INTRODUCTION

Queen's University Biological Station continues to be an active teaching/research facility. Serving as a site for field courses, workshops, field trips and providing research facilities and accommodations, the Station plays an important role in teaching and research programs at Queen's and several other Universities. In 1982, research numbers averaged 34, our highest level in the history of the Station, surpassing even 1980 at 33. This high level of activity presents some logistical problems, but ultimately assures the survival of the Station as a viable facility.

A "Visiting Field Scientist" program was initiated in 1982 with the help of funding support from Queen's School of Graduate Studies and Research. Dr. John Alcock, Arizona State University, was our first guest in what we hope will be a continuing program. The Visiting Field Scientist seminar series, and John Alcock's involvement at QUBS, are described later in this report.

In 1982, there were 6 field courses offered under the auspices of the Ontario Universities Program in Field Biology. These are detailed in Table 1. For completeness, Tables 2 and 3 list the remainder of the modules in the OUPFB program in 1982. In addition, the Naturalist Workshop was held at the beginning of June. Although we had planned to offer several weekend workshops, as we had in 1981, all were cancelled because of low enrolment. The reasons for this are unclear, but we were unable to offer students financial assistance this year and some problems with scheduling were apparent. Perhaps next year the weekend workshops will resume and revitalize if we can overcome the inherent difficulties.

Resumes of research are presented in the following pages of this report and an overall summary of research use appears in Table 4. A list of visitors is appended to Table 4. Groups making use of the Station in 1982 are listed in Table 5. For the third time, the Station hosted the Queen's-Ottawa Physiology Conference. It would appear that this will now be an annual event at QUBS.

Our second instalment of the Community Newsletter was delivered to residents in Chaffey's Lock and Elgin and adjacent areas. Serving to keep the local people informed of events and research at the Station, feedback from local residents has been favourable. Our annual Open House was advertised in this year's Newsletter and in many of the Rideau Canal events publications. The Open House was held much later than usual, on the August 1st long weekend, in conjunction with many other local events to commemorate the 150th anniversary of the Rideau Canal. To judge from the attendance, our Open House was a resounding success, with over 400 visitors touring the facilities and displays. Many thanks to the Station Regulars for putting together a fine program.
As our first Visiting Field Scientist, John Alcock presented 6 seminars on his work with insect ecology and behaviour, lending a real spark to the summer's seminar series. Lorne Wolfe organized the 1982 seminar schedule outlined in Table 6. Interest in the seminars was high and we hope to be able to offer such a varied program in 1983.

When use of the Station is at high levels our part-time staff play an important role in the effective operation of the Station. Jim Complak, as managerial assistant was invaluable in day-to-day operations. Our food service staff, Liz Ford and Bev Amundrud showed their skill at cost-effective kitchen management and, more importantly, prepared delicious, imaginative menus throughout the summer. Alain Ouellet and Douglas Harnsen, our poorly paid (unpaid?) help assisted with many important but all-too-often-invisible-except-to-the-discerning-eye projects. To all of these people the Station owes a great deal. Thank you.

In 1982, renovations were completed to Dr. Keast's cottage. A new cabin was erected on the site of old cabin #11, a victim of the tornado of 1978. This new cabin #11 should be completed for summer 1983. To provide additional, immediate lab space and, in the long run, a year-round laboratory, work commenced in the basement of the White House to provide lab space and storage. Renovations were made to the Kitchen in Earl cottage. The Boathouse, sagging on poor foundations was jacked up and levelled. Quite a bit more effort will be needed on this over time, but a start has been made. Refacing the docks with concrete helps stabilize the Boathouse substructure. Another dock section was completed this fall. The final section should be refaced in 1983. Because of all the assistants to the manager this year, the Lodge, Trilab, Boathouse, Cabin #8 the Shaker and trim on Earl Cottage were painted. By mid-summer, Station residents were treated to a proper facelift - many of the buildings had never looked better.

Some Station residents had their love of sport rub off on everyone, resulting in weekly slow-pitch baseball games at the diamond in Elgin. These games were immensely popular and enjoyable, providing another means of keeping our Regulars a close group. Hopefully, this recreation program will be continued in 1983.

As an appendix to this report, we are publishing a list of theses based on work done at QUUBS. We would like to keep a complete file of these in our library. Make sure that you make sufficient copies of the current theses to send us a copy. If you notice errors or omissions in the attached list, please let us know. These lists will be updated annually and we plan to publish updated lists every 5 years.

The fee schedule for 1983 appears in Table 7.

Best wishes to all for 1983.
The Visiting Field Scientist Program was initiated in 1982 as a means of bringing to QUBS an established researcher in some area of field biology. The objective of this program is to provide intellectual stimulation and an introduction of new ideas through a combination of seminars and interaction with students in the field on their own or on the visitor's project.

Dr. John Alcock, Arizona State University at Tempe, was our first Visiting Field Scientist. John and his family, Sue, Joey and Nicky, were in residence from 1-20 July.

John is widely known for his widely used textbook, Animal Behavior, An Evolutionary Approach, and for his work on mating systems in insects. While at the Station, he presented a series of 6 seminars on evolution, sexual selection, and insect mating systems (see seminar list), and conducted a field study on mate guarding in the damselfly, Calopteryx maculata (see research resumes). Everyone enjoyed the seminars, and many of the residents spent some time with John in the field, becoming impressed with the advantages and opportunities for work on insect behaviour.

The success of our first Visiting Field Scientist program has encouraged us to continue this as a regular program. Dr. Lew Oring, University of North Dakota, known for his work on mating systems in birds, has been invited to be our Visitor for 1983. Lew has expressed an interest in working on pollination ecology with Bob Montgomery, and interacting with the various 'bird people' with whom he shares a common interest.

Queen's School of Graduate Studies and Research generously contributed to funding this program in 1982, and it is hoped funding will continue for 1983.
The main, week-long workshop was held at the beginning of June, in mixed weather. This year we had 15 attendants. Since we could not subsidize student registrations this year, no students attended, but we had 5 independent registrants including some welcome old faces, Ed Medhurst, Marylee Stephenson and Robert Martin. Parks Canada (Georgian Bay Islands and St. Lawrence Islands), Ontario Ministry of Natural Resources (Murphy's Point and Wawa), Ganaraska Forest Centre and 2 school boards were represented.

The programme was varied and, as always, interesting. Dr. I. Brodo (National Museum - Ottawa) and his Graduate Student Sharon Gowan ran a very successful, day-long session on lichen identification. A special thanks to them. We should also like to thank the insect hunters, Dr. Al Downe, Dorothy Young and crew, the plant pressers, Dr. Jim Pringle (Royal Botanical Gardens) and Dr. J. Michael Bristow, the birders Dr. Raleigh Robertson and Dr. Ron Wypkema (keen emphasis on recognition of songs, tweets, peeps and decent songs) and the general assistance of Dr. Gary Bell, Frank Phelan and Jim Complak.

The weekend workshops all had to be cancelled. Marylee Stephenson's photographic workshop will be slated again for summer 1983. Our thanks to other weekend leaders, including Dr. Paul and Cathy Keddy (Univ. of Guelph), whom we hope to invite again. If you have suggestions for module topics you would be interested in, please let us know so we can plan an effective programme for 1983.
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<tr>
<th>Module Topic</th>
<th>Professor &amp; Affiliation</th>
<th>Dates</th>
<th>Credit per Student</th>
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<th>Carleton</th>
<th>York</th>
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<th>Other</th>
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TABLE 2: Summary of course credits in the Ontario Universities Program in Field Biology earned at Locations other than QUFS in 1982.

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ABSTRACTS OF RESEARCH CONDUCTED AT QUBS 1982.
I: RESEARCH BY QUEEN'S UNIVERSITY STUDENTS AND STAFF

DR. P.W. COLGAN

"Field Ethology of Centrarchid Fishes"

A Federal Student Summer Employment grant to P.W.C. and Dr. J.A. Keast enabled hiring of five students to study the spawning grounds and young fish production in the Gananoque and Rideau watershed systems, and behavioural adaptations of young Largemouth Bass. The work was linked to the thesis research of J. Brown, L. Deacon and S. Orsatti and included surveys of the distribution of spawning grounds and spawning densities of major species, detailed breeding site examination in Upper and Lower Beverley Lakes, consideration of habitat utilization and growth of young-of-the-year fish, water chemistry analysis of the Gananoque watershed and experiments of behavioural ontogeny and predation pressure and predator efficiency of young-of-the-year Largemouth Bass. A report has summarized this work.

Assistants: Mary Anne Domarchuk, Vic Nishi, Tracy Oliver, Rob Snetsinger, Sue Wood

Joseph A. Brown - "Aspects of Parental Care and Behavioural Ontogeny in some Centrarchid Fish". Ph.D. thesis.

This past summer was largely spent analyzing and writing my thesis which will be submitted and defended by the time you read this. However, research was continued on a number of fronts including parental care and selected aspects of the behavioural ontogeny of some Centrarchid species. Data on the ontogeny of predator avoidance in Pumpkinseed sunfish (Lepomis gibbosus) in their first three weeks of free-swimming were collected. Analysis of these data together with data collected the previous summer supports the prediction that the ontogeny of predator avoidance in a species lacking extended parental care will be complete compared to species with extended parental care. This hypothesis had been generated from previous work on the ontogeny of this behaviour in Rock Bass (Ambloplites rupestris) and Largemouth Bass (Micropterus salmoides), a species with extended parental care. Other laboratory projects centered on determining the role of fry size in the ontogeny of feeding and social aggressive behaviours in
Pumpkinseeds and Largemouth Bass fry. The results of these studies will provide information which will be used to ascertain the relative importance of size and age in the onset and expression of these two behaviours.

Field projects included a continuation of a study on the economy of nest defense in some Centrarchid fish as well as an initiation of a project comparing parental care activities of male Black Crappie (Pomoxis nigromaculatus) and male Largemouth Bass. This latter project will test some of the predictions of Carlisle's model (Anim. Beh., 1982) on the allocation of parental care in variable environments.

Assistants: Vic Nishi, Rob Snetsinger


The effects of sublethal acid levels on the behaviour of young-of-the-year Largemouth Bass were examined. Bass were exposed to four pH levels: 3.8, 4.8, 6.0 and 7.2 for a total of 60 days. During the first 30 days of exposure, frequency data of feeding behaviours (orientations, bites), comfort movements (yawns, coughs, body bends, chases) and social behaviours (attack, chase, flee, bite, butt, threat) were collected, as well as a time budget of time spent foraging, swimming and hovering.

The final 30 days, predator efficiency was evaluated weekly using live fish prey. A variety of parameters were measured. These included: strikes, captures, escapes, times of behaviours and prey size. Throughout the acid exposure, growth rates at the four pH levels were recorded (lengths and weights).

Assistants: Vic Nishi, Rob Snetsinger

The dragonfly *Nannothemis bella* is a sexually dimorphic species found exclusively in bog habitats in this region. Though males have a body length of only 18mm, they vigorously defend individual areas ranging from 0.03 sq.m. to 7.98 sq.m. These territories exist over water of bog pools as well as over mat vegetation. Field work carried out from June to August 1982 concerned two topics: The first involved the ability of a previous resident to regain his territory after removal and reintroduction; The second concerned establishment of a field colony under experimental conditions reflecting natural habitat.

Research conducted during the summer of 1982 was a continuation of studies begun by F. Connor and F. Phelan in the summer of 1980. A method was developed for holding a resident removed from his territory and for reintroducing him to that territory after varied periods of time. Observations were made on whether the male did or did not regain his territory, time required to accomplish this, and behavioural acts involved in the process. Data were also collected on the tendency of males to localize around artificial pools inside a large screened enclosure in an open field. The behaviour of marked males within the cage was documented in the hope that a field colony could be established for more closely controlled experimental manipulations of male territorial activity.

DR. A. CROWDER and DR. R. HARMSEN

"Successional Sequences and Community Structure"


In summer 1982, the succession project entered its eighth year. We continued with bi-weekly collections of the insect fauna and bi-annual recording of the vegetation in the plots. The most dramatic change observed over the past eight years was the outbreak of *Trirhabda*.

A population of the Chrysomelid beetle (*Trirhabda virgata* Le Conte) reached such a high density between 1976 and 1978 that the Goldenrod population in one field was almost eliminated. The general effect of this insect was to reverse the normal successional sequence from a community dominated by perennial forbs to one dominated by grasses and annuals. The effect of the beetle was not as severe in
those plots that had been treated with an insecticide since 1979.

A previously undescribed egg parasite Tetrastichus sp. (Hymenoptera: Eulophidae) of Trirhabda was found. This egg parasite may have an important influence on the population dynamics of Trirhabda.


DR. J.A. KEAST

"Field Ethology of Centrarchid Fishes" - see resume under Colgan

Lois Deacon - "Habitat Utilization, Reproduction and Growth of Sunfish in two Lakes". M.Sc. thesis

Work this season concentrated on quantifying habitat use by nest-building Centrarchids in two lakes of differing physical, chemical and biological backgrounds. A wide variety of possible spawning sites were available to Pumpkinseed, Bluegill and Rock Bass in both Upper and Lower Beverley Lakes, situated near Delta, Ontario. The observed distribution of nests appeared to be non-random. Preference was shown for areas low in silt and/or organic content. Limited availability of this type of habitat in one lake is being examined as a possible cause of observed nesting patterns.

Preliminary analysis of growth and maturation rates indicate that although growth rates differ in the two populations, age of first maturity is similar. Implications with respect to 1) fecundity and 2) which males actually nest successfully, are being considered.

Assistant: Kathleen Lisk


Work at QUBS during September included collection of
fish for laboratory experiments, snorkel observations of tagged fish adjacent to the station to determine activity patterns and laboratory examination of fish diets. Netting for fish as well as minnow trapping was performed at six sites in the lake.

Next season, investigation will begin in earnest on fish abundance and available prey and the effect of water temperature and oxygen concentration on feeding activities, time budget studies to determine seasonal changes in feeding behaviour and habitat use and physiological and behavioural experiments in controlled environments.

DR. R.D. MONTGOMERIE

"Pollination Ecology of Spring Woodland Herbs".

In 1982, we completed three different studies on spring wildflowers that are visited by bumblebees and/or hummingbirds and we are now beginning to write these up as follows:

(1) Phenology and Seed Set in *Dicentra cucullaria*.

We examined the relative seed set in early, middle and late-blooming flowers of Dutchman's Breeches as a test of Thomson's (1980 Ecology 61:572-579) hypothesis on the shapes of flowering phenologies. *Dicentra* is a particularly good species for this kind of study because each plant produces many flowers and flowers can be late within a plant yet still relatively early in the short flowering season. Thus, problems of comparison among plants in different environments are lessened. *Dicentra* nectar is also robbed by *Bombus terricola* who do not pollinate and we will again be examining the consequences of this "floral larceny" in 1983. We also discovered considerable seed abortion which we think is due to inbred pollen and a critical analysis of this pattern will form a major part of research in April/May 1983.

(2) The Advantages of Clumping in *Sanguinaria canadensis* L.

We looked at the relationship between patch size and seed set in Bloodroot and tested the hypothesis that larger clumps attracted more pollinators. We also controlled for plant size, distance to neighbouring clumps and within-clump dispersion patterns. The advantages of increased seed set in larger patches are enhanced by the fact that many clumps are clones.

(3) Optimal Outcrossing in *Aquilegia canadensis* L.

Columbine is a hummingbird and bumblebee pollinated
plant that has a relatively long flowering season during which it produces many flowers. We did reciprocal crosses of plants up to 5 km apart to test the hypothesis that there is a best pollen transfer distance to maximize fitness (seed set and germination, in this case). Unfortunately, we know little about the genetic neighbourhood size in Aquilegia, but our experimental design should have encompassed a range of pollen transfer distances from well-inside to well-outside the normal distances that birds and bees would transfer pollen.

"Bumblebee Foraging Behaviour and Competition"

Using enclosures I began to examine the resource partitioning and competitive interactions among Bombus in the vicinity of Lake Opinicon. Pam Mirehouse latched onto one aspect of this work for her B.Sc. thesis (see below). In 1983, I will continue to examine pair-wise interactions between species in different competitive environments.

"Adaptive Significance of Inflorescence Architecture"

In this study I am examining the effects of floret density, floret dispersion, nectar dispersion and nectar availability on the ability of both hummingbirds and bumblebees to handle inflorescences efficiently. This is a long-term project in which we examine different aspects of inflorescence design each year. In the fall of 1982, Mary Anne Domarchuk did her B.Sc. thesis on the effects of nectar predictability on the foraging behaviour of hummingbirds in the lab (see below).

Assistant: Pam Mirehouse


Pamela Mirehouse - "Individual Foraging Strategies in Two Bumblebee Species (Bombus fervidus and B. rufocinctus)". B.Sc. thesis.

During the month of August, I set up two observation bumblebee colonies on the New Land near the R.L.A. road entrance. These colonies contained individually marked bees that had been previously weighed and measured. One colony contained about 60 Bombus fervidus workers, a long-tongued species and the other colony contained about 90 short-tongued Bombus rufocinctus workers. These colonies
were observed during good weather by sitting at the colony entrance and recording the bees' activities (times of entering and leaving the colony, pollen and nectar collections and basic natural history observations). Each time a bee entered the colony carrying pollen loads, one entire load (pollen basket) was removed and saved for later analysis. In the laboratory, these pollen loads were examined under a microscope. The first 300 grains looked at from each load were identified to give ratios of the various plant pollens that the bee collected. These data will provide insight into individual bee foraging strategies including seasonal, daily and hourly trends. Both species will be compared at individual and colony levels.


I am studying the foraging behaviour of Ruby-throated Hummingbirds to determine how the birds behave if given a choice between alternatives of nectar availability in artificial inflorescences. The experiments involve choices between constant vs. variable and predictable vs. unpredictable situations. The choices made by the birds are analysed in terms of the energetic costs and benefits of foraging on the different flower types presented to them. The degree of risk involved in choosing between the various conditions will be taken into consideration. Determining the birds' preferences for specific arrangements is the ultimate goal of the project. This information will then be related to strategies employed by plants to encourage "desired" pollen movements. The study was carried out using five birds captured at QUBS in August 1982.

DR. R.J. ROBERTSON

"Selective Forces and the Evolution of Breeding Strategies in Birds"

Our field program focussed on the M.Sc. and B.Sc. projects outlined below. In addition, the long-term aspects of the Tree Swallow study were continued in an effort to determine the factors responsible for the uniform dispersion pattern and the relationship between habitat and nesting success. Continuing work will focus on the occurrence of first year females breeding in relation to nest density and
habitat. Boxes in the Northeast Sanctuary are being monitored in this part of the study.

Assistant: Lesley Cameron

Publications and Theses:


Andrew Hurly - "Female Competition in Red-winged Blackbirds". M.Sc. thesis

Previous studies concerning sexual selection and reproductive success in Red-winged Blackbirds have concentrated on the effects of male and/or territory quality in determining harem size. I have investigated the importance of female-female aggression to the reproductive strategy of female Redwings.

During early May I completed a few model experiments and collected data concerning vocal interactions between females. The rest of the summer was spent analyzing and writing. The thesis was defended in December 1982.

Female Red-winged Blackbirds exhibit a well developed system of aggressive social interactions. Removal experiments indicated that aggressive and territorial behaviours were effective in deterring further recruitment
into harems. The results of model experiments indicated that highly aggressive females were capable of maintaining monogamous status with their mates and experienced a high reproductive success. Less aggressive polygynous females experienced increased nestling starvation and predation.


Kevin Teather - "Breeding Strategies of Male and Female Brown-headed Cowbirds at Lake Opinicon". M.Sc. thesis.

The 1982 field season marked the completion of an investigation of the social organization and breeding strategies of the Brown-headed Cowbird. The main questions asked were:

1) Are cowbirds monogamous?

2) Are females territorial? If so, to what extent does this territorial behaviour exclude other females from an area?

3) What is the relationship between male bowing contests and dominance among males?

It appears that Cowbirds, at least in the Lake Opinicon area, are not strictly monogamous. Of the three resident males in 1982, one was mated to three females, another to at least two, while the third was mated monogamously. In 1981, one male was bigamously mated, two others were monogamous, while the number of mates a fourth had was uncertain.

Females, at times, were aggressive toward other females. However, a female who is very aggressive one day, may, under similar circumstances, show no aggression a few days later. It is possible that females do not defend a large area but are aggressive to other females only when in laying condition. This is supported by evidence indicating a large degree of overlap among female ranges and would explain the unpredictability of aggressive encounters.

It appears that males use bowing contests to set up a dominance hierarchy. Mark Brigham worked on this aspect of Cowbird behaviour for his B.Sc. thesis.

Assistant: Mark Brigham

This study was designed to examine the variety of bowing displays given by males and the contexts in which these occur. It appears that these displays are important in dominance interactions, clearly delineating dominance, while avoiding direct contact between males in a contest.

Mark Burgham - "Breeding Biology of the Eastern Kingbirds of Lake Opinicon".

Observations of nesting Kingbirds in the summer of 1982 is being used in the development of a new model of the adaptive significance of mobbing behaviour in nest defense. Other work formed part of an ongoing study of nesting success in relation to nest placement in Kingbirds. Data were recorded on the reproductive success of all breeding pairs, water loss and density of eggs and growth rates of nestlings. Nests were tagged and all chicks were banded. A few adults were colour banded for future identification. A promising new method of capture of adult birds was developed.


During the summer of 1982, I collected data on two aspects of Tree Swallow reproductive behaviour. The first concerned mate-guarding. To determine if mate-guarding occurred, I monitored the amount of time spent by the members of a pair together and alone at the nest box, both within and outside of the female's fertile period. The second part concerned division of labour with respect to the feeding of the young. By monitoring feeding rates of both natural and manipulated broods, I hoped to determine how male and female participation in feeding is regulated by brood size.

Assistant: Harold Fife


I studied breeding populations of Yellow Warblers
(Dendroica petechia) and Common Yellowthroats (Geothlypis trichas) in the area of the Station as part of a study of the role of sexual selection in the evolution of sexual dimorphism in monogamous species. The former species is only slightly dimorphic, while the latter has highly dimorphic plumage patterns, yet both species are monogamous. Within the closely related group of warbler species, a continuum of degree of sexual dimorphism in plumage exists. I was testing the hypothesis that pronounced sexual dimorphism has evolved in those species in which there has been a higher level of intermale competition for territories or mates and a lower level of relative parental investment by males. This hypothesis is commonly advanced as an explanation for the sexual dimorphism seen in polygynous species of birds. I was testing its value as an explanation for the variation seen in monogamous species.

My results generally supported the above hypothesis. Yellowthroats responded much more aggressively to presentations of model conspecifics accompanied by playback than did Yellow Warbler males. Pre-nesting time budget observations suggest the male Yellowthroats defend much larger territories, are challenged more often by other males and that a large floater population of males may be excluded from the breeding population. During incubation and nestling development, differences between the two species were not as clear. However, unlike male Yellowthroats, male Yellow Warblers were attentive at the nest and often fed the female during incubation. Snake presentations were made to measure the intensity of nest defense by males, but the results were inconclusive when the species were compared.

Assistants: Harold Fife, Jackie Studd

Martha Capreol - "Effect of Nest Structure and Nest Insulation on the Temperature Dynamics of Tree Swallow Nests". B.Sc. thesis.

DR. D. TURPIN

"Physiological Aspects of Limnology".

This summer, I looked at carbon fixation rates of mixed assemblages of phytoplankton in Lake Opinicon, comparing the rates measured in the samples and other samples with added phosphate, nitrate and silicon dioxide. Ultimately, an indication of the extent of nutrient limitation in natural assemblages of phytoplankton will be obtained.
II: RESEARCH BY NON-QUEEN'S STUDENTS AND STAFF

DR. J. ALCOCK - Dept. of Zoology, Arizona State University

"A Study of Mate-guarding in the Damselfly Calopteryx maculata"

This study attempted to determine if males regularly guard females other than those with whom they had mated. Although this does occur under some conditions, males very rarely copulate a second time in a day with a previous mate, whereas they do respond sexually to new arrivals on their territories, sometimes even when guarding previous mates. The interchange of signals between territory owners and arriving females leads males to copulate primarily with new partners.

DR. SPENCER BARRETT - Dept. of Botany, University of Toronto

Lorne Wolfe - Dept. of Botany, University of Toronto

"Pollination Ecology of Tristyous Pontederia cordata". M.Sc. thesis

Tristyly is a genetically controlled floral polymorphism which promotes outcrossing in flowering plants. Populations of tristyly species contain three floral morphs which differ in style length, anther height and pollen size. The fact that three different sized pollen grains are produced within one population enables a direct measure of pollen dispersal. While tristyly is a rare plant breeding system, Pontederia cordata (Pickerelweed) is one such plant which is a relatively common inhabitant of wetlands in the QUBS area.

Pontederia cordata's spikate inflorescences produce approximately 200 one-day blue flowers over their two week period of flowering. Populations flower from early July until mid-September. My thesis is concerned with quantifying pollen transfer within and between inflorescences and studying various parameters associated with the pollination process of P. cordata. Field work was conducted in Pothole Lake.
1) Patterns of Pollen Transfer

Some of the questions addressed in this section were: What is the composition (proportion selfed or outcrossed) of the pollen load deposited on a stigma after one pollinator's visit? Do different pollinator species vary in their deposition effectiveness? How do successive flowers differ in their probability of receiving selfed or outcrossed pollen?

2) Pollinator Ecology

Flowers of *Pontederia cordata* were visited primarily by bumblebees and other Hymenoptera. The most common early season visitors were *Bombus pennsylvanicus* queens and *B. bimaculatus* workers while *B. vagans* and *Apis mellifera* were dominant in the later stages of flowering. The number of pollinator species and density of individuals peaked in the first week of August. Bees foraged in a relatively predictable manner, arriving near the bottom of an inflorescence and then moving upward until departing. Most flights were to nearest neighbouring inflorescences. These insects were found to be sensitive to nectar volume. The mean duration of floral visits was significantly longer in nectar enriched flowers.

3) Some Aspects of the Reproductive Biology of *Pontederia cordata*

Four cohorts of 30 inflorescences were followed sequentially through the flowering season to determine if reproductive success (% seed set) varied over time. Percent seed set increased from cohort 1 (early season) to cohort 3 (mid-season) and then dropped dramatically in cohort 4 (late season). I believe the low temperatures of August were responsible for the drop in seed set in cohort 4.

A controlled experiment was performed in a greenhouse built on the QUBS property to test the hypothesis that the sequence of application of legitimate and illegitimate pollen grains on stigmas affects seed set. The idea here is that illegitimate grains may clog the stigmatic surface thus acting as a barrier to legitimate pollen tubes advancing down the style. The data indicate that there is an effect of pollen type application sequence. Seed set was greater when legitimate pollen was placed on stigmas before illegitimate compared to the reciprocal test.
DR. I. BAYLY - Dept. of Biology, Carleton University

Eleanor Bottomley - Dept. of Biology, Carleton University

"Seasonal and Aquatic Macrophyte Influences on Pore-water Phosphate Concentrations in a Littoral Sediment". M.Sc. thesis

Sampling conducted in May and June 1982 concluded a project begun in May 1981 in which the effect of Milfoil (Myriophyllum spicatum) on pore-water phosphate concentrations was examined. Pore-water concentration gradients of phosphate varied seasonally, with summer profiles (1981) exhibiting a dissolved phosphate maximum at 10-16 cm sediment depth. This maximum occurs deeper in the profile in samples collected in early spring (1982).

Pore-water concentrations of phosphate were significantly depleted within the Milfoil weedbed sediments at rooting depth relative to concentrations in an area of sediment denuded of Milfoil. Concentration gradients of phosphate surrounding the root zone of individual plants indicated that phosphate is taken up on a horizontal radius of 20 cm around the root crown, and vertically to about 50 cm deep in the sediment. The fate of the phosphorus taken up by Milfoil roots is probably translocation to the shoots and eventual release to the overlying water upon death of the shoot. This suggests that the weedbed acts as a source of phosphorus to the overlying water rather than as a sink, at least for part of the year.

Assistant: Dave Omond

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DR. G. BELL - Department of Biology, McGill University

Richard Norman - Department of Biology, McGill University

"Sexual Selection in Nannothemis bella"

In 1982, I found answers to two questions about the behaviour of Nannothemis bella that had puzzled me since 1976. First, why do males marked with red paint aggregate non-randomly along the edge of the bog shrub zone and second, why do females mate preferentially with red marked
males when they establish a central territory? The formulation of these questions came about gradually over a period of three years. My first introduction to the Little Bog Dragonfly was in 1973 while accompanying Adrian Forsyth and Phil Ward to their study areas in Hebert and Westport Bogs. Observations in 1973 and the following year in bogs in the Rideau Lakes area piqued my interest in the extraordinary degree of sexual dimorphism of this species. Finally, in 1975, Floyd Connor identified the Little Bog Dragonfly as belonging to the little studied monotypic genus Nannothemis. After completing Floyd's dragonfly ecology course, and being introduced to Campanella and Wolf's study of lekking behaviour in Plathemis lydia, I was convinced that Nannothemis offered outstanding research possibilities. Research conducted from 1975 to 1979 confirmed that Nannothemis was not a lekking species, but rather more conventional in its territorial spacing system. But, I was at a loss to explain why red marked males behaved so differently than males marked with blue, green or yellow.

A possible explanation of the peculiar behaviours associated with red marking occurred to me during Dr. W.D. Hamilton's memorable address to the June ESS conference at Queen's. The crucial proposition was Hamilton's agreement with Zahavi's handicap principle and his subsequent exploration of the importance of parasitism as a handicapping effect. In Nannothemis, red marked males enjoy a female preference and parasitism in this species is primarily by highly visible red mites. Hamilton's line of argument suggested to me that females might prefer red marked males (and males heavily loaded with red mites as noted in the summers of 1976, 1978 and 1979) because these males represent (or are) handicapped individuals of superior quality by virtue of being able to win and hold a central territory despite the cost of being parasitized. This hypothesis was corroborated indirectly by observations collected in 1977 which suggest that males with heavy mite loads are 1) significantly disadvantaged in fights with unparasitized males, 2) have lower success at reestablishing their tenure when removed from their territory, and 3) normally occupy territories for fewer days than unparasitized males. Nevertheless, it was necessary to demonstrate that mite parasitism confers a metabolic cost before accepting Zahavi's principle as an explanation of female choice in Nannothemis.

Hence, my 1982 research focussed on mite parasitism. Individuals of both sexes collected at Westport, Hebert and a small newly-discovered bog at the South-west end of Upper Rock Lake were scored for mite loading and weighed in the laboratory. Statistical analysis revealed a significant sex-specific negative correlation between an individual's weight and number of mites carried by it, indicating that
post-emergence weight gain is limited by mite parasitism. Moreover, males with territories on the primary mating areas such as pools and small inlets showed lower frequency and intensity of mite infestation than did satellite males. Females were found to be parasitized much less frequently and less intensely than males. It is difficult to explain such sex-specificity since Frank Phelan and Floyd Connor's research has shown that females do not seem to emerge at different microsites than males. I suggest that the most plausible explanation is that females engage in some sort of grooming behaviour to remove mites and eliminate the associated costs that would reduce egg production (egg clusters from unparasitized females averaged 34.2 eggs, whereas those from parasitized females averaged 19 eggs).

In 1983, my research will centre on parthenogenetic populations of Nannothemis discovered in the smaller pool at Portland Bog and at two isolated bogs near Hart and Connell Lakes. My efforts will be directed at estimating population sizes (which seem to cycle wildly) and completing a morphological study (colouration is predominantly female-like with some male pigmentation on the thorax).

"Floral Ecology of Hairy Beardtongue (Penstemon hirsutus).

In 1982, I started a pilot study on the insect inquilines of this 'scroph'. The generic epithet of this flower means literally '5 stamens' and the sterile fifth stamen, an important characteristic of the genus, is modified into a fine brushlike structure that functions to dislodge pollen transported by insect visitors. However, hirsutus is not exclusively cross-pollinated and its self-fertilizing ability may be important because of the considerable amount of corolla destruction caused by various floral herbivores. One of these, a small Syrphid fly larva pointed out to me by Adrian Forsyth, resides inside the flower, probing the ovarian tissue for sustenance. In past summers, I have found it to be the more predominant floral herbivore. This past summer, I did a more extensive survey and found five other species, mostly Lepidoptera and some which prey upon the Syrphid larva. Most of these leps feed inside the corolla causing it to wither, moving on to a new unopened flower and entering by a small hole after consuming the ovaries of the previous bloom. However, in one species, found at Upper Rock Lake, the caterpillar, which must feed externally because of its size, displays a remarkable body colour that is perfectly camouflaged with the flower's mauve-rose corolla. Research in 1983 will be on the life histories of these insects.

Publications:


DR. D. BOUCHER — Department of Biology, McGill University.

Julie Cartier — Department of Biology, McGill University


Self-fertilization is considered as a more economical and efficient breeding system than outcrossing. Why then is outcrossing maintained in highly self-compatible species? Heterosis or the selective advantage of an outcrossed progeny over its selfed siblings is well known to plant breeders as an obvious short-term advantage of outcrossing. This phenomenon has been reported extensively in normally outcrossing species. It appears that heterosis is not so evident in usually self-fertilizing species.

The purpose of my work is to investigate heterosis in the highly self-fertile *Corydalis sempervirens*. Individuals of this species can produce their full seed complement by selfing alone (Cartier, 1981, M.Sc. thesis, Universite de Montreal). On the other hand, the flowers attract several pollinators thus providing opportunities for outcrossing.

*Corydalis sempervirens* is unusually abundant in localized patches around QUBS. In the summer of 1982, I manipulated flowers in such a way as to obtain selfed and outcrossed seeds from several individuals. Selfed seeds were obtained after bagging flower buds, outcrossed seeds after emasculation of flower buds followed by manual pollen transfer from a selected donor. In order to simulate natural pollination, most pollen donors were chosen as the nearest neighbour plant. However, some experiments consisted in varying the distance of the donor plant from a
few meters to several hundred kilometers.

Future laboratory work will consist in comparing the performance of the selfed and outcrossed progeny under different environmental conditions for several generations. I plan to return to QUBS in 1983 in order to establish some of the above comparisons under natural field conditions.

DR. J. FULLARD - Dept. of Zoology, Erindale College of U of T.

"Neuroethology of Arctiid Moths"

This summer was devoted to collecting and rearing a variety of moths for eventual testing in the laboratory.

Assistant: Morgan Hull

DR. S.E. Frey - Dept. of Biology, Indiana University

"Gamogenesis in Chydorid Cladocera in Ontario Lakes".

The high diversity of Chydorid Cladocera in the Lake Opinicon samples collected by Dr. D. G. Frey in September, as well as the presence of Chydrorus canadensis in the samples, was the stimulus for my visit to QUBS in October to collect Chydorid Cladocera during gamogenesis.

Most of the collections were within a short radius of the Station because of the abundance of lakes, ponds and marshes in the area. A two-day collecting trip was made to Algonquin Park, however, to sample the acid lakes and bogs along Hwy 60, for comparison with the Chydorid populations of the alkaline lakes of southern Ontario.

The males of Chydorids are morphologically distinct from the females, for example in the attenuation of the rostrum, in more highly developed antennules, modified postabdomens, and copulatory hooks on the first trunk limb, so that males are desirable, if not absolutely necessary, in the description of new species and for comparison with males of similar species from widely separated geographical areas.

The results of the sampling are summarized in the accompanying table.
New Occurrences

Males of Alona bicolor were collected for the first time in Tea Lake, Algonquin Park, while males of Chydorus canadensis were collected in abundance, albeit for the first time, in Lake Opinicon and Newboro Lake.

Males and ephippial females of Disparalona acutirostris, and of a new species of Alonella, as yet undescribed, were found for the first time in samples from Northern Wisconsin lakes in October 1981. Gamogenetic populations of both species were present in Algonquin Park lakes as well.

Particularly noteworthy was recovery of a Chydorus piger male from Devil Lake. This was the first that we have seen, despite extensive collections of this species in the fall of the year. It differs in a number of respects from illustrations in the literature, those of Lilljeborg (1900), Smirnov (1971) and Flössner (1972).

Chydorus canadensis was described by Chegalath and Hann (1981) from a sample collected in Frying Pan Bay, Beausoleil Island, Georgian Bay Islands National Park. Of 356 samples they collected in Ontario and across Canada in 1979, this was the only sample which contained C. canadensis. This species was found in 7 samples from the Rideau Lakes area and more intensive examination of the samples could yield more records. D.C. Frey has found this species in samples from Massachusetts and Hann (pers. comm.) reports collection of this species in the Windsor, Ontario area since publication of her paper in 1981, so that the known distribution of C. canadensis has expanded considerably in the past year.

Chydrorid Systematics

The accompanying table is only a tentative listing of the Chydrorid species from my samples. Few North American Chydrorid species have been studied and described definitively in the literature. Many of the names in common use are those of European species. One of the more obvious systematic problems concerns the genus Acroperus, an abundant Chydrorid in the Ontario samples. While only two spaces are allotted it in the table, at least four species are present in the samples with both males and females of the species resembling the European species Acroperus harpae, A. angustatus and A. alonoides. Chengalath and Hann, in their Survey of the Littoral Cladocera of Canada (1980), listed only A. harpae and A. alonoides, but noted that populations of A. harpae from different parts of the country showed great variability in size and development of the head keel, and thought it likely that more than one species was involved.
Chengalath and Hann also noted that A. barbulata was found mainly west of Ontario, but populations of a species resembling it were found in the Ontario samples and placed with A. cf. guttata in the table, a species it resembles, until they can be differentiated with certainty.

Genus Chydorus (cf. brevilabris), in 98% of the samples is listed as Chydorus spp. in the table, for there appeared to be more than one species in many of the samples.

Species Diversity

All of the acid lakes of Algonquin Park had high species diversity, all the more remarkable because of the adverse weather which shortened the sampling period and area sampled for many of the lakes. Tea Lake is particularly notable, not only for its diverse Chydorid fauna, but also for the sizable populations of many species.

The calcareous lakes of southern Ontario also exhibited high species diversity, except for Crow Lake, Wolfe Lake and Upper Rideau Lake which were severely affected by man, at least in the areas sampled. Trout Lake and Lake Kamaniskeg in northern Ontario also appeared degraded from man's activities and this was reflected in the low number of species and of total organisms found in the samples. Carson Lake, on the other side of the causeway, somewhat protected from the effluents affecting Trout Lake, had a significantly higher number of Chydorid species, but in low numbers. Construction was in progress (new hatchery facilities) at the only accessible site at White Lake and may have been responsible for the low diversity within that sample.

Lake Opinicon was sampled more intensively than any other lake, but the high diversity of this lake was independent of that factor, with all three sampling sites, QUBS, Darling's Bay and Telephone Bay, quite diverse habitats, yielding consistently high numbers of species.

The bogs and marshes sampled had low species diversity, but all except one had one or more species in considerable numbers.

Gamogenesis

The value of sampling many water bodies, large and small, in any given area, is apparent from the results, in that only by that type of sampling were strong gamogenetic populations obtained of nearly all the Chydorid species of the region.

Of the Chydorid species found in many lakes and in some abundance, only Chydorus piger and C. gibbus were conspicuous by their non-gamogenetic state. Pseudochydorus globosus appeared in 50% of samples and in Indian Lake in considerable numbers but was only weakly gamogenetic at 3
sites. One Oxyurella male was recovered from samples of Found Lake, but was rare in numbers and occurrence. Anchistropus was a strongly gamogenetic species and further examination of the samples may show that it was gamogenetic at all sites in which it occurred.

DR. M. R. GROSS - Dept. of Biol. Sci., Simon Fraser University

"Mating Systems and Life History Evolution in Fishes"

The 1982 field season involved a continuation of work on the evolution of alternative reproductive strategies in sunfishes. Films were made of the breeding success of cuckolders at nests of parental males in Bluegill sunfish. This is part of a project investigating how a fitness equilibrium is obtained between alternative mating types. The second major project was a breeding cross to determine the underlying genetics of cuckolder and parental life history tactics. The offspring from this cross are presently doing well at a State Hatchery in Illinois under the supervision of Dr. D. Philipps.

Assistant: Eric van den Berghe

Publications:


DR. R.S. MILLER - School of Forestry, Yale University

"Spatial Learning and Memory in Rubythroated Hummingbirds".

Research was conducted on the relative importance of
colour vs. position of artificial feeders in hummingbird feeding activity. A second experiment, which will be completed in spring of 1983, tested the effect of amount of nectar reward in artificial feeders on whether hummingbirds feed by hovering or perching.

DR. J. TOOHEY - Dept. of Medicine, University of California at Los Angeles.

"Fungus Rings in Soil"

As part of a continuing study, the known rings were checked in October. It was a better than average year for mushroom production and rings of 5 species had heavy crops of mushrooms.

DR. S. Vander KLOET - Dept. of Biology, Acadia University

"Demography of Pinus rigida and the Pollination and Reproductive Strategies of Vaccinium angustifolium and V. corymbosum".

Recently, I have shown that seed dispersal and seedling establishment of Vaccinium angustifolium markedly differs in Nova Scotia and Ontario. According to the evolutionary model based on the guessing game theory, blueberry populations from these two localities should have differing reproductive strategies. In Eastern Ontario, where very few seedlings have established themselves over the last 40 years, the few survivors should allocate more of their energy to non-sexual modes of reproduction. Nova Scotia populations, which reproduce readily from seed, should put more of their available energy into seed production.

To test this hypothesis, I have established trial plots at Lake Opinicon and Pictou County, N.S. Plants begun from seed in the greenhouse from both localities and headlands of Newfoundland have been transplanted in 12 replicated triplets to each locality and will be left in place for 5 years, during which time, rhizome growth and seed production will be monitored, and in this way, bring hard evidence for or against this evolutionary model.

After 5 years, plants set out in Nova Scotia,

The 50 tagged *V. corymbosum* plants in Hebert Bog have recovered somewhat from the 1980 cold snap. Although many of the older shoots died back, in most cases, several new shoots have emerged from the root crown; where the winter kill was not too severe, those shrubs bore moderate quantities of fruit in 1982.

DR. P. WEATHERHEAD - Dept. of Biology, Carleton University

"Factors Influencing Nest Defense in Passerines"

Nest defense behaviour of Song Sparrows (*Melospiza melodia*) was studied again in 1982. Two general objectives are being addressed in this study. The first, and that for which adequate data have now been collected, involves determining the importance of renesting potential within a breeding season on the risks parents take in defense of their nests. The second objective is to determine the importance of lifetime renesting potential in shaping nest defense behaviour. This component of the study requires the collection of data from marked individuals in at least two consecutive breeding seasons. Birds banded and studied in 1982 that return in 1983 will be the focus of next year's research on this topic.

Assistants: Sheila Macfie, Karyn Boak

"Territoriality as Paternity Protection"

The aim of this study is to determine the extent to which the dynamics of territoriality in male Song Sparrows reflects their changing vulnerability to cuckoldry. Although this study was initiated in 1981, a weakness in the original experimental design required that the study be modified and repeated in 1982. Preliminary analysis suggests that the modification was successful and that no further data collection will be required.

Assistants: Sheila Macfie, Karyn Boak

"Breeding Site Fidelity in Song Sparrows"
In conducting the two studies described above, an unusually high degree of movement between territories within a breeding season by both male and female Song Sparrows was detected. In 1982, particular attention was paid to these movements to determine the factors responsible for individuals changing territories. Further data will be collected in 1983.

Assistant: Sheila MacFie, Karyn Boak

"Non-random Sex Determination in Red-winged Blackbirds"

Having found non-random sex allocation patterns in Red-winged Blackbirds (*Agelaius phoeniceus*) with regard to when in the breeding season a nest was initiated in 1981, a new study was undertaken in 1982 to determine whether the sex of an egg was independent of its laying sequence or size. Two principal patterns emerged. In 3-egg clutches, first eggs were most often male and non-first eggs most often female, while the pattern was reversed in 4-egg clutches. Egg size increased with laying sequence in both 3- and 4-egg clutches but egg sex was independent of egg size. These results form the basis of a new study to be initiated in 1983 in Manitoba.

Assistant: Morgan Hull, Drew Hoysak, Mary Sean Kelley

"Energetics of Nest Cleaning in Tree Swallows"

As with many birds with altricial young, Tree Swallows (*Iridoprocne bicolor*) remove fecal sacs from the nest. Removal from the nest is presumably for the purposes of hygiene while transport of fecal sacs away from the nest is an antipredator behavior. Two general hypotheses were tested. Because fecal sac weight increases substantially with nestling age, the cost of transportation increases proportionately. As a test of "reverse central place foraging", drop distances were recorded for birds with different aged nestlings. The data suggest that, contrary to predictions, drop distance does not decrease significantly with nestling age.

The second aim of this study was to compare the strategies of birds nesting over water with those over land based on the assumption that water should be a much better medium in which to dispose of fecal sacs. Substantial differences in drop distances were found between birds in the two habitats and analysis is currently underway to determine whether the energetic savings so realized by birds nesting over water is adequate to account for their larger clutches.
Assistant: Drew Hoysak

"Black Rat Snake (Elaphe obsoleta) Behaviour and Ecology"

Improved funding (thanks to World Wildlife Fund - Canada) and superior telemetry equipment (thanks to Fred Anderka - CWS) in 1982 produced marked improvements in the quality and quantity of data yielded in this, the second year of the study. Seven snakes had transmitters implanted and were monitored for a combined total of over 600 snake-days. Overall success at locating snakes to the end of August was 91%. A solid data base was accumulated on habitat selection, temperature regulation and home range size. In addition to the telemetered snakes, 68 new snakes and 21 snakes marked last year were processed (marking and measuring). Next year will see the completion of the Lake Opinicon component of this study and the initiation of comparative data collection from other parts of the population’s range.

Assistant: Brent Charland (habitat selection data to be used for B.Sc. thesis), Mary Wilcox

"Avian Responses to Black Rat Snakes"

Egg and nestling losses to Black Rat Snakes by breeding birds in the Lake Opinicon area are substantial. To test the hypothesis that the birds contribute to the snakes' success at locating nests by responding to the snakes at an intensity proportional to the distance of the snake from the nest, a series of model tests (using live snakes) was conducted. Additional data analysis is required before a verdict can be rendered.

Assistant: Mary Wilcox

Publications:


<table>
<thead>
<tr>
<th>Project Supervisor</th>
<th>Project Title</th>
<th>Students and Affiliation</th>
<th>Residency</th>
</tr>
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<tbody>
<tr>
<td>Dr. P.W. Colgan and Dr. J.A. Keast (Queen's)</td>
<td>Field Ethology of Centrarchid Fishes</td>
<td>Mary Anne Domarchuk (Queen's)</td>
<td>May 3-Aug. 17, Sept. 5-11</td>
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<td>Vic Nishi (Queen's)</td>
<td>May 7-Sept. 10</td>
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<td>Rob Snetsinger (Queen's)</td>
<td>May 10-June 25, Occasional</td>
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<td>Sue Wood (Queen's)</td>
<td>May 21-Sept. 10</td>
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<tr>
<td>Dr. P.W. Colgan (Queen's)</td>
<td>Parental Care and Behavioural Ontogeny in Centrarchids</td>
<td>Joseph Brown (Queen's)</td>
<td>Occasional</td>
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<td></td>
<td>Acid Level Effects on Behaviour and Growth of Bass</td>
<td>Sandi Orsatti (Queen's)</td>
<td>May 19-24, May 31-June 25, July 12-21</td>
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<tr>
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<td>Behaviour of the Little Bog Dragonfly</td>
<td>Barb Hilder (Queen's)</td>
<td>May 1-Sept. 30</td>
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<tr>
<td>Dr. A. Crowder and Dr. R. Harmsen (Queen's)</td>
<td>Plant Succession and Phytophagous Insects</td>
<td>Heather McBrien (Queen's)</td>
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<td>Dr. J.A. Keast (Queen's)</td>
<td>Fish Communities</td>
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<td>May 14-Aug. 4</td>
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<td>Habitat Utilization, Reproduction and Growth of Sunfish</td>
<td>Lois Deacon (Queen's)</td>
<td>May 9-Aug. 1, Occasional</td>
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<td>Water Temperature and Foraging Activity</td>
<td>Kathleen Lisk (Queen's)</td>
<td>May 15-June 26</td>
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<td>David Booth (Queen's)</td>
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<td>Dr. R.D. Montgomerye</td>
<td>Pollination Ecology</td>
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<td>May 7-24, July 15-Aug. 27, Occasional</td>
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<td>(Queen's)</td>
<td>Foraging Strategies in Two Bumblebees</td>
<td>Pam Mirehouse (Queen's)</td>
<td>May 3-July 13, July 28-Aug. 31</td>
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<tr>
<td>Dr. R.J. Robertson</td>
<td>Breeding Strategies in Birds</td>
<td>Lesley Cameron</td>
<td>May 4-Aug. 12</td>
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<td>May 18-June 18, July 1-22</td>
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<tr>
<td>Cowbird Breeding</td>
<td></td>
<td>Kevin Teather (Queen's)</td>
<td>Apr. 10-Aug. 12, Sept. 8-11</td>
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<td>Strategies</td>
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<td>Bowing Displays of</td>
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<td>Mark Brigham (Queen's)</td>
<td>May 1-Aug. 24</td>
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<td>Male Cowbirds</td>
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<td>Andy Hurly (Queen's)</td>
<td>May 5-Aug. 20, Aug. 29-30</td>
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<td>Redwinged Blackbirds</td>
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<td>Dimorphism in Wood</td>
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<td>Mike Studd (Queen's)</td>
<td>May 1-Aug. 7</td>
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<td>Harold Fife (Queen's)</td>
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<td>Mark Burgham (Queen's)</td>
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<td>Dave Lefelaar (Queen's)</td>
<td>Apr. 14-Aug. 12</td>
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<td>in the Tree Swallow</td>
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<td>Martha Capreol (Queen's)</td>
<td>May 9-Aug. 27</td>
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<td>Dr. D. Turpin</td>
<td>Physiological Ecology of Phytoplankton</td>
<td>Ivor Elrifi (Queen's)</td>
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<td>Mating-Gurding in the Black Damsel Fly</td>
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<td>Dr. S. Barrett</td>
<td>Plant Pollination Ecology</td>
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<td>Pollination Ecology ofPickerelweed</td>
<td>Lorne Wolfe (U. of Toronto)</td>
<td>May 3-Sept. 11</td>
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<tr>
<td>Dr. I. Bayly</td>
<td>Nutrient Profiles in Milfoil weedbeds</td>
<td>Eleanor Bottomley (Carleton)</td>
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<td>Dr. D. Boucher</td>
<td>Heterosis in Corydalis</td>
<td>Julie Cartier (McGill)</td>
<td>May 18-19, May 28-June 5, June 9-23, June 29-July 14</td>
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<td>(U. of Toronto, Erindale)</td>
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<td>Dr. J. Fullard</td>
<td>Neuroethology of Arctiid Moths</td>
<td>Morgan Hull (Carleton)</td>
<td>May 18-27, June 15-25</td>
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<tr>
<td>Dr. S.E. Frey</td>
<td>Gamogenesis in Chyadorid Cladocera in Ontario Lakes</td>
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<td>Oct. 1-12</td>
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<td>(Indiana Univ.)</td>
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<td>Dr. M.R. Gross</td>
<td>Mating System and Life History Evolution in Fishes</td>
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<td>June 7-20, June 28-July 13</td>
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<tr>
<td>(Simon Fraser)</td>
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<td>Eric Vanden Berghe (Simon Fraser)</td>
<td>June 10-July 19</td>
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<td>Dr. R.S. Miller</td>
<td>Spatial Learning and Memory in Hummingbirds</td>
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<td>May 15-23, Aug. 15-30</td>
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<td>Apr. 19-23, Oct. 13-15</td>
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<td>Dr. S. Van der Kloet</td>
<td>Blueberry Reproductive Strategies</td>
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<td>Dr. P. Weatherhead</td>
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<td>Karyn Boak (Carleton)</td>
<td>May 1-Sept. 5</td>
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<td>Non-Random Sex Determination in Blackbirds</td>
<td>Drew Hoysak (Carleton)</td>
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<td>Mary Sean Kelley (Carleton)</td>
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<td>Black Rat Snakes</td>
<td>Brent Charland (Carleton)</td>
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<td>Mary Wilcox (Carleton)</td>
<td>May 1-July 10, July 22-Aug. 20</td>
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TABLE 4  PART 2

Documentation of research use for 1982 (April - 31 Aug.)

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<td>Keast</td>
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<td>Colgan</td>
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<td>Montgomerye</td>
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<td>Harmsen</td>
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<td>Turpin</td>
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<td>Fullard</td>
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<td>Simon Fraser:</td>
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<td>Gross</td>
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<td>Supervisor</td>
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<td>Arizona State U.</td>
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<td>Vander Kloet</td>
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<td>Yale U.</td>
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<td>Miller</td>
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<td>U. Indiana:</td>
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<td>TOTAL External</td>
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<td>GRAND TOTAL</td>
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<tr>
<td>% Queen's</td>
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<tr>
<td>% External</td>
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TABLE 4  PART 3

OTHER VISITORS TO QUBS IN 1982 INCLUDE:

Barb Martin
Dr. G. Woolfenden (U. of S. Florida)
Dr. I. Brodo (Nat. Mus - Ottawa)
Mark Woolhouse (Queen's)
Jane Watson
Floyd Connor
Brian McLaughlin (Queen's)
Cathy Running
Dr. Don Thomas (Carleton)
Rob Alvo (Trent)
Harry Parsons (Bufo Inc.)
Tracy Allen
Jean McNaughton
Barb Beasley
Ray Feraday (U. of T.)
Jacqui Shykoff (U. of T.)
Ted Tozer
Billie Pryer
Neil McLean (MNR)
W. Garry Smith (MNR)
Dr. P. Johansen (Queen's)
Dr. Craig Sargent (SUNY - Stonybrook)
Dr. Dave Phillipp (Ill. Nat. Hist. Survey)
Dr. D. Layzell (Queen's)
Vanda Cuccaro (Carleton)
Mark Abrahams (Queen's)
Debbie Glover (U. of T.)
Sue Hendler (U. of Calgary)
Dr. R. Charnov (U. of Utah)
Dr. W.D. Hamilton (U. of Michigan)
Dr. J. Brockman (U. of Florida)
Dr. C. Harley (U. San Fran.)
Dr. A. Grafan (Oxford)
Dr. P. Taylor (Queen's)
Dr. P. Boag (Oxford - Edward Grey Inst.)
Anne Gunter (Cat. Reg. Cons. Auth.)
Dr. A. Forsyth
Turid Holldobler-Forsyth
Fred Murrin
Bill Nowell
Debbie Perzow
Lynn and Bryan Hughes
Dr. J.B. Falls (U. of T.)
Dr. R. Wypkema
Ross Smith (Carleton)
Doug Alexander (Carleton)
John Eberlee (Carleton)
Ian Dobson (Carleton)
Dr. G. Williams (SUNY - Stonybrook)
Dr. F. Cooke (Queen's)
Janet Nicholson
Greg Taylor (Queen's)
Dr. K. Storey (Carleton)
Ione Hunt von Herburg (Queen's)
Barry Briggs (Queen's)
Karen Brown (Parks Canada)
Jennifer Harker (Dillon Associates - Toronto)
Karen Clark (MNR)
John Munro (MNR)
H. Lisle Gibbs (U. of Michigan)
Dave Barker (Windsor)
Dave Levine
Lynn Bray-Brodsky (Carleton)
Jill Lightbody (Carleton)
Bill Carman
Karl Dilcher (Queen's)
Anna Devries (Queen's)
Dr. P. Blancher (Queen's)
Jan Anderson (U. of T.)
Dr. R. Knapton (Brock)
John Eadie (Queen's)
Hamish McIntosh (Queen's)
Jackie Belwood (U. of Florida)
TABLE 5: Summary of Conference, Meeting and Field Trip use of Queen's University Biological Station - Lake Opinicon - 1982

<table>
<thead>
<tr>
<th>Organizer(s)</th>
<th>Function</th>
<th>Number of Participants</th>
<th>Duration</th>
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<tbody>
<tr>
<td>DR. R.J. ROBERTSON (Queen's Biology)</td>
<td>Graduate Student Discussion with Dr. G. Woolfenden</td>
<td>10</td>
<td>Jan. 25-26</td>
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<tr>
<td>Floyd Connor (Queen's Biology)</td>
<td>Station Reunion</td>
<td>45</td>
<td>Feb. 5-7</td>
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<tr>
<td>Marcia Stayer (Queen's - Douglas Library)</td>
<td>Staff and Guests of Douglas Library</td>
<td>15</td>
<td>Feb. 19-21</td>
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<tr>
<td>Gary Bell (Carleton Biology)</td>
<td>Chordate Zoology - Course Outing</td>
<td>13</td>
<td>Feb. 22-23</td>
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<tr>
<td>Floyd Connor (Queen's Biology)</td>
<td>Bio 300 (Ecology) Weekend</td>
<td>10</td>
<td>Feb. 26-28</td>
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<tr>
<td>Dr. D. Bastianutti (Queen's Languages)</td>
<td>Italian Immersion Weekend</td>
<td>12</td>
<td>Feb. 12-14</td>
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<tr>
<td>Dr. D. Bastianutti (Queen's Languages)</td>
<td>Italian Immersion Weekend</td>
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<td>Feb. 19-21</td>
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<tr>
<td>Dr. W. Reeve (Queen's Languages)</td>
<td>German Immersion Field Camp</td>
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<td>May 1-8</td>
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TABLE 5 (continued - page 2)

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<th>Organizer(s)</th>
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<th>Number of Participants</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Peter Hall</td>
<td>Ottawa Field - Naturalists Field Trip and Picnic</td>
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<td>May 8</td>
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<td>Hugh Gibson (A.Y. Jackson School)</td>
<td>Canoe Trip Bivouac</td>
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<td>July 14</td>
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<td>Dr. P. Zarzecki (Queen's Physiology)</td>
<td>Ottawa - Queen's - Physiology Conference</td>
<td>60</td>
<td>Aug. 21</td>
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<td>Dr. S.R. Brown (Queen's Biology)</td>
<td>Limnology Weekend</td>
<td>36</td>
<td>Sept. 24-26</td>
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<td>Shelagh Mathers (Queen's Biology)</td>
<td>Bio 300 (Ecology) Weekend</td>
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<td>Shelagh Mathers (Queen's Biology)</td>
<td>Bio 300 (Ecology) Weekend</td>
<td>39</td>
<td>Oct. 22-24</td>
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<td>Marcia Stayer (Queen's - Douglas Library)</td>
<td>Staff and Guests of Douglas Library</td>
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<td>Nov. 26-28</td>
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TABLE 6: Seminars at QUBS - 1982

MAY 19 DR. R. MONTGOMERIE - Department of Biology, Queen's University
"Ephemeral ecology" or "Why does the Bloodroot bleed?"

MAY 26 JIM COMPLAK - Department of Biology, Queen's University
"The monsters of Atkins Lake: Loch Ness revisited?"

JUNE 3 DR. MARYLEE STEPHENSON
"The Galapagos Islands".

JUNE 9 DR. P. WEATHERHEAD - Department of Biology, Carleton University
"Testing Sexual Selection Theory: A clean story".

JUNE 16 DR. S. BARRETT - Department of Botany, University of Toronto
"Sex in the Plant Kingdom: Variations and contrivances".

JUNE 23 BRENT CHARLAND - Department of Biology, Carleton University
"Snakes: Reflections on a myth".

JUNE 29 DR. CRAIG SARGENT - Department of Zoology, SUNY - Stonybrook
"Modelling sexual selection: Sticklebacks".

DR. DAVE PHILLIPP - Illinois Natural History Survey
"Hybridization in the Centrarchidae".

JULY 1 DR. J. ALCOCK - Department of Zoology, Arizona State University
"Adaptation: The vulgar adaptationist view".

JULY 6 DR. J. ALCOCK
"Sexual selection and a Solitary Bee".

JULY 8 DR. J. ALCOCK
"Male mating systems in insects".

JULY 13 DR. J. ALCOCK
"Hill-topping in insects".

JULY 15 DR. J. ALCOCK
"Postcopulatory competition in insects".

JULY 19 DR. J. ALCOCK
"Female choice and female mating systems in insects".

DR. A. FORSYTH
"Species richness of Costa Rican fauna and flora".
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<tr>
<th>Date</th>
<th>Speaker</th>
<th>Department</th>
<th>University</th>
<th>Title</th>
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<tr>
<td>JULY 21</td>
<td>LORNE WOLFE</td>
<td>Department of Botany</td>
<td>University of Toronto</td>
<td>&quot;Flora, fauna, people and mountains of the Nepal Himalayas&quot;</td>
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<td>JULY 28</td>
<td>ANDY HURLY</td>
<td>Department of Biology</td>
<td>Queen's University</td>
<td>&quot;Female mate choice and aggression in the Red-winged Blackbird&quot;</td>
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<td>AUG. 4</td>
<td>LOIS DEACON</td>
<td>Department of Biology</td>
<td>Queen's University</td>
<td>&quot;The Gananoque watershed: Effects on Centrarchids&quot;</td>
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<td>AUG. 11</td>
<td>DAVE LEFFELAAR</td>
<td>Department of Biology</td>
<td>Queen's University</td>
<td>&quot;Reproductive Strategies in the Tree Swallow&quot;</td>
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<td>AUG. 18</td>
<td>BARBARA HILDER</td>
<td>Department of Biology</td>
<td>Queen's University</td>
<td>&quot;Territoriality in the Little Bog Dragonfly&quot;</td>
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<td>AUG. 25</td>
<td>KEVIN TEATHER</td>
<td>Department of Biology</td>
<td>Queen's University</td>
<td>&quot;Female territoriality in the Brown-headed Cowbird&quot;</td>
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**TABLE 7: Fee Schedule for 1983**

I. ACCOMMODATION (Room and Board)

- $200/mo - includes obligation for chores on a rotating schedule
- $285/mo - no obligation for chores
- $100/wk - including weekend, e.g. Field Camp (includes a lab fee)
- $12.50 - 24 hr. room and board
- $2.00 - breakfast only
- $2.00 - lunch only
- $4.00 - dinner only
- $5.00/person - overnight accommodation - academic purposes - no food
- $7.00/person - overnight accommodation - non-academic purposes - no food

II. BOATS

- BOAT RENTAL - includes maintenance on boats and motors
  - $95/month; $40/week
  - Gas and oil not included in rental fee.
  - Purely recreational use should be limited to non-motorized craft.

III. BENCH FEES

- $3/day - Non-Queen's staff or major researcher*

Bench fees may be waived or reduced if sufficient research funds are not available upon written application to the Station Director, Dr. R.J. Robertson.

*M.Sc. or Ph.D. candidate, project coordinator or Post-doctoral Fellow
Queen's University
Biological Station
List of Theses

Ph.D. THESIS:


M.Sc. THESIS:


BALLANTYNE, P.K. 1976. Sound production during agonistic and reproductive behaviour in the Pumpkinseed (Lepomis gibbosus), the Bluegill (L. macrochirus) and their hybrid sunfish. M.Sc. thesis. Dept. of Biology, Queen's U.


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