INTRODUCTION

Nineteen eighty-seven was a year of high levels of research and teaching activity at the Queen’s University Biological Station. On average, 32 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 and are summarized in Table 4. In teaching activities, QUBS hosted six modules in the Ontario Universities Program in Field Biology. Titles and enrollments for modules held at QUBS and for the OUPFB program in general are found in Tables 1 to 3. The Naturalist Workshop was full to capacity with an enrollment of 20 - 18 full-time and 2 part-time. QUBS also provides an extremely important facility for a variety of field trips, especially those associated with fall and winter term university courses (cf. Table 6). In many cases, this exposure to field work is a key element in stimulating interest in field biology.

In 1987, QUBS, through the Department of Development, kicked off a special capital appeal. Contributions to this appeal will help to provide improved and expanded facilities for teaching and research programs at QUBS. The lion’s share of monies from this appeal will go to replace the old lodge with a much-improved, winterized building. It is hoped that all past users of the station will contribute to this appeal, if only in a small way. Every donation puts us that much closer to realizing our goal.

Nineteen eighty-seven was the first season of operation of the new electronic weather monitoring system. This system was purchased with monies from Queen’s Appeal, Provincial Excellence Fund and an NSERC Operating Grant per Dr. R.J. Robertson. Despite some initial problems with lightning strikes, the system performed well throughout the year. The initial installation enables monitoring of 9 variables: 1) 1 metre high enclosed air temperature 2) 1 metre high enclosed relative humidity 3) surface lake temperature 4) 1 metre deep lake temperature 5) 3.5 metre deep lake temperature 6) 50 cm deep soil temperature 7) rainfall (tipping bucket rain gauge) 8) wind speed (anemometer) 10 metres above ground 9) solar radiation (pyranometer) 12 metres above ground. Presently, we are deciding on a format for data storage. Once in operation, a yearly compendium of daily data summaries will be kept on hard copy in the library. A complete file of half-hourly data will be kept on computer disks.

Although not at the same level as during the international conferences held locally in 1986, there were many visitors to QUBS in 1987 (cf. Table 4). Table 5 documents research and teaching use in user-days for comparison with previous years.

QUBS continues to be a popular destination for field trips, small conferences and meetings. Table 6 presents a list of these uses through 1987. The seminar schedule was organized by Dr. Raleigh Robertson in 1987. This forum is an interesting and valuable addition to events at QUBS. Table 7 lists the range of speakers and topics for 1987.

The new fee schedule for 1988 appears in Table 8. Note that there are new rates for non-academic and/or non-university groups. Conference fees are assessed on the basis of size of group, special arrangements and facilities used.

An updated list of theses and publications emanating from work done at QUBS is presented as an appendix to this report. Please forward copies of articles and theses as these become available. Please check your listings carefully for errors or omissions.
Nineteen eighty-seven saw continuing improvements to the facilities at QUBS. In spring, a new cabin, #13, was erected. Twice the size of our bunkie juniors, the new cabin was ready for summer use. Also in spring, a coin-operated dyer was purchased to assist with necessary laundry. In fall, the boathouse roof was reshelved and the roofs of the storage barns at Hughson's were repaired. The common areas of Curran Cottage are presently undergoing renovation. Work on the bathrooms and wash-up room should be completed soon. In preparing to receive delivery of a new commercial propane range for the lodge kitchen, some renovation is taking place in the lodge kitchen and food service area - new flooring, enlarging kitchen doorways, adding to serving counter space, altering electrical service to the kitchen. In late fall, construction was begun on a boundary fence between QUBS and Curtis property on the East side of the station road. This fence should be completed by spring. Already Floyd has got a garden worked up in the field near the road. The removal of all old fencing within the new boundaries was started. Over time, all old fence will be removed from QUBS property.

The annual Open House was held on July 5. QUBS regulars hosted over 300 visitors who toured the displays of research species and projects. In June, the seventh edition of our Community Newsletter was delivered to most households in the area. This summary of activities at QUBS is aimed at those unable to attend the Open House. Response to the Open House remains high and many favourable comments have been received about the Community Newsletter. These public relation events are important in maintaining contact with our neighbours and friends throughout the area. The regulars at QUBS are to be heartily thanked for their efforts in making these events so successful.

A new portable fire pump was acquired through the Vice-Principal of Services Risk Committee. This pump was mounted with all the necessary equipment on a small trailer to allow quick response in case of emergency. Bob Bell, Queen's Fire Safety Officer conducted hands-on fire extinguisher courses for QUBS regulars on June 15. At the same time, Frank and Floyd practiced with the new fire pump. Later, on July 9, members of the Elgin Volunteer Fire Department came to QUBS on a familiarization tour of facilities and to review procedures to be utilized in case of fire. Thanks to Hank Neff, Elgin V.F.D. Fire Prevention Officer for arranging this visit.

Our kitchen staff, Melinda Warren, Janice Frame, Linda Hughson and Marg Phelan provided excellent table fare for the station users. The operation of the kitchen was outstanding in 1987. Thank you for your efforts.

In fall, a new program at QUBS was initiated. In response to requests from high schools, a field trip program in environmental biology, focusing on aquatic systems, was tried. Two high school groups, one biology, one environmental studies came for day-long modules on limnology. These trips were successful, leading to the possibility of developing a full-blown field studies teaching program in environmental biology at QUBS.

QUBS alumni (read old-timer) Dr. Gary Bell was married to Rici Peterson in Peterborough, New Hampshire on July 26. Right after the ceremony, Gary packed his new bride and the 'best dog' in the truck and headed off to California to take up his new post at the Santa Rosa Plateau Preserve. Best of luck from all of us at QUBS!

In October, Janice Frame was married to Tom Radcliffe in Kingston. Best wishes from QUBS.

Thanks to Dr. Dolf Harmsen for his sketch which forms the cover of this report.
The ninth annual Naturalists' Workshop was held May 23-30, 1987. We were pleased to have Dr. Adele Crowder once again at the helm, having returned from her 1986 sabbatical leave.

Twenty naturalists participated in the workshop. A few of these were returnees from past workshops. A fair cross-section of interests and organizations were represented – Parks Canada, Ducks Unlimited, Rideau Valley Conservation Authority, Provincial Parks (Carillon, Murphy's Point, Charleston Lake), Universities and Schools (Queen's University, Queen Elizabeth Collegiate and Vocational Institute, Welborne Public School, Humber College).

Dr. Jim Pringle (Royal Botanical Gardens) was once again a valuable asset as one of our teaching and resource team. Many thanks also to our other team members: Dr. Allen Keast (Queen's - Biology), Peter Good (Q.E.C.V.I.), Dr. Sandra McBride (Queen's - Geological Sciences), Dr. Raleigh Robertson (Queen's - Biology), Dr. Adrian Forsyth, Dr. Peter Beal (Queen's - Biology), Dr. Francis Cook (Curator of Herpetology - National Museums), Terence Dickinson, Dr. Al Gorman (Queen's - Geological Sciences), Dr. W. Vreeken (Queen's - Geography), Ken Robinson (St. Lawrence Islands National Park), Dorothy Young (Queen's - Biology), Jennifer Harker (M.M. Dillon Consultants), Dr. James Fullard (Erindale College - Zoology), Dr. Bruce Smith (University of New Brunswick - Zoology), Frank Phelan and Floyd Connor (both QUBS).

This year, the day-long trip took us to several islands in the St. Lawrence Islands National Park. Highlights of the day were geological formations and soils, rare plants and unusual habitats. Despite rainy conditions, we fully enjoyed the trip to this diverse and beautiful assemblage of islands.

Many of the sidelights to the main programme prove to be some of the highlights when judging from participant's comments. In particular, the three evening presentations by Terence Dickinson, Dr. Adrian Forsyth and Dr. James Fullard were excellent. Mr. Dickinson, a freelance author and contributor to Equinox magazine gave a superb slide presentation on astronomy. Dr. Forsyth, a freelance author, talked about insect behaviour and ecology using illustrations from his own experiences in Costa Rica and locally. Dr. Fullard's inimitable style and enthusiasm made the segment on bats and moths most informative and enjoyable.

Dr. Sandra McBride was new to the program this year. Her keen interest in geology and her articulate, enthusiastic manner brought new life to this component. With luck, we will be able to persuade her to become involved in the workshop on a regular basis.

Next year's plans are ready and include a transect of the Frontenac Axis to investigate geological formations and major habitat types and vegetation associations.

Suggestions for topics for inclusion in the main workshop programme or other week-long or weekend workshops are welcome.
<table>
<thead>
<tr>
<th>Module Topic</th>
<th>Professor and Affiliation</th>
<th>Dates</th>
<th>Credit/Students</th>
<th>Queen's</th>
<th>Carleton</th>
<th>York</th>
<th>Brock</th>
<th>Western</th>
<th>Waterloo</th>
<th>U of T</th>
<th>Total Students/Module</th>
<th>Total 1/2-course credits</th>
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<td>Gill (Carleton)</td>
<td>May 10-16</td>
<td>1/4</td>
<td>5</td>
<td>1</td>
<td>3</td>
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<td>0</td>
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<td>Smol (Queen's)</td>
<td>May 17-23</td>
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<td>4</td>
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<td>5</td>
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<td>1</td>
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<td>0</td>
<td>8</td>
<td>4</td>
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<tr>
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<td>Fenton (York)</td>
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<td>1/4</td>
<td>3</td>
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<td>2</td>
<td>0</td>
<td>9</td>
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<tr>
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<td>Peck (Carleton)</td>
<td>Aug. 30-Sept. 5</td>
<td>1/4</td>
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<td>0</td>
<td>3</td>
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<td>11</td>
<td>5.5</td>
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| Total Number of Student-weeks | 27 | 1 | 17 | 4 | 2 | 3 | 2 | 57 |
| Half Course Credits | 13.5 | 0.5 | 8.5 | 2 | 1 | 1.5 | 1 | 28.5 |
Table 2: Summary of course credits in the Ontario Universities Program in Field Biology earned at locations other than QUBS in 1987.

<table>
<thead>
<tr>
<th>Module Topic</th>
<th>Professor and Affiliation</th>
<th>Dates</th>
<th>Location</th>
<th>Credit/Students</th>
<th>Queen's</th>
<th>Carleton</th>
<th>York</th>
<th>Brock</th>
<th>Western</th>
<th>Waterloo</th>
<th>U of T</th>
<th>Total Students/Module</th>
<th>Total 1/2-course credits</th>
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<td>Handford (Western)</td>
<td>Apr. 25-</td>
<td>Arizona</td>
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<td>1</td>
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<td>0</td>
<td>0</td>
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<td>Cameron (York)</td>
<td>May 6-25</td>
<td>California</td>
<td>1/2</td>
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<td>0</td>
<td>8</td>
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<td>1</td>
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<td>May 31-</td>
<td>Huntsman</td>
<td>1/2</td>
<td>3</td>
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<tr>
<td>Aquatic Ecology</td>
<td>Bailey (Western)</td>
<td>Aug. 14-28</td>
<td>Dorset</td>
<td>1/2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>7</td>
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<td>1</td>
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<td>Marine Biology</td>
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<td>1/2</td>
<td>6</td>
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<tr>
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<td>Aug. 17-31</td>
<td>Churchill</td>
<td>1/2</td>
<td>4</td>
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<td>1</td>
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<td>15</td>
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<tr>
<td>Alpine Ecology</td>
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<td>Aug. 21-</td>
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<td>1</td>
<td>0</td>
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<td>Conservation Ecology</td>
<td>Middleton (Brock)</td>
<td>Aug. 23-30</td>
<td>Bacchus</td>
<td>1/4</td>
<td>3</td>
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<td>4</td>
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<td>1</td>
<td>10</td>
<td>5</td>
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<tr>
<td>Terrestrial-Aquatic</td>
<td>Barrett (U of T)</td>
<td>Aug. 28</td>
<td>Dorset</td>
<td>1/2</td>
<td>2</td>
<td>0</td>
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<td>Experimental Marine</td>
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<td>Huntsman</td>
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<td>15</td>
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<tr>
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Total Number of Student-weeks: 93, 13, 30, 11, 84, 20, 125, 342

Half-course Equivalents: 29.5, 6.5, 15, 5.5, 42, 10, 62.5, 171
Table 3: Overall Summary of the Ontario Universities Program in Field Biology for 1987.

<table>
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<tr>
<th></th>
<th>Queen's</th>
<th>Carleton</th>
<th>York</th>
<th>Brock</th>
<th>Western</th>
<th>Waterloo</th>
<th>U of T</th>
<th>Total Student Weeks in Modules</th>
<th>Total Half Course Credits</th>
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<tr>
<td>Total Student-weeks not at QUBS</td>
<td>59</td>
<td>13</td>
<td>30</td>
<td>11</td>
<td>84</td>
<td>20</td>
<td>125</td>
<td>342</td>
<td>171</td>
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<tr>
<td>Total Student-weeks at QUBS</td>
<td>27</td>
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<td>17</td>
<td>4</td>
<td>2</td>
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<td>Total Student-weeks in Field Modules</td>
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<td>7</td>
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<td>7.5</td>
<td>43</td>
<td>21.5</td>
<td>63.5</td>
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ABSTRACTS OF RESEARCH CONDUCTED AT QUBS 1987

I. RESEARCH BY QUEEN’S UNIVERSITY STUDENTS AND STAFF

DR. L. AARSEN

"Competitive Ability in Plants"


Research performed in the summer of 1987 was part of an on-going series of manipulative experiments on plant interactions in old hayfields. Previous experiments involved species removals, and annual surveys for species abundance. The experiments done in 1987 were a series of nutrient additions varying concentrations of nitrogen, phosphorus, and potassium. Results will be recorded as changes in biomass and will be interpreted using response coefficients. All of the above experiments were performed in the Cemetery Field site.

Assistant: Stan Vasiliauskas


The hayfields on the QUBS property near Lake Opinicon provide a convenient system for studying competition and coexistence in grassland plant communities. Current theory on species coexistence suggests that if species compete, they may coexist only if they are sufficiently differentiated in their niche requirements. Nevertheless, in these grasslands (more specifically, the East Field) we commonly find different species of grass growing less than an inch apart and apparently in severe competition with each other. In the summer of 1986 I surveyed the field to assess distributional relationships, and collected neighbouring clones to be used in glasshouse experiments to assess the relative competitive abilities of neighbouring genotypes. The glasshouse experiments are in progress.

Thesis:

McKinley, K.J. 1987. Neighbour effects in mast year seedlings of sugar maple Acer saccharum Marsh. B.Sc. (Hons.) Thesis. Dept. of Biology, Queen’s University, Kingston, Ontario.

DR. P.W. COLGAN

"Field Ethology of Fishes"

In 1987, Lake Opinicon was the source of Killifish for laboratory studies on habituation of predatory stimuli (Hons. B.Sc. student Carolyn Welch) and for behavioural comparisons with another population (M.Sc. student Liane Gabora) and of Bluegill and Largemouth Bass for studies on foraging and predator avoidance (research associate Vytenis Goticelis).
Publications:


DR. R. HARMSSEN & DR. A. CROWDER

"Effects of Grazing on Succession in an Old-Field Community"

Co-Investigator: Bruce Henderson - Research Associate.
John-Paul Sigouin - Undergraduate.

This is a continuation of a long-term project initiated in 1975. In two old hayfields, 27 100m² research plots were permanently established in 1975. Every year, insect, rodent and plant populations are quantitatively sampled in all 27 plots, of which nine are screened with rodent-proof fencing and trapped empty once a year. In 1987 we continued to monitor closely the population of Trirhabda spp. (Goldenrod beetles) and the introduced grassfeeding caterpillar, Thymelicus lineola (the European Skipper). Unfortunately, the entire research area was affected by drift from nearby insecticide spraying against a declining gypsy moth infestation, so that all foliage feeding larval insects died. Since from 1988 onwards no further spraying is expected. we predict a rapid recovery of several species, including Trirhabda and Thymelicus over the next two or three years.

The emphasis this year was on sex-ratio and species distribution for the three species of Trirhabda in relation to overall population density and dispersal.

Publications:

"Ecology of Fish Communities, Inter-lake Comparisons"

Comparative studies on the fish communities of a series of lakes (Opinicon, Upper and Lower Beverley, Sydenham, Gould, Fish, Atkins) were continued with emphasis on the role of lake type, prey resource base, and potential competitors, on diets, habitat use, and growth rates of individual species. Objectives are to determine why fish species occur where they do, what governs their combination into communities and what 'contours' species ecology under different circumstances.

No two water-bodies have exactly the same combination of species, or species in equal proportions. Some individual species, however, occur in all the lakes so that their ecological role, age structure, and growth can be investigated relative to a precise set of physical and biological variables. Data accumulation and work with aquaria populations continues with special emphasis on game species like the Largemouth Bass and major prey species (Golden Shiner, Black-chinned Shiner).

"Long-term Changes in the Fish Community of Birch Bay, Lake Opinicon"

This broad sandy inlet was the site of the first fish community study in Lake Opinicon, published in 1965. The study involved a detailed assessment of the zoobenthic prey resource base, zooplankton, and diets of the fish species and their year classes on a monthly basis. Ten years later Jennifer Harker, as an M.Sc. thesis project, repeated the study, comparing fish ecology at this site with other sections of the foreshore. Now (1987) the site has changed slightly, with more weed growth so that some inshore areas are now used by young-of-year Yellow Perch, which were uncommon there previously. A third comparative study has now begun to see if, and what changes have occurred in this fish community over 20 years.

"Insect Cycles, Feeding Zones, and Locomotory Movements in Lake Opinicon Birds"

This study investigates the ecology of Lake Opinicon terrestrial birds in terms of the annual cycle, especially breeding and the prey resource base. During the summer of 1987, comprehensive weekly counts of caterpillars, spiders, and Diptera were made on the leaves and trunks of maple (the commonest tree in the area), and basswood. This was related to times of return and peak abundance of the major forest bird species and, particularly, their nesting periods.

Refoliation occurred in late April, 1987 (in 'late' years it takes place about May 10-12). Peak caterpillar abundance occurred early, preceding the nesting period of most bird species. A compounding factor was that caterpillar species diversity and abundance has now been lower for two years than during the early 1980's when detailed studies were last made: this is apparently due to the spraying of the adjacent property for Gypsy Moth. The birds adapted to low caterpillar numbers in late May - early June by feeding their young large numbers of odonates (eg. Tree Swallows, Red-eyed Vireos) diversifying the diet (eg. Song Sparrows), and making increasing use of the hairy gypsy moth caterpillars. This was done in one of two ways, by holding the larvae on a branch and extracting the insides (eg. Chickadees, Red-eyed Vireo) or banging the caterpillar against a branch until many of the stinging guard hairs came free. The beginnings of the habit were noted last year.
With these modifications to diet and feeding behaviour nestling success was apparently equal to that of other years.

"Periodicity of Territorial Song, Relationship to Stage of Breeding Cycle"

This work, part of a comparative study of the annual cycle in Ontario and New South Wales, Australia forest birds, had as one of its objectives the study of why different bird species differ in time of maximal territorial song. Does the timing of maximal territorial song differ in the members of a bird community because they breed at different times (a longer term evolutionary feature) or, since it is undesirable for different species to drown each other out, because of interspecific competition for 'broadcasting space'? The issue has now been resolved in favour of the former explanation. Notwithstanding this remains that closely related species, e.g. Red-eyed and Warbling Vireos, monitor each other's calling and partly avoid calling at the same time.

Assistant: Michele Flatters, Krista Johansen.


This is my second year of the project, which involves a comparison of pumpkinseed feeding, growth and life history in shallow ponds with that of Lake Opinicon. This year, with the help of Ian Smith, I sampled the fish populations, stomach contents and benthos of Lake Opinicon, Dowsley Pond (2.6 ha) and Upper Poole Pond (0.7 ha) in May, July, August and October. Water temperatures and dissolved oxygen concentrations were recorded; and the state of pumpkinseed reproductive organs were examined in breeding season. Pumpkinseed life history traits in Dowsley Pond are of special interest. They mature in their third growing season at lengths varying from 70-90 mm; this is 2-3 years earlier and 25-50 mm smaller than Lake Opinicon pumpkinseeds at first maturity (excluding sneakers). The small mature males of Dowsley are nesters, not cuckolders. Despite early maturity and large gonads, Dowsley pumpkinseeds grew faster in 1987 than comparably-sized lake fish. This ability to "burn the candle at both ends" was likely made possible by a winterkill in Dowsley, which reduced the population density by 85%. Life history characteristics of the fish of Upper Poole are intermediate to those of Dowsley and Lake Opinicon. It appears that summer growing conditions are near-optimal for pumpkinseeds in the shallow ponds, and that their population dynamics and life history patterns are determined by periodic winterkills.

Assistant: Ian Smith.


Work continued on populations of Golden Shiner with the fish of the Cataraqui Conservation Pond (which are long-lived and grow to a large size) being compared with those in Lake Opinicon and other systems. First year shiners, that live in the littoral zone with a range of other fish species were found to grow at the same rate in different systems. Larger-bodied shiners inhabit the open waters of the Cataraqui Pond and apart from Brown Bullhead are the only other fish in that habitat. They thus have few competitors in that habitat compared with the open water habitat in other
The division of broods by male and female parents after nest departure has now been documented in a number of passerine birds. In this study we are asking whether robin parents also divide their broods, both within the nest and after fledging, and if so whether broods are divided according to the sex, size or some other characteristic of the offspring. We are also interested in documenting whether renesting activities influence brood division and in testing the variety of hypotheses proposed to explain this parental behaviour (foraging efficiency, predator avoidance, experience, etc.). The results from 1987 show clearly that parents do not divide the brood while it is still in the nest but that some division may occur after nest departure.
II. "Parasites, Plumage, and Performance"

We collected small blood samples from each adult captured and sent them to Dr. Gordon Bennett (Memorial University, Newfoundland) for analysis of blood parasites. The aim of this study is to determine whether blood parasite levels are correlated with plumage and other phenotypic characters quantified at the time of sampling, or with a variety of other measures of reproductive (mating, nesting, brood rearing) and behavioural (foraging, singing, territorial) performance. We know now that there is some variation in the parasite loads among individuals but some critical experiments are required to determine whether there is a plausible cause and effect relationship between blood parasite levels and performance.

III. "Song Performance of Territorial Males"

As a measure of song performance both for the study described above and also as part of a test of various hypotheses to explain the dawn chorus of birds in general, we quantified both the diurnal and seasonal patterns of singing by territorial males in this population. In addition, the songs of 15 individually-marked males were recorded on several occasions to look for seasonal and microgeographic patterns in song structure and complexity. These songs will also be compared with those of males recorded at Chaffey's Lock, Elgin, and Kingston to determine whether there are local dialects in this species. Data from each of the males studied in detail will be used to look for correlations between singing activity and song complexity and various measures of reproductive performance and aggression.

IV. "Foraging Mechanisms"

In collaboration with Dr. Barry Frost (Dept. of Psychology, Queen's University), we are examining in detail the behavioural and neurophysiological mechanisms used by robins when foraging for earthworms on a lawn. This work was prompted by someone asking whether robins used sight or sound to find worms. Contrary to an earlier paper published on this subject we discovered that robins can actually use both sensory modes to locate worms. This project will now focus on determining how and when birds use sight and sound and how prey localization is mapped within and between these two modes.

V. "Parenthood"

Since both egg-dumping and extra-pair copulations have been reported in this species, knowledge of the precise parenthood of broods is essential for the correct evaluation of patterns of both parental care and mate choice. To do this we hope to use recombinant DNA techniques (e.g. DNA fingerprinting) to determine the exact parentage of each nestling in the population. In collaboration with Dr. Peter Boag (Biology, Queen's University) we began collecting blood samples from both adults and offspring so that techniques and the feasibility of this sort of analysis could be assessed. One of our most important goals in this work will be to examine the variation in the actual reproductive success of males relative to our various measures of phenotypic quality (singing, plumage, parasites, territoriality, etc.).

Assistants: Tracey Thompson, Susan McRae, Tarmo Poldma, Karen Holder, Linda Dupuis, Elsie Krebs.
C. Infranticide males were removed shortly after clutch completion to determine whether replacement males would disrupt a clutch of eggs. Females were receptive and copulated with replacement males as long as 12 days after clutch completion. Males which replaced during the first few days of incubation adopted the nestlings. Males which replaced late in incubation, even though in some cases they had copulated with the female, killed the
nestlings as the eggs hatched. Apparently the former males had been "fooled" into "thinking" they had sired the brood. These studies on infanticide by replacement males and counter-strategies by females will continue in 1988.

Field Assistants: Catherine Vardy and Lisa Venier

Wallace B. Rendell - "Natural Populations of Tree Swallows (Tachycineta bicolor)" - B.Sc. Thesis.

For the second breeding season, Tree Swallows breeding in natural cavities in Allen's Pond and Osprey Marsh were studied by Wally to enable comparisons with those breeding in grids of nest boxes. Information was obtained on nest dispersion, extra-site defense (quite common), polygyny (there was none), frequency of breeding by subadults (higher than in the grids), clutch size (lower than in the grids), and cavity characteristics in relation to nest success. Nest sites were measured using ropes, ladders, and the help of Floyd, Mark Mallory, Helen Gamble, Janet Cox, and RJR in January/February. Wally completed his thesis in Dec. and after a 6 month stint of working on finches in the Galapagos he will return to write papers from his thesis.

Lisa Venier - "Age-related Patterns of Reproductive Effort in Female Tree Swallows" - B.Sc. Thesis.

Feeding rate, nestling growth rate, and adult weight loss, as indicators of reproductive effort, were measured in paired nests of adult and subadult females.

II. Male Care and the Maintenance of Monogamy in Eastern Bluebirds

The role of paternal care in the maintenance of monogamy in Bluebirds is unclear. Gowaty found male care was unimportant to female success in South Carolina, yet in Ontario, we found male care did affect nesting success. In a cooperative study involving Greg Ball and Al Dufty in New York, and Patty Gowaty at Clemson, we did a geographic comparison, all in the same year, in which males were removed and held in captivity, and female feeding rates and nestling growth rates were measured. Results are currently being analysed. Of peripheral interest to this study was the large amount of variation in the behaviour of replacement males toward the brood of the previous male. This and other aspects of the study will be pursued in 1988.

Field Assistant: Monica Mather

III. Graduate Students

Monica Mather - "Bobolink Breeding Behaviour and Ecology"

As a pilot study for possible M.Sc. projects, Bobolink territories were mapped, nests were located, and model presentations were tried at a number of fields on the New Land and near Crosby and Elgin. A thesis proposal involving male song and female choice is being developed.
In exploring possible studies for Ph.D. research, goldfinch nests were located and the involvement of the male and any secondary males (none) was observed. Nests were found over a range of heights and habitats that were unexpected based on previous literature.

Jessie Deslauriers – "Phoebe Response to Cowbird Presence at the Nest" – B.Sc. Thesis

The nest parasitism of Brown-headed Cowbirds can provide a source of nesting failure for many small passerines. It is hypothesized that some passerines have learned to recognize female Cowbirds as a possible threat, and react aggressively to their presence near the nest. Some passerines may also have learned to recognize female Cowbird chatter. To test these hypotheses, during a one-week period in mid-May and during one day in late June, a series of presentations of female cowbird models and song sparrow models (non-threatening controls) was made to nesting phoebes on eggs. Presentations were made both silently, and accompanied by recordings of female cowbird and song sparrow songs. A female cowbird model was presented at one nest at one-hour intervals throughout one day to test the possibility of either habituation to the model or increased aggressiveness due to positive reinforcement by removal of the model by the investigator. It is planned to continued this project for at least a further five years.

As well, a mist-net banding program with consistent handling and recording of birds was carried out, a continuation of a program begun the previous year to serve as a control for banding data from Prince Edward Point being analysed for differences in temporal movement during spring migration of selected passerine groups and selected Parulid species. Captures were extremely sparse and insignificant data were obtained. However, it is planned to continue this project for at least one more year, since the poor capture results may have been the result of a notably poor spring migration showing throughout the eastern Ontario region.

Publications:


In 1987 work continued on the maternal care tactics of the treehopper Pubililia concava (Hemiptera: Membracidae). We conducted an ant exclusion experiment preventing ants from tending half of a membracid population located on 60 Eupatorium plants. Ant-tended females abandoned their egg masses twice as often as ant excluded females. Females which abandoned clutches usually began new clutches. Egg-guarding by females resulted in greater hatch success than clutches in which females were removed. Egg predation and parasitism by Mymarid wasps were major mortality sources. Survivorship of membracid nymphs was enhanced by ant-tending but the effect was reduced when large numbers of nymphs were found on the same plant. Lady beetles were more abundant on ant-excluded plants and consumed large numbers of young membracid nymphs. Ants, primarily Camponotus pennsylvanicus, aggressively exclude predatory insects. Preliminary evidence suggests that Crematogaster tending slows nymphal...
The terminal ganglion and the anteriorly projecting ventral nerve cord of the neuropteran, Corydalis sp. and a trichopteran were examined for wind responses to filiform receptors located along fleshy cercal-like projections on the posterior margin of the last abdominal segment. Long hairs were found that would activate large (although not giant) extracellular spikes in the...
nerve cord connective. These hairs were concentrated in patches facing outward on the terminal abdominal segment and may function as either wind or disturbance receptors. Large axons associated with rapid, anti-predator response are known in cockroaches and grasshoppers but homologous neural circuits in more primitive insects have not been investigated. A study examining such receptors and CNS interneurons in the firebrat, Thermobia, suggested that only insects that undergo incomplete metamorphosis would be expected to possess such receptors. The presence of these cells in neuroptera and trichoptera, insects with complete metamorphosis suggests that functions other than predator avoidance (e.g., flight control) may be the primitive roles associated with such neurons.

Assistant: Jayne Yack

Dr. J. Fullard and Dr. G. Boyan (Australian National University)

"Functional Organization of the Moth Auditory System"

In a previous publication we identified a set of sound-sensitive interneurons in a noctuid moth (Heliothis virescens) and based on their physiological properties we proposed a model for how evasive behaviour (against bats) may be effected. Our results indicated that three of the four most commonly encountered interneurons (501, 503, 504) will receive monosynaptic input from the most sensitive (AI) auditory receptor and predicted the types of connections these neurons make with flight motor neurons. In Catocala noctuid moths, we identified the same set of sound-sensitive interneurons as in H. virescens and tested aspects of the model. Our results are summarized as follows: 1. Interneurons 501, 503 and 504 receive monosynaptic EPSP's from the AI auditory afferent; 2. within this group, interneuron 504 appears not to receive input from the second auditory afferent (A2), suggesting a separate circuit processing information derived from this afferent; 3. intracellularly filled AI receptor processes indicate this cell has outputs in: (a) the anterior region of the metathoracic ganglion (where interneurons 501, 503, 504 receive input), and where stainings of interneuron 503 and AI afferent in the same preparation suggest synapses occur, (b) anterior in the mesothoracic ganglion, where we identified an interneuron (510) which does, indeed, receive monosynaptic input from the AI afferent, and probably from other sound-sensitive interneurons as well; 4. we have yet to find a thoracic sound-sensitive interneuron whose morphology does not correspond to the U-shape we previously described. This suggests a ladder-like arrangement of intra- and inter-segmentally repeated morphologies; 5. we now have evidence to suggest that the previously reported 'pulse-coder' interneuron fires phasically as a result of inhibition which may have its origin in a feed-back loop; 6. we have now identified a rhythmically active (flight) interneuron (401) which receives powerful excitatory auditory input sufficient to reset the rhythm. The exclusively ipsilateral morphology of 401 and its excitatory response conform to a prediction as to how the auditory pathway to the flight musculature is organized. Further, the mesothoracic motor neuron innervating the dorsal longitudinal flight muscle contralateral to the stimulated ear is inhibited by sound as predicted by the model. Whilst results conform to our model of anti-bat evasive flight behaviour in moths, we
are impressed by the complexity of central auditory processing in an insect with only two auditory afferents.

Assistant: Mike Stoneman

Mike Stoneman - "Captive Studies of a Substrate-gleaning Bat, Myotis septentrionalis"

This summer we recorded the feeding and flight behaviour of two male eastern long-eared bats, Myotis septentrionalis, a species which, until now, has not been observed in close quarters. Observations were carried out under red lights in a plastic-screened enclosure. This enclosure (idea courtesy of R. Barclay) has the advantage of providing an ambient-temperature holding area with a durable type of screen not injurious to the bats. The animals were fed moths taken from a nearby collecting lamp, required no hand-feeding or additional vitamin supplements and were released two months later. Myotis septentrionalis orients to non-flying insects, either on the screen or in the hand whenever they were actively flapping their wings. Recordings were made of the bat's echolocation emissions as they flew in the room and as they approached the insects. We predict that M. septentrionalis like its western congener, M. evotis, feeds on substrate-located insects and uses high-frequency sounds emitted by the insect to find them. The success at keeping the bats healthy for so long without involved feeding programmes suggests that this cage type is an efficient method to study temperate substrate-gleaning species.


It has been commonly supposed, although never tested experimentally, that insect tympanal organs represent the evolutionary adaptation of a primitively proprioceptive structure monitoring stretch or tension of the cuticle. Moths of the superfamily Noctuoidea possess a pair of metathoracic tympanal organs used primarily for the detection of the ultrasonic echolocation cries of insectivorous bats. Tympanal organs are absent however, in other taxa, such as the superfamilies Bombycoidea and Coccoidea. I predicted that atympanate moths possess neural elements which are homologous to the tympanic nerve cells in the noctuid moth, and that these homologues act as proprioceptors monitoring tension of the cuticle or body wall.

Morphological studies of the peripheral nervous system in 8 atympanate moth species show that atympanate moths possess an homologous nerve (IIIN1b) to the noctuid tympanal nerve. Neurophysiological recordings of the IIIN1b nerve in atympanate species suggested that individual cells are homologous to the acoustic cells of the noctuid ear and that they act as proprioceptors monitoring movements of the hindwing.

These data support the hypothesis that insect tympanal organs are derived from proprioceptive sensilla.

Thesis:

Our group at the Illinois Natural History Survey is collaborating with Dr. Mart Gross and his research team at the University of Toronto to study a
number of aspects of bluegill reproduction. The bulk of our studies center on assessing the genetic, physiological and environmental factors which may influence alternative reproductive behaviors among male bluegill. During 1987, these studies included experiments designed to assess how the density of young-of-the-year bluegill and density of adult parental male bluegill affected the rate of precocious maturation of these young. That is, can precocious maturation be influenced by the social structure of the population? In addition, we have continued selective breeding experiments designed to construct all-parental and all-cuckolder strains of Lake Opinicon bluegill. We have also finished a four-year life history study on an experimental population of bluegill established in a research pond.

**Assistants:** Pam Austin, Desarae Bushong, John Reinke

Julie Claussen - "The Dynamics of Colony Formation and the Reproductive Effort of a Bluegill Population"

1987 was the third year of this study. For the last two years, we have tracked the spawning activity of all colonies formed in a five bay study area throughout the spawning season. To determine if parental males routinely respawn during a season, males were marked and recaptured. We have monitored how many of these males returned to the study area each year to spawn. We also have assessed how reproductive success varied spatially among nests on different areas within a colony, among colonies from different areas of the study site and temporally among the different individual spawning bouts during the season. In addition, during 1987 we determined the rates of egg fertilization and successful hatching in the field and under laboratory conditions for several colonies during each spawning bout to assess the spatial and seasonal variation in spawning success.

Pawel Kindler - "Hormonal Analysis of Male Bluegill during the Spawning Season" - Ph.D. Thesis.

Pawel has developed the radioimmuno assay (RIA) techniques to quantify testosterone levels in the sera of male bluegill. Using this technique, Pawel has determined the pattern of testosterone production among male bluegills throughout the annual cycle. He has also studied how testosterone levels change during the spawning season in detail. In addition, by determining the differences in testosterone levels among parental males from different areas within a bluegill colony, he is assessing the relationship between hormone production, aggression and reproductive success. He is also assessing the role which testosterone plays in determining which life history, parental or cuckolder, a male bluegill assumes. In addition, during 1987, Pawel conducted a series of experiments in which he manipulated androgen and prolactin levels among parental male bluegill through exogenously implanted pellets. Behavioral observations of the ensuing spawning and parental care activities were then made to determine effects of these treatments.

Blake Konkle - "Interspecific Hybridization of Bluegill and Punkinseed"

Blake's research has several goals. First, he hopes to unravel the dynamics of the hybridization events, that is, to determine how these hybrids are being formed and why. This will be accomplished through a combination of behavioral studies in the field and laboratory studies using restriction endonuclease digestion analysis of mitochondrial DNA to determine maternity.
He also hopes to assess why total introgression between the two species does not occur even though the amount of F1 hybrid production is quite significant. This will be accomplished through molecular genetic analysis of broods produced in the wild at Lake Opinicon and of broods produced in the laboratory from specific in vitro crosses. During 1987 behavioral observations were begun in the field, collections of known bluegill, pumpkinseed, and F1 hybrids were made, and mitochondrial DNA isolated. In addition, F1 crosses of known direction were produced and are being reared for further experimentation.

Publications:


DR. BRUCE P. SMITH - Dept. of Biology, University of New Brunswick, Fredericton, New Brunswick.

"Water Mite Parasitism of Aquatic Insects"

During 1987 I continued research on water mites of the genus Arrenurus. Intensive collections of emergent insects at Deadlock Bay were again conducted in order to determine patterns of host utilization, and spatial and temporal relationships within this host/parasite community. This concludes sampling for the descriptive phase of the study. Collections will be sorted and specimens will be identified through the upcoming year.

Intensive collecting of female Arrenurus, Hydrachna and Eylais mites was conducted, and females were maintained in the laboratory to obtain eggs, and subsequently, larvae. This rearing program resulted in many associations between adults and compose diagnoses and keys for the larval stage, and can identify larval mites encountered in my studies of the host/parasite community.

Assistants: Wanda Cook, Lori Laughland

Publications:


Wanda Cook - "A Comparative Study of Reproductive Strategy among Females of Arrenurus spp."

This summer I continued my study of the reproductive strategies of female water mites; I was able to significantly increase my sample sizes. Species of the genus Arrenurus show dramatic differences in the size and number of eggs which they produce in a clutch. I looked at these differences on an intraspecific level, among species in each of the four subgenera, and among the subgenera. The resulting patterns seem to be related to the the type of
Lori Laughland - "Stimuli for successful detachment of larval Arrenurus danbyensis mites from Coquillettidia perturbans mosquitoes" - B.Sc. (Hons.) Thesis.

Larvae of most species of water mites are parasites of aerial insects, but must somehow return to the water to continue their lifecycle. Previous researchers have speculated that the larval mites due to the host's egg-laying or to contact with water to initiate detachment from the host, while others suggest detachment is by chance. One author observed that crushing the host's head resulted in rapid detachment by the mite, while crushing other parts of the body had no effect. One possibility is that the head crush releases hormones from the corpora cardiaca and corpora alata located in the insect's brain - hormones known to be related to the host's ovarian cycle.

In the summer of 1987 I conducted experiments with larval Arrenurus danbyensis, a parasite of the mosquito Coquillettidia perturbans, to test potential stimuli for detachment. Mite behaviour (time to drop off) was recorded with respect to the following manipulations: 1. water, 2. carbon dioxide, 3. head crush, 4. abdominal crush, 5. thoracic crush, 6. head extract, 7. abdominal extract and 8. head crush with the head isolated by neck ligature. Free-flying mosquitoes for these experiments were caught as they were attracted to lights left on by late-working biologists in the trilab at the station. Research for this project has been completed, and analysis of data is nearing completion. Thesis and manuscript preparation should begin shortly.


During July of 1987, adult chironomids of the genus Chironomus were gathered at the Queen's Biological Station. These chironomids were examined for evidence of mermithid nematode parasitism. Nonparasitized chironomids and mermithids reared to adulthood were mounted for classification. Both parasitized and nonparasitized chironomids and all of the life-cycle stages of the mermithids (with the exception of the preparsitic stage) were fixed for later histological and ultrastructural examination.

My master's project will entail an investigation of any structural pathology of the chironomid reproductive system resulting from the presence of mermithid parasites. To fully explain such damage I will also examine the nervous, endocrine, digestive, and circulatory systems of the chironomid.

DR. S. VAN DER KLOET - Department of Botany, Acadia University, Wolfville, Nova Scotia

"Demography of Vaccinium corymbosum in Hebert Bog"

After nine years of observation, this population of 50 tagged shrubs is steadily losing its vigour. If I compare seed production prior to the December 1980 cold-wave, which killed all the flower buds resulting in no fruit production in 1981, I found that in 1979 and 1980 about 66% of the bushes bore some fruit with 8% yielding > 1000 berries. After 1981, only about 40% bore any fruit at all, and then rarely more than 300 berries. Thus
in 1987, although flowering began very early (1st corollas were at anthesis on 6 May 87) and consequently, fruiting also began a month earlier than usual. Thus by 20 July 1987, most of the fruit had already been dispersed. Nevertheless only 44% of the bushes produced any fruit at all and only four shrubs had between 300 and 500 berries, the rest fewer than 50. Furthermore, main stems are still dying back to the crown, and the emerging basal sprouts are still browsed by snow-shoe hares and deer.

DR. P. WEATHERHEAD - Department of Biology, Carleton University, Ottawa.

"Mate Choice and Sexual Selection in Red-winged Blackbirds"

This project, now in its third year, is aimed at applying molecular biological techniques to determine patterns of reproductive success, and therefore mate choice in red-winged blackbirds. Complete blood sampling of the breeding population and their offspring was continued in 1987. The laboratory work being done at Queen's by Drs. Boag and White, has proceeded to the point where preliminary results relevant to the project's aims are imminent. Blood sampling was also extended to include the production of smears for general blood parasite sampling. Information gained from the smears will allow the determination of the role of parasites in the expression of secondary sexual characteristics in mate choice. This project will be continued in 1988.

Assistants: Drew Hoysak, Kevin Dufour, Linda Dupuis.

"Mate Choice and Sexual Selection in Robins"

This project is under way in conjunction with Dr. R.D. Montgomerie (Queen's). Details of research during 1987 were presented in this report in Dr. R.D. Montgomerie's resume.

"Ecology and Behaviour of Black Rat Snakes"

No specific studies were undertaken with this project in 1987, but the long term monitoring of the population by marking and measuring all black rat snakes encountered near the field station was continued.

Assistants: Linda Dupuis, Drew Hoysak, most everyone.


Field work was completed on this project in 1987. Two general approaches were used to address the question of whether "male" characteristics expressed in females are the result of direct sexual selection on females associated with female-female competition, or due only to incomplete suppression of a trait selected for in males. Field studies examined nesting parameters and the effect of female plumage variability on male and female behaviour. An aviary study investigated the role of plumage variation on dominance relationships. In general, the data appear to support the hypothesis that these traits in females are nonadaptive, reflecting only incomplete suppression of male traits.
Studies conducted outside the breeding season have shown that trapping methods that rely on food or decoys disproportionately capture birds that are younger and in poorer condition. To determine whether these biases persisted during the breeding season (when food should be abundant), and in a brood-parasitic species (that is paying no cost for parental care), cowbirds caught throughout the breeding season in decoy traps were compared with those caught by other means. The data indicate that age and condition biases do persist, and that overlaying these biases are patterns specific to sex and habitat.


Robin nestlings were given identifying marks and then videotaped so that their movements in response to patterns of parental feeding could be observed. Variables of interest were the predictability of parental perch locations at the nest and how perch location affected the pattern of food distribution to various positions in the nest. Prior to fledging, nestlings were banded and their movements monitored for up to two weeks after fledging. The aim of this aspect of the study was to determine whether there was brood division by the parents and how fledgling movements affected parental foraging patterns before and after fledging.

Publications:


Weatherhead, P.J., Greenwood, H. and R.C. Clark. Natural selection and sexual selection on body size in red-winged blackbirds. Evolution 41: 1402-
The range of organisms studied at the Biological Station was expanded with the introduction of bacteriological investigations this summer. Dr. Wyndham's work at the University of Toronto had uncovered a strain of a common surface water bacterium, *Alcaligenes*, capable of degrading 3-chlorobenzoate which is a chlorinated organic molecule intermediate in the breakdown of herbicides, PCB's and related compounds. This strain, named *Alcaligenes* sp. BR60, evolved in the Niagara region in contaminated waters and shows potential as a biological agent for waste water cleanup. Its ability to survive in natural communities other than its place of origin is unknown, so the object of research is to determine the survival characteristics of BR60 under a range of chlorobenzoate contamination conditions. The QUBS station was chosen because of its surface water chemistry and because of the availability of a convenient toxicology facility. This facility was used to set up natural water mesocosms receiving different concentrations of chlorobenzoate. The survival of BR60 was tracked using specific DNA probes.

Preliminary experiments carried out in summer of 1987 indicate that the bacteria persist in natural waters even in the absence of chlorobenzoate contamination and that genetic material is transferred from BR60 to other bacterial species within the community. The nature of this genetic transfer and its implications for the use of specialized bacteria in waste water cleanup are being investigated, and more refined mesocosm experiments are planned for the coming summer.
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|                                   | Fish Community Ecology of Beaver Ponds | Michael Fox (Queen's) Ian Smith (Queen's) | May 8 - July 31 May 17 - Aug. 20
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<td>Occasional</td>
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<td></td>
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<td>Elsie Krebs (Queen’s)</td>
<td>Occasional</td>
</tr>
<tr>
<td>Dr. R.J. Robertson (Queen's)</td>
<td>Breeding Strategies in Birds</td>
<td>Monica Mather (Queen's)</td>
<td>Apr. 15 - Aug. 27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wally Rendell (Queen's)</td>
<td>Apr. 29 - Sept. 1</td>
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<td></td>
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<td>Catherine Vardy (Queen’s)</td>
<td>Apr. 20 - July 16</td>
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<td>Lisa Venier (Queen’s)</td>
<td>May 1 - Aug. 23</td>
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<tr>
<td></td>
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<td>Pheobe Behavioural Responses to Cowbirds</td>
<td>Jessie Deslauriers (Queen’s)</td>
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<td>June 14-23</td>
</tr>
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<td>Students and Affiliation</td>
<td>Residency</td>
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<td>-----------------------------------</td>
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<tr>
<td>Dr. J. Smol (Queen's)</td>
<td>Diatoms as Indicators of Lake Trophic Status</td>
<td></td>
<td>Occasional</td>
</tr>
<tr>
<td></td>
<td>Zooplankton Communities in Beaver Ponds</td>
<td>Michelle Flatters (Queen's)</td>
<td>May 9 - July 31</td>
</tr>
<tr>
<td>Dr. A. Forsyth and Dr. M. Wood (Biological systematics Research Institute)</td>
<td>Maternal Care in Treehoppers</td>
<td>David Bell (Queen's)</td>
<td>May 18 - Aug. 17</td>
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<tr>
<td>Dr. J. Fullard (Erindale - U. of Toronto)</td>
<td>Insect Neuroethology and Sensory Physiology</td>
<td></td>
<td>May 9 - July 29</td>
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<tr>
<td></td>
<td>Functional Organization of Moth Auditory System</td>
<td>Dr. George Boyan (Australian National University)</td>
<td>July 2 - 31</td>
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<tr>
<td></td>
<td>Mechanoreceptor Origins of Insect Auditory Systems</td>
<td>Jayne Yack (Erindale - U of T)</td>
<td>May 8 - July 7</td>
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<td></td>
<td>Captive Studies of a Substrate-gleaning Rat</td>
<td>Mike Stoneman</td>
<td>June 1 - Sept. 10</td>
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<tr>
<td>Dr. M.R. Gross (U. of Toronto)</td>
<td>Evolutionary Ecology of Fish Reproduction</td>
<td>Ron Coleman (U of T)</td>
<td>Occasional</td>
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<tr>
<td>Dr. D.P. Philipp (Illinois Natural History Survey)</td>
<td>Genetic Aspects of Bluegill Reproduction</td>
<td>Julie Claussen (INHS)</td>
<td>May 26 - July 31</td>
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<td></td>
<td>Colony Formation and Reproductive Effort in Bluegill</td>
<td></td>
<td></td>
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<td>Students and Affiliation</td>
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<td>Dr. B.P. Smith (U. of New Brunswick)</td>
<td>Water Mite Parasitism of Aquatic Insects</td>
<td>Pam Austin (U. of Illinois)</td>
<td>May 3 - Sept. 1</td>
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<td>Reproductive Strategies among Female Mites</td>
<td>Wanda Cook (U.N.B.)</td>
<td>May 4 - Sept. 1</td>
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<td>Stimuli for Detachment of Larval Mites</td>
<td>Lori Laughland (U.N.B.)</td>
<td>May 16 - Sept. 1</td>
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<tr>
<td></td>
<td>Structural Pathology of Parasitized Chironomids</td>
<td>Patti Ramsey (U.N.B.)</td>
<td>June 1 - 3, July 1 - 14</td>
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<td>Dr. S. Vander Kloet (Acadia)</td>
<td>Demography of Pinus rigida and Vaccinium corymbosum</td>
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<td>Dr. P. Weatherhead (Carleton)</td>
<td>Mate Choice and Sexual Selection in Red-winged Blackbirds</td>
<td>Drew Hoysak (Carleton)</td>
<td>Apr. 24 - July 21</td>
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<td>Apr. 1 - Aug. 14</td>
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<td>Project Supervisor and Affiliation</td>
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<tr>
<td></td>
<td>Ecology and Behaviour of Black Rat Snakes</td>
<td>Linda Dupuis (Carleton)</td>
<td>May 1 - July 31</td>
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<tr>
<td></td>
<td>Decoy Trap Biases in Brown-headed Cowbirds</td>
<td>Kevin Dufour (Carleton)</td>
<td>Apr. 15 - Aug. 17</td>
</tr>
<tr>
<td></td>
<td>Nestling and Fledgling Behaviour of Robins</td>
<td>Susan McRae (Carleton)</td>
<td>Apr. 24 - Aug. 9</td>
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<tr>
<td></td>
<td>Sexual Selection in Female Red-winged Blackbirds</td>
<td>Kit Muma (Carleton)</td>
<td>Apr. 1 - Sept. 1</td>
</tr>
<tr>
<td>Dr. Wyndham (Carleton)</td>
<td></td>
<td></td>
<td>Occasional</td>
</tr>
<tr>
<td>Roberta Fulthorpe (Carleton)</td>
<td></td>
<td></td>
<td>June 7 - Sept. 4</td>
</tr>
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</table>
Other Visitors to QUBS 1987

Sheila Macfie (U. of Alberta)
Chris Eckert (M.N.R.)
Tracey Burton
Lorne Wolfe (U. of Illinois)
Dr. W. Redmond (S.U.N.Y.)
Brent Charland (U. of Victoria)
Dr. P. Gregory and Family (U. of Victoria)
Dr. R.D. Oliver (Biosystematics Research Institute)
Valerie Palda (Queen's)
Barbara Martin
Margaret Beilharz (U. of Melbourne, Australia)
Dr. S.E. Frey (U. of Indiana)
Janet Cox (Queen's)
Dr. Tombi Singh (U. of Manipur, India)
Dr. Miko Azuma (Nagasaki University)
Bridget Stutchbury (Yale)
Hamish McIntosh
Sandy Connell
Dr. P.N. Johansen (Queen's)
Sean Sharpe (Queen's)
Dr. Green
Lenore Fahrig
Dr. G. Whitt
Dr. R. Wattendorf
Dr. C. Kroeger
Andrew Mason (U. of T. - Erindale)
Myron Smith (U. of T. - Erindale)
Michelle Venence
Liz Dobson
Johanne Ranger (Pelee Island National Park)
Jane Watson
Jennifer Templeton (Queen's)
Caroline Dunlop (Queen's)
H. Lisle Gibbs (U. of Michigan)
Dr. Jim Sutcliffe (Queen's)
Brad Strawbridge
Shannon McCorquodale
Peggy Latimer
Alan Dufour
Mike Eliaszw
Andre Rudnicky
Charles Rendell
Jean Greig (Queen's)
Dr. J. Michael Bristow
Dr. George Williams (S.U.N.Y.)
Linda Fleming
Sharon Fleming
Sharon Stoneman
Wilt Lambo
Doug Menard
Barbara Hilder
Roman Romaniuk
Yves Lariviere
Sue and Nick Alcock
Frank Rohwer and Family (Queen's)
Jim Mountjoy
Ted Joens and Family
Charlotte London
Perry Johnson-Green (Queen's)
Kevin Teather (Carleton)
Jim Complak
Michael Harrison and Family
Patty Rivera
Tim Thompson
Anders Kraus
Don Franklin
Gary Mallen (M.N.R.)
Dr. Ken Budd (Queen's)
Morgan Hull
Jennifer Smith
Fran and Peter Thompson
Table 5 (continued)

<table>
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<tr>
<th></th>
<th>Supervisor</th>
<th>Graduate Student</th>
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<tr>
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<td>Queen's:</td>
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<tr>
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<td>121</td>
<td>11</td>
<td>132</td>
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<td>Crowder</td>
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<td>13</td>
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<td>Johansen</td>
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<td>Keast</td>
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<td>61</td>
<td>147</td>
<td>337</td>
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<td>Montgomerie</td>
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<td>Ratcliffe</td>
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<td>Robertson</td>
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<td>166</td>
<td>347</td>
<td>625</td>
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<tr>
<td>Smol</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Sutcliffe</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>11</td>
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<tr>
<td><strong>Total Internal</strong></td>
<td>360</td>
<td>396</td>
<td>772</td>
<td>1528</td>
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<tr>
<td><strong>Total External</strong></td>
<td>398</td>
<td>419</td>
<td>1100</td>
<td>1917</td>
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<tr>
<td><strong>Grand Total</strong></td>
<td>758</td>
<td>815</td>
<td>1872</td>
<td>3445</td>
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<tr>
<td>% Queen's</td>
<td>47.5</td>
<td>48.6</td>
<td>41.2</td>
<td>44.4</td>
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<tr>
<td>% External</td>
<td>52.5</td>
<td>51.4</td>
<td>58.8</td>
<td>55.6</td>
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</table>

User-days in teaching activities: 1476

Miscellaneous User-days (visitors, families of researchers, field trip participants): 1260

Total User-days: 6181

(Part-time and full-time support staff excluded from above figures)
Table 6: Summary of Conference, Meeting and Field Trip Use of Queen's University Biological Station - 1987.

<table>
<thead>
<tr>
<th>Organizers</th>
<th>Function</th>
<th>No. of Participants</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Sheila Macfie (Queen's)</td>
<td>Bio 202 (Ecology) Weekend</td>
<td>10</td>
<td>Jan 9 - 11</td>
</tr>
<tr>
<td>Kit Muma (Carleton)</td>
<td>Station Reunion</td>
<td>12</td>
<td>Jan 16 - 18</td>
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<tr>
<td>Dr. R. Harmsen (Queen's)</td>
<td>Bio 439 (Population Ecology) Weekend</td>
<td>12</td>
<td>Jan 30 - Feb 1</td>
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<tr>
<td>Dr. D. Bastianutti (Queen's)</td>
<td>Italian Club Weekend</td>
<td>8</td>
<td>Feb 6 - 8</td>
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<tr>
<td>Dr. W. Reeve (Queen's)</td>
<td>German Language Immersion Field Camp</td>
<td>30</td>
<td>Apr 25 - May 2</td>
</tr>
<tr>
<td>Dr. G.P. Morris (Queen's)</td>
<td>Departmental Retreat</td>
<td>35</td>
<td>Apr 27 - 28</td>
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<tr>
<td>Bob Bell (Queen's Safety)</td>
<td>Fire Extinguisher Course</td>
<td>40</td>
<td>June 15</td>
</tr>
<tr>
<td>Peter Hall</td>
<td>Ottawa Field Naturalists</td>
<td>49</td>
<td>July 12</td>
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<tr>
<td>Hamish McIntosh</td>
<td>Biology Specialist course (MacArthur Coll.) Field Trip</td>
<td>6</td>
<td>July 16</td>
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<tr>
<td>Dr. Peter Zarzecki (Queen's)</td>
<td>Ottawa U.-Queen's Physiology Conference</td>
<td>45</td>
<td>July 18</td>
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<tr>
<td>Dr. D. McQueen</td>
<td>Limnology Field Trip</td>
<td>15</td>
<td>Sept 18 - 20</td>
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<tr>
<td>Rose Jones (Lasalle H.S.)</td>
<td>Gr. 13 Ecology Field Trip</td>
<td>30</td>
<td>Sept 29</td>
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<tr>
<td>Sean Sharpe (Queen's)</td>
<td>Bio 202 (Ecology) Field Trip</td>
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<td>Oct 2 - 4</td>
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<tr>
<td>Roger Lupton (Lasalle H.S.)</td>
<td>Environmental Studies Field Trip</td>
<td>17</td>
<td>Oct 6</td>
</tr>
<tr>
<td>Mary Brodie</td>
<td>Faculty Wives Association Field Trip</td>
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<td>Oct 8</td>
</tr>
<tr>
<td>Dr. J.J. Hamm (Queen's)</td>
<td>Yoga Weekend</td>
<td>9</td>
<td>Oct 16 - 18</td>
</tr>
<tr>
<td>Organizers</td>
<td>Function</td>
<td>No. of Participants</td>
<td>Duration</td>
</tr>
<tr>
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<td>-------------</td>
</tr>
<tr>
<td>Sean Sharpe</td>
<td>Bio 202 (Ecology) Field Trip</td>
<td>65</td>
<td>Oct 23 - 25</td>
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<tr>
<td>George Lamarcraft</td>
<td>Working Session on Needs of Special Students</td>
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<td>Oct 28 - 29</td>
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<tr>
<td>Jocelyne Devi-Leyton</td>
<td>Yoga Workshop</td>
<td>8</td>
<td>Dec 13</td>
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Table 7: Queen's University Biological Station Seminar Schedule 1987.

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker/Presenter</th>
<th>Title</th>
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<tbody>
<tr>
<td>19 May</td>
<td>Dr. John Smol</td>
<td>&quot;Paleolimnology &amp; Acid Rain&quot;</td>
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<tr>
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<td>Queen's</td>
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<tr>
<td>21 May</td>
<td>Dr. John Smol</td>
<td>&quot;High Arctic Limnology&quot;</td>
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<td>Queen's</td>
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<tr>
<td>26 May</td>
<td>Terence Dickenson</td>
<td>&quot;Astronomy&quot;</td>
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<tr>
<td>3 June</td>
<td>Dr. Raleigh Robertson</td>
<td>&quot;Delayed Breeding, Polygyny, and Infanticide: Facultative Reproductive Tactics of Tree Swallows&quot;</td>
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<tr>
<td></td>
<td>Queen's</td>
<td></td>
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<tr>
<td>10 June</td>
<td>Dr. Pat Weatherhead</td>
<td>&quot;The Black Rat Snake: Know Thine Enemy&quot;</td>
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<tr>
<td></td>
<td>Carleton</td>
<td></td>
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<tr>
<td>17 June</td>
<td>Monica Mather</td>
<td>&quot;A Sheep in Wolf's Clothing&quot;</td>
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<td>24 June</td>
<td>Dr. Bill Redmond</td>
<td>&quot;Feeding Apparatus of Water Mites&quot;</td>
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<tr>
<td></td>
<td>S.U.N.Y. St. Paul's, New York</td>
<td></td>
</tr>
<tr>
<td>1 July</td>
<td>Julie Claussen, Illinois &amp; Pat Weatherhead</td>
<td>&quot;Conch Genetics &amp; Belize Travelogue&quot;</td>
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<tr>
<td></td>
<td>Carleton</td>
<td></td>
</tr>
<tr>
<td>8 July</td>
<td>Sean Sharpe</td>
<td>&quot;Punkmice: Why Breed Early?&quot;</td>
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<tr>
<td>15 July</td>
<td>Dr. George Boyan</td>
<td>&quot;Neuronal Segmentation &amp; Development in the Insect&quot;</td>
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<td>Australia (A.N.U.)</td>
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<tr>
<td>20 July</td>
<td>Kit Muma</td>
<td>&quot;Breeding Tactics of Female Redwings&quot;</td>
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<td>Carleton</td>
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<td>27 July</td>
<td>Honours Student Symposium - Michele Flatters, Sue McRae, Ian Smith, Lisa Venier, Wally Rendell, Kevin Dufour</td>
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<tr>
<td>29 July</td>
<td>Dr. George C. Williams</td>
<td>&quot;Demographic Consequences of Natural Selection&quot;</td>
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<td>S.U.N.Y. Stony Brook</td>
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<tr>
<td>5 August</td>
<td>Michael Fox</td>
<td>&quot;Pumpkinseed Growth, Feeding &amp; Life History in Beaver Ponds&quot;</td>
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<td>Queen's</td>
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<tr>
<td>12 August</td>
<td>Mike Stoneman</td>
<td>&quot;Bats &amp; Things&quot;</td>
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**Table 8: Fee Schedule for 1988**

**Accommodation - Room and Board**

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<td>$250/mo</td>
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<tr>
<td>$375/mo</td>
<td>no obligation for chores</td>
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<tr>
<td>$135/wk</td>
<td>including weekend, eg. Field courses (includes a lab fee)</td>
</tr>
<tr>
<td>$18/day</td>
<td>24 hr. room and board (includes meals &amp; overnight, no chores)</td>
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<tr>
<td>$3.25</td>
<td>breakfast only</td>
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<tr>
<td>$3.25</td>
<td>lunch only</td>
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<tr>
<td>$6.50</td>
<td>dinner only</td>
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<tr>
<td>$7.50</td>
<td>overnight accommodation - academic purposes - no food - Queen's</td>
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<td>$12.00</td>
<td>overnight accommodation - academic purposes - no food - non-Queen's</td>
</tr>
<tr>
<td>$12.00</td>
<td>overnight accommodation - nonacademic purposes - no food - Queen's</td>
</tr>
<tr>
<td>$20.00</td>
<td>overnight accommodation - nonacademic purposes - no food - non-Queen's</td>
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Fees for conferences are negotiated directly with the manager or director. Accommodation Surcharges (applied as additional % to above charges).

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<th>Surcharge</th>
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<td>Whitehouse (Dormitory, Curran Cottage (multi))</td>
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<tr>
<td>5%</td>
<td>Cabins 1-7, 9, 10, 12, 13 and Shaker</td>
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<tr>
<td>10%</td>
<td>Cabins 8 (if solo), 11 and White House apartment</td>
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<tr>
<td>15%</td>
<td>Keast, Earl, and Suac Cottages</td>
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</table>

**Boat Rental**

$150/mo, $65/wk - includes maintenance on boats and motors
- gas and oil not included in rental fee

**Bench Fees**

$3.83/day - Non-Queen's staff or major researcher (M.Sc., Ph.D. candidate, project coordinator or Post-doctoral Fellow)

$1.31/day - each non-Queen's assistant

If sufficient research funds are not available, bench fees may be reduced or waived upon written application to the Director.
Queen's University Biological Station
List of Theses

Ph.D. THeses:

BARCLAY, R. M. R. 1981. Interindividual use of echolocation calls:
Eavesdropping by the Little Brown Bat, Myotis lucifugus. Ph.D. thesis,
Department of Biology, Carleton University, Ottawa, Ontario.

BROWN, J. A. 1983. A comparative study of behavioural ontogeny in four
species of centrarchid fish. Ph.D. thesis, Department of Biology,
Queen's University, Kingston, Ontario.

CAVALCANTI, R. B. 1981. Nest desertion: Theory and tests of its adaptive
significance in birds. Ph.D. thesis, Department of Biology, McGill
University, Montreal, P.Q.

FULLARD, J. H. 1979. Auditory components in the defensive behaviour of
certain tympanate moths. Ph.D. thesis, Department of Biology, Carleton
University, Ottawa, Ontario.

GOTCEITAS, V. 1987. Microhabitat selection by bluegills (Lepomis
macrrochirus) avoiding predation. Ph.D. thesis, Department of Biology,
Queen's University, Kingston, Ontario.

strategies in sunfishes (Lepomis: Centrarchidae). Ph.D. thesis,
Department of Biology, Univ. of Utah.

LONKER, S. 1979. Conditions of metamorphism in high grade pelites from the
Frontenac Axis, Ontario, Canada, calculated from experimental and
theoretical equilibria. Ph.D. thesis, Department of Geological Sciences,
Harvard Univ.

STUDD, M.V. 1987. Alternative strategies of allocation of reproductive
effort in Yellow Warblers. Ph.D. thesis, Department of Biology, Queen's
University, Kingston, Ontario.

Department of Biology, Queen's University, Kingston, Ontario.

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