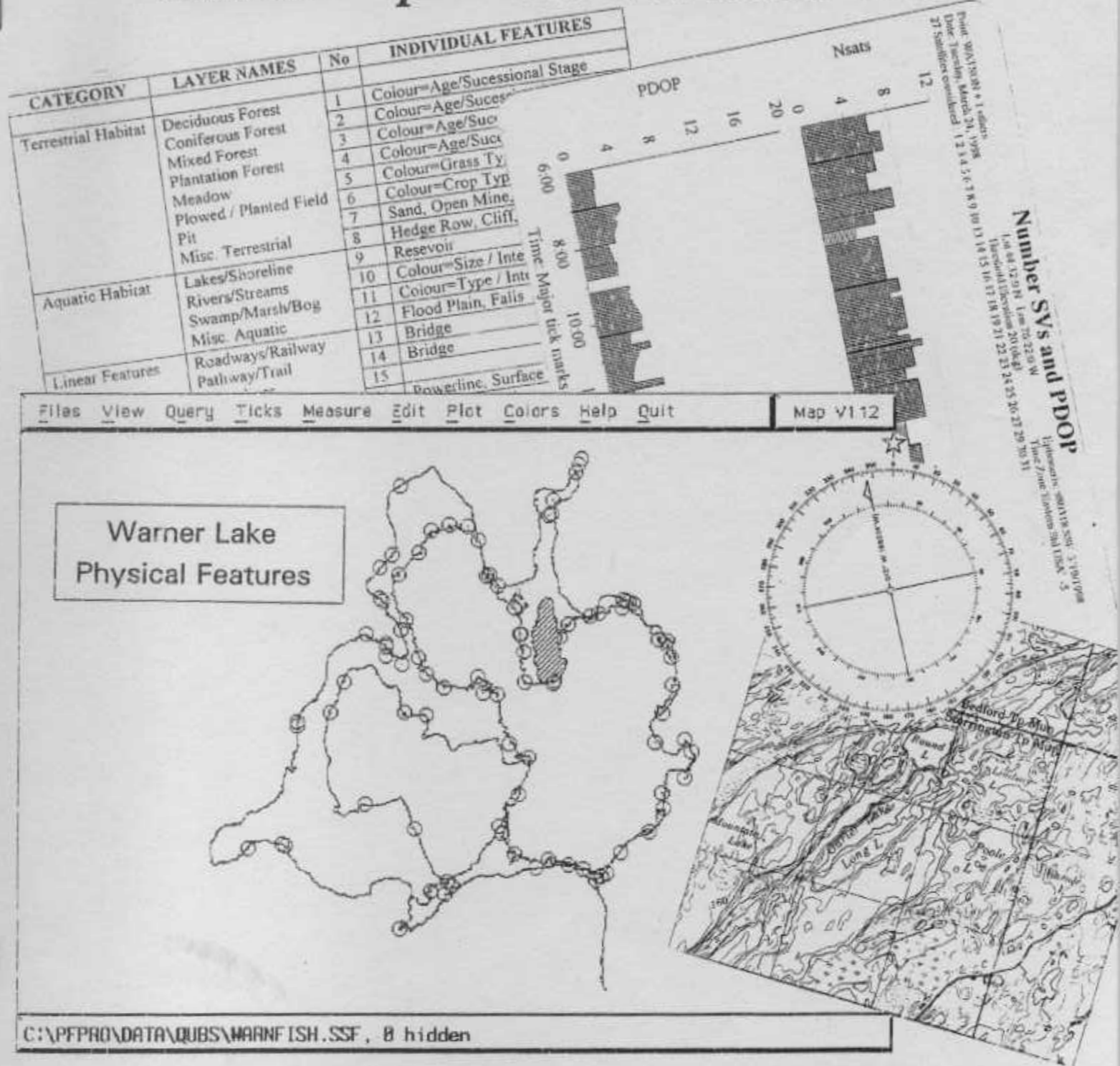


Queen's University Biological Station

Annual Report and Newsletter 1997

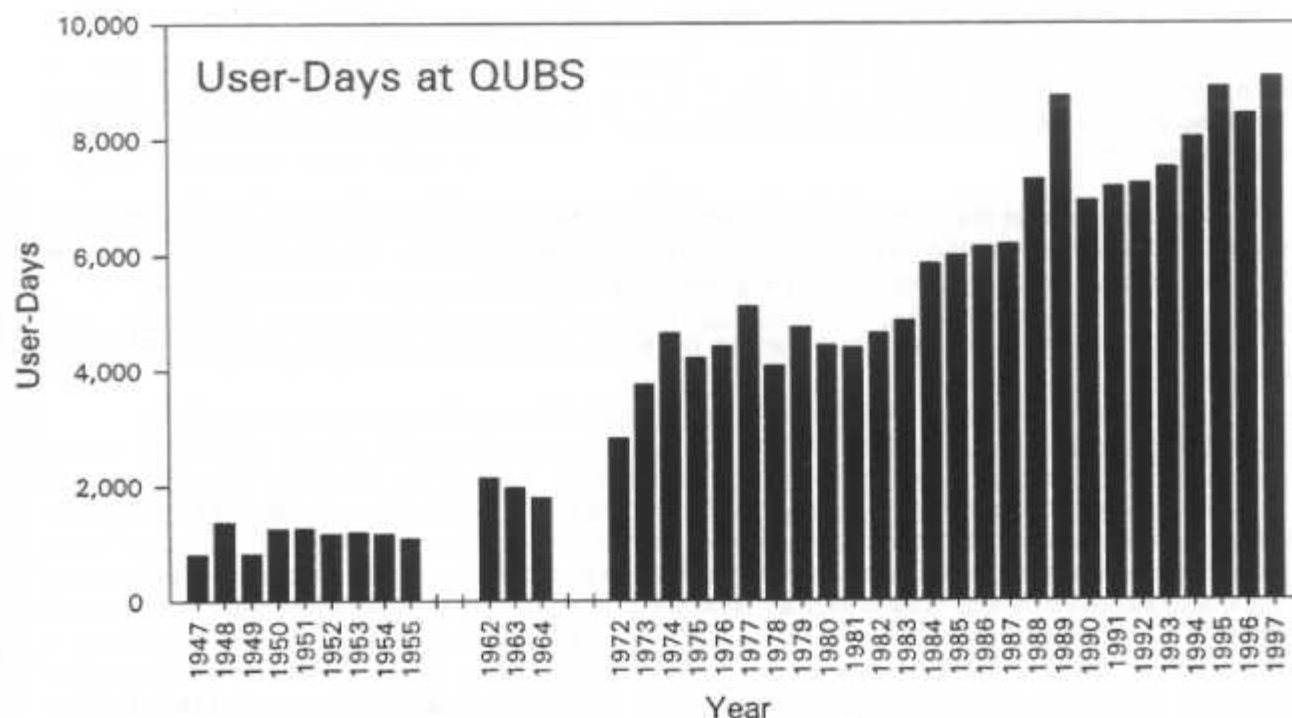


Director: Dr. Raleigh J. Robertson

Manager: Frank J.S. Phelan

Introduction

Nineteen ninety-seven was the busiest year yet experienced by Queen's University Biological Station. Some 9069 user-days were recorded (8% increase from 1996)(User-day data are displayed in tabular form later in this report (pp. 56-57). On average, 40 researchers (professors, graduate students, honours students and assistants) were in residence throughout the summer. Abstracts of research projects and personnel involved are contained in the following pages (pp. 22-53).



In teaching activities, QUBS hosted 11 modules (14 weeks of modules, since several were of two weeks duration) in the Ontario Universities Program in Field Biology (OUPFB). 6 of these were presented by Queen's faculty, 5 by faculty from other institutions. Titles and enrolments for modules held at QUBS and for the OUPFB program in general are found in Tables 1 through 3 (pp. 11-13). In addition to the modules mentioned above, Dr. Ed Kott (Wilfrid Laurier University) brought his field course for senior undergraduates to QUBS for two weeks in late summer. In July, Dr. Steve Loughheed spearheaded the second edition of the International School of Biodiversity at QUBS (pp.16-18). The nineteenth edition of the Naturalists' Workshop, described in more detail later in this report (pp. 14-15), was held in three sessions, May 1-3, July 24-27 and September 21-24.

The demand for small conferences, meetings and workshops remains high. However, QUBS is able to host these events only when not in conflict with teaching and research uses. In 1997, with high levels of use in research and teaching activities, only small number of these events were hosted at QUBS. Perhaps by extending the available season, we might be able to accede to more of these types of requests. A new central building would definitely improve our ability to host small conferences and workshops (see below re. Biodiversity Centre). QUBS continues to be an important destination for a variety of field trips, especially those associated with fall and winter term courses. In many cases, this exposure to field work is cited as a key element in stimulating interest in field biology. A tabular summary of conference, meeting and field trip use of QUBS in 1997 appears later in this report (pp. 54-55).

Visiting Scientist

Dr. Ian Jamieson from University of Otago, Dunedin, New Zealand spent part of his sabbatical as a visiting scientist at Queen's University Biological Station this summer. Dr. Jamieson's expertise is in behavioural ecology and conservation biology of vertebrates. He gave two seminars: one on the reproductive biology of a large flightless rail in New Zealand (the Maori word is Takahe). The Takahe is one of the world's most endangered birds. His second seminar was on the costs and benefits of communal breeding in another rail species: a species that shares a resemblance to the North American coot (or swamp hen) and goes by the seemingly demeaning name of Pukeko. Ian has combined behavioural and genetical studies to demonstrate how skewed reproductive success among individuals within a breeding group can produce what appears to be co-operative behaviour. Ian is well known internationally for his critiques on apparent co-operative breeding in birds, and for his detailed conservation work.

Ian's presence at the station was welcomed by students. He spent countless hours in the field discussing research plans and helping others solve logistical problems. As a visiting scientist, he fulfilled nearly every role imaginable from field assistant to mentor.

Funding for this program was granted by Bruce Hutchinson, Director, Queen's Research Services.

Biodiversity Centre

At long last, plans for a new central building for the Biological Station are moving forward. The need to replace our venerable old lodge has been keenly felt for a number of years. A larger, year-round building with improved kitchen, dining facilities and washrooms, plus space for a conference room, computer room, interpretive area etc., is planned. To reflect the fundamental role of the central building in all aspects of operations, it is proposed to call the new building the Biodiversity Centre. Many generous donations and a series of applications by Raleigh and Frank to funding sources has resulted in over \$300,000 toward the \$500,000 to \$600,000 required for such a project. Our sincerest thanks to all who have helped with donations. Presently, a final push on fundraising is being made, since approval to proceed will not be forthcoming until all of the funds required for the project are in hand.

In order to minimize the timeline for the building, it has been decided to move ahead with the planning of such a building. Raleigh and Frank met with several architects to discuss potential involvements. Based on these meetings, it was decided to invite two architects to participate in an "ideas competition". The architects provided design sketches and outlined their approaches and underlying considerations for construction. These sketches were posted in the Biosciences Building and Queen's users were asked for comments. Finally, a selection committee met with each architect in February and heard their presentations. The committee members were:

- Dr. Raleigh Robertson - Director, QUBS
- Frank Phelan - Manager, QUBS
- George Hutson - Director, Campus Services
- Pat Caulfeild - Project Manager, Campus Services
- Ken Roth - Campus Planning and Development
- Dr. Gerry Morris - Chair, Department of Biology
- Dr. Chris Eckert - Department of Biology
- Dr. Laurene Ratcliffe - Department of Biology

As a result of committee deliberations, Tom Blood (Blood Architects, Nepean) was chosen as architect for the project. Tom has extensive experience with the type of construction anticipated and has worked on several projects in the vicinity of QUBS. Tom's approach is to begin with fundamentals, examine needs and requirements, discuss linkages, relationships and appearances and

develop a cost-effective design. Tom's sketch from the ideas competition is posted on the QUBS web page if one wishes a peek (<http://biology.queensu.ca/~qubs/>).

Presently, we hope to arrange a series of meetings with the architect to develop a set of sketches which meet our needs. On final approval, the architect will then prepare working drawings for contractors. With these plans in hand, and once the fundraising is completed, the demolition of the old lodge and construction of the new building can swiftly move ahead. Donations to the Opinicon Appeal (Account #884-399) will be used exclusively for the new Biodiversity Centre.

Seminars

Raleigh and Frank organized the seminar program for 1997. A full list of speakers and topics appears later in this report (p.58).

Open House

The Open House was held on July 6 in 1997. We hosted some 350 visitors during the day. Thank you to all the regulars who work hard to prepare displays, serve as hosts to our visitors and make this event a success.

The 1997 version of the Community Newsletter (sixteenth edition) was distributed in early July to more than 900 households and cottages in the vicinity of Chaffey's Lock, Elgin and Perth Road Village. The newsletter keeps contact with our friends and neighbours even if they are unable to attend the Open House.

Both of these initiatives are important in maintaining close contact with the neighbouring community. It is most encouraging to see continuing involvement in field station activities by the local community.

1997 Renovations and Additions

In 1997, a series of changes and improvements to QUBS facilities were undertaken. Some of these include:

- 1) As an outpost on the research property, we built a small cabin on Long Lake on the Pangman Conservation Reserve. Dr. Allen Keast provided the impetus to do this and contributed the funds to build the cabin. It is 12x20 feet, with a steel roof. It is provided with built-in bunks for two and a kitchen table and chairs. Pots, pans, kerosene lamps and other essentials will be left in a cupboard at the cabin. Since Long Lake is quite far into the QUBS property, a shelter and base of operations was seen as desirable. 2) Access to the back lakes and to the Long lake outpost cabin was much improved with the purchase of an all-terrain vehicle. This Yamaha Big Bear 350 was purchased with funds donated to QUBS by Dr. Allen Keast. QUBS also purchased a small trailer which, with the addition of a folding tailgate/ramp built by Rod Green, can not only carry the ATV, but serves as a tow-behind trailer for the ATV for equipment. This combination of ATV and trailer was invaluable in moving the necessary building materials for the Long Lake cabin. 3) In later fall, repairs were made to the upper level of the Horse Barn, behind George Hughson's house. We have used the lower level for storage of research gear. However, the upper level was sagging, with some broken and rotting timbers. Gary Prue, a barn contractor from Lansdowne, removed the siding from the Northwest wall and replaced several rotting timbers and shored up the building. Hopefully, this repair will enable full use of the Horse Barn for storage for some time. 4) In summer, a pressure washer was purchased for the shop. This piece of equipment will aid in maintaining trucks, tractor, boats and buildings. 5) In early winter, the heater cable in the line from the White House to the well short-circuited. The old Pyrotenax core was removed and replaced by Champan's. This heater cable is necessary to prevent freezing of the well line as it passes under the main station road. 6) In summer, we continued with



Long Lake Cabin under construction, ATV and trailer in foreground

efforts to control erosion of the walkways around the station. The pathways from the lodge to the Boathouse and White House to Trilab were terraced with broad steps made of pressure-treated lumber and filled with stone dust. 7) Last year, the canopy of the Rappinicon (our large pontoon boat) was ripped, the result of a lot of rain and poor support of the canopy. In summer, new supports were fabricated, incorporating an arch for the top to aid drainage and several longitudinal supports. The old top was resewn and fitted to the new superstructure. Fall field courses successfully tested the new design. 8) A large pull-down projector screen was installed in the Curran library. This was salvaged from the Queen's Recycle and Reuse Centre. 9) To house some of the books donated to QUBS by Mrs. Hilda Pangman, a display case was built into the bookshelves in the Curran library. Three of Lansdowne's books, *Birds of the Northern Forest*, and Volumes 1 and 2 of *Birds of the Eastern Forest* now reside in this display case. Thank you, Mrs. Pangman for your kindness. 10) To improve access to the waterfront, a ramp was built. At the lake side of the Trilab and connecting the driveway between the Aquarium and Trilab to the dock area by the big barge slip, this ramp enables safety equipment (fire pump) and small vehicles to access the dock area. At present, all station vehicles, including the ATV and lawn tractor can pull the fire pump quickly and easily to the water's edge, greatly improving the speed of fire protection. 11) A new photocopier was acquired for QUBS this year. The new one has many more features and is faster than the old one. It is located in the upper Brown Lab computer rooms. 12) With the progressive failure of the septic system in Keast Cottage, a new system was installed in spring. This filter bed system necessitated some tree removal and grade changes near the cottage. Because of level differences, the system has been outfitted with a pump chamber next to the cottage which then delivers elixir to the tank and field. 13) In late summer, some of the rooms in Maplewood Cottage were touched up and repainted. 14) In fall, signs were placed along the old rail line which cuts through QUBS property. It is hoped that this will reduce the number of non-conforming uses made by hunters, ATV and snowmobile users entering from the tracks. In all about 100 signs were required to cover the 7 km of the track. 15) In late summer, we added crushed

gravel to the lower areas of the parking lot. Maybe now Raleigh won't get his feet wet on those rainy days. 16) As this is written, we have started cleanup after the ice storm of January. QUBS was hit pretty hard, with power out for 15.5 days and a lot of trees and limbs down. It is anticipated that it will take until well into summer to sort out the mess. Despite all this, damage to structures was surprisingly light.

Geographic Information System Project

As an aid to all QUBS users and an attempt to consolidate available information on QUBS properties and research, and to form the basis of an overall management plan for QUBS properties, development of a Geographic Information System (GIS) continues. A high-powered computer (DTK Pentium 223 MMX computer, 64 MB Ram, 4 GB SCSI hard drive, 24X SCSI CD-ROM, 1 GB SCSI Iomega JAZ drive, 100 MB Iomega external ZIP drive - Crosby Computer) has been acquired with funds (\$5K) from the Queen's Faculty of Arts and Science Equipment Fund. Many thanks to those involved with decisions regarding this allocation, especially Dr. Gerry Morris (Chair - Biology), who included the QUBS request within the Departmental application. Software for the GIS applications has been acquired through partnership with Queen's GIS Lab (Dr. Rollie Tinline) and agreements with Autodesk. AutoCad Map has been chosen as the GIS database software, because of its general applicability, power and user-friendly nature. Frank and Floyd have had several training sessions with the new software at the GIS lab with Dr. Tinline. In developing the rudiments of the GIS, a fourth-year Geography student, Sean Cashin, has been working with Frank and Floyd to develop standards and fundamental procedures for the database. As this is written, Sean has developed a guideline for the standards. With agreement from Ontario Ministry of Natural Resources (Jim Peets), digital format Ontario Base Maps pertaining to QUBS properties have been downloaded and are now available. Floyd has spent quite a bit of time this fall and winter mapping lakeshores, trails and physical features. Over time, it is expected that increasing levels of detail and information will be encompassed by QUBS maps.

In fall, a depth-finder (Meridata MD100 - Cansel Survey Equipment; links directly to QUBS' Trimble GPS unit) was obtained from Dean Silverman's Funds for Equipment and Curriculum Development (\$3K). The proposal was submitted by Drs. Smol and Cumming. In the proposal, they emphasized the value of such equipment to QUBS infrastructure. This shared unit will enable bathymetric mapping of all lakes within and adjacent to QUBS properties.

To enable production of maps at QUBS, the memory capacity of the Hewlett-Packard Laserjet III printer was increased to 5 MB. This should solve our memory overflow problems of the past.

This work continues in conjunction with the development of a management plan for QUBS properties. Of course, the first requirement of such a management plan is adequate information and mapping about QUBS holdings.

Communications Systems

For 1997, new phones were installed at QUBS. With the upgrade from rotary service to touch-tone, QUBS users could make use of switchboard systems (handy when trying to make calls to Queen's). Also, the phones in the lodge and White House are programmable, enabling local calls but not long-distance calls. This permits access for local and emergency calls without having locks on the dials, as had been the case. In fall, CallAnswer was added to the main line to facilitate receipt of messages.

In late summer, a millennium phone was installed in the lodge. This phone should simplify communications for QUBS visitors, since it accepts any credit card and Bell Calling Cards and the new

phone cards.

E-mail access from QUBS was provided to QUBS researchers and toll-line access paid for by QUBS as a service to users. For 1998, one computer will be used only for e-mail, reducing competition for time and equipment by users. We have relocated this computer to the small computer room. The weather computer and the GIS computer now reside in the collections room.

The Weather Report

The electronic weather station continues to provide fundamental data on the local physical environment for QUBS users, whether for teaching purposes or for research. Various parameters are measured and recorded. Presently, temperatures are recorded for a Stevenson screen reference air temperature, three water temperatures (surface, one meter and three meters) and one soil temperature (15 cm). In addition, wind speed and direction, rainfall and solar radiation are measured and recorded. Sensors are scanned at five-second intervals and final storage data are available at a variety of intervals from 10 minutes to 1 day.

In early 1997, the anemometer was taken down and sent away for servicing and reinstalled on March 13. The relative humidity/air temperature probe was replaced in March, along with a new probe used in the "tube snake" model. To accommodate this new sensor array, a new micrologger program was also installed. In summer, the micrologger box and the Stevenson screen were repaired and repainted.

Later in this report, there is a sample of the kinds of data which can be produced from the electronic weather system (pp. 19-21). With seemingly incredible variation between years in weather, we show monthly data for the 1996 versus 1997 research seasons (daily rainfall, daily average air temperature in Stevenson screen, daily average water temperature at 1 metre depth, daily average solar radiation). In 1996, spring was early (ice-off April 16) followed by a warm, dry summer. In contrast, spring was late in 1997 (ice-off April 22) and summer was generally cool and wet.

Friends of Opinicon

Activities of the Friends continued in 1997, under the guidance and encouragement of Naz MacDonald. The Friends had only three or four get-togethers in the summer of 1997, including the ever-popular potluck dinner at Naz's island (Hughson Island in Lake Opinicon). Naz was especially busy with her stained-glass design and fabrication; she and Larry spent many, many hours at this with exceptional results. The Friends all wish them well in this endeavour, and admire their creativity.

Most of the walks were toward Lindsay and Long Lakes on the Pangman Reserve. It is a rare day that we get very far on these walks, as there is always so much to see at any given point and so much important chatting to be done among the Friends. We are pleased to see that, in spite of the reduced numbers of formal walks, there now seems to be many get-togethers of members of our organization that didn't know each other before the Friends group was created.

A highlight of this year's events was a tour of Turid Forsyth's garden. Turid's talents and green thumb show clearly in her array of plants and colours.

It is with much sadness that we report the passing of three good friends in 1996 and 1997. Jim MacLatchie, Ellie Eisenberg, and Ted Johnson will be greatly missed by the Friends. The rest of us sincerely hope that their families will continue to enjoy nature, our occasional seminars, and our other get-togethers with us.

Congratulations

Congratulations to Bart Kempenaers (Konrad Lorenz Institute, Austria) and An Blicek on the birth of their second child, Nele on November 29, 1997, a little sister for Tine.

Congratulations to Drs. Barb Zeeb (Royal Military College/Queen's) and Julian Szeicz (Queen's - Geography) who "tied the knot" September 13 in a ceremony held at QUBS. A tent on the lawn guaranteed nice weather. It was gratifying to see QUBS users want to be married on site. Friends and family greatly enjoyed the opportunity to experience a taste of the field station during wedding celebrations.

In Sympathy

Dr. Harold Good, past Director of QUBS (1952 - 1954), died on July 28, 1997. We at QUBS extend our sympathies to Harold's family, especially his wife Barbara. We will miss Harold's wry wit and opportunities to sound the depths of his knowledge and experience.

The following was written by Dr. Gerry Morris, Chair of Queen's Biology Department, and was originally printed in the Queen's Gazette Vol. 28 (13), August 11, 1997 and reprinted in Biology This Week, September 1, 1997:

"Former Head oversaw farsighted changes to biology program"

Harold Good, Professor Emeritus of Biology, died on July 28, 1997 at the age of 77. Harold received his undergraduate education and hid PhD from the University of Toronto and, after two years as a lecturer in botany at Toronto, came to Queen's as an assistant professor in 1949. Harold conducted research on the pathology of forest trees, and was a respected plant pathologist and naturalist. Harold was president of the Queen's Faculty Association in 1953-54 and president of the Canadian association of University Teachers in 1959-60. He was Acting Head of biology on two occasions, served for two years as director of the Queen's University Biology Station and from 1973-75 was director of the program for instructional development of the Council of Ontario Universities.

Harold was a dedicated teacher and was devoted to the study of educational theory and university administration. One of his articles, remembered with fondness by past and present heads, noted that universities could achieve financial and administrative savings by dispensing with the decanal level of administration. Harold played a major role in preparation of the documents which led in 1963 to funding of a new biology building which became Earl Hall. The current biology curriculum is also a product of a review chaired by Harold in the early '70s. The result was a controversial transition from the practice of providing many courses on a wide range of subjects, to a focus on an efficiently taught, essential body of knowledge. During the same period, Harold designed and taught a highly successful introductory course in which memorization of information was made secondary to the process of problem solving. He also introduced the use of full-time instructors who were responsible for the preparation and organization of laboratories in large core courses. In releasing professors from the task of demonstrating in laboratories, this change significantly increased the time available for research and advanced teaching. Much of the considerable success in scholarship of the department has resulted from those far-sighted changes initiated more than 25 years ago.

During his 49 years in the Kingston area, Harold also grew orchids, acres of asparagus, and heritage apples. He collected oriental carpets, silver, and porcelain. He had the best nose in the biology wine-tasting group, an unequalled knowledge of Scotch whisky, and was an accomplished carpenter and restorer of antiques. He and his wife Barbara raised four children and were a vital part of the lives of a generation of grandchildren. Harold officially retired in 1982, but remained an active contributor to Queen's and to the wider community. He was an active participant in the restoration and operation of MacPherson House in Napanee, and with his friends and colleagues Allen West and Bev Smallman, published a history of Queen's Biology in 1991."

Station User Fees

The fee schedule for 1998 appears on the last page of this report. These fees reflect about a 1% increase to keep us abreast of the current inflation rate and the Consumer Price Index.

Theses and Publications

In an attempt to keep our listing of theses and publications emanating from work at QUBS as current as possible, please submit citations as soon as available. In addition, copies of theses should be forwarded to QUBS (we will have them bound as necessary). Reprints of publications would also be appreciated.

Parks Canada - Rideau Canal

For the past several years, and again in 1997, the Superintendent of the Rideau Canal, on behalf of Parks Canada - Rideau Canal, has provided QUBS with complimentary lockage passes for both of our pontoon boats (floating classrooms). This generosity, especially in view of severe fiscal restraints, is greatly appreciated and facilitates study of a variety of water bodies along the Rideau Canal during research and teaching initiatives. All users of QUBS thank Parks Canada for their continued support.

In 1997, John Bonser retired as Superintendent. QUBS had developed a good working relationship with Mr. Bonser and we will miss him. We at QUBS hope that Mr. Bonser's retirement will be rewarding. In this case, retirement will not slow John down one iota. Now he can pick and choose where he will direct his talents and energy. It is hoped that John's successor, Doug Stewart will continue to develop the relationship between QUBS and Parks Canada - Rideau Canal.

Acknowledgements

QUBS staff play an important, but often overlooked, role in the continued success of the field station. Thank you to Floyd Connor (Assistant Manager), Roger (Rod) Green (Maintenance Assistant), Marg Phelan, Earl Grace and Glenna McGill (Food service Staff), Ron Vinkle Jr. (Part-time Assistant), Clark Phelan (grounds maintenance) and Debbie Heintzman (assisted kitchen staff with fall field courses and weekends).

Cover

The cover of this year's annual report and newsletter features some of the materials used in GPS and GIS work, a focus of activities in 1997.

QUBS Properties

For records-keeping purposes, this section of the Annual Report will list uses of properties, management activities and changes pertinent to specific areas. Entries will be made corresponding to particular tracts of land.

GIS Mapping

As mentioned in the introduction, development of a Geographic Information System database is moving forward. With the acquisition of a suitable computer and software and with help in designing the system from Dr. Rollie Tinline (Queen's GIS Lab) and Sean Cashin (Queen's Geography), the fundamentals are all in place. Floyd and Frank have spent time afield mapping trails, roads, shorelines and habitats on the various properties, accumulating mapping information for use in the database. We will embellish the digital Ontario Base Maps obtained from Ontario Ministry of Natural Resources and gradually add finer detail in the QUBS system. There have been some glitches, however, especially in reconciling survey and metes and bounds descriptions of properties with on-site GPS data.

It is necessary to have descriptive and significant names for features throughout QUBS properties, so Frank has been working with locals like George Hughson and Allen Bonwill to retain traditional names for homesteads, fields and natural features. To this end, it is also necessary to have adequate descriptions of various sites for naming. Tim Demmons helped with this in late summer, sketching the various fields and links of the old fields back on the Pangman Reserve.

Over time, a fully functional GIS will develop. This will form the basis of an overall management plan for QUBS properties.

Hughson Tract

The Hughson Tract was used for studies of Tree Swallows, Eastern Bluebirds, damselflies, dragonflies, water mites, forest edge communities, Black Rat Snakes, Northern Water Snakes and the effect of roads on snake populations in 1997.

Dr. Weatherhead and his students continue to use the snake pens constructed at the back of the S.R. Brown fields, just at the east side of Lindsay Lake Pond.

The various bird box grids were used intensively by Dr. Raleigh Robertson and his students in work on cavity-nesting birds (Tree Swallows and Eastern Bluebirds).

The plots used by Dr. Aarssen and his students were ploughed and tilled in fall. These include the large plot in the Lane Sargent Field and the two smaller plots (one fenced, the second unfenced) in the New Barn Field.

Discussion with George Hughson revealed that traditionally there were linkages between all of the fields on the north and south sides of the Opinicon Road. At one time, it was possible to travel from the Bedford Road to Warner Lake or from the mines at Pothole Lake to the Lindsay Field (small field south of Osprey/Spar Marsh) without once coming out onto the main road. To facilitate access and to avoid the need to travel the main road, some of these linkages have been reopened, especially between the East Fields and Lindsay lake Road. It is intended that most or all of these linkages be reopened if possible.

Haying of the open fields was done by Bob Butterill and David Hughson. David has been using the New Barn to store some of this hay. In late summer, the Lindsay Field was partially bushhogged to reopen this pocket. Had this not been done, it would have disappeared as a field very soon. Also, the field edges on the Hughson Tract were trimmed back with the bushhog in late summer/early fall.

Bonwill Tract

In 1997, The Bonwill Tract was used for studies of Cerulean Warblers, American Redstarts, Red-eyed Vireos, forest edge communities, damselflies, dragonflies, water mites, Black Rat Snakes, Northern Water Snakes and effect of roads on snake populations. In addition, the Canadian Wildlife Service Forest Bird Monitoring Plots were visited by Floyd Connor and Dr. Allen Keast and the Ontario Ministry of Natural Resources (Eric Boysen - Kemptonville) maintains several Growth and Yield Plots.

flanking the Bedford Road.

In fall, the areas facing the abandoned railway tracks was posted with signs in an effort to keep non-conforming users (hunters and ATV and snowmobile riders) from entering off the tracks.

Haying of the open fields was done by Bob Butterill.

John M. Cape-Charles Sauriol Environmental Studies Area

The Cape-Sauriol Tract was used for studies of Cerulean Warblers, dragonflies, damselflies, paleolimnology, Largemouth and Smallmouth Bass, water mites, Black Rat Snakes and forest communities in 1997.

In fall, a group from the Chaffey's Lock and Area Heritage Society hiked back to the mine sites near Pothole Lake. Neil Patterson (formerly from Queen's Engineering) provided interesting historical perspective on human settlement, mining and farming.

Hilda and John B. Pangman Conservation Reserve

In 1997, the Pangman Reserve was used for studies of Cerulean Warblers, American Redstarts, Red-eyed Vireos, Golden-winged Warblers, Black Rat Snakes, Northern Water Snakes, Largemouth Bass, Yellow Perch, fish communities and effect of roads on snake populations.

Warner Lake continues to be a site of intensive study on Largemouth Bass populations. Frank Phelan, Dr. David Philipp and students have individually PIT-tagged most of the male bass in the lake and are conducting a multi-year study of bass populations. The lake has been posted as a research lake and closed to fishing.

Initial lake surveys, including fish community composition, were started in 1997 for Lindsay, Long, Garter, Round and Poole Lakes.

An outpost cabin was built on Long Lake to facilitate study in areas well away from roads. A modicum of kitchen kit plus survival gear will be housed in this cabin.

In fall, the areas facing the abandoned railway tracks was posted with signs in an effort to keep non-conforming users (hunters and ATV and snowmobile riders) from entering off the tracks.

The Lindsay Lake Road continues to be a popular place for nature walks with various groups.

Bracken Tract

The Bracken Tract was used for studies of Tree Swallows, Eastern Bluebirds and forest edge communities in 1997. A new grid of nest boxes was constructed in the fields leading down to Iron Mine Bay. With help from Maurice Hutchings and son, this portion of the property was fenced to keep cattle away from the bird boxes.

In fall, the property was intensively used by students in Geology 221 (Geological Field Methods). Doug Archibald had the students determine the stratigraphy of the surficial sediments with soil augers and conduct a magnetometer survey to determine the contact zone between the background gneiss and the magnetic gabbro which holds the magnetite. This work is of interest since the area used to be home to a very successful iron (magnetite) mine.

Maurice Hutchings is permitted to graze cattle on this tract. In exchange, Maurice keeps an eye on the property.

Moore's Tract

In 1997, the Moore's Tract was used in studies of snakes and forest edge communities.

In fall, Dr. Ralph Morris' small mammal field course set up live-trapping grids through the old field areas of the property.

Preliminary discussions with Dr. Gerry Wyatt, who owns the property immediately to the west of the Moore's tract, indicated that there used to be a walking trail through the property, along the ridgetops from the Wyatt property to the Indian Lake Road. Reopening this trail would improve access to the interior of the property.

In fall, the areas facing the Indian Lake Roads was posted with signs in an effort to keep non-conforming users (hunters and ATV and snowmobile riders) from entering.

Table 1: Summary of course credits in the Ontario Universities Program in Field Biology earned at Queen's University Biological Station in 1997.

| MODULE TOPIC | Professor and Affiliation | Dates | Credit/Student | B | C | G | M | O | Q | To | Tr | Wa | We | W1 | Y | Other | Total students /Module |
|---------------------------------|---------------------------|---------------|----------------|---|-----|---|-----|-----|------|------|----|-----|----|----|------|-------|------------------------|
| Acoustic Communication in Birds | Ratcliffe (Q) | May 4-10 | 1/4 | 1 | 0 | 0 | 1 | 1 | 3 | 2 | 0 | 0 | 2 | 0 | 2 | 0 | 12 |
| Fish Ecology | Phelan (Q) | May 18-24 | 1/4 | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 4 | 0 | 11 |
| General Limnology | Zeeb (Q/R/IC) | May 25-31 | 1/4 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 6 | 0 | 10 |
| Behavioural Ecology of Bats | Fenton (Y) | Aug 5-15 | 1/2 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 2 | 3 | 11 |
| Plant Systematics | Pringle (M/RBG) | Aug 10-16 | 1/4 | 0 | 0 | 0 | 1 | 0 | 1 | 3 | 2 | 2 | 0 | 0 | 1 | 0 | 10 |
| Applied Environmental Ecology | Snetsinger/Kristensen (Q) | Aug 17-30 | 1/2 | 1 | 1 | 0 | 2 | 0 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 12 |
| Evolutionary Ecology of Plants | Eckert (Q) | Aug 17-23 | 1/4 | 0 | 1 | 0 | 1 | 0 | 2 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 10 |
| Systematic Ichthyology | Friesen Birt (Q) | Aug 17-30 | 1/2 | 1 | 1 | 0 | 0 | 0 | 3 | 3 | 0 | 1 | 1 | 0 | 1 | 0 | 11 |
| Aquatic Community Ecology | McQueen (Y) | Aug 24-30 | 1/4 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 1 | 0 | 5 | 0 | 10 |
| Insect Taxonomy | Gunderman (M) | Aug 31-Sept 6 | 1/4 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 1 | 0 | 2 | 0 | 10 |
| Small Mammal Ecology | Morris (B) | Aug 31-Sept 6 | 1/4 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 1 | 0 | 4 | 0 | 10 |
| Total Number of Student - Weeks | | | | 6 | 7 | 2 | 9 | 1 | 31 | 25 | 10 | 9 | 10 | 4 | 31 | 6 | 151 |
| Half - Course Equivalents | | | | 3 | 3.5 | 1 | 4.5 | 0.5 | 15.5 | 12.5 | 5 | 4.5 | 5 | 2 | 15.5 | 3 | 75.5 |

| MIDDLE TOPIC | Professor and Affiliation | Dates | Location | Credit/ student | B | C | D | M | O | Q | To | Tr | We | We | Wt | Y | Total students /Module | Total 1/2 course Credits | |
|--|---------------------------|-----------------------|------------------|-----------------|----|------|-----|------|----|----|------|----|------|----|----|------|------------------------|--------------------------|-------|
| Biology of Neotropical Migrants | Nel (V) | Feb 13-27 | Vuonon | 1/2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 10 |
| Tropical Zoology | Hobert (C) | Apr 28-May 15 | Australia | 1/2 | 0 | 0 | 16 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 18 | 18 |
| Introduction to Tropical Ecosystems | Johnson (O) | May 1-14 | Costa Rica | 1/2 | 0 | 0 | 0 | 1 | 6 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 11 | 11 |
| Ecology and Behaviour of Small Mammals | Wernman (V) | May 4-14 | Algarquim | 1/2 | 1 | 1 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 3 | 0 | 12 | 12 |
| Ecosystem Response to Human Disturbance | Woodellie (Tr) | May 11-24 | Pedrobonough | 1/2 | 0 | 0 | 0 | 1 | 0 | 4 | 1 | 2 | 0 | 4 | 0 | 0 | 0 | 12 | 12 |
| Field Ecology | Marshall (C) | May 11-24 | Virginia | 1/2 | 1 | 0 | 6 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 12 | 12 |
| Great Lakes Field Ecology | Marbanaq (W) | May 11-24 | Windsor | 1/2 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 2 | 5 | 1 | 1 | 15 | 15 |
| Field Ornithology | Blasing (To) | May 17-31 | MAISC | 1/2 | 1 | 0 | 0 | 0 | 0 | 1 | 11 | 0 | 1 | 1 | 0 | 0 | 0 | 15 | 15 |
| Techniques in Field Ornithology | Ovatin (O) | May 16-29 | Queen Charlotte | 1/2 | 0 | 1 | 0 | 2 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 10 |
| Biodiversity and Ecology of Invertebrata | Murphy (To) | May 19-30 | Vietnam | 1/2 | 1 | 0 | 3 | 0 | 0 | 1 | 14 | 0 | 0 | 1 | 0 | 0 | 0 | 20 | 20 |
| Marine Invertebrates | Marled (C) | May 25-Jun 7 | MAISC | 1/2 | 1 | 4 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 4 | 0 | 13 | 13 |
| Natural History | Lesht (Y) | Jun 22-28 | Algarquim | 1/4 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 4 | 0 | 8 | 4 |
| Marine Mammals | Kovacs (W) | Jul 17-Aug 9 | HBISC | 1/2 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 7 | 7 |
| Arctic Ecosystems | Hik (To) | Aug 1-12 | Yukon | 1/2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 11 |
| Field Ecology | Brooks (O) | Aug 10-23 | Algarquim | 1/2 | 0 | 1 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 13 | 13 |
| Marine Biology | Malloch (To) | Aug 10-23 | HBISC | 1/2 | 0 | 0 | 0 | 0 | 1 | 0 | 13 | 0 | 0 | 1 | 1 | 0 | 0 | 16 | 16 |
| Biodiversity of NW Argentina | Harford (W) | August | Argentina | 1/2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 7 | 7 |
| Ecology of Recently Deglaciated Terrain | McCarthy (B) | Aug 13-28 | British Columbia | 1/2 | 6 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 12 | 12 |
| Marine Biology and Oceanography | Baillanyet (G) | Aug 13-30 | HBISC | 1/2 | 0 | 0 | 18 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 19 |
| Alpine Ecology | Milder (V) | Aug 16-29 | Kananaskis, AB | 1/2 | 0 | 2 | 0 | 2 | 1 | 4 | 0 | 2 | 1 | 3 | 0 | 1 | 0 | 16 | 16 |
| Bird Migration and Feeding | Fravel (O) | Aug 17-30 | Poule Rouxas, ON | 1/2 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 1 | 3 | 2 | 3 | 0 | 14 | 14 |
| Tropical Forest Biodiversity | Wood (C) | August | Costa Rica | 1/2 | 1 | 1 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 7 |
| Terrestrial and Aquatic Biology | Hambroog (W) | Aug 21-Sep 7 | Algarquim | 1/2 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 5 | 2 | 1 | 3 | 0 | 16 | 16 |
| Experimental Studies in Marine Biology | Owen (We) | Aug 22 - Sep 7 | HBISC | 1/2 | 0 | 1 | 0 | 0 | 0 | 3 | 1 | 0 | 4 | 5 | 0 | 0 | 0 | 13 | 13 |
| Biogeochemical Processes in Natural Waters | Ferris (To) | Aug 22-29 | Chalk River, ON | 1/4 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 0 | 9 | 4.5 |
| Lake Ecosystems | Zimmerman (To) | Aug 23-29 | Algarquim | 1/4 | 1 | 1 | 0 | 1 | 0 | 2 | 5 | 0 | 2 | 1 | 0 | 1 | 0 | 14 | 7 |
| Tropical Ecology | Kotze (M) | Dec 26/97 - Jan 10/98 | Jordanis | 1/2 | 0 | 1 | 1 | 9 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 16 | 16 |
| Marine Biology | Williams (To) | Feb 14- 22/98 | Barbados | 1/2 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 12 | 12 |
| Total Number of Student - Weeks | | | | | 16 | 39 | 114 | 37 | 34 | 70 | 140 | 44 | 35 | 74 | 22 | 45 | 7 | 685 | |
| Half - Course Equivalents | | | | | 19 | 16.5 | 17 | 18.5 | 17 | 20 | 22.5 | 22 | 17.5 | 17 | 11 | 11.5 | 1 | | 342.5 |

Naturalists' Workshop 1997

In 1997, QUBS offered its nineteenth edition of the naturalists' workshop. Three workshops were offered in 1996:

1) *Harbingers of Spring* - May 1-4

This workshop focused on spring flowers, amphibians and reptiles and birds. To offer such a broad program, a number of instructors were involved. These included Dr. Francis Cook (former Curator of Herpetology, Canadian Museum of Nature - herpetology), Dr. Chris Eckert (Department of Biology, Queen's University - floral morphology and pollination ecology), Gabriel Blouin-Demers (PhD student, Department of Biology, Carleton University - black rat snake researcher) and Don Cuddy (Ecologist, Ontario Ministry of Natural Resources, Kemptonville - natural history). With much time outdoors, participants experienced an abundance of spring flora and fauna.

Derek Anderson (Bewdley, Ontario) received the S.B. Rutherford Scholarship to enable him to attend this session. This scholarship is named for S.B. Rutherford, a former biology teacher at Clarke High School (Orono, Ontario) and a local champion of interest in natural environments. The selection committee for this scholarship is headed by Roy Forrester, a naturalists' workshop alumnus himself. The S.B. Rutherford Foundation plans to make one scholarship available each year.

12 participants enrolled in this workshop.

2) *Drawing from Nature* - July 24-27

Turid Forsyth, a local artist-photographer-gardener, was the instructor for the workshop. Turid divides her time between her country home near Lake Opinicon and her mountain home at Monteverde, Costa Rica. Turid studied at the Art and Design School in Wurtzburg, Germany. She has worked as a biological illustrator. Turid is probably best known locally for her botanical illustrations and photographs in a variety of garden books, calendars and magazines.

The workshop introduced techniques of sketching and water colours, with emphasis on interpreting nature through art.

10 participants enrolled in this workshop.

3) *Mushrooms - Identification, Ecology and Edibility* - September 21-24

Richard Aaron, an avid naturalist and long-time associate of the Naturalist Workshops, worked on our behalf to locate an expert on fungi. Richard was able to connect with David Fischer, an internationally known expert of the identification and ecology of wild mushrooms. David serves as mushroom identification consultant for several organizations, and has lectured widely on the subject of mushrooms. He is co-author of Edible Wild mushrooms of North America: a Field-to-kitchen Guide (1992, University of Texas Press) which has been widely applauded by experts, and of Mushrooms of Northeastern North America (1997, Syracuse University Press).

A wet late summer and early fall encouraged a profusion of mushrooms for the workshop. David guided workshop participants through a wide variety of fungi in the field and the lab.

14 participants attended this module.

The workshops continue to be well-attended and much in demand. Our singular difficulty is in keeping up with the participants. These people are keen! They want to do it all. Our instructors

deserve special thanks for being inspiring, informative and equally enthusiastic as the workshop participants.

A special vote of thanks to all QUBS regulars! Workshop participants benefit greatly from interaction with field researchers working on-site at an active biological research station.

Naturalist Workshop Participants 1997

Harbingers of Spring

Richard Aaron - Toronto, Ontario
 Jacqueline Bartnik - Kingston, Ontario
 Derek Anderson - Bewdley, Ontario
 Rhonda Elliott - Leeds County Stewardship Council - Delta, Ontario
 Roy Forrester - Orono, Ontario
 Nancy Lemon - Kingston, Ontario
 Basia Lodzinski - Kingston, Ontario
 Simon Lunn - Parks Canada - Rideau Canal
 Kim Mustard - St. Lawrence Islands National Park
 Gary Nielsen - Leeds County Stewardship Council - Brockville, Ontario
 Shelby North - St. Lawrence Islands National Park
 Sandra Rutenberg - Kingston, Ontario

Drawing from Nature

Gwen Cook - Don Mills, Ontario
 Moira Drummond - Kingston, Ontario
 Carole Greig - Kingston, Ontario
 Mary Guest - Cavan, Ontario
 Joy Hodges - Peterborough, Ontario
 Nancy Lemon - Kingston, Ontario
 Jocelyne Leyton - Kingston, Ontario
 Fred Parkinson - Beaconsfield, Quebec
 Mary Warren - Chaffey's Lock, Ontario
 Dorothy Young - Kingston, Ontario

Mushrooms - Identification, Ecology and Edibility

Richard Aaron - Toronto, Ontario
 George Ambury - Sydenham, Ontario
 Karisa Ambury - Cataraqui Region Conservation Authority
 Derek Anderson - Bewdley, Ontario
 Jacqueline Bartnik - Kingston, Ontario
 Philip Careless - Friends of Presqu'ile Park, Toronto, Ontario
 Turid Forsyth - RR#1 Elgin, Ontario
 Mary Harari - Dollard des Ormeaux, Quebec
 Dr. Allen Keast - Queen's University
 Louis Kennedy - Kingston, Ontario
 Lena McPhee - Yarker, Ontario
 Angelo Varriano - Kingston, Ontario
 Gordon Vogg - Darlington Provincial Park
 Mary Ev Wyatt - Kingston, Ontario

International Summer School on Biodiversity and Systematics

This course, coordinated by Dr. Steve Loughheed (Queen's Biology) originated as a cooperative effort between museums and universities. It addresses a very timely and pertinent topic and gives a variety of perspectives on the measurement of, meaning of and importance of biodiversity. The listing below (from the preliminary outline of the course) gives the reader some impression of the scope of the course and the wide range of presenters. Only part of the course was held at QUBS in 1997.

OTTAWA VICTORIA MUSEUM BUILDING

Wednesday July 9

Dr. Michael Ruse (University of Guelph) - "The rise of science as a value system"

Dr. Tom Nudds (University of Guelph) - "The philosophy of science and the nature of credibility"

Thursday July 10

Dr. Paul Handford (University of Western Ontario) - "Species diversity: pattern and process"

Dr. Chris Humphries (Natural History Museum UK) - "Systematics and choices in conservation"

Friday July 11

Dr. Robert Montgomerie (Queen's University) - "The use and misuse of statistics in the science of biodiversity"

Dr. Chris Humphries (Natural History Museum UK) - Demonstration of WORLDMAP software.

Dr. Dan Simberloff (Florida State University) - "Ecosystem health, the balance of nature, and the role of biodiversity?"

Dr. Stuart Pimm (University of Tennessee) - "Building a bridge between ecology and conservation"

Mr. Steven Price (WWF Canada) - "Applied strategies in conservation"

Dr. Avrim Lazar (Asst. Dep. Minister Envir. Canada) - "Science and social interest: forming biodiversity policy"

Saturday July 12

Dr. John Hartwick (Queen's University) - "Global economics, natural resources and habitat conversion"

Dr. Steve Polasky (Oregon State University) - "Economic valuation of biodiversity and creating incentives for sustainable use of resources"

Mr. John Roberts (VP Env. Services, Noranda Forest) - "Corporate decision-making and the environment"

Sunday July 13

Dr. Debra VanNijnatten (Queen's University) - "Defining stake-holders in biodiversity policy"

Ms. Irene Pisanty, M.Sc (Commission for Environmental Co-operation) - "Trans-national regulation of biodiversity"

Ms. Beatrice Torres, M.Sc (Secretariat, Convention on Biodiversity) - "Implementing the Rio convention on biodiversity"

Mr. Ian Attridge, LL.B. (Research Associate, Canadian Institute for Environmental Law and Policy) - "Ownership and regulation of biodiversity"

QUEEN'S UNIVERSITY BIOLOGY STATION, LAKE OPINICON

Tuesday July 15

Dr. Denis Lynn (University of Guelph) - "An overview of bacterial evolution and diversity"

"An overview of protist evolution and diversity"

Wednesday July 16

Dr. Irwin Brodo (Canadian Museum of Nature) - "An overview of lichen evolution and diversity"

Dr. James Anderson (University of Toronto) - "An overview of fungal evolution and diversity"

Dr. Adele Crowder and Mr. Dale Kristensen (Queen's University) - Field practicum on "vegetative life".

Dr. Karl Niklas (Cornell University) - "Evolution and diversity of vascular plants"

Thursday July 17

Dr. Karl Niklas (Cornell University) - "Evolution and diversity of vascular plants"

Dr. Adele Crowder and Mr. Dale Kristensen (Queen's University) - Field practicum on "vegetative life"

Dr. Claude Gascon (Smithsonian Institution and INPA Brazil) - "The fragmentation project in Manaus, Brazil."

Friday July 18

Dr. Joel Elliott (Queen's University) - "An overview of invertebrate evolution and diversity"

Dr. Robert Anderson (Canadian Museum of Nature) - "An overview of invertebrate evolution and diversity (insects & arachnids)"

Saturday July 19

Drs. Elliott and Anderson - Field practica on invertebrates

Sunday July 20

Dr. Don McAllister (Canadian Museum of Nature) - "An overview of fish evolution and diversity"

Ms. Leslie Rye (University of Guelph) - "An overview of amphibian and reptile evolution and diversity"

Monday July 21

Dr. Stephen Loughheed (Queen's University) - "An overview of avian evolution and diversity"

Dr. Mark Engstrom (Royal Ontario Museum) - "An overview of mammalian evolution and diversity"

Tuesday July 22

Dr. Lawrence Packer (York University) - "Dividing up diversity (trophic approaches, species concepts)"

Mr. Jeremy Kerr (York University) - "Spatial and temporal patterns of diversity"

Wednesday July 23

Quantitative methods; measures of diversity etc.

QUEEN'S UNIVERSITY, KINGSTON

Thursday July 24

Dr. Michael Huston (Oakridge National Laboratory, Tennessee) - "Contemporary ecological theory I"

Friday July 25

Dr. Michael Huston (Oakridge National Laboratory, Tennessee) - "Contemporary ecological theory II"

Sunday July 27

Dr. Peter Wainwright (Florida State University) - "Ecomorphology and diversity"

Dr. Allen Orr (University of Rochester) - "Classical models of speciation"

Monday July 28

Dr. Allen Orr (University of Rochester) - "Genetical models of speciation"

Dr. Chris Eckert (Queen's University) - "Speciation in plants"

Tuesday July 29

Dr. Michael Sanderson (University of California at Davis) - "Phylogenetics: theory and practice"

Thursday July 31

Dr. Gilles Seutin (McGill University) - "Biogeography and phylogeography"

Friday August 1

Conservation issues: ecological and evolutionary considerations.

OTTAWA /AYLMER, PQ

Saturday August 2-3

Mr. Gerald Fitzgerald, Ms. Darlene Balkwill, Dr. Jean-Marc Gagnon, Mr. Mike Shchepanek, and Robert Waller (Canadian Museum of Nature) - Discussions and practica considering the role of museums in biodiversity and systematics.

OTTAWA VICTORIA MUSEUM BUILDING

Monday August 4

Dr. Gordon Surgeoner (University of Guelph) - "Agriculture and biodiversity: feeding 10 billion people"
Ms. Henrietta Marrie (Secretariat, Convention on Biodiversity) - "Indigenous peoples and biodiversity"
Dr. George Miller (Pres. & CEO, Canadian Mining Association) - "Changing perspectives in the mining industry"

Wednesday August 6

Dr. Jamie Benedickson (University of Ottawa) - "Legal issues in biodiversity revisited"
Mr. Kevin McNamee (Canadian Nature Federation) - "The role of non-governmental organizations in conservation of biodiversity"

Thursday August 7

Dr. Scott Findlay (University of Ottawa) - "Translating science into policy"
Dr. Thomas Lovejoy (Smithsonian Institution) - "Forming conservation policy into the 21st century"

For more information on this course (there is a shortened course planned for 1998), contact:

Dr. Stephen C. Loughheed

Director

International Summer School on Biodiversity and Systematics

Department of Biology

Queen's University

Kingston, Ontario

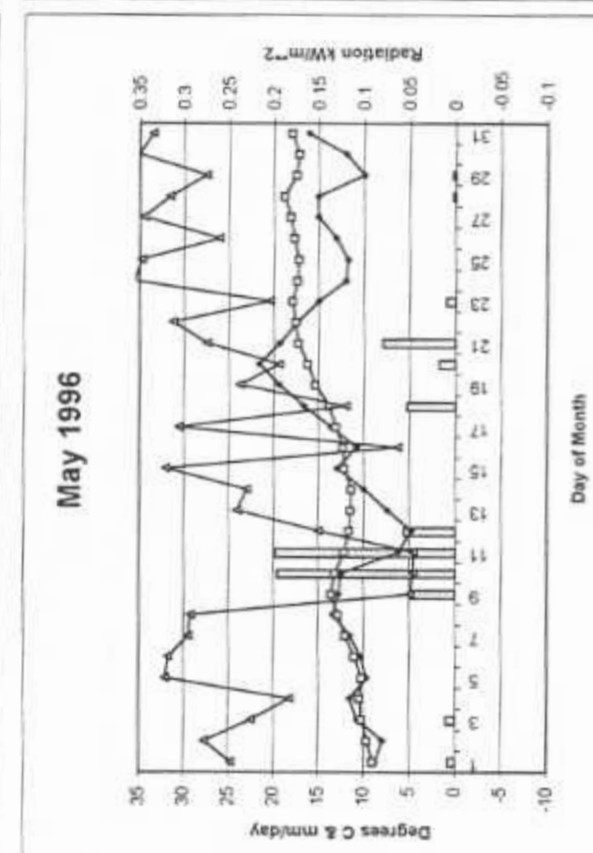
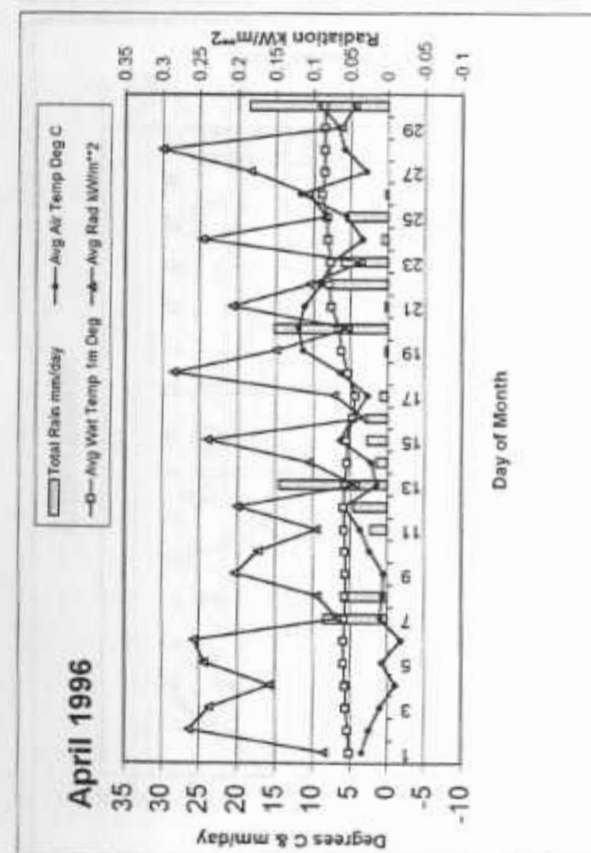
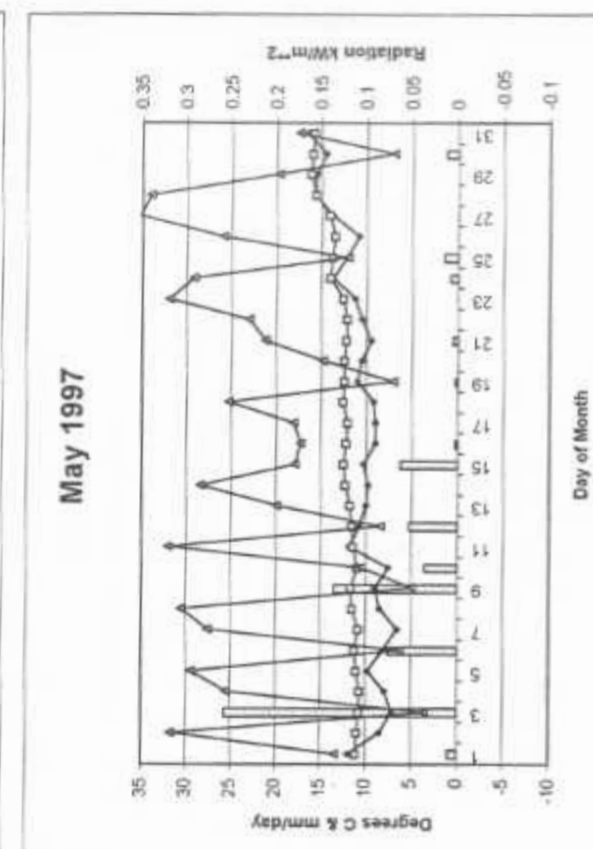
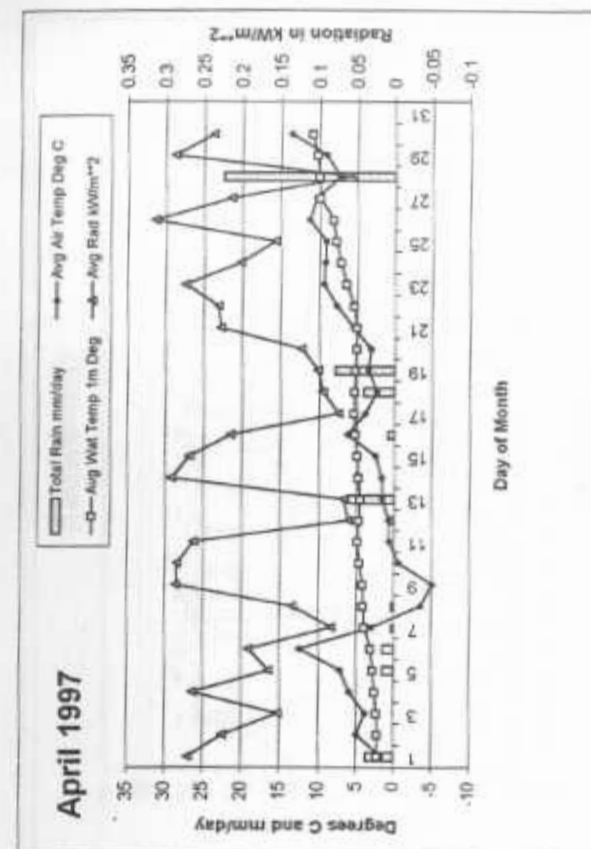
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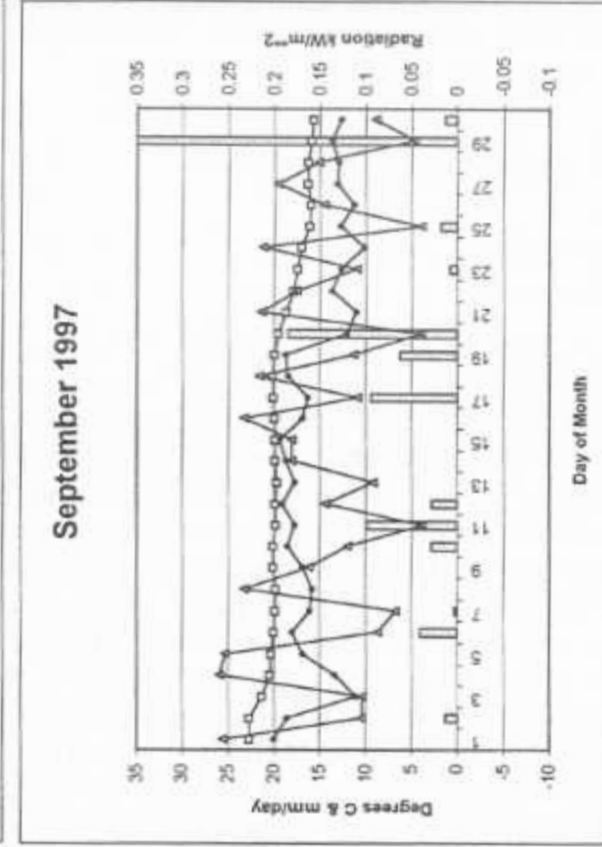
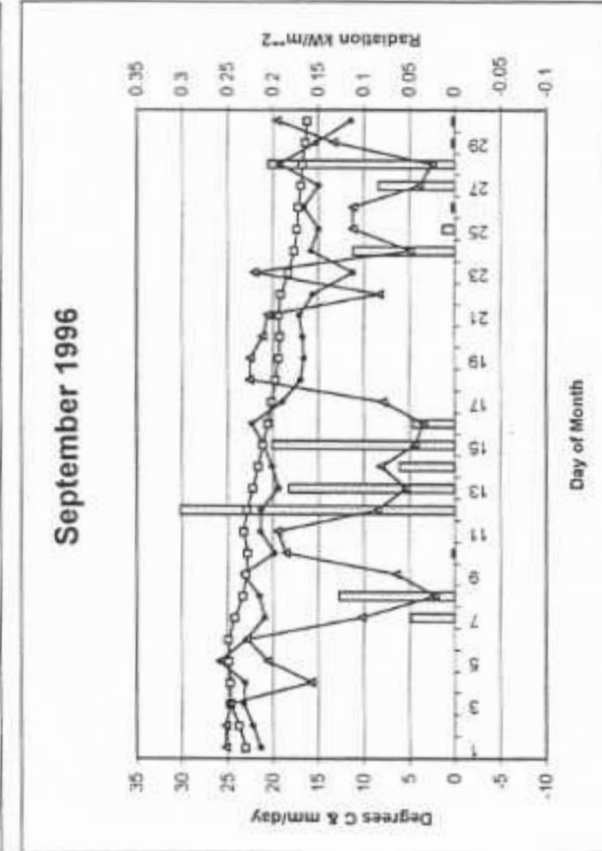
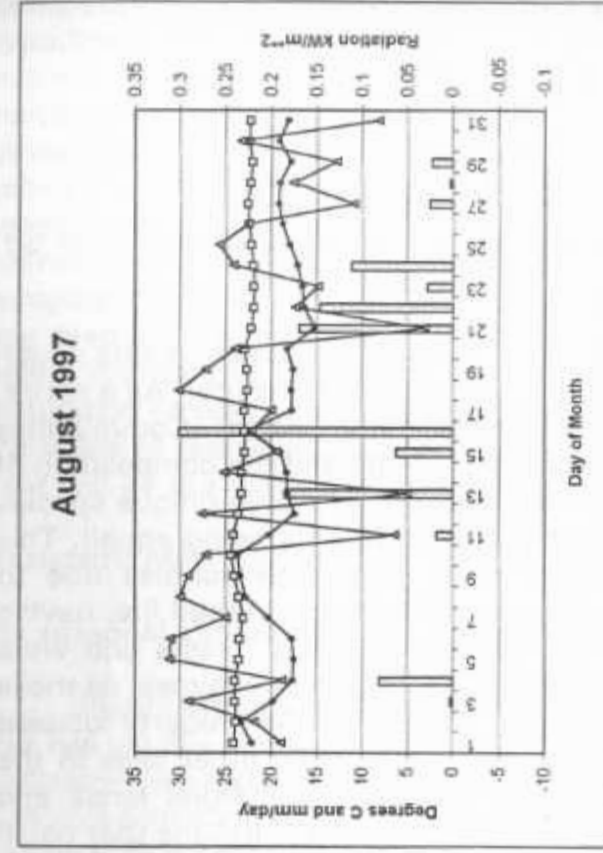
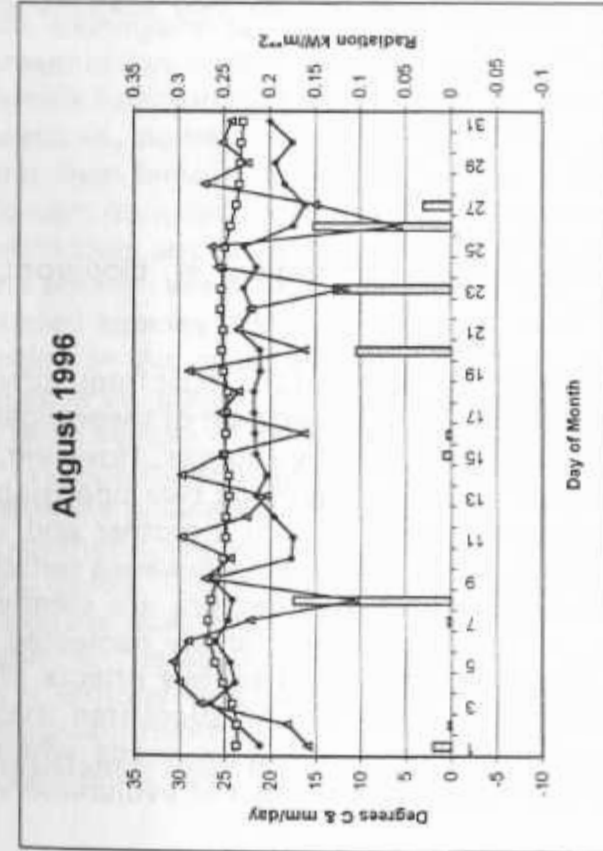
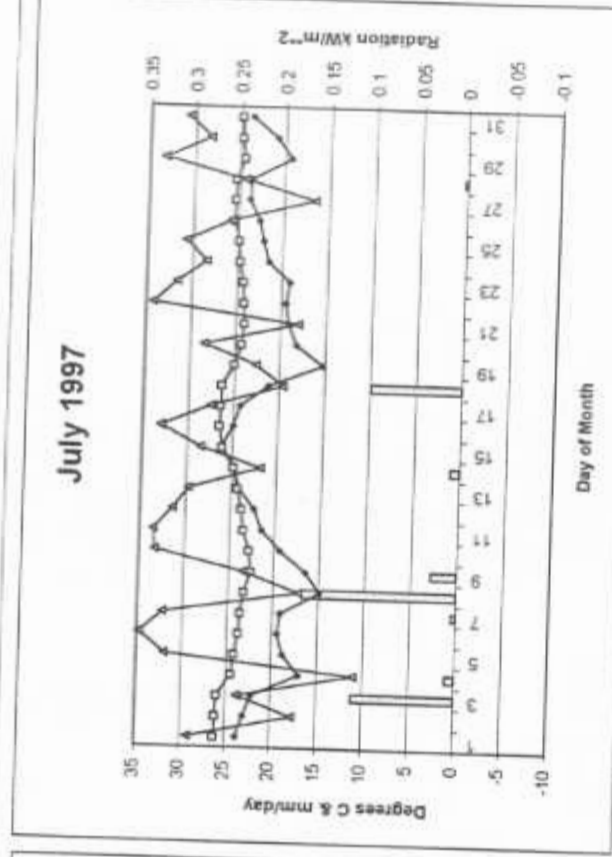
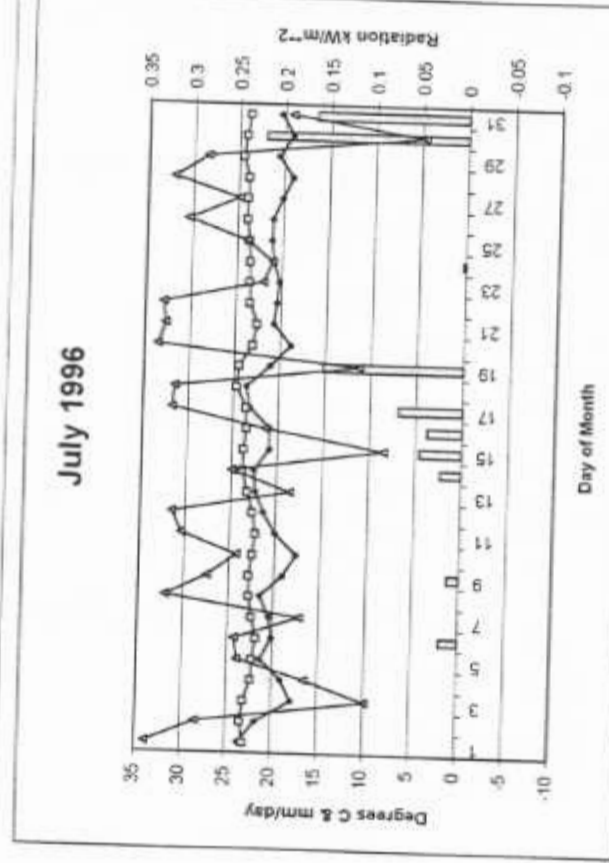
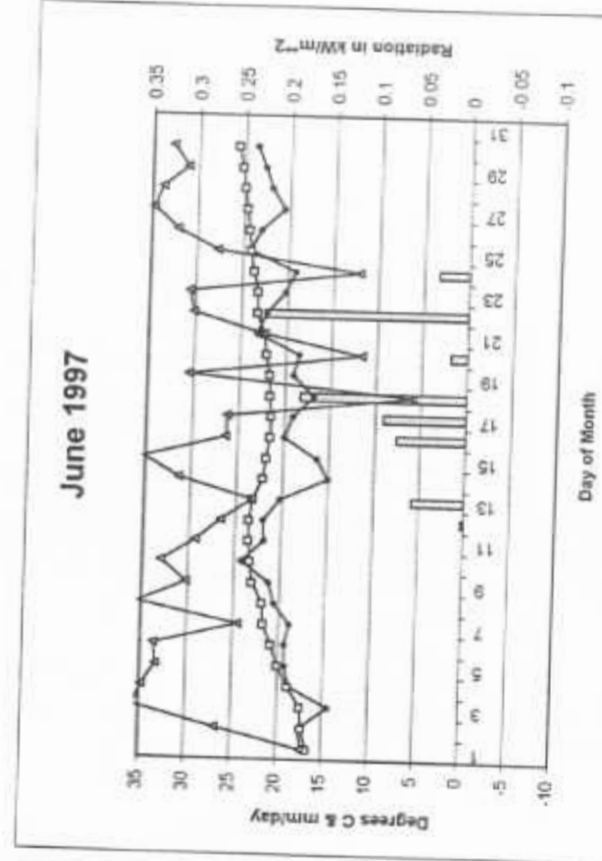
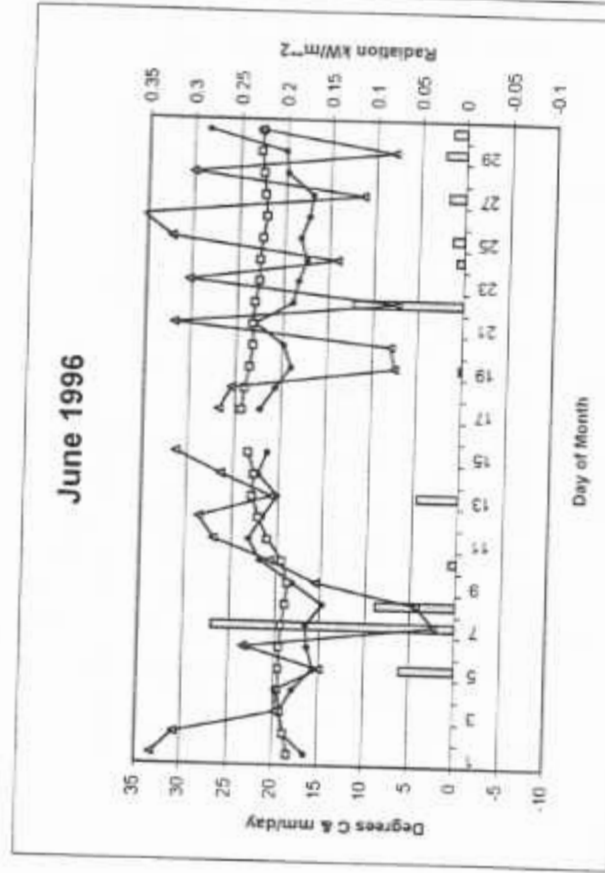
Telephone: (613) 545-6128

FAX: (613) 545-6617

email: loughheed@biology.queensu.ca or biodiv@biology.queensu.ca

<http://biology.queensu.ca/~biodiv>





I: Research conducted by Queen's University Personnel in 1997

Dr. Lonnie Aarssen

"Plant Ecology and Evolution"

Shane McCloskey - "The effects of adjacent land use on forest edges" - M.Sc. Thesis

The forest edge and forest interior are two distinct microenvironments which differ in the availability of light, intensity of wind, and level of humidity. As a result, forest edges and interiors have developed unique floral communities. Communities that differ both in the density of trees and herbaceous plants and the composition of species. There is evidence that forest edges may develop their own unique species assemblages based solely on adjacent land use (all other factors being equal). This study attempts to characterize differences in forest edge communities due to differences in adjacent land use. Sites selected were all well established (i.e. having a closed side canopy), south-facing edges of mature deciduous forests and were chosen so as to minimize variance in soil, topography and moisture regimes, as these factors may themselves affect species composition. Sites on QUBS property focused on edges adjacent to oldfields, secondary roads and trails while other sites in the neighbouring landscape focused on forest edges abutting agricultural lands and primary roads. Comparison of these edge types should yield conclusions that could be of direct use in land management. This was the first of two field seasons at QUBS.

Assistant: Heather Meyers

Dr. Chris Eckert

"Reproductive assurance and the evolution of self-fertilization in bloodroot, *Sanguinaria canadensis* (Papaveraceae)"

The transition from outcrossing to self-fertilization is one of the most frequently trod evolutionary pathways in flowering plants, and there has been a lot of theoretical work on the action and interaction of various potential selective forces. However, most of the empirical work on this problem has focused primarily on two opposing genetic factors: Selfing is advantageous because a selfer is both a mother and a father to its own seeds. On the other hand, selfing is disadvantageous because selfed offspring suffer from inbreeding depression. While these two factors are clearly important, there are other major selective forces that have been largely neglected. After Charles Darwin completed a set of experiments showing negative effects of self-fertilization on progeny fitness in a wide variety of plants, he suggested that selection would only favour selfing if it allowed a plant to produce seeds when pollinators or potential mates are scarce. Despite the total devotion of evolutionary

biologists to almost every utterance of the great bard, his reproductive assurance (RA) hypothesis has languished with little serious testing. More recently, RA has been invoked to explain mechanisms for automatic self-pollination observed in several members of our early spring flora. We tested this hypothesis in bloodroot (*Sanguinaria canadensis*), which flowers in very early spring when conditions for successful pollination seem infrequent at best. We (i.e. Matt) experimentally eliminated the capacity of flowers for automatic self-pollination by removing anthers before they opened. As predicted by the RA hypothesis, seed set was 28% lower in emasculated compared to intact control flowers. However, the fact that emasculated flowers set any seed at all is remarkable given the rainy cold spring of '97 (flowers don't open unless it's sunny) and the near absence of any insect pollinators from the study population (unless you count blackflies as potential pollinators). The extent to which the value of reproductive assurance varies from population to population or year to year will be the focus of future work.

Assistant: Matthew Routley

"Is seasonal variation in seed set a sex allocation strategy in *Aquilegia*?"

Plants often show a decline in seed set throughout the flowering season. While this has usually been explained by concurrent seasonal declines in either resources or pollinator visitation, recent theory suggests that such seasonal variation may be an adaptive allocation strategy. Since most plants possess hermaphrodite flowers, fitness can be accrued through either male or female sexual function. Moreover most species are dichogamous, in which there is temporal separation in pollen and stigma presentation within a flower. Since, the potential fitness gains through male and female function may vary across the season it follows that the relative investment in seeds vs. pollen might also vary. Recent experimental work with protandrous (male first then female) *Aquilegia caerulea* supported this hypothesis. Early in the season, flowers invested more heavily in seed when there was little scope for male success, while they set fewer seed when there was more opportunity for male siring later in the season. We evaluated this hypothesis further with *Aquilegia canadensis*, a closely related species that differs from *A. caerulea* in being protogynous (female first then male). In this case, one would expect a seasonal increase in the relative investment in seed vs. pollen. We measured seasonal variation in pollen and ovule production in a large sample of marked plants, and assessed seasonal variation in pollinator service by comparing seed production on plants where flowers had been hand-pollinated with naturally-pollinated controls. Contrary to the prediction of the sex allocation hypothesis, we observed a strong seasonal decline in the production of pollen, ovules and seeds. This was not associated with a decline in pollinator service as hand- and naturally-pollinated flowers did not differ in seed set at any point in the flowering season. The occurrence of a similar seasonal decline in seed set in both protandrous and protogynous *Aquilegia* casts serious doubt on the general validity of the sex allocation hypothesis.

Assistants: Blandine Massonet and Pascal Thomas

Drs. Dolf Harmsen and Adele Crowder

"Patterns in ecological succession in old field communities"

A long term project was started in 1975, studying the overall community structure and successional changes in two abandoned hayfields. The emphasis has been on the interactions of insect populations and vegetative succession. In 1997, this project was continued, focussing on the turn-over in dense, highly competitive young woody communities. Most mortality is either due to rodent grazing or vegetative competition for light and possibly nutrients. At this successional sere, insect grazing appears to be of little importance. The project will continue for at least five more years.

Dr. J. Allen Keast

"Long-term changes in fish assemblages, Lake Opinicon"

In recent years committees have been set up by the Ecological Society of America and other bodies to stress the need to assemble long-term ecological data and development mechanisms for a clearing house for such data. The need for data on multiple species systems and precisely relating this to environmental changes has been stressed. Opinicon has a potentially important set to offer in this regard.

Surveys on the fish of Lake Opinicon began in the late 1940's with work on the Largemouth Bass by the original Director Wes Curran. Quantitative data on whole community assemblages stems from in the early 1960's, with sets on Birch and Cow Island Bays, in 1962-64, 1974, and 1985, with continuing data gathering since then. Opinicon is a rich and diversified lake with contrasting littoral and limnetic zone habitats and assemblages, and with a balanced fish fauna of 18 species that combines different ecomorphological types of species belonging to 9 families of different origins in geological time. Specific habitats within the system have different combinations of species and age classes of species. These were early documented and related to locally available resources.

Progressive environmental changes since the 1960s include siltation and extensive macrophyte development in what were formerly sandy habitats, changes in the distributions and abundances of juvenile bluegill, pumpkinseed, black crappie, and yellow perch; dislodgement of mid-aged bluegill from shallows alienated by the introduced *Myriophyllum spicatum* to offshore sand-bars and open waters.

Data obtained during the summer of 1997 quantified: (i) changed community compositions in some littoral zone habitats; (ii) good growth of Year 0 fish in the newly available (since 1980s) macrophyte habitat; (iii) basic diet changes in the few larger members of those species that continue to occupy the choked and now less desirable habitats; (iv) some shifts in growth and age distribution of older age classes of bluegill; and (v) changed abundance cycles of the large cladoceran *Daphnia retrocurva* which was in 1997, and in contrast to previously abundant in mid-lake in May. It is hypothesized that this is related to the secondary rarity of the major

mid-like planktivore, the alewife, but they remain to be investigated. Studies on long-term changes in Opinicon continue at the community level and related to season.

Dr. Bill Leggett

"Fish Production and Recruitment"

Dr. Joel Elliott - "Growth dependent mortality during the early life history of fishes" -
Postdoctoral Fellow (presently Assistant Professor, The University of Puget Sound, Tacoma, Wa.)

We examined growth and size-dependent survival of larval fishes in lake Opinicon. This involved both laboratory and field based studies. An individual-based analysis of the relationship between somatic growth and otolith growth was conducted with laboratory reared larval fishes. An honour's thesis by Vandersteen examined the growth of larval bass and further research by Elliott et al. examined the growth of larval perch. Larval fishes were reared individually and were measured daily under the microscope for 30 days. Larval fish size was compared to the width of the increment deposited on their otoliths. A repeated measures analysis of individual somatic growth vs otolith growth showed that otoliths provided a relatively precise measure of larval growth. Larvae were also reared in groups in pots and this allowed a cross-sectional analysis of the relationship between otolith and somatic growth. This confirmed the relationship between otolith increment number and larval age.

We also conducted mesocosm experiments in Lake Opinicon to examine the relative survival and growth rates of larval perch in mesocosms (high and low food treatments) with those in the natural environment. These experiments showed that perch larvae experience lower mortality rates and higher growth rates in high food treatments, and that those larvae that survive in the natural environment are the faster-growing individuals.

Field studies examined three factors influencing the mortality of larval fishes in lake Opinicon. The first was a study of the hatching times and growth rates of perch larvae. The second project examined the spawning times, egg and egg mass sizes, and hatching times of perch larvae. This study showed that most egg masses were produced by small females, but the small number of large females produce the majority of the eggs. Relationships between egg mass length, volume, and number of eggs were also established to allow quantification of spawning in the field. The third project examined the effect of predation by hydra on larval fishes in lake Opinicon. We found that large numbers of hydra occur in lake Opinicon and that they can cause significant mortality of larval fishes (Elliott et al., in press). An honour's student (Geof Hall) also examined factors influencing the distribution and abundance of hydra in Ontario lakes.

Assistants: Jacqueline Elliott (presently an Instructor, The University of Puget Sound, Tacoma, Wa.), Geof Hall and Emma Turner

Publications:

Elliott, J. K., Elliott, J.M., and W.C. Leggett. 1997. Predation by Hydra on larval fish: field and laboratory experiments with bluegill (*Lepomis macrochirus*). *Limnology and Oceanography* 42(6):1416-1423.

Steve Chong - "Spatial variability in yellow perch (*Perca flavescens*) year-class strength along a latitudinal gradient" - M.Sc. Thesis

In my current research I am looking at factors affecting year-class strength in yellow perch (*Perca flavescens*). The yellow perch is a very important fish species both commercially and as a sport fish. The success of yellow perch reproduction from year to year varies considerably as does the survival of the young of the year (YOY) fish. As an economically important species, it is important to understand what causes these fluctuations in year-class strength. In this study I will be comparing the year-class strength of yellow perch from different water bodies along a latitudinal gradient. The data collected will be used to look for spatial correlations in year-class strength as well as connections to climate data. In past research I compared growth rate and otolith shape characteristics among two closely related perch species, the Eurasian perch (*P. fluviatilis*) and the yellow perch (*P. flavescens*). The classification of these two percids as separate species has long been questioned. The data collected in this research demonstrated that the otolith shape difference between Eurasian and yellow perch is substantial, providing further evidence that these two species should be considered separate. This work also evaluated the relative importance of genetics vs. growth rate in determining otolith shape.

Geoffrey Hall - "*Hydra canadensis* population dynamics on common macrophytes in Lake Opinicon" - B.Sc. Thesis

Hydra are small, freshwater cnidarians that live on numerous substrates, including macrophytes, rocks, and logs. Hydra can exist attached to a substrate, or can be released into the water column to migrate to new locations. Hydra generally feed on planktonic organisms, but are also known to feed on larval fish. The extent of this pressure can be attributed to such factors as Hydra population densities and locations. Identification of the different substrates that promote high Hydra densities is key to understanding this predation pressure, both in larval fish rearing facilities and in the wild.

This project focused on the differential population sizes and densities of *Hydra canadensis* seen on common macrophytes in Lake Opinicon. An attempt to explain the high population densities seen on *Myriophyllum spicatum*, an introduced macrophyte, was undertaken. Numerous species of macrophytes were attached to specially constructed, submerged booms to determine *H. canadensis* settlement levels per macrophyte over different depths. Numerous surveys were undertaken throughout the lake to determine *H. canadensis* population sizes, densities and migration rates. In order to complete this study, snorkelling and scuba diving were employed.

The Queen's Biological Station was indispensable for this project. Both the staff and facilities provided the absolute optimum conditions for carrying out this study. The outstanding rapport that exists between the station and the surrounding land-owners and cottagers made working near populated shoreline locations more comfortable.

Assistant: Emma Turner

Frank Phelan, Dr. David Philipp (Illinois Natural History Survey) and **Dr. Anna Toline** (Utah State University)

"Black Bass Populations and Management"

For seven years now, QUBS has been involved in a partnership with the Ontario Ministry of Natural Resources (OMNR), addressing bass management issues. This **Cooperative Bass Project** was initiated when local guides and anglers expressed concern about the prevalence of pre-season angling for bass. Using student researchers, hands-on study of timing of spawning, extent of pre-season angling activities and effects of catch-and-release angling on nesting bass was carried out. In addition, information about bass in various water bodies was collected (more under Drs. Philipp and Toline later in this report). With funding from OMNR, interest groups (Loughborough Lake Association and Loyalist Sportfishing Association) and logistical support from Storrington Guides Association and Chaffey's Lock Guides Association, real data on bass and excellent training for students was provided through the project. Over the seven years of the project, seventeen summer student positions were created and two Master's theses (Ferguson - Queen's; Kubacki - U. of Illinois) and partial information for a PhD thesis (Kieffer - Queen's) were obtained. Currently, a new partnership agreement is being negotiated. This new agreement will broaden the scope of experience obtained by students. Under this **Apprenticeship in Fisheries Biology**, students will both work on assessment programs vital to OMNR (eg. spring littoral index netting (SLIN) for lake trout and nearshore community index netting in target lakes) and continuing research on Largemouth and Smallmouth Bass.

Assistant: Cory Suski, Amar Nirwal

Dr. Laurene Ratcliffe

"Acoustic Communication and Mate Choice"

In 1997 our long-term study of sexual selection in chickadees focussed on causes and consequences of female-female competition for high-quality mates (Ramsay, PhD in progress). A new study on Least Flycatchers was initiated to test the hidden lek hypothesis for territory clustering (Tarof, PhD in progress). In addition,

a collaborative study with Tim DeVoogd and Tom Smulders (Cornell) examined whether seasonal changes in brain song nuclei in chickadees are associated with changes in song structure.

Assistant: Amar Nirwal

Scott M. Ramsay - "Mating tactics of female Black-capped Chickadees" — Ph.D. Thesis

Recent studies have revealed that sexual selection, typically thought to exist in sexually dimorphic, socially polygynous species, also operates in sexually monomorphic, socially monogamous species and affects females in previously unconsidered ways. Much of the evidence for this has come from behavioural observation and DNA fingerprinting. In the species where it has been possible to identify the fathers of extra-pair young, extra-pair males are often of higher quality than the social partners of the females. In black-capped chickadees the difference in quality between males is most readily observed in the social rank that individuals attain within winter flocks. Females also establish social hierarchies and mate assortatively by rank, but it is not clear whether rank is a cause or consequence of pairing success. In my research I am studying female-female competition for mates in chickadees. My questions deal with who wins in female-female competition and what are the outcomes for the winners and losers of competition.

The first question I am dealing with in my research is what makes a female a winner in competition for males. I am attempting to answer this question through selective removal experiments, wherein I capture females mated to high rank males, hold them in captivity for periods of approximately 90 hours, then return them to their territories and observe their interactions with the females that have replaced them in their absence. In 1997 I removed 9 females in mid-April and early May. In 8 of these removals the males attracted replacement females. The pattern of who wins and the timing of removals in the season yield clues to the answer to the question. The results from 1997 combined with those I collected in 1996, with 8 of 11 removal females successfully regaining their partnership, support the resource holding potential hypothesis where females win because they have social status. I will be repeating this experiment in 1998.

If a female loses in the competition for social partnership with a high rank male, she can adopt tactics to have some of her offspring sired by him. Extra-pair young occur in approximately 30 % of chickadee nests and the extra-pair males are usually higher ranked than the female's social partner. To facilitate access to extra-pair males and to better monitor the partnership status of the same neighbours, females might choose to locate their nests adjacent to the territory boundaries of males who are targets for extra-pair copulations or higher status social partnership. Alternatively, nest choice might be based on habitat characteristics such as vegetation features or prey abundance; it may be based on previous nesting experience, or it may be based on simple conspecific attraction without any element of sexual selection. Analysis of characteristics at 26 nests in 1997 combined with results from 1996 failed to reveal

any distinctions between nest and control sites for any of 40 measured characteristics. Previous experience (prior residency and previous fledging success) do not appear to influence placement of nests. The position of nests with respect to territory boundaries reveals a pattern supportive of the notion that nests sites are chosen based on conspecific attraction, although at this point it is not clear that extra-pair copulation is the driving force. In an attempt to clarify this point I will be mapping nest locations with respect to territory boundaries and neighbour rank again in 1998. In addition to mapping nest locations I will be conducting paternity analysis for nests from 1996 through 1998 to examine whether the males whose territories are nearest to a female's nest are the individuals who sire extra-pair offspring.

In addition to the above studies, I collected data in 1997 on female reproductive success and male and female social rank. I collected blood samples from all of the individuals I banded for analysis of blood parasite levels. I made recordings in May 1997 of two different vocalisations used by females in interactions with males. I will be using these recordings in experimental playback in 1998.

Assistants: Tuula Talvila, Amar Nirwal, Bill McLeish

Scott Tarof - "Sexual and natural selection in Least Flycatchers: Why do breeding birds cluster?" - Ph.D. Thesis

The longstanding explanation of why birds aggregate their territories is derived from natural selection theory. The **material resources hypothesis** states that the distribution of ecological elements (such as vegetation features, insect abundance) provides preferential breeding sites to which birds respond. The **predation hypothesis** suggests that clumped nesting may be an adaptive response to reduce predation. Recently, a new theory based on mating strategies and sexual selection has been proposed to explain aggregative behaviour. The **hidden lek hypothesis** holds that birds aggregate breeding territories for extra-pair matings, just as lekking species cluster for promiscuous matings. Conspecific interaction through a mixed reproductive strategy, where socially monogamous birds co-operate in raising offspring but are genetically promiscuous by copulating outside the partnership, may be an essential component of why birds aggregate on the breeding grounds.

Least Flycatchers (*Empidonax minimus*) are socially monogamous suboscines that breed throughout much of Canada and the United States. Individuals defend all-purpose breeding territories (i.e. where feeding, mating and nesting co-occur) that have been found to be tightly clustered in previous studies. I am investigating the possible mechanisms of such aggregative behaviour.

In the summer of 1997 12 males were caught and banded to identify individuals. Blood samples were drawn from males and two complete sets of nestlings, despite nest heights of 5-20m. Territory boundaries were mapped using the Global Positioning System and territories were highly clustered ($n = 2-20$ territories per cluster at 4 study sites), with nearly all boundaries contiguous. I collected extensive data during morning focal watches on mating behaviour and song output. Least Flycatchers commonly visit neighbouring territories and seek extra-pair

copulations (EPCs). The frequency of EPCs is virtually identical to that of within-pair copulations, as males aggressively compete for access to non-mate females. Males invest highly substantial amounts of energy and time into singing, with some males singing in excess of 3000 songs/hr. Incidental observations suggest that there is fine structural variation in the songs of individual males. This variation may have critical implications for female mate choice, particularly for suboscines that are typically resistant to environmental influences on song development. Preliminary results indicate that vegetation characteristics do not explain aggregation.

Over the next two summers, I will measure insect abundance and assess clustering at the landscape level. Model experiments will be conducted to quantify responses to predator threat to examine the relationship between clustering and levels of predation. Additional blood samples will be collected from adults and offspring to assess paternity patterns in relation to cluster morphology. Male removals will be used to detail cluster formation and to improve our understanding of how position within clusters correlates with male quality and mating success. In addition, behavioural watches and radiotracking will be performed to further investigate reproductive tactics used by females. To date, results are suggestive of a relationship between mating strategy and clustering in this species. This study is the first to test the hidden lek hypothesis in a bird with all-purpose territories, to document paternity patterns in Least Flycatchers, and may identify critical cues used by females in mate choice.

Assistants: Hynek Holka, Bill McLeish, Laura Santry

Publications:

Fotheringham, J.R., Martin, P.R. and L. Ratcliffe. 1997. Song transmission and auditory perception of distance in wood warblers (Parulinae). *Animal Behaviour* 53: 1271-1285.

Otter, K., Chruszcz, B. & L. Ratcliffe. 1997. Honest advertising and singing during the dawn chorus of black-capped chickadees. *Behavioral Ecology* 8: 167-173.

Otter, K.A., Ratcliffe, L., Michaud, D. & P.T. Boag. (in press). Do female black-capped chickadees prefer high-ranking males as extra-pair partners? *Behavioral Ecology and Sociobiology*, (accepted 16 March 1998)

Phillimore, L. S., Sturdy, C., Ramsay, S. M. & R. Weisman. (in press). Discrimination of auditory distance cues by black-capped chickadees (*Poecile atricapillus*) and zebra finches (*Taeniopygia guttata*). *Journal of Comparative Psychology* (accepted December 1997)

Dr. Raleigh J. Robertson

"Evolution of Breeding and Parenting Strategies in Birds "

Studies on mating systems and reproductive strategies of birds continued to focus on Tree Swallows in 1998. In collaboration with Bart Kempenaers, Konrad Lorenz Institute, Vienna, Austria, we studied Tree Swallow floaters on the Hughson Tract (HU swallow grid), by doing both floater and focal box watches. In an effort to assign paternity to the some 50% of nestlings that are from extra-pair fathers, we concentrated on obtaining blood samples for DNA fingerprinting from as many floaters as possible, as well as from all residents and nestlings. Cheryl Bishop worked as an assistant on this project and used the behavioural study for her B.Sc. honours thesis at Queen's. In addition, Katharina Peers, from Austria, working with Bart and RJR, did a study on floater strategies and sperm competition. This latter study was based on a new grid established on the Bracken Tract.

Wally Rendell, with assistance from Amy MacDougall, continued his Ph.D. study on evolution of clutch size and the relationships between clutch size, box size and fledging success in Tree Swallows.

"Conservation Biology of Cerulean Warblers and Golden-winged warblers"

Our studies on Conservation Biology, initially focusing on Cerulean Warblers, were broadened to include a new study on Golden-winged Warblers. These studies are conducted on the Hilda and John B. Pangman Conservation Reserve, as well as the John M. Cape - Charles Sauriol Environmental Studies Area, and the Bonwill-Skycroft Tract.

With funding from the World Wildlife Fund, Jason Jones, assisted by Bill McLeish, expanded the area and intensity of Cerulean Warbler population sampling. Jason completed his mini-masters in December and is now enrolled in a Ph.D. program.

B.Sc. honours student Robyn Valey examined behavioural interactions between Ceruleans and both American Redstarts and Red-eyed Vireos. As described below, there is no indication of detrimental interaction between these species.

Tim Demmons began a study on habitat qualities, nesting distribution and parental care in Golden-winged Warblers. This study will comprise Tim's B.Sc. honours thesis, and will also be the focus of his M.Sc. study to begin in spring 1998. A major component of Tim's study is to develop a habitat management plan that will enhance forest edges for Golden-wings.

Wallace Rendell - "Determinants of clutch size in a cavity-nesting bird" - Ph.D. Thesis

My PhD thesis has evolved since my first field season in 1995. It continues to be devoted to exploring the proximate and ultimate factors that determine clutch size in a hole-nesting bird, but it's focus has broadened.

The initial objective of the thesis remains the same; i.e., to explore the hypothesis that clutch size in secondary cavity-nesting birds has evolved to match

cavity size, because cavity size may determine the size of brood that can be raised (see QUBS Annual Reports, 1995, 1996 for more information). To this end, I have conducted experiments on tree swallows breeding in nestboxes around QUBS property for 3 field seasons (1995-97), where I: i) manipulated cavity size before egg-laying to determine what size of clutches females would lay in large and small boxes, and ii) manipulated cavity and brood size simultaneously at hatch to explore how these two variables influenced nestbox temperature and humidity. Preliminary results suggest that females lay smaller clutches in smaller cavities. Also, large broods in small cavities experience very high nestbox temperatures and humidities, particularly when nestlings are about 12 days old, as predicted by the hypothesis. Yet, cavity size apparently does not influence nestling quality or fledging success; i.e., despite experiencing much higher temperatures, young in large broods in small cavities don't differ physically, or with respect to survivorship, from young raised in large broods in large cavities, the latter being "the microclimatically ideal" environment. Two chapters from my PhD thesis will be devoted to: i) describing variation in microclimate in tree swallow cavities, and ii) describing the Cavity Optimization Hypothesis, and the results of the experiments mentioned above. Other objectives of my thesis now include: i) testing predictions of the Cost of Reproduction hypothesis, ii) analyzing annual variation in clutch size, and finally, iii) analyzing the influence of age on reproduction, all in female tree swallows. To address these topics, in combination with data I collected since 1995, I have been granted access to Dr. Raleigh Robertson's long-term database on banding returns and nest records for tree swallows, dating back to 1975. To gather useful information from these databases I, and others, have devoted considerable time at our computers inputting and manipulating records in preparation for analysis. Data on banding and nest records from the 1997 field season were the last to be collected that I will include in any analyses. I hope that each of these three topics will be the basis for a chapter in my thesis.

My research was supported by an NSERC operating grant to Raleigh Robertson, and is now funded also by an Ontario Graduate Scholarship.

Assistant: Excellent, patient field and lab assistance in 1997 were given by the ever-enthusiastic and capable Amy MacDougall, for the second straight year.

Jason Jones - "Conservation biology of a peripheral population: Cerulean Warblers in eastern Ontario." - Ph.D. Thesis

The major findings of the 1997 field season are as follows:

1. Cerulean Warblers are enjoying high reproductive success in Eastern Ontario.
2. No habitat features appear to be definitively linked with reproductive output but territory density is positively correlated with output at one of the unmanaged study sites.
3. Managed sites host significantly lower densities than unmanaged sites but we were unable to assess breeding success at the managed sites to see if the lower density results in lower reproductive success.

4. Pairing success of adult males was lower in managed sites.
5. Territory density is positively correlated with canopy closure, maximum tree height, timber basal area and tree species diversity.
6. The estimated population size for Eastern Ontario is 29,424 pairs.

These results are based only on one field season and should be interpreted with caution. Our general impressions from the 1997 field season are that managed landscapes (e.g. forests producing maple syrup) can support self-sustaining populations of Cerulean Warblers. These populations may not be as healthy as those in unmanaged forests but the results indicate that this species is flexible in some of its habitat requirements. This bodes well for the development of multiple-use land management strategies and provides a reason to view the future of Cerulean Warblers in Eastern Ontario in a positive light. It is important to note that our population estimate is ten times the size of previous estimates and indicates the magnitude of the responsibility that Ontario has toward the continental conservation of this vulnerable species.

Robyn Varey - "Interspecific interactions: Do American Redstarts and Red-eyed Vireos interact aggressively with Cerulean Warblers?" - B.Sc. Thesis

Interspecific aggression between the Cerulean Warbler (*Dendroica cerulea*) and two other avian species, the American Redstart (*Setophaga ruticilla*) and Red-eyed Vireo (*Vireo olivaceus*) has been observed in southeastern Ontario. Populations of the three species were observed through the breeding season of 1997, for the regularity and context of the antagonistic interactions at a site near Queen's University Biological Station. Recognizing the Cerulean's vulnerable status in Canada makes this investigation an important conservation priority. Heterospecific playback methods were used to stimulate aggressive responses. Results showed overt aggression to be fairly infrequent, as there is no threat of mate competition and all three species occupy reasonably separate niches within the forest. Aggressive interactions always occurred in close proximity to nest sites which supports theories of defensive behaviour around nests as an adaptive behaviour to guard against nest predators. Red-eyed Vireos appeared to be the more dominant and most frequent instigator of aggressive interactions. Due to the rarity of antagonistic encounters, we presume this present level is not negatively affecting Cerulean Warbler distributions.

Jessie Deslauriers - "QUBS mosses"

As part of the continuing effort to develop a reference collection and plant list of the mosses occurring on the Station, for the second year a number of specimens were collected and later identified. Thanks to Jason Jones, the specimens included several collected from a major side branch of an old oak over 20 feet above ground level. Thus far, 322 specimens have been collected over the last two years. The sphagnum list remains at one. The acrocarp list includes 122 specimens representing 39 species of 21 genera and 13 families. The pleurocarp list includes 199 specimens of 65 species or 32 genera and 14 families. The list now stands at a fairly impressive

total of 106 species and much of the Station still remains to be surveyed. It is planned that most of the specimens will be placed in the Fowler herbarium at Queen's University, following comparison with herbarium specimens to confirm identification.

During the course of collecting, a number of specimens of liverworts have also been accumulated. A handful have now been identified, but further work is needed in this area and is planned.

During the 1998 collecting period, it is planned to take advantage of the devastation wrought by Ice Storm '98 and concentrate on fallen trees and branches as a source of specimens normally almost inaccessible.

Publications:

Conrad, C.K., R.J. Robertson and P.T. Boag. 1998. Frequency of extra-pair young increases in second broods of Eastern Phoebes (*Sayornis phoebe*). *Auk* 115: 497-502.

Rooneem, T.M. and R.J. Robertson. 1997. The potential to lay replacement clutches by Tree Swallows. *Condor* 99: 228-231.

Barber, C.A. and R.J. Robertson. (in press). Homing ability of Tree Swallows during the breeding season. *Journal of Field Ornithology*. (Accepted 27 Sept 1997)

Jones, J. (in press). Occurrence and abundance of chiggers (Acari: Trombiculidae) on bats (Chiroptera: Vespertilionidae) in Eastern Ontario, Canada. *Canadian Field-Naturalist*.

Kempenaers, B., R. Lanctot and R.J. Robertson. (in press). Certainty of paternity and paternal investment in Tree Swallows and Eastern Bluebirds. *Animal Behaviour* (accepted approx. June '97)

MacDougall-Shackleton, E.A. and R.J. Robertson. (in press). Confidence of paternity and paternal care in eastern bluebirds. *Behav. Ecology* (accepted June '97).

Dr. Raleigh J. Robertson and Dr. Vicki L. Friesen

M. Lisa Veit - "Genetic structure and gene flow in Cerulean Warblers: A test of the Source-Sink Model in nature" - M.Sc. Thesis

Species experiencing spatially divided populations across their geographic range may exhibit source-sink population dynamics, in which "sink" habitats may be supplemented by individuals dispersing from more productive "source" populations. My study investigates the potential for a "source-sink" system in Cerulean Warblers. Despite an overall trend in population decline experienced by Cerulean Warblers throughout their breeding range, ongoing research at QUBS indicates that the eastern

Ontario population is stable or potentially increasing. Three populations will be evaluated for this study: eastern Ontario, Tennessee, and Illinois. These areas delineate the upper, intermediate, and lower latitudinal regions of the species' breeding range and will provide an excellent opportunity to analyze the genetic structure of populations in potential "source" and "sink" habitats. In the 1997 field season, 29 blood samples were collected from Cerulean Warblers at QUBS. In 1998, an intensive blood collection effort will be concentrated in all three study regions, with particular emphasis on Tennessee and Illinois. Molecular research will focus on examining the degree of genetic structure and gene flow among populations. The results of this study could have significant conservation and management implications for Cerulean Warblers by determining the extent to which highly productive areas may contribute to the supplementation of "sink" populations.

Special thanks to Dr. Raleigh Robertson, Jason Jones, Bill McLeish, Robyn Varey, and Tim Demmons for their extremely competent and enthusiastic assistance. Molecular research is being performed in the laboratory of Dr. Vicki L. Friesen.

Dr. John Smol

"Paleolimnological Research"

Euan Reavie and Joanne Little - "Establishing development guidelines for lake watershed management: A paleolimnological investigation of four control lakes"

This study is designed to reconstruct past changes in lake and watershed systems using paleolimnological methods. By using fossil data (e.g. diatoms, chironomid remains) preserved in lake sediment cores, past ecological conditions can be determined. Government scientists are currently using an advanced mass-balance model, known as the Lakeshore Capacity Study Trophic State Model (TSM), which is now being adopted in many lake regions to set watershed development guidelines. Because these models have not yet been fully evaluated, we use paleolimnological techniques to help evaluate and possibly modify the models to determine how much development can be allowed to occur before adverse repercussions occur in lake systems. Our present work in the Opinicon region is designed to investigate the recent (~300 year) paleolimnology of four 'control' lakes. Hart, Long, Lindsay and Round lakes are four relatively undeveloped (i.e. little or no human watershed use) systems within QUBS lands that have been cored for sediment analysis. Diatom and chironomid microfossils are currently being assessed from sedimentary profiles. We assume these lakes have maintained their pristine state, so they serve as systems that presumably require no rehabilitation measures, and will be compared to degraded, culturally eutrophic lakes from southern Ontario. years, but due to the rapid growth of woody plants methods of insect sampling and vegetation analysis will be changed. In 1997 no new experimental work was carried out, and none is planned for 1998, but all necessary surveys will continue.

II: Research conducted by non-Queen's University Personnel in 1997

Dr. Robert L. Baker - Department of Zoology, University of Toronto at Mississauga, Mississauga, Ontario

"Behavioural Ecology of Aquatic Invertebrates"

My research deals with the ecological significance of antipredator and antiparasite behaviour of aquatic insects. I am analyzing the selection pressures (reduced foraging, fewer chances to mate, etc.) that shape the antipredator and antiparasite behaviour of larval dragonflies and chironomids and I am experimenting with the role of these behaviours in affecting population growth and life cycles. My most recent work at QUBS involves antipredator and antiparasite behaviour of larval damselflies. Dr. Bruce Smith (Ithaca College) and I have shown that, in the lab, larval damselflies increase their risk of fish predation when they attempt to rid themselves of parasitic mites. We are currently investigating the importance of this increased risk under field conditions.

Merrylee McGuffin - "Use of predator cues in oviposition site selection by adult damselflies of the genus *Enallagma*." - M.Sc. Thesis

The purpose of this study is to determine whether adult damselflies have the ability to recognize and respond behaviourally to fish predators. Fish are a common predator of larval damselflies, and some species occur exclusively in ponds and marshes which lack fish. Other species invariably co-occur with fish, their primary predator being the larva of large dragonfly species. My study will determine whether damselfly distribution is maintained, in part, by the ability of adults to detect and respond to the presence of fish in the water when selecting an oviposition site.

A survey of both damselfly and dragonfly species is being performed at six sites on the QUBS property. The species composition will be compared between the sites which contain fish and those that are fishless in order to establish the distribution pattern in the area. To determine whether adults damselflies detect fish, I am using three different species from the genus *Enallagma*. Males and females are collected from various sites at QUBS and then transferred to mesh tents which house several artificial pools containing various predator cues. Oviposition site selection and duration are observed during the daily flight period. As well, the influence of predator chemical cues on egg production is being examined in a series of laboratory experiments. All animals used in these experiments are collected at QUBS.

Assistant: Kit Muma

Publications:

Baker, R.L. and B.P. Smith. 1997. Conflict between antipredator and antiparasite behaviour in larval damselflies. *Oecologia* 109: 622-628.

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Forbes, M.R.L., J.M.L. Richardson, R.L. Baker. 1995. Frequency of female morphs is related to an index of male density in the damselfly, *Nehalonia irene* (Hagen). *Ecoscience* 2: 28-33.

Dr. Spencer Barrett - Department of Botany, University of Toronto, Toronto, Ontario,
Taline Sarkissian - Department of Biological Sciences, University of Calgary, Calgary, Alberta and **Line Magnusson** - Department of Plant Ecology, University of Copenhagen, Denmark

"Evolution of Sexual Systems in *Sagittaria latifolia* (Alismataceae)"

We are investigating the ecology and genetics of sexual systems in the aquatic macrophyte *Sagittaria latifolia* (Alismataceae). This species is of considerable interest to plant evolutionary biologists because populations differ in their sexual systems. Some populations are largely monomorphic for gender composed of cosexual plants with male and female flowers. In other populations gender dimorphism with distinct male and female plants in different ratios occur. This pattern of variation is quite rare in the flowering plants and may assist in thinking more generally about the evolution of combined vs. separate sexes in plants. In cosexual populations there is evidence that gender modification is size-dependent with increased numbers of female but not male flowers produced as plants get larger. Allozyme studies indicate moderate levels of selfing in cosexual populations and no evidence of genetic differentiation between the two sexual systems.

Dr. Mark Forbes - Department of Biology, Carleton University

"Parasitism and Phenotypic Plasticity in Invertebrates and Other Organisms"

The conceptual framework of my research is life history theory and how it applies, in particular, to parasite-host-stress interactions and to intraspecific variation in ecology and behaviour. My research at the Queen's University Biological Station has included: developing and testing theory of insect-parasite interactions, developing and testing ideas about stress-fitness relations (and the use of deviations from symmetry as indicators of stress or fitness), and testing evolutionary models on the maintenance of phenotypic plasticity versus polymorphism in insect populations.

Brian Leung - "Developmental stability in relation to parasitism and stress" - Ph.D. Thesis

Brian uses mathematical models and empirical tests to investigate whether deviations from bilateral symmetry can be used as indices of environmental stress and/or fitness of organisms. He uses damselflies and mites as model organisms for empirical tests. Last year, Brian also examined whether nutritional stress influenced susceptibility of damselflies to their ectoparasitic mites, and/or accounted for the incidence of damselfly phenodeviants (individuals that lacked normal wings). QUBS is an important collection site for such laboratory tests.

Gina Schalk - "Phenotypic plasticity of amphibians in relation to pH stress and leech presence" - M.Sc. Thesis (co-supervised with Dr. Pat Weatherhead - Carleton University)

The factors favouring the evolution of phenotypic plasticity have been elucidated in several predator-prey systems. However, the importance of environmental stresses for expression of certain prey phenotypes is not well understood. Gina examined whether pH stress influenced ability of amphibian embryos to show developmental responses to predators. Gina's research may have implications for population biology of amphibians. In particular, Gina's has implicated leeches as amphibian predators worthy of further investigation (abundances of some frog species are inversely correlated with leech abundance estimates) and her work suggests that pH stress may reduce ability of amphibian embryos to detect leech predators.

Nancy Leonard - "Plasticity in commitment to reproduction in relation to mite parasitism" - M.Sc. Thesis (co-supervised with Rob Baker - Erindale College of U of T)

Nancy studied whether adult insects show adaptive plasticity in reproductive effort in response to colonization by parasitic mites. She tested the prediction that hosts parasitized by *Limnochares* mites might actually increase their current reproductive effort, over controls, as a way of ensuring some reproduction before mites start to engorge and detract considerable energy from their hosts. As predicted, Nancy showed that some damselflies groom more than controls once colonized by mites, but she did not detect any effect of mites on the following traits: male survival,

male mate-searching effort and female fecundity. Following work by Wanda Cook and Bruce Smith a few years ago, Nancy is also examining reasons for biases in mite parasitism in relation to host gender of damselflies.

Assistants: Susan Drover, Chris Yourth

Kerry Hecker - "Morph ratios in damselflies in relation to population density and prevalence of parasitism" - M.Sc. Thesis

Despite considerable work on the subject, the existence of female-limited polymorphisms in damselflies remains a mystery. Earlier work by myself and Aldopho Cordero in Spain has indicated that population density may relate to the proportion of male-like females (one genetic morph) in local populations of damselflies. We know from other work that prevalence of parasitism also increases as population density of insects increases leading to the possibility (being tested by Kerry) that female morphs differ in their susceptibility to parasites and that this difference results in differences in life history traits (i.e. clutch size) in high density populations. Of course, other differences between the morphs are expected such as susceptibility to male harassment. We expect that the complex interplay between frequency and intensity of potentially injurious interactions with males, parasitism by eugregarine protozoans, and population density might help explain morph ratios at different sites.

Publications:

Schalk, G. and M.R. Forbes. 1997. Sex biases in parasitism of mammals. *Oikos* 78:67-74.

Leung, B. and M.R. Forbes. 1997. Modeling fluctuating asymmetry in relation to stress and fitness. *Oikos* 78:397-405.

Leung, B. and M.R. Forbes. 1997. Fluctuating asymmetry in relation to indices of quality and fitness in the damselfly, *Enallagma ebrium* (Hagen). *Oecologia* 110:472-477.

Leung, B. and M.R. Forbes. 1996. Fluctuating asymmetry in relation to stress and fitness: effects of trait types as revealed by meta-analysis. *Ecoscience* 3:400-413.

Forbes, M.R., Leung, B. and G. Schalk. 1996. Fluctuating asymmetry in *Coenagrion resolutum* damselflies in relation to size, age, and parasitism. *Odonatologica* 26:9-16.

Forbes, M.R. and B. Leung. 1995. Pre-fabricated dining shelters as outdoor insectaries: an assessment using *Enallagma ebrium*. *Odonatologica* 24:461-466.

Theses:

Schalk, G. 1997. Single and interactive effects of low pH and leech predators on frog embryos and adults. M.Sc. thesis, Department of Biology, Carleton University, 77 pp.

Dr. Susan Foster - Department of Biology, Clark University, Worcester, Mass.

Thomas Artiss - "Phylogeny, patterns of homoplasy and character evolution in odonates" - Ph.D. Thesis

My dissertation research examines the systematics of the dragonflies in the genus *Libellula*. Using specimens collected at several field sites including the Queen's University Biology Station, I have used molecular data to reconstruct the phylogeny of the group. This phylogeny will be used to examine the evolution of male and female genitalia. Tremendous interspecific variation exists among genitalia, and basic genitalia types in males and females may be co-evolving. Alternatively, some studies have indicated that female genitalic morphology may be evolving to reduce the effects of sperm displacement or removal by males. I will map morphological characters associated with the genitalia onto the molecular phylogeny to determine whether male and female genitalia are evolving together or whether they are evolving in response to an arms race. In addition, I hope to determine whether homoplasy is common in the evolutionary history of these characters.

Assistant: Jennifer Cave

Dr. Michael Fox - Environmental and Resource Studies Program and Department of Biology, Trent University, Peterborough, Ontario

"Genetic Determinism vs Phenotypic Plasticity in Pumpkinseed Sunfish Life Histories"

The long term objectives of my research are to explain the high degree of life history variation exhibited by pumpkinseed (*Lepomis gibbosus*) populations. I initiated an experiment in 1995 to determine the extent to which life histories converge when individuals from early and late maturing populations are reared in a common environment. Mature individuals from five populations in eastern and central Ontario (including Lake Opinicon) and one from northern Pennsylvania were captured in the spring, and individuals from each population were transplanted to artificial ponds at Cornell University. The offspring produced in 1995 were sampled in early and late June, 1997 for percent maturity at age (adjusted for body size) and gonadosomatic indices. Unfortunately, few of the individuals showed any signs of maturity, and this may have been related to the unusually cold spring weather experienced in the region. The experiment will be continued for another year, with individuals sampled in the

spring of 1998.

A concurrent experiment conducted in MNR ponds at Westport using replicate ponds stocked with one early maturing (Little Round Lake) and one late-maturing (Loughborough Lake) pumpkinseed population was also assessed in June 1997. In this experiment, the differences between the early and late-maturing populations appear to have been preserved in the common pond environment, with most Little Round Lake progeny maturing at age 2 and few of the Loughborough Lake offspring maturing at the same age. The Westport Pond results suggest that among-population differences in age at maturity is largely due to genetic factors.

Assistants: Gloria Gillespie, Tom Pratt, Mark Wilson

Publications:

Fox, M. G., and A. J. Crivelli. (in press). Body size and reproductive allocation in a multiple spawning centrarchid. *Can. J. Fish. Aquat. Sci.*

Bernard, J., and M. G. Fox. 1997. Effects of body size and density on overwinter survival of young-of-year pumpkinseeds (*Lepomis gibbosus*). *N. Am. J. Fisheries Manage.* 17: 581-590.

Fox, M.G., J.E. Claussen, and D.P. Philipp. 1997. Geographic patterns in genetic and life history variation in pumpkinseed (*Lepomis gibbosus*) populations from four east-central Ontario watersheds. *N. Am. J. Fisheries Manage.* 17: 543-556.

Dr. James Fullard - Department of Biology, Erindale College, University of Toronto.

"Insect Sensory Ecology and Neuroethology"

Nadia Napoleone and James Fullard - "Automatic light-sensing near infra-red video analyses of moth and butterfly flight activity."

This study involved a novel approach to analyzing flight behaviour. Throughout the summer 27 local species of butterflies and moths were collected and housed in outdoor cages over a 24 hour period in order to observe natural day/night cycles. An automatic light-sensing near infra-red camera and VCR were used to monitor and record the flight behaviour of each individual specimen. Flight activity was analyzed in 10 minute intervals over 24 hours in order to quantify the nocturnality of each species. Nocturnal behaviour was based on sun and twilight tables as obtained from the Herzberg Institute of Astrophysics (National Research Council Canada) for the Ottawa area. An alternative measure of nocturnal behaviour was based on bat emergence times. A colony of 800 to 1000 Little Brown bats (*Myotis lucifugus*) located in the nearby town of Westport was monitored and emergence times recorded

to provide an additional definition of "night time" for moths. Using these values, nocturnal behaviour was measured as a percentage with completely diurnal species, e.g. *Colias philodice* (Clouded sulphur), achieving values of 0%, while completely nocturnal species, e.g. *Panthea furcilla* (Eastern panthea), achieved values of 100%. Nocturnality will then be covaried to the eye-size of each specimen to determine whether eye-size is a good predictor of nocturnal behaviour in Lepidoptera. Interestingly not all species were observed to be either fully nocturnal or diurnal. Exceptions include the Gypsy moth (*Lymantria dispar*) and the Ruby Tiger Moth (*Phragmatobia fuliginosa*) of which certain individuals exhibited flight activity during daylight and/or twilight hours. This suggests behavioural polymorphism and these species can be classified as neither nocturnal or diurnal, which poses an interesting statistical problem.

Assistant: Kathleen Pendlebury and Tarah Harrison

Vicki Macdermid - "The ascending excitatory contribution in the tiger moth tymbal response central pattern generator."

My work at the Queen's Biology Station last summer further examined the tymbal central pattern generator (CPG) in the dogbane tiger moth, *Cycnia tenera*. The tymbal CPG is a neural circuit believed to be responsible for a series of ultrasonic clicks elicited by these moths in response to the echolocation calls of bats (Fullard, 1992). When both pro-terothoracic connectives in the central nervous system are intact, the two tymbal nerves bilaterally innervating the tymbal musculature, fire cooperatively (Dawson and Fullard, 1995). However, preliminary data suggested that the tymbal nerves fire uncooperatively following unilateral transection of these connectives (Dawson, 1995). The effect of unilateral transection of the pro-terothoracic connectives was explored further last summer at the Queen's Biology Station. Unilateral transections of the pro-terothoracic connectives were performed in *Cycnia tenera* that were caught near the station property. Our results show that unilateral transection of the pro-terothoracic connectives elicits firing only from the tymbal nerve that is ipsilateral to the intact pro-terothoracic connective. Furthermore, this nerve continues to fire rhythmically. This strongly suggests that the tymbal CPG is actually comprised of two bilateral circuits, each responsible for the rhythmic firing of the ipsilateral tymbal nerve. These bilateral circuits are termed hemiganglionic oscillators, and have been found to comprise other insect pattern generators (Ronacher, 1988).

Assistant: Kathleen Pendlebury

Vicki Macdermid - "Effects of the insect hormone, octopamine, on the auditory thresholds of the underwing noctuid moth, *Catocala cerogama*".

The second part of the summer was devoted to understanding how octopamine, a norepinephrine derivative, heightens the tymbal CPG's sensitivity to

auditory stimulation. We wanted to determine whether octopamine could act directly on the chordotonal cells in the moth ear, as previous literature had depicted that octopamine possesses neuromodulatory effects on other chordotonal cells in the insect body (Matheson, 1997). Audiograms were run; before the topical application of octopamine in the thoracic cavity of *Catocala cerogama*, just after an application of octopamine, and following a saline rinse to the thoracic cavity. Our results show that octopamine has no neuromodulatory effect on the chordotonal cells in the ear. This is likely because the chordotonal cells of the ear are wrapped in a layer of epithelium that is not likely permeable to large blood borne molecules like octopamine.

Assistant: Kathleen Pendlebury

Dr. Jim Grant - Department of Biology, Concordia University, Montreal, PQ

Stacey Robb - "Home range size in juvenile centrarchid fishes: a feasibility study."

This field study investigated the feasibility of using elastomer dye as a means of tagging and, hence, determining the home range size of juvenile sunfishes in the wild. Stacey Robb was able to successfully tag several hundred juvenile sunfish, primarily pumpkinseed and bluegill, as small as 20 mm in total length. The marks lasted for at least 6 weeks and she was able to "recapture" marked individuals using minnow traps or by snorkeling observations. The capturing, tagging and recapturing techniques seem reasonable so that home range estimates can be made for small sunfishes in the wild.

Assistant: Andrea Dobrin

Dr. Mart R. Gross - Dept. of Zoology, University of Toronto

"Evolutionary Ecology of Fish Reproduction"

This was the first summer in 24 consecutive years that we did not collect new data on reproduction and life histories of fish at Lake Opinicon. Our field work was stalled when my 1997 NSERC Research Grant was reduced, and although the cut was only about 8% it left insufficient money to continue a field program at Lake Opinicon in addition to our other work. Since NSERC has acknowledged that their decision was inappropriate and the cut will be re-considered, I hope that we can continue with our on-going field research in 1998. In 1997 we did work with data that had been collected in previous years at Lake Opinicon and additional papers have been produced from this. In addition, Bryan Neff has completed the microsatellite analyses of the bluegill sunfish colony collections from Sandy Bay in 1996.

Dr. Bart Kempenaers - Konrad Lorenz Institute for Comparative Ethology, Vienna, Austria

"Extra-pair Paternity and Reproductive Behaviour in Tree Swallows"

As part of a continuing collaboration with Dr. Raleigh J. Robertson, who provided organisational help and assistance in the field, we further investigated the reproductive behaviour of tree swallows. This year, we focused on the reproductive strategies of male floaters. Tree swallows show one of the highest levels of extra-pair paternity known in passerine birds, but extra-pair behaviour is still poorly understood. Previous studies using various molecular techniques showed that some extra-pair young are fathered by neighbouring residents, but the majority of the biological fathers of the extra-pair offspring could not be found. One possibility is that male floaters father offspring. We investigated the reproductive role of floaters in three ways. (1) We observed floater behaviour on a nestbox grid (Hughson's grid) to determine whether floaters attempted to copulate with resident females. This work forms part of the BSc thesis of Cheryl Bishop (see elsewhere for details). (2) We compared the reproductive organs of floaters with those of male residents. This study was part of the BSc thesis of Katharina Peer (see below). (3) At Hughson's grid, we collected blood samples from all resident individuals, all offspring, and as many floater males as we could catch. We also collected blood samples from most resident males in solitary boxes or on neighbouring grids. Paternity analyses with microsatellite markers will enable us to search the biological fathers of the extra-pair offspring and to estimate the reproductive success of floater males.

Assistants: Cheryl Bishop, Penny Stephens

Katharina Peer - "Reproductive strategies of floaters in tree swallows" - B.Sc. Thesis

Theory predicts that under intense sperm competition selection favours males that produce more sperm. Comparative studies in birds and other taxa provided evidence that the level of sperm competition influences relative testes size and sperm production. However, intraspecific adaptations to different levels of sperm competition, for example in populations where individuals follow different mating tactics, have received far less attention. In birds, populations often consist of residents and floaters. Floater tactics and reproductive success have rarely been carefully studied. Katharina assessed the reproductive role of male floaters in the tree swallow by comparing their reproductive organs and morphology with that of residents. For this study, a new nestbox grid was set up on the Bracken Tract. Resident and floater males were collected and their reproductive organs removed. Dissection and further labwork was carried out at the University of Sheffield (in collaboration with Dr. Tim Birkhead) and at the Konrad Lorenz Institute.

Assistant: Penny Stephens

Publications:

Kempenaers B., Lanctot R.B. & R.J. Robertson. (in press). Certainty of paternity and paternal investment: an experimental approach. *Anim. Behav.*

Dr. Tom Nudds - Department of Zoology, University of Guelph, Guelph, Ontario

"Faunal Collapse in Woodland Fragments: Rigorous Tests with Forest Songbirds"

In 1997, Chris Henschel revisited many of the sites sampled in 1996, completing vegetation sampling and surveying forest songbirds in large tracts of contiguous forest and adjacent isolated forest patches. Although much has been made of the decline in species richness of neotropical, forest-interior birds species in forest patches and attributed the decline to habitat fragmentation, the great majority of these studies used inappropriate controls, if they used any at all, to evaluate the effects of fragmentation. After much searching for study areas that would afford the best geographic configuration of contiguous forest (the control) with adjacent woodlots (the treatments) in the same ecodistrict, they settled on the QUBS as the ideal location. Nowhere else could the need for spatially-juxtaposed study areas that would allow for control of other confounding variables, like weather and forest type, be found in southern Ontario.

Dr. David Philipp (Aquatic Biology Section, Illinois Natural History Survey), **Dr. Anna Toline** (Utah State University) and **Frank Phelan** (QUBS)

"Catch-and Release Angling of Largemouth and Smallmouth Bass"

To measure the impacts of preseason catch-and-release angling on the reproductive success of largemouth and smallmouth bass, researchers angled parental males of both species off their nest sites and determined the time it took to return, as well as the level of brood predation and subsequent abandonment rates. During the angling, aspects of the handling and release, such as time in the boat, distance from the nest, etc. were varied to assess their importance for minimizing negative effects. In addition as an initial step in modeling these impacts, experiments to determine average catch rates of nesting bass were conducted at various sites.

Assistants: Jim Ludden, Cory Suski, Leo Lentsch and Amar Nirwal

"Spawning Dynamics of Largemouth and Smallmouth Bass"

Little is known about the spawning dynamics of large mouth and smallmouth bass within a season and among years. To monitor the mating and reproductive success of individual males of both species and their movements in appropriate habitat

(lentic for LMB - Warner Lake and lotic for SMB - Mississippi River), nesting and non-nesting fish were caught, weighed, measured, fin-clipped and tagged to identify location, and released at the point of capture. In Warner Lake, male bass were tagged with an individually-numbered PIT (passive integrated transponder) tag. Data on mating success and success of raising their brood were taken. Within year movements and among year spawning location fidelity are being assessed.

Assistants: Jim Ludden, Cory Suski, Amar Nirwal

"Largemouth and Smallmouth Bass Reproductive Success "

This long-term study concentrates on documenting the annual variation in largemouth and smallmouth bass reproductive success. Intensive monitoring of spawning success and the duration of nesting and parental care behaviors in both species continued to be documented at Lakes Opinicon and Charleston, and the Mississippi River.

Assistants: Jim Ludden, Cory Suski and Juile Claussen

"Conservation Zones as Management Tools"

Efforts to assess the effectiveness of voluntary no fishing conservation zones and permanent sanctuaries to protect bass spawning efforts were initiated in Bob's Lake, Loughborough Lake, and Lake Opinicon. If important nesting areas are protected from angling by compliance with peer-enforced designations or regulation, then does this ensure effective reproduction and recruitment? This research is supported by the Ontario Ministry of Natural Resources and various interest groups.

Assistants: Jim Ludden, Cory Suski, Jeff Stein, Julie Claussen

Publications:

Kieffer, J.D., M.R. Kubacki, F.J.S. Phelan, D.P. Philipp and B.L. Tufts. 1995. Effects of catch-and-release angling on nesting male Smallmouth Bass. Transactions of the American Fisheries Society 124:70-76

Philipp, D.P., C.A. Toline, M.F. Kubacki, D.B.F. Philipp and F.J.S. Phelan. 1997. The impact of catch-and-release angling on the reproductive success of Smallmouth Bass and Largemouth Bass. North American Journal of Fisheries Management.

Dr. Usher Posluszny - Department of Botany, University of Guelph, Guelph, Ontario

Jason C. Burnham - "The reproductive biology of *Hydrocharis morsus-ranae* L. (Hydrocharitaceae): a comparison of sexual vs. asexual reproduction." - M.Sc. Thesis

Hydrocharis morsus-ranae L. (Hydrocharitaceae), European Frog's bit, is an aquatic plant that grows in marshes from Windsor to Quebec City. It is one of five invasive plants that has been reported to have had an impact on natural ecosystems in Canada. This plant reproduces by seeds or asexually by over-wintering buds called turions. Past studies have investigated seed production and morphology. However, quantitative information concerning the production, viability and growth of seeds in comparison to turions is lacking. This knowledge is required for efficient management as well as for inferences on the evolution and dispersal of this invasive aquatic plant. The objective of this research is to compare the two modes of reproduction to hypothesize which one leads to rapid population growth. The production of seeds and turions was studied at QUBS during the summer of 1997. Originally individual plants were placed in floating buckets; however due to lack of water circulation these plants died. A second method was developed by examining reproduction by area and biomass. Wet biomass, number and sex of flowers, number and mass of turions, fruits and seeds per fruit were recorded for thirty-six replicates. Testing for viability and growth of will be done at the Hagan Aqualab at the University of Guelph during the fall/winter of 1998.

Dr. Peter Sale - Department of Biological Sciences, University of Windsor, Windsor, Ontario

"Fisheries and Aquatic Studies"

Dean Fitzgerald - "Growth, survival and bioenergetics of young Yellow Perch in temperate lakes" - Ph.D. thesis

Population estimates of important commercial and recreational fisheries within Great Lakes and inland fishes fluctuate widely, and a reliable technique to predict abundance is still lacking for all lake types and many fish species (Paloheimo and Chen, 1996; J. Casselman, pers. comm.). Past studies have identified that overwinter size is a key factor shaping young-of-year (YOY) fish and abundance of second year fish, ultimately determining recruitment into the fishery for many species including Yellow Perch (*Perca flavescens*) (Shuter et al., 1980; Post and Evans, 1989; Post et al., 1997). One limitation of these studies was their focus on lakes of similar size and have collectively failed to address the role of juvenile size-dependent overwintering success across different lake sizes.

This study is examining separate cohorts of YOY and age-1 Yellow Perch across three scales of lake size (800-1,000 ha; 18,000-20,000 ha; and basins of the Great Lakes) from 1997 to 1999. It will attempt to determine whether YOY overwinter survival is largely shaped by stochastic (eg. thermal experience) processes and/or vary in a predictable manner with density-dependent forces reflected in activity costs (bioenergetic estimate of cost of foraging, predator avoidance and competition) (Boisclair and Leggett, 1989) for a particular lake habitat. Preliminary studies completed during 1997 within three separate bays (Birch, Cow Island,

Stumpy) of Lake Opinicon (800 ha lake) to compare differences in size and growth rates in YOY Yellow Perch relative to other lake systems investigated (820 ha Canadarago Lake and 20,000 ha Oneida lake, both in New York state; western basin of Lake Erie; Canadian side of Lake St. Clair) produced fish with similar size ranges, weight-length relationships, and adequate sampling numbers within each bay with limited efforts during each sampling season. This generally supports the observation of similar growth rates and sizes at the end of the first growing season among these littoral zones (fish ranged from 5.0 to 7.5 cm fork length and 2.0 to 3.5 g wet weight in fall). Further confirmation will be realized through otolith analyses for more precise estimates of daily growth rates and statistical comparisons of fish size distributions.

Identification of minimum size requirements for overwinter survival has meaningful implications for helping elucidate factors which shape YOY survival dynamics in a widely distributed fish like Yellow Perch. Keast (1977) anecdotally supports the notion of similar end-of-season YOY size based on his studies of Lake Opinicon perch as well: "The overview emerging is that in mean length at the end of the first summer in Lake Opinicon fish are equivalent to those of most other waterways". The curious fact is that little work has been completed to investigate this process and the inference made by Keast in 1977. Future work in this project on Lake Opinicon will involve sampling YOY and age-1 overwintering juveniles during 1998 and 1999.

Assistant: Mike Erhardt

Mike Erhardt - "Erythropoiesis as a sensitive tool for describing growth in freshwater fishes" - B.Sc. Thesis

There is a need for the development of inexpensive, time efficient and sensitive indicators to assess growth in natural fish populations. Current methods use nucleic acid synthesis (RNA:DNA ratios) and/or otolith microstructure analysis. Quantification of red blood cell production (erythropoiesis) as a surrogate for protein synthesis could provide a new alternative to these techniques. Rapid growth stimulates erythropoiesis; a transition from easily identifiable reticulocytes (immature erythrocytes) lacking haemoglobin to mature erythrocytes. Preliminary studies of fish blood were completed using Lake Opinicon age-1 centrarchids (bluegills and pumpkinseeds) during the spring (June) of 1997 to refine blood extraction and mounting techniques. This work was followed by formal assessment of erythropoiesis as a tool to describe growth of these freshwater fish in Lakes Erie and St. Clair. Blood stains were prepared using standard techniques and cell ratios determined using a compound microscope interfaced with a microcomputer, with repeated measure to assure precision in percent reticulocyte estimates. Periods of rapid, intermediate, and slow growth, represented by changing reticulocyte ratios, correlated well with water temperature and otolith-derived growth rates for each species. These results support use of reticulocyte ratios as an appropriate, simple, cost-effective, sensitive alternative approach for describing fish growth in natural populations.

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

"Water Mite Parasitism of Aquatic Insects"

"Systematics of *Arrenurus* spp. water mites "

Arrenurus is a very large and common genus, with almost 1000 described species worldwide and about 60 species found in the region of QUBS. Species of this genus are defined by morphology of adult males, while most females and larvae are undescribed and unidentifiable. One of my long-term projects has been to associate the two genders and larvae of these species, making it easier to conduct ecological and behavioural studies on these organisms. During the summer of 1997 I concentrated on identifying larvae of species of the subgenus *Arrenurus*, which are especially difficult to distinguish. Species of this subgenus parasitize odonates, and make for an especially useful system for studying host/parasite interactions. The difficulty identifying mites has been a limiting factor in past studies.

Numerous samples of engorged larval mites were collected from damselflies and dragonflies (see Derek's research, below), and raised to their adult stage. Through this study I was able to recognize distinguishing larval characters for most species of this subgenus. In the process, three rare species were found (*A. pollictus*, *A. drepanophorus*, and *A. compactilis*), and appear to be specialists on small isolated lakes and marshes. *Arrenurus drepanophorus* also was a very early species, specializing on *Enallagma boreale* damselflies, while *A. pollictus* specialized on *Lestes* species. Through this study I discovered two *Arrenurus* species new to science in the QUBS region, and an additional one from the Black River at Highway 7.

Assistant: Derek Budman

Derek Budman - "Guild structure of damselflies and their parasitic mites"

The purpose of this study was to survey damselfly populations and the mites infesting them. Competition theory would suggest that when resources are limiting, there would be resource partitioning among potentially competing species of mites. The hypothesis in this project is that guild structure of parasitic mites on damselflies does not reflect strong competition among mite species:

1. there would be extensive interspecific multiple parasitism (more than one species of parasite on the same host)
2. most species of mites would be generalists, regularly parasitizing a broad range of damselfly species.

Damselflies on the wing were sampled weekly at five sites: Telephone Bay, Jack's Marsh, Barb's Marsh, Two-Island Lake, Dowsley Ponds. A total of 1,621 damselflies belonging to 19 species were sampled from mid-May to late July, yielding many thousand larval mites belonging to at least 12 species (identifications are under way, and at least three species new to science have been discovered). Early

emergent species apparently avoid most parasitic larval mites: only 1 of 165 *Enallagma vernale* were parasitized, and one early species of *Arrenurus* mite specialized on *Enallagma boreale*. *Enallagma ebrium* and *Ischnura verticalis* were very heavily parasitized, and individuals regularly carried several different species of mites (interspecific multiple parasitism).

Publications:

Baker, R.L. and B.P. Smith. 1997. Conflict between antipredator and antiparasite behaviour in larval damselflies. *Oecologia* 109:622-628.

Rousch, J.M., Simmons, T.W., Kerans, B.L. and B.P. Smith. 1997. Relative acute effects of low pH and high iron on the hatching and survival of the water mite, *Arrenurus manubriator* and aquatic insect, *Chironomus riparius*. *Environmental Toxicology and Chemistry*, 16(10) 2144-2150.

Smith, B.P. 1998. Loss of larval parasitism in parasitengonine mites. Proceedings of the Third Symposium of the European Association of Acarologists. Scheduled for April issue of *Experimental and Applied Acarology*, to be reprinted in proceedings, scheduled for publication by Chapman and Hall in summer 1998.

Smith, B.P. 1998. Larval Hydrachnida and their hosts: biological inference and population structure. Proceedings of the 9th International Congress of Acarology. Invited paper - accepted, waiting for publication.

Dr. C. Anna Toline (Department of Fisheries and Wildlife, Utah State University),
Dr. David Philipp (Illinois Natural History Survey) and **Frank Phelan** (QUBS)

"Movements of Smallmouth Bass in Rivers"

For the last several years, nesting male smallmouth bass have been individually marked to track individual movements and population changes. This work has focussed on a chain of pools in the Mississippi River between Miller's Lake and Ragged Chute, near Snow Road Station. Results show high nest fidelity among males who are successful in raising young. Unsuccessful males are much more likely to relocate between nesting bouts, although long-distance moves are rare. Clouding this pattern is the replacement of entire cohorts of males between years. It would appear that small river environments are very demanding environments, with males having short lives and wholesale replacement of males frequent.

Assistants: Leo Lentsch, Jim Ludden, Cory Suski and Amar Nirwal

Dr. Patrick Weatherhead - Department of Biology, Carleton University, Ottawa, Ontario

"Long-term study of red-winged blackbirds"

In 1997 the long-term study of red-winged blackbirds was continued, with most of the effort going toward data analysis.

Collaborator: Dr. Kevin Dufour

Gabriel Blouin-Demers - "Thermal ecology of the black rat snake (*Elaphe obsoleta*) in a cool temperate environment" - Ph.D. Thesis

This project was initiated in 1996 to continue the long-term ecological and demographic study of black rat snakes at QUBS and to undertake a detailed investigation of thermoregulation by this species. Black rat snakes are at the northern limit of their range in eastern Ontario and close to the northern extreme of snake distributions. Black rat snakes thus experience high thermoregulatory costs in Ontario (cool temperatures, short active season, etc.). General models in thermal biology predict that species experiencing such high thermoregulatory costs should not invest substantial effort in thermoregulation and thus should have fluctuating body temperature profiles. Species that experience fluctuating body temperature profiles are also expected to demonstrate maximum performance under a broad range of body temperatures. These predictions have never been adequately tested using septentrional snake species. The central goal of my research is to understand the ecological factors affecting body temperature selection (foraging, reproduction, ecdysis) and how the preferences influence habitat use, to gain insight into the thermoregulatory strategies of black rat snakes. I use temperature-sensitive radio-telemetry to document body temperature selection, habitat use, and movement patterns.

Assistants: Heather McCracken and Jana Svec

Kelley Kissner - "Genetic and ecological factors affecting juvenile survival in northern water snakes" - PhD thesis

The cryptic nature of snakes generally, and of juveniles snakes in particular, means that very little is known about the factors that affect juvenile survival, and how this in turn might affect the reproductive behaviour of the adults. Possible genetic factors that could affect juvenile survival include parental quality mediated by the number and quality of males with which a female mates. Potential ecological factors include neonatal size, influenced by female investment decisions, and time of birth, influenced in part by female behavioural thermoregulation. I will use a combination of paternity analyses and mating and rearing experiments to examine the factors affecting survival of juvenile northern water snakes. Survival of juveniles will be

monitored using individuals maintained in outdoor enclosures, complete with ponds and hibernacula, located in the Hughson tract.

Assistants: Dr. Greg Brown, Jana Svec, and Heather McCracken

Jana H. Svec - "Factors affecting road mortality of snakes" - B.Sc. Thesis

Several studies have shown that road mortality could be having a negative effect on snake populations. My goal is to look at the factors affecting road mortality of snakes while attempting to determine if roads are having similar negative effects on the snake populations in the Rideau Lakes area. I propose that these factors are movement associated with foraging, nesting, hibernation, and the dispersal of young, and the use of roads for thermoregulation. Based on the results I obtain, an additional goal is to develop management policies that reduce road mortality. Possibilities include public education, management of traffic patterns, and modification of roadside habitat.

Assistants: Gabriel Blouin-Demers, Greg Brown, Kelley Kissner, Heather McCracken

Lori Macadam - "Fluctuating asymmetry relative to habitat quality in bullfrogs" - B.Sc. Thesis

Substantial evidence exists that when animals are stressed during development, bilaterally paired traits that would normally develop symmetrically can become asymmetric. The goal of this study was to compare the degree of asymmetry in several bilateral characters in bullfrogs sampled in the Rideau Lakes area around QUBS, with frogs sampled in Jock and Rideau rivers near Ottawa. Previous toxicological work on the Rideau lakes frogs indicated that these frogs are relatively free of contaminants. By contrast, extensive urban and agricultural runoff in the Ottawa area was expected to produce high levels of contamination. Preliminary analyses have confirmed that frogs in the Ottawa area are less symmetrical than Rideau Lakes frogs.

Publications:

Brown, G.P. and P.J. Weatherhead. 1997. Effects of reproduction on survival and growth of female northern water snakes, *Nerodia sipedon*. Can. J. Zool. 75: 424-432.

Dufour, K. W. and P. J. Weatherhead. 1998. Bilateral symmetry as an indicator of male quality in red-winged blackbirds: associations with measures of health, viability, and parental effort. Behav. Ecol., in press.

Dufour, K. W. and P. J. Weatherhead. 1998. Reproductive consequences of bilateral asymmetry for individual male red-winged blackbirds. Behav. Ecol., in press.

Dufour, K. W. and P. J. Weatherhead. 1998. Bilateral symmetry and social dominance in captive male red-winged blackbirds. Behav. Ecol. Sociobiol., in press.

Montgomerie, R. and P.J. Weatherhead. 1997. How robins find worms. Anim. Behav. 54: 143-151.

Prior, K.A., H.L. Gibbs and P.J. Weatherhead. 1997. Population genetic structure in the black rat snake: implications for management. Conserv. Biol. 11:1147-1158.

Weatherhead, P.J. 1997. Breeding synchrony and extra-pair mating in red-winged blackbirds. Behav. Ecol. Sociobiol. 40: 151-158.

Weatherhead, P.J. and P.T. Boag. 1997. Genetic estimates of annual and lifetime reproductive success in red-winged blackbirds. Ecology 78: 884-896.

Weatherhead, P. J. and S. M. Yezerinac. 1998. Breeding synchrony and extra-pair mating in birds. Behav. Ecol. Sociobiol., in press.

Yezerinac, S.M. and P.J. Weatherhead. 1997. Extra-pair mating, plumage coloration and sexual selection in yellow warblers (*Dendroica petechia*). Proc. Roy. Soc. Lond. B 264: 527-532.

Yezerinac, S. M. and P. J. Weatherhead. 1997. The effects of synchrony and individual quality on extra-pair mating strategies in the socially monogamous yellow warbler. Anim. Behav. 54: 1393-1403.

Theses:

Brown, G. P. 1997. Sexual size dimorphism and demography, thermoregulation and mating activity of northern water snakes (*Nerodia sipedon*). Ph.D. Thesis. Department of Biology, Carleton University, Ottawa, Ont.

Dufour, K.W. 1997. Symmetry, quality and sexual success in red-winged blackbirds. Ph.D. Thesis. Department of Biology, Carleton University, Ottawa, Ont.

Prior, K.A. 1997. Conservation biology of black rat snakes: ecological, demographic, and genetic approaches. Ph.D. Thesis. Department of Biology, Carleton University, Ottawa, Ont.

Schalk, G. 1997. Single and interactive effects of low pH and leech predators on frog embryos and adults. M.Sc. Thesis (co-supervised with M. R. Forbes). Department of Biology, Carleton University, Ottawa, Ont.

Summary of Conference, Meeting and Field Trip Use of QUBS in 1997

| Organizer | Function | Number of Participants | Duration |
|--|---|------------------------|------------|
| Kathy Marocco (Amherstview Public School) | Skills Development and Counselling | 10 | Jan 28-30 |
| Dr. R. Harmsen (Queen's - Biology) | Bio 528 (Population Ecology) weekend | 16 | Feb 1-2 |
| Dr. J. Szeicz (Queen's - Geography) | Geography Field Trip | 15 | Feb 9 |
| Dr. A. Crowder (Queen's - Biology) | Elderhostel Program Emerging from Hibernation | 20 | April 8 |
| Jason Jones (Queen's - Biology) | Cerulean Warbler Monitoring Workshop | 15 | April 26 |
| Jacqueline Elliott (Queen's - Biology) | Enrichment Studies - Freshwater Fish Communities | 19 | May 8 |
| Jim Complak (Holy Cross H.S. - Kingston) | OAC Biology Field Trip - Fish Ecology | 10 | May 15 |
| Dr. R. Harmsen (Queen's - Biology) | Workshop on insect population dynamics | 7 | Aug 16-23 |
| Doug Archibald (Queen's - Geology) | Geology 221 (Geological Field Methods) Field Trip | 36 | Sept 17-18 |
| Dr. L. Aarssen (Queen's - Biology) | Biology 302 (General Ecology) Weekend | 74 | Sept 20-21 |
| Shane (Queen's - Track) | Queen's Cross-country Team Training Weekend | 27 | Sept 26-27 |
| Dr. V. Remenda (Queen's - Geology) | Hydrogeology Field Trip | 41 | Sept 27 |
| Dr. J. Szeicz (Queen's - Geography) | Geography Field Trips | 66 | Sept 27-28 |
| Jeff Ruttan (Bell H.S. - Nepean) | Field School | 36 | Sept 29-30 |
| Dr. L. Aarssen (Queen's - Biology) | Biology 302 (General Ecology) Weekend | 83 | Oct 4-5 |
| Dr. J. Smol (Queen's - Biology) | Biology 335 (Limnology) Field Trips | 65 | Oct 4-5 |
| Dr. D. McQueen (York U. - Biology) | ES 5112 (Environmental Science) Field Trip | 27 | Oct 18-19 |

Summary of Conference, Meeting and Field Trip Use of QUBS in 1997, cont'd

| Organizer | Function | Number of Participants | Duration |
|--|----------------------------------|------------------------|-----------|
| Kent Prior/ Kringen Henein | Algonquin to Adirondacks Meeting | 20 | Nov 14-15 |
| Mona McDiarmid (Queen's - Residences) | Student Leadership Retreat | 15 | Nov 22-23 |

Documentation of Use of QUBS in 1997 - User-Days

| User | Supervisor | Post-Doc | Graduate Student | Assistant | TOTAL |
|--|------------|-----------|------------------|-------------|-------------|
| INTERNAL (QUEEN'S) RESEARCH | | | | | |
| Aarssen | 5 | 0 | 46 | 36 | 87 |
| Eckert | 7 | 0 | 2 | 73 | 82 |
| Friesen | 0 | 0 | 42 | 0 | 42 |
| Harmsen | 2 | 0 | 0 | 8 | 10 |
| Keast | 79 | 0 | 0 | 0 | 79 |
| Leggett | 2 | 50 | 9 | 209 | 270 |
| Montgomerie | 8 | 0 | 0 | 3 | 11 |
| Phelan | n/a | 0 | 0 | 99 | 99 |
| Ratcliffe | 4 | 0 | 259 | 263 | 526 |
| Robertson | 70 | 0 | 238 | 430 | 738 |
| Smol | 1 | 0 | 7 | 6 | 14 |
| Total Internal | 178 | 50 | 593 | 1127 | 1948 |
| EXTERNAL RESEARCH | | | | | |
| University of Toronto | | | | | |
| Baker | 4 | 0 | 81 | 85 | 170 |
| Barrett | 0 | 0 | 0 | 26 | 26 |
| Fullard | 61 | 0 | 4 | 295 | 360 |
| Carleton University | | | | | |
| Forbes | 73 | 0 | 156 | 79 | 308 |
| Weatherhead | 60 | 5 | 464 | 281 | 810 |
| Illinois Natural History Survey | | | | | |
| Philipp | 63 | 8 | 5 | 80 | 156 |
| University of Guelph | | | | | |
| Bogart | 0 | 0 | 2 | 0 | 2 |
| Nudds | 0 | 0 | 5 | 7 | 12 |
| Posluszney | 0 | 0 | 12 | 0 | 12 |
| Konrad Lorenz Institute | | | | | |
| Kempenaers | 50 | 0 | 0 | 144 | 194 |
| Ithaca College | | | | | |
| Smith | 69 | 0 | 0 | 62 | 131 |
| Trent University | | | | | |
| Fox | 0 | 0 | 3 | 6 | 9 |
| Utah State University | | | | | |
| Toline | 21 | 0 | 0 | 21 | 42 |
| McMaster University | | | | | |
| Gibbs | 0 | 0 | 4 | 0 | 4 |
| Clark University | | | | | |
| Foster | 0 | 0 | 25 | 25 | 50 |

Documentation of Use of QUBS in 1997 - User-Days (continued)

| User | Supervisor | Post-Doc | Graduate Student | Assistant | TOTAL |
|---------------------------------|------------|-----------|------------------|-------------|-------------|
| Concordia University Grant | 0 | 0 | 51 | 7 | 58 |
| University of Windsor Sale | 0 | 0 | 8 | 8 | 16 |
| Total External | 401 | 13 | 820 | 1126 | 2360 |
| Total Research User-Days | 579 | 63 | 1413 | 2253 | 4308 |
| % Queen's | 31 | 79 | 42 | 50 | 45 |
| % Non - Queen's | 69 | 21 | 58 | 50 | 55 |

| | |
|----------------------------------|------|
| USER-DAYS IN TEACHING ACTIVITIES | 2712 |
| CONFERENCE AND FIELD TRIP USE | 655 |
| OTHER* | 1394 |

GRAND TOTAL USER-DAYS IN 1997 9069**

(* QUBS staff, family and their visitors are not included)

(** up 8% from 1996)

Seminars 1997

Thursday May 8

Ruth Woodward (Dept. of Biology, Queen's University)
"Song repertoires of Cerulean Warblers"

Thursday May 15

Dr. Ian Jamieson (University of Otago, New Zealand)
"The costs, constraints and conflicts of shared reproduction in a communally breeding bird, the Pukeko"

Thursday June 5

Dr. Ian Jamieson (University of Otago, New Zealand)
"The conservation and management of the flightless Takahe - one of New Zealand's most endangered birds"

Saturday June 7

Dr. Howard Reinert (College of New Jersey)
"Behaviour and ecology of Timber Rattlesnakes"

Thursday June 12

QUBS Graduate Students (Thomas Artiss, Steve Cooke, Gabriel Blouin-Demers, Kerry Hecker, Kelley Kissner, Nancy Lemon, Merrylee McGuffin, Scott Ramsay, Wally Rendell, Scott Tarof, Lisa Veit)
"Research Snapshots 1997: Topics, tactics and progress"

Thursday June 19

QUBS Honours Thesis Students
"Research Snapshots 1997: Topics, tactics and progress"

Thursday June 27

Deb Hume (Dept. of Biology, Queen's University)
"Asymmetry and attractiveness in humans: What's hot and what's not"

Thursday July 10

Dr. Allen Keast (Dept. of Biology, Queen's University)
"Flora and fauna of the Pacific: Origins and evolution"

Thursday July 24

Gina Schalk (Dept. of Biology, Carleton University)
"Single and interactive effects of low pH and leech-predators on frog embryos and adults"

Friday July 25

Turid Forsyth (local artist/photographer)
"Drawing from Nature: The artist's portfolio"

Fee Schedule for 1998

Board Charges - Meals only

| | |
|--------------------|--|
| \$445/month/person | -no obligation for chores |
| \$308/month/person | -includes obligation for chores on a rotating schedule |

Accommodation Charges - Housing only

| | |
|-----------------------|--|
| \$17.17/month/person | -dormitory (White House or Curran Cottage) |
| \$34.34/month/person | -small cabin |
| \$68.68/month/person | -medium cabin (Cabins 3, 8, 9, 10, 14) |
| \$91/month/person | -large cabin (Cabins 12, 15 and White House Apartment) |
| \$127.50/month/person | -Cottage (Keast, Earl, Sumac or Maplewood) |

Room and Board Rates for Short-term Visitors

| | |
|--------------------|--|
| \$190/person | -weekly R&B for field courses - includes a lab fee |
| \$24.50 day/person | -24 hr. room and board |
| \$4.10 | -breakfast or lunch only |
| \$7.60 | -dinner only |
| \$10.00/person | -overnight accommodation - academic purposes |
| \$20/person | -overnight accommodation - non-academic purposes |

NOTE - Fees for groups and conferences are negotiated directly with the Manager or Director

Boat Rental

\$210/month, \$95/week - includes maintenance from normal use - gas and oil not included
\$42/day - includes gas and oil for one day rental

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

Bench Fees

\$4.80/day - non-Queen's staff or major researcher (M.Sc. or Ph.D. candidate, project coordinator or Post-Doctoral Fellow)

\$1.70/day - each non-Queen's assistant

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

Provincial Sales Tax

P.S.T. is applicable to oil used in boats, to photocopies and Fax.

Goods and Services Tax

G.S.T. is applicable to charges for boat rental, direct sales (e.g. equipment) and all charges for room and board from casual users.