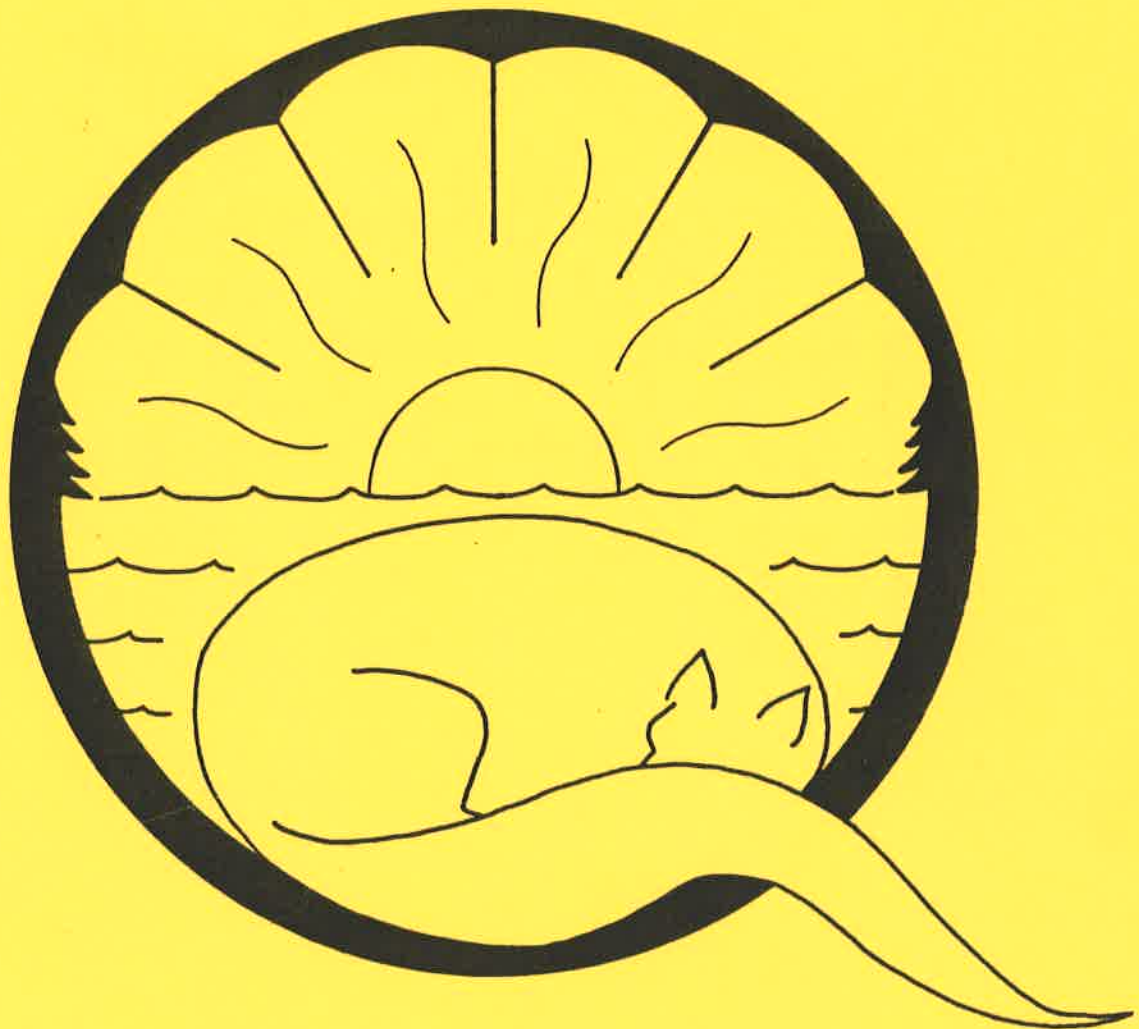


Queen's University Biological Station

Annual Report and Newsletter

1988



Director - Dr. R.J. Robertson

Manager - Frank Phelan

INTRODUCTION

Nineteen eighty-eight was a year of very high levels of research and teaching activity at the Queen's University Biological Station. Overall, the number of user days jumped upward by 18% from 1987 to 1988. On average, 37 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 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 tenth edition of the Naturalist's Workshop was held in 1988 (more on this later). Dr. Ed Kott of Sir Wilfrid Laurier University brought the senior undergraduate course in field biology to QUBS August 28 through September 10. In addition, the Shell Summer Program for Science Teachers was held, in part at QUBS July 8-12 (more on this later). In fall, QUBS hosted classes in Insect Physiology (Bio 825), a graduate course organized by Drs. Sutcliffe and Downe. This course, actually a joint venture of Queen's and University of Ottawa, made good use of the Brown Lab conference room from October 12 through November 30. QUBS continues to provide an 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 late summer, QUBS acquired the eastern half of Cow Island from Ms. Frances Murray. This came as somewhat of a surprise since popular belief was that QUBS already owned the property. Indeed, this half of the island had always belonged to the Murray family. When 'For Sale' signs abruptly appeared along the eastern shore of Cow Island, the Director and Manager started to investigate means by which the University could acquire the property. It was easy to establish the importance of the island to QUBS, but purchase by the University could not be accomplished immediately. Still, it was late in the season of 1988, so there was always next year... Then, on a Friday afternoon in early August, it was learned that the property might go to someone else. An offer had been tendered, to be acted on by 6:00 pm the same day. Raleigh, Frank and Dr. Keast, forming an ad hoc committee, decided that, because of the perceived importance of the island to the field station, it must be obtained, and swiftly. With a combination of funding, some from the Capital Appeal and some from the Opinicon Trust fund, an offer was put together in that short afternoon and secured with the Manager's certified cheque. It was an anxious few hours for those involved, but the offer was accepted and, in due course, the eastern half of Cow Island officially became property of the Biological Station on October 28, 1988. Funds for the purchase were assembled as follows: From the Opinicon Trust \$20,000 and from the Capital Appeal \$39,500 (\$25,000 of this was donated by the Stouffer Foundation to be used only for land acquisition), for a total purchase price of \$59,500. Such a large expenditure has necessitated a revision of priorities and sorely limited short-term projects at QUBS, but it was felt that acquisition of this property was vital to QUBS in the long term. Needless to say, without discretionary funds on hand, the purchase would not have been possible.

During 1988, improvements to QUBS facilities continued. The washup room in Curran was finished for summer use. Earl Cottage was reroofed.

Significant improvement of the road to Keast Cottage was undertaken. A propane heater was purchased and installed in the lodge to allow extended season use. Carpeting, vinyl flooring and trim were installed in Sumac Cottage, completing the construction phase. Storage cabinets for the collections room were constructed. For safety reasons, the gasoline tank was moved and mounted over a spill catchment. Then, the entire setup was roofed over. The south entrance to the lower Brown Lab was improved with patio stones and a retaining wall. A new culvert replaced the old one at the swamp on the main entrance road to QUBS. In late summer, the basement of the library was excavated, parged and improvements to drainage around the building were made. Hopefully, this will solve the water infiltration problems in the basement.

QUBS obtained some new equipment in 1988. Through the Principal's Development Fund and Provincial Excellence Fund, a new overhead projector, spotting scope and tripod, two pair of binoculars and some sampling gear were purchased. A Nikon teaching head dissecting microscope was also bought. From the NSERC infrastructure grant, a new air compressor was purchased and installed in the workshop.

The annual QUBS Open House was held on Sunday, July 17. Station regulars hosted over 275 visitors who toured the displays of research species and projects. In July, the eighth edition of our Community Newsletter was delivered to most households in the area. This summary of QUBS activities is aimed at those unable to attend the Open House. These events are important in maintaining contact with our neighbours and friends throughout the area. The station regulars are to be heartily thanked for their efforts in making these events so successful.

On the heels of the Open House, the Biology Department picnic was held in the afternoon of July 17. Some sixty-five members of the Department and their guests attended. We hope to make this more of a social event in future by planning some events to encourage participation and interaction. Suggestions and help with this will be most welcome.

A list of most of the visitors to QUBS during 1988 not mentioned elsewhere in this report is found in Table 4. Table 5 documents teaching and research 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 1988.

The seminar schedule was again organized by Dr. Raleigh Robertson in 1988. This forum proves to be most interesting and a valuable addition to events at QUBS. Table 7 lists the range of speakers and topics for 1988.

The new fee schedule for 1989 appears in Table 8. Increases are tailored to keep pace with inflation and increases in the Consumer Price Index.

We are attempting to keep a current list of theses and publications emanating from work done at QUBS. Please forward copies of theses (we will have them bound) and articles as they become available.

Our kitchen staff, Melinda Warren, Cheryl MacDonald and Marg Phelan provided us all with excellent meals in 1988. They are to be commended for their organizational skills and attention to detail. The operation of our food service in 1988 was superb. Sincere thanks for a job well done!

Tedd Robertson worked as an assistant to the manager in 1988. Truth to tell, the title is more glamorous than the actual job. Tedd worked hard in his vital role and performed all tasks well. Thanks Tedd!

Now that the list of QUBS alumni and friends has grown so large, our list of significant events in the lives of our people has grown correspondingly. During 1988, Jim Complak married Mary Anne Bradley on

August 6 in Milton, Ontario, Jim, in addition to being a QUBS alumnus was Assistant Manager at QUBS. Both Jim and Mary Anne teach in Oakville. Dr. H. Lisle Gibbs married Lisa Tabak on August 6 in Durham, New Hampshire. Lisle was an undergraduate at Queen's and worked at QUBS for Dr. Robertson. Presently, Lisle is back at Queen's as a Post-Doctoral Fellow. Scott Findlay married Nicole Bruinsma on September 17, at QUBS. Scott and Nicole are Queen's alumni and Nicole also worked at QUBS. The first wedding held entirely on the premises of QUBS! Best wishes to all three couples! There were two births to report in 1988. Jayne Yack (Erindale) and Myron Smith had a baby daughter, Josefine on March 4, 1988. Anna and Pawel Kindler (Ill. Nat. Hist. Survey) had a second son, Antoni on May 16, 1988. Congratulations to both sets of parents.

Sadly, Dr. Peter Johansen died December 30, 1988. although Peter was a minor user of QUBS, we will miss him. Our fondest sympathy goes out to his family, friends and colleagues.

Thanks to Brenda Aarssen for the concept of the front cover of this year's Annual Report.

NATURALISTS' WORKSHOP 1988

The tenth annual Naturalists' Workshop was held May 21-28, 1988. Twenty naturalists participated in the workshop, eighteen full-time and two part-time. A few of these are returnees from past workshops. A good cross-section of interests and organizations were represented - Provincial Parks (Sandbanks, Presqu'ile, Bon Echo), Nature Conservancy, Federation of Ontario Naturalists, Royal Ontario Museum, Ministry of Natural Resources, Universities and Schools (Queen's, Laurentian, U. of Ottawa).

Dr. Jim Pringle (Royal Botanical Gardens) was once again a valuable part of our team of instructors. Thanks Jim. Thanks also to our other team members: Dr. Peter Boag (Queen's - Biology), Dr. Francis Cook (Curator of Herpetology - National Museums), Dr. Adele Crowder (Queen's - Biology), Terence Dickinson, Michael Fox (Queen's - Biology), Dr. James Fullard (U. of Toronto, Erindale - Zoology), Jennifer Harker (M.M. Dillon consultants), Dr. J. Allen Keast (Queen's - Biology), Dr. Sandra McBride (Queen's - Geological Sciences), Dr. Raleigh Robertson (Queen's - Biology), Dr. Martin Edwards, Dorothy Young (Queen's - Biology), Dr. John Craig (U. of Auckland), Dr. Bruce Smith (U. of New Brunswick), Floyd Connor and Frank Phelan (both QUBS).

This year, the day-long field trip took us on a transect across the Frontenac Axis, from Brockville in the east to Camden East in the west, with stops of geological and biological interest. Under Dr. McBride's instruction an understanding of local geological principles was obtained - everything from conglomerates, glacial action, moraines, dikes, and fossils. Thank you Sandra for your continuing involvement.

Terence Dickinson's evening programme on astronomy and cosmology was a highlight of the workshop. Noteworthy also were the evening presentations by Dr. James Fullard on the interaction of bats and moths and by Dr. John Craig on the behavioural ecology of New Zealand Pukekos - not a bird we were likely to see during the workshop.

At the end of the workshop, presentations were made to Dr. Adele Crowder and Dr. Jim Pringle for their long-term involvement in the workshop program. Adele received an original watercolour of 'Wild Ginger' by Turid Forsyth in recognition of her role in conceiving the workshop and planning it each year. Jim received an album of Irish folk music and a 'Polar Bear' sweatshirt for sharing his depth of knowledge at each workshop and for his enthusiasm for natural history.

In 1988, the Kingston Field Naturalists offered a scholarship to fund one person's attendance at the workshop. Kit Chubb was the recipient of the first award of this scholarship. Apparently, the program is recognized as a valuable experience for keen naturalists. This KFN special scholarship will be offered again in 1989.

In 1989, the McCorquodale scholarship will also be made available. The name comes from Mrs. Shannon McCorquodale, whose generous donation to the workshop enables us to make available the funds to sponsor a student or a senior citizen to attend the workshop in 1989. Thank you Shannon.

Plans for 1989's version of the workshop are well under way. Highlights will be a trip to Prince Edward Point to trap and band birds and a day-long session on the principles of limnology with comparisons between deep and shallow lakes.

Suggestions for topics for inclusion in the main workshop programme or other week-long or weekend workshops are welcome.

SHELL SUMMER SCIENCE TEACHERS PROGRAM JULY 3-15, 1988

Each year for the past several years, Shell Canada has funded a summer science teacher's program through Queen's University. Participants are selected in a Canada-wide competition and are awarded the prestigious Shell Canada Merit Fellowship. This year program coordinator Dr. R. Uffen (Queen's - Geological Sciences) settled on 'Population Biology' as the topic for 1988.

The twenty-five merit fellows spent five days (July 8-12) of the two week long program at the biological station. During this time, they were exposed to contemporary topics in field research and hands-on field sessions on a variety of organisms. Involved as instructors in the QUBS segment were (from Queen's) Dr. Raleigh Robertson (mating systems in birds), Dr. John Smol (limnology), Dr. Laurene Ratcliffe (communication and sex selection in birds), Dr. Fred Cooke (population genetics of snow geese), Dr. Lonnie Aarssen (plant communities and competition) and Dr. Allen Keast (biogeography and freshwater fish communities). Dr. Mart Gross of University of Toronto contributed a session on alternate reproductive strategies in fish.

From comments received, the participants thoroughly enjoyed the opportunity to experience field work life at an active field station and interact freely with persons conducting research in the field. This program is instrumental in keeping teachers in touch with current developments in biological theory and research.

Table 1: Summary of course credits in the Ontario Universities Program in Field Biology earned at Queen's University Biological Station in 1988.

Module Topic	Professor and Affiliation	Dates	Credit/ Students	Queen's	Carleton	York	Brock	Western	Toronto	Waterloo	Windsor	Total Students/ Module	Total 1/2-course credits
Parental Investment in Birds	Robertson (Queen's)	May 1-7	1/4	3	2	2	0	1	0	0	0	8	4
Territoriality in Birds	Weatherhead (Carleton)	May 8-14	1/4	3	3	1	0	1	0	0	1	9	4.5
Bat Behaviour	Fenton (York)	Aug 21-27	1/4	2	1	3	0	2	1	0	0	9	4.5
Plant-Insect Interaction	Damman (Carleton)	Aug 21-27	1/4	5	3	2	0	0	2	1	0	13	6.5
Small Mammal Ecology	Boag (Queen's)	Aug 28-Sep 3	1/4	4	1	2	1	1	1	0	0	10	5
Vegetation Patterns and Processes	Aarssen (Queen's)	Sep 4-10	1/4	3	0	1	0	1	1	0	0	6	3
Total Number of Student-weeks			20	10	11	1	6	5	1	1		55	
Half Course Credits			10	5	5.5	0.5	3	2.5	0.5	0.5		0	27.5

Table 2: Summary of course credits in the Ontario Universities Program in Field Biology earned at locations other than QUBS in 1988.

Module Topic	Professor and Affiliation	Dates	Location	Credit/ Students	Queen's	Carleton	York	Brock	Western	Toronto	Waterloo	Windsor	Total Students/ Module	Total 1/2-course credits
Sonoran Desert Ecology	Hardford (Western)	Apr - May	Arizona Mexico	1/2	2	0	1	0	4	2	1	0	10	10
Tropical Marine Ecology	Duthie and Barton (Waterloo)	Apr 24 - May 8	Jamaica	1/2	1	2	0	0	1	1	12	0	17	17
Shallow Water Marine Biology	Lewis (Brock)	Apr 28 - May 16	Tobago	1/2	2	0	0	9	3	0	0	2	16	16
Bird Migration	Cooke (Queen's)	May 7 - 21	Prince Edward Point	1/2	3	2	1	1	2	3	0	0	12	12
Great Lakes Biology	Haffner (Windsor)	May 22 - Jun 4	Windsor	1/2	4	0	2	1	1	1	0	4	13	13
Field Ornithology	Parsons and Hansell (Toronto)	Jun 22 - Jul 6	Churchill	1/2	1	1	0	0	2	8	0	0	12	12
Natural History	Licht (York)	Aug 14 - 20	Algonquin	1/4	2	1	1	0	0	1	0	1	6	3
Marine Biology	Calder (Toronto)	Aug 20 - Sep 4	Huntsman	1/2	9	3	1	0	0	7	0	0	20	20
Terrestrial and Freshwater Biology	Mackay (Toronto)	Aug 26 - Sep 10	Dorset	1/2	2	0	1	2	1	3	1	0	10	10
Experimental Marine Biology	Owen (Western)	Aug 26 - Sep 11	Huntsman	1/2	4	1	2	0	5	1	0	2	15	15
Aquatic Ecology	Bailey (Western)	Aug 28 - Sep 10	Dorset	1/2	3	0	1	0	4	0	0	0	8	8
Freshwater Communities	McQueen (York)	Aug 28 - Sep 3	Algonquin	1/4	2	3	3	2	2	0	0	0	12	6
Terrestrial and Aquatic Biology	Hawthorne and Kendrick	Sep 3 - 16	Algonquin	1/2	3	0	0	2	1	0	2	0	8	8
Total Number of Student-weeks					69	22	22	32	50	53	32	17	297	—
Half-course Equivalents					34.5	11	11	16	25	26.5	16	8.5	—	148.5

Table 3: Overall Summary of the Ontario Universities Program in Field Biology for 1988.

	Queen's	Carleton	York	Brock	Western	Toronto	Waterloo	Windsor	Total Student Weeks in Modules	Total Half Course Credits
Total Student-weeks not at QUBS	69	22	22	32	50	53	32	17	297	148.5
Total Student-weeks at QUBS	20	10	11	1	6	5	1	1	55	27.5
Total Student-weeks in Field Modules	89	32	33	33	56	58	33	18	352	-
Total Half-course Equivalents in Field Modules	44.5	16	16.5	16.5	28	29	16.5	9	-	176

ABSTRACTS OF RESEARCH CONDUCTED AT QUBS 1988

I. RESEARCH BY QUEEN'S UNIVERSITY STUDENTS AND STAFF

DR. L.W. AARSSSEN

"Competition and Coexistence in Plants"

Douglas Taylor - "Coexistence and competitive Abilities in Perennial Grasses" - M.Sc. Thesis

In 1988, competitive relationships were studied among genotypes of Agropyron repens, Phleum pratense and Poa pratensis collected from the East Field. One clone (genotype) of each species was collected from each of ten neighborhoods (7 cm² in size) within the community. Each genotype was propagated vegetatively and grown in the glasshouse in monocultures and in pairwise mixtures with all other genotypes collected from the community. Analyses revealed significant genotypic variability for competitive ability. Competitive relationships were transitive at the species level but intransitive at the genotype level. Genotypes collected from the same neighborhood exhibited competitive standoffs or transitive relationships. Competitively subordinate genotypes from different neighborhoods however, belonged to different species. These data provide preliminary support for the competitive combining ability hypothesis for competitive abilities at the genotype level (spanning across taxonomic boundaries) may prevent competitive exclusion at the whole population level and hence maintain both species and genotypic diversity within vegetation.

Thesis:

Taylor, D.R. 1988. Coexistence and intransitive competitive abilities among genotypes of three perennial grasses. M.Sc. Thesis. Dept. of Biology, Queen's University, Kingston, Ontario.

Publications:

Taylor, D.R. and L.W. Aarssen. 1988. 1988. An interpretation of phenotypic plasticity in Agropyron repens (Graminae). Amer. J. Bot. 75: 401-413.

DR. P.W. COLGAN

"Field Ethology of Fishes"

In 1988, 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 Sunfish and Largemouth Bass for experiments on foraging and predator avoidance (research associate Vytenis Gotceitas).

Publications:

- Colgan, P.W. and J.A. Brown. 1988. Dynamics of nest defense by male centrarchid fish. Beh. Proc. 17: 17-26.
- Gotceitas, V., & P. Colgan. 1988. Individual variation in learning by foraging juvenile bluegill sunfish (Lepomis macrochirus). J. Comp. Psychol. 102: 294-299.
- Morgan, M.J. and P.W. Colgan. 1988. The role of experience in foraging shoals of bluntnose minnows (Pimephales notatus). Behav. Proc. 16: 87-93.

DR. A. FORSYTH

I. "Maternal Care in Gargaphia tiliiae (Hemiptera: Tingidae)"

Adult and nymphal lacebugs, Gargaphia tiliiae, suck juices from Basswood, Tilia americana, leaves. Females lay clutches of 60-70 eggs and tend eggs and nymphs until maturity. We hypothesize that predation by assassin bugs, spiders, etc. selects for this tending or "guarding" behaviour exhibited by females. To test this hypothesis, females were removed from their clutches and nymphal survivorship was measured. Guarded clutches had lower mortality than unguarded clutches. This differential clutch survivorship was attributed to female clutch guarding behaviour.

II. "Comparison Between Two Coexisting Lacebugs (Hemiptera: Tingidae)"

The lacebugs Gargaphia tiliiae and Corythucha juglandis coexist on Basswood. G. tiliiae females exhibit maternal care whereas C. juglandis females exhibit none. What are the costs and benefits of maternal care? G. tiliiae laid few, large clutches while female C. juglandis laid many small clutches. How do C. juglandis avoid predators that G. tiliiae find so important? Preliminary studies suggest that C. juglandis nymphs are more mobile and may have better physical defenses. These characteristics could make C. juglandis nymphs less vulnerable to predation.

Assistant: David Bell

DR. R. HARMSSEN & DR. A. CROWDER

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

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 and nine others are treated with insecticides in order to avoid insect grazing damage to vegetation. In 1988 we continued to monitor closely the population of Trirhabda spp. (Goldenrod beetles) and the grassfeeding caterpillar, Thymelicus lineola (the European Skipper). (Co-investigator Bruce Henderson)

The area started to recover from the 1987 insecticide drift resulting from careless gypsy moth control practices in adjacent wood lots. Both the beetle and caterpillar populations were higher in 1988 than they had been

for a number of years.

Katherine Kraulis - "Host Plant Specificity in Trirhabda beetles"

Populations of larvae were collected on two species of goldenrod and one of aster, and reared in captivity on three species of goldenrod and one aster in all possible combinations of origin plant and food plant. Growth rates, weights and survival were recorded, and eggs laid for each group are overwintering for follow-up experiments in 1989. The objective is to record the duration and depth of the various troughs between original adaptive peaks and new adaptive peaks produced in the laboratory.

Mary Stockdale - "Life Strategy Comparisons between Two Species of Lygus"

Lygus lineolaris and L. vanduzeei were collected, alive, in August and host plant preference experiments were conducted. The generalist lineolaris was indeed much less specific in its host plant requirements, but the reputed goldenrod specialist was surprisingly broad in its host selection. Longer term experiments testing for survival on different host plants also indicated that both species survived well on a broad spectrum of plant species. Further experiments are planned for 1989.

Thesis:

Sigouin, J.P. 1988. Population dynamics of the goldenrod leaf beetles, Trirhabda virgata, T. borealis and T. canadensis during outbreak in Southeastern Ontario. B.Sc. thesis. Department of Biology, Queen's University, Kingston, Ontario.

DR. P.H. JOHANSEN

"Aquatic Toxicology"

Andrew Samis - "Long Term Effects of Acute and Sub-chronic Pentachlorophenol Exposures on the Growth and Lipid Reserves of Centrarchid Fishes." - M.Sc. Thesis

This study involves exposing juvenile Bluegill Sunfish to varying sub-lethal concentrations of pentachlorophenol for durations of three to thirty days. Prior to, during, and following exposure, lipid reserve size and overall somatic growth are examined and compared. It is hypothesized that both growth and lipid reserves would be significantly reduced after sub-lethal exposure to PCP, when compared to untreated controls.

Although the majority of the experimentation involved in this project takes place at Earl Hall, it was necessary to utilize QUBS in order to seine for juvenile Bluegill Sunfish.

DR. J.A. KEAST

"Inter-lake Fish Community Studies"

Comparative studies continued on the littoral zone fish communities of a series of water-bodies that include lakes of different nutrient status, sizes, and morphometries. Objectives include documenting the taxonomic and ecomorphological structure of the fish communities and relating this to the prey resource base. A major objective is to define the feeding ecology of species that range through several different kinds of water-bodies, and establish their relative ecological plasticity.

"Analysis of a Northern Deciduous Forest Bird Community, Lake Opinicon"

This long-term project is nearing completion. It seeks to define composition of the community, its adaptations to the highly seasonal northern environment, and analyse the annual cycle and how its components vary between species.

Analysis of the seasonal invertebrate prey resource base by various methods show that there is an explosive peaking in May as the leaves emerge and the lake waters start to warm. The return of the bulk of the migrants corresponds to this and it serves not only to provide them with much needed food but to provide the surplus for energy deposition needed for the activity-demanding period of territoriality and egg production. The bulk of more important prey types crash in June (dropping to 1/4 or 1/5 of maximum populations). Though this is the time most species have young there is no evidence of starvation. However, the documented population drop, plus the rapidity with which many species vacate the breeding area as soon as young fledge, is persuasive evidence that it is shortage of food that terminates the breeding season in most species.

Current work includes comparative analysis of such subjects as to why bird species vary widely in amount of time spent in the north, in seasonal territorial song, and why some bird species can maintain their populations on one brood a year when others require two.

Assistant: Sari Saunders

Michael Fox- "The Effect of Fish Density on the Growth and Survival of Juvenile Walleye in Rearing Ponds" - Ph.D. Thesis

This experiment was carried out in cooperation with the Ontario Ministry of Natural Resources at their White Lake Fish Culture Station, 80 km northwest of QUBS. We stocked two-day-old walleye at 3 density levels (20, 40 and 60 m⁻³) in 8 fertilized outdoor ponds and reared the fish for six weeks. Walleye size, stomach contents, zooplankton and zoobenthos were sampled weekly. Size at harvest showed an inverse logarithmic relationship with stocking density, but there was no relationship between density and survival rate. Size variability of the fish at harvest was unrelated to stocking density, final density or mean walleye size. Our results showed that growth is more responsive than mortality in adjusting population biomass to environmental conditions. However, between-pond differences in growth rate were better explained by population density than by the amount of food consumed, probably because density affected the activity level of the fish. This hypothesis will be tested with Kitchell's bioenergetic

growth model for percids.

Assistant: Christine Watters

"Pumpkinseed Growth and Life History in Beaver Ponds; A Comparison with Lake Populations"

This was my third summer on the beaver pond project. I studied Lower Dowsley, Upper Poole and Lower Poole Ponds, and used Lake Opinicon for comparison. Pumpkinseed density and age class structure were surveyed in the ponds in May, using mark-recapture of trapped fish. Specimens and scale samples were collected to ascertain growth history, age at maturity and gonadosomatic index (GSI). Comparable data were obtained from the previous winter to determine pond winterkill potential.

Pumpkinseed overwinter mortality was 85% in Upper Poole due to a severe drop in water level from a hole in the dam. Dissolved oxygen levels were below 2 ppm in much of Dowsley Pond in February, but there was no detectable overwinter mortality because of a March thaw. Pumpkinseed mortality in Lower Poole Pond could not be estimated, but open water in the vicinity of the dam probably kept mortality low. Female pumpkinseeds in Lake Opinicon most frequently matured at age 4-5, while males matured a year later. The earliest age class showing > 50% mature individuals was age 3 for males and females in all three ponds. Approximately 40% of Upper Poole pumpkinseeds were mature at age 2, but few fish in Lower Poole or Dowsley were mature until age 3. In 1987, following a winterkill in Dowsley, over 80% of pumpkinseeds were mature at age 2, while no Upper Poole fish were mature at this age. Beaver pond pumpkinseeds had much higher GSI than did lake fish, and mean GSI was highest in populations which matured earliest. The fact that pumpkinseeds adjusted their life history strategy to annual population changes has not, to my knowledge, been previously shown in natural fish populations.

Assistant: Christine Watters

Publications:

Fox, M.G., J.A. Keast and R.J. Swainson. The effect of fertilization regime on juvenile walleye growth and prey utilization in rearing ponds. *Env. Biol. Fish.* 25, (in press).

Keast, A. 1988. Planktivory in larval, juvenile, and adult planktivores: resource division in a small lake. *Proc. Intern. Assoc Theoret & Applied Limnol.*, New Zealand, Vol. 23: 1692-1697.

Williamson, M. & A. Keast. 1989. Retinal structure relative to way of life in a planktivore and bottom invertebrate feeder, the bluegill and rock bass. *Can. J. Zool.* 67. (in press)

DR. ROBERT MONTGOMERIE

"Behavioural Ecology of American Robins"

This is a long term collaborative project with Dr. Pat Weatherhead (Carleton University) in which we are attempting to look at various aspects of parental care and sexual selection in this species. In 1988 our research

focussed on several aspects of nesting biology (see under Weatherhead), and on the following two questions.

I. How do Robins find Worms?

This study grew out of our research on parents gathering food for their nestlings. We often wondered whether robins were listening or looking when they cock their heads just before diving for a worm. Frank Heppner (1965, Condor 67:247-256) had previously done some detailed experiments showing that robins do use vision to find worms. He had not, however, eliminated the possibility that they could use their hearing as well. With some carefully controlled experiments using robins in the aviary, we were able to demonstrate that they can also use their hearing to find worms buried in the soil, in the absence of any visual or tactile cues. Since worms obviously do not make much noise, we are now interested (with the help of Dr. Barry Frost in the Dept of Psychology at Queen's) in trying to figure out how they can localize such quiet and apparently low frequency sounds as are made by worms moving through the soil. In 1989 we will continue this study focussing on the neurophysiological aspects of this interesting behaviour.

Assistant: Linda Dupuis

II. Do Robins have Song Dialects? (Tarmo Poldmaa - B.Sc. thesis)

Many birds exhibit song dialects on micro- and/or macro-geographic scales but the significance of these patterns is not well understood (although theories abound). In 1988 we simply tried to record the songs of as many male robins as possible both on our study area at QUBS (where most males are individually colour-banded) and at various localities between there and Kingston. Robin males have a song repertoire composed of 10-20 distinct syllables but this repertoire appears to change completely as they get older (comparing the same few males in 1987 and 1988). Males also share more syllables with their immediate territorial neighbours than they do with non-neighbours. This suggests that males may copy one another's songs but the significance of this song sharing is as yet unknown. We expect that repertoire size and the ability to learn another male's song may be an indicator of male quality and our work in 1989 will focus on tests of this and other hypotheses that might explain the observed patterns.

Assistants: Jim Briskie, Karen Holder, Ian Jones, Adele Mullie

DR. L. RATCLIFFE

"Vocal Behaviour of Chickadees"

1. Neighbour-Stranger Discrimination by Song

In 1988 we continued a series of playback experiments on territorial males to determine what aspects of "fee bee" song function in individual recognition. Analysis of 1987 recordings from 120 marked males showed marked species constancy of pitch interval (between notes), whereas absolute pitch of song showed high individual variability. Playback experiments using computer-synthesized songs implicate absolute pitch as a key feature for individual recognition.

II. Pitch Interval Perception

Our lab trials on territorial chickadees from QUBS provided the first evidence for relative pitch perception in a vertebrate apart from humans. To determine whether chickadees are sensitive to the exact ratio of the frequency of Fee and Bee notes, i.e. whether this is a key feature for species recognition, we carried out field experiments presenting songs with normal and doubled intervals, while controlling for absolute pitch of the songs. Songs with normal intervals elicited the strongest responses; however, absolute pitch of the song also influences response. Experiments in 1989 will sort out this interaction.

Assistants: Lesley James, Andy Hurly, Ingrid Johnsrude, Tina Chin

Susan Lempriere - "Call Convergence in the Black-capped Chickadee - the Process and its Significance" - M.Sc. Thesis

The "chick-a-dee" call shows significant structural variation among winter flocks. This flock "uniqueness" may be achieved by convergence in call characteristics of flock members, as work on captive flocks suggests. I am interested in the possible utility of convergence for flock members. During February-April 1988, I studied flocks in outdoor aviaries to determine whether convergence occurs in this context, how quickly calls change, and whether there are individual differences in the degree of convergence. The 1989 season will examine whether call convergence enhances discrimination among own - and foreign flock members.

Publications

Ratcliffe, L. & R.G. Weisman. 1988. Representation of conspecific song by chickadees: comparisons among embedded "Fee Bees". *Behav. Proc.* 17: 199-203.

Weisman, R.G. & L. Ratcliffe. In press. Absolute and relative pitch processing in Black-capped Chickadees (Parus atricapillus). *Animal Behaviour*.

DR. R.J. ROBERTSON

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

I. "Behavioural Ecology of Tree Swallows"

The focus of the Tree Swallow study in 1988 was on infanticide. Having established that replacement males will kill young nestlings and then mate with the widowed or a new female, this year I did experiments to determine whether replacement males would disrupt a clutch in order to obtain a breeding opportunity. Males were removed at various times of the incubation period. Replacement males that arrived as early as day 3 of incubation paired with the widowed female, defended the nest, did not disrupt the eggs, but killed the nestlings as soon as they hatched. In most cases, the female was receptive and copulated with the replacement male, even as late as day 12 of incubation. It is not clear why the male does not destroy the eggs in order to shorten the time before he can sire a brood.

Other aspects of the Tree Swallow study involved further studies on settling patterns of males and females at single and paired boxes, time allocation of polygynous males, the ability of secondary females to raise young without male help, studies of copulation patterns, and natural occurrences of infanticide.

Assistants: Lisa Venier, Sarah Kalff, Larissa White

Publications:

- Mountjoy, D.J. and R.J. Robertson. 1988. Nest construction tactics in the Cedar Waxwing. *Wilson Bull.* 128-130.
- Mountjoy, D.J. and R.J. Robertson. 1988. Why are waxwings "waxy"? Delayed plumage maturation in the Cedar Waxwing. *Auk* 105: 61-69.
- Mountjoy, D.J. and R.J. Robertson. 1988. Response to R.P. Yunick. *Auk* 105: 808.
- Robertson, R.J. and B.J. Stutchbury. 1988. Experimental evidence for sexually selected infanticide in Tree Swallows. *Animal Behavior* 36: 749-753.
- Stutchbury, B.J. and R.J. Robertson. 1988. Within-season and age-related patterns of reproductive performance in female Tree Swallows (*Tachycineta bicolor*). *Can. J. Zool.* 66: 827-834.
- Studd, M.V. and R.J. Robertson. 1988. Differential allocation of reproductive effort to territorial establishment and maintenance by male Yellow Warblers (*Dendroica petecia*). *Behav. Ecol. Sociobiol.* 23: 199-210.
- Hayes, P.A. The role of male parental care in Eastern Kingbirds. *Wilson Bull.* (in press, accepted 22 Aug '88).
- Studd, M.V. and R.J. Robertson. Influence of age and territory quality on the reproductive behaviour of male Yellow Warblers. *Auk* (in press, accepted 3 Feb '88).

Jessie Deslauriers - "Phoebe Response to Cowbird Presence at the Nest"

Since much nesting failure of small passerines is caused by Brown-Headed Cowbird parasitism, many passerines may have learned to recognize female Cowbirds as a possible threat, and react aggressively to their presence near the nest. Indeed, some may have learned to recognize the chatter of female cowbirds. In an ongoing experiment to test this possibility, and to ascertain whether response to Cowbird presence varies between male and female, model presentations were made of female Cowbirds and Song Sparrows (non-threatening controls), accompanied by tape recordings of typical songs, to several Eastern Phoebe nests. Tests of possible habituation to the Cowbird model were also carried out. It is planned to continue this project for at least a further five years.

As well, the mist-net banding program begun two years ago was continued. Also a long-term project, it is intended to act as a control for banding data from Prince Edward Point being analyzed for differences in

temporal movement during spring migration of selected passerine groups and Parulid species.

Kelvin Conrad - "Allocation of Reproductive Effort in the Eastern Phoebe" - Ph.D. Thesis

The purpose of this study is to examine allocation of reproductive effort in the Eastern Phoebe by increasing parental investment in first broods, and examining the effects of this treatment on second broods within the same season. Parental investment was increased by causing parents to defend their nests daily against predator models placed near their nest. Nesting statistics and chronology were almost identical to previously published data. Early nests suffered predation of eggs while nests later in the season suffered predation of nestlings by black rat snakes and deaths by non-predatory means. Day-eleven nestling weight decreased with season and this may have been influenced by the very large number of northern fowl mites in later nests. Nestlings from infested nests were significantly smaller than nestlings from uninfested nests. Attempts to increase parental investment by presentation of predator models were not very successful. No significant differences were found between experimental and control nests for all parameters of reproductive effort, offspring number and offspring quality measured.

Assistant: Jennifer Magwood

Susan Meek - "Parental Care and Nest Defense in Eastern Bluebirds" - Ph.D. Thesis.

I began my study in 1988 on a population of Eastern Bluebirds breeding in nestboxes along a Bluebird trail consisting of 100 boxes.

When female Eastern Bluebirds are widowed or deserted, replacement males from the non-breeding ("floater") population take over the territory. My study involves the temporary holding of male Eastern Bluebirds in order to assess the response of replacement males to offspring already present in the nest, and the extent of parental care exhibited by such males. Factors such as male-female relations, paternity, and the probability of renesting with the female will be examined, and parental care by replacement males, resident males and females will be measured in terms of feeding and defending the young.

This study will also examine whether Tree Swallows or "floater" male Eastern Bluebirds interfere with the nesting activities of paired Eastern Bluebirds, and whether male Eastern Bluebirds guard their mates.

Assistant: Caroline Tomlin.

Monica Mather - "The Significance of the Flight Display in Bobolinks" M.Sc. Thesis

My hypothesis is that bobolinks (Dolichonyx oryzivorus) use their song-flight display to advertise male quality. In this study, I recorded display rates of males in a breeding population to determine if there are detectable differences in advertisement rates and success in attracting mates. To date my analysis shows that there is variability in display rates among males, and that those that displayed less had fewer mates. Another field season in

1989 may be necessary to confirm these findings and show that it is primarily the display that dictates a male's mating success.

Assistant: Kathy Kraulis and Ivan Grabovac

Scott B. Morrill - "Evidence for a Mixed Reproductive Strategy in the Tree Swallow (Tachycineta bicolor)" - B.Sc. Thesis

This study involved the first field use of cloacal microspheres as markers of sperm transfer events between birds. By inserting small polystyrene beads into male cloacas and subsequently searching for them in surrounding resident female cloacas, I was able to document high occurrence of extra-pair copulations in the Tree Swallow. I conclude that though they are monogamous, males pursue a mixed reproductive strategy - attempting to increase their relative fitness by copulating with non-mate females, as well as investing considerable energy in raising a brood of their own. A male's confidence of paternity is decreased as a result of the high frequency of extra-pair copulations. Within-pair copulation patterns were, therefore, monitored, and it was found that pair copulations occur much more frequently than would be expected if fertilization of eggs was the only intent. Based on this, I am proposing that male Tree Swallows ensure their confidence of paternity through frequent pair copulations, which would devalue any sperm introduced during extra-pair copulation.

DR. J. SMOL

"Aspects of Limnology"

"Catherine Christie - "The Quantification of Trophic Distributions in Southern Ontario Lakes" - Ph.D. Thesis

Diatom assemblages are being identified and enumerated from the surface sediments of 50 southern Ontario lakes from which good water chemistry data are available. Lake Opinicon and several of the lakes in the vicinity of QUBS are used in this lake survey. The goal of this research is to exploit the statistical inference techniques that were developed for lake acidification studies, and transfer this technology to the study of lake trophic history. The next phase of this research will apply these transfer functions to sediment cores from culturally disturbed lakes and infer and quantify past changes in trophic status.

Michael Agbeti - "Phytoplankton Seasonal Succession — what are the relative roles of allogenic and autogenic processes?" - Ph.D. Thesis (Smol/Kingston - co-supervisors)

This research project is an intensive study of seasonal phytoplankton dynamics in Lake Opinicon (an example of a shallow, non-stratifying system and Upper Rock Lake (a deep, dimictic system). A combination of standard sampling protocols, as well as the exploratory use of long-term algal traps, are employed to study the seasonal dynamics of algal populations in these chemically similar but morphometrically very dissimilar lake systems. Several recent studies have continued to show that allogenic factors are of primary importance in determining the class of algae that will succeed in a lake system; however, this study will attempt to predict successional shifts

at the species level.

II. RESEARCH BY NON-QUEEN'S STUDENTS AND STAFF

DR. ROB BAKER - Department of Zoology, Erindale College of University of Toronto, Mississauga

Mark Forbes - "Effects of Ectoparasitic Mites (Arrenurus spp.) on Reproductive Success of Damselflies (Enallagma spp.)." - Ph.D. Thesis.

My research in 1988 focused on what effects ectoparasitic mites have on reproductive success of their damselfly hosts. Results are still pending as to whether or not mites affect longevity, fecundity, and/or vigor of adult Enallagma. Preliminary analyses, however, showed that male Enallagma ebrium parasitized by larval water mites were less likely to be paired with females than were unparasitized males for 2 of the 5 sample populations. In 1989, I plan to collect larger samples of paired Enallagma spp. to determine whether or not assortative mating occurs with respect to parasite loads. I hope to determine whether or not mating biases in some populations may be the result of parasite-mediated changes in the male competitive ability, female choice of parasite-resistant males, or a combination of the two selective agents.

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

Chris Eckert - "Ecological Genetics of Mating System Variation in Decodon verticillatus and Lythrum salicaria (Lythraceae)" - Ph.D. Thesis

Population genetic models of trimorphic incompatibility in plants predict that mating types (style morphs) should occur at equal frequencies in large populations at equilibrium. However, none of the tristylous species studied to date support this prediction. In 1988 we began investigating this problem in two tristylous species in the family Lythraceae: D. verticillatus and L. salicaria. Both genetic and ecological factors may contribute to uneven morph frequencies within and among populations. Genetic drift associated with small or periodic fluctuations in population size and/or founder effect may result in deficiencies of one or two morphs across populations. Asymmetries in reproductive success and viability among morphs may account for uneven morph frequencies within populations. These two processes may also interact. The many and varied wetlands in the vicinity of QUBS support diverse populations of both species. L. salicaria has been rapidly colonizing wetland habitats in this area over the last 20 years. We investigated the strength of genetic drift in 54 of these colonizing populations by sampling 7500 individuals for style morph. The results clearly support models of mating system variation through drift. The pattern of style morph frequencies in D. verticillatus, on the other hand, suggest that morph-specific fitness differences may play a greater role in this species. This summer we examined 19 populations of D. verticillatus. Intensive investigation of morph-specific reproductive parameters was carried out on 120 marked individuals in two of these populations.

Both of these studies at QUBS will extend through 1990 and are being integrated with ongoing genetic analyses, controlled greenhouse experiments and broader geographic surveys.

DR. J.H. FULLARD - Department of Zoology, Erindale College of University of Toronto, Mississauga

"Insect Sensory Physiology and Neuroethology"

Neuromuscular Organization of the Arctiid Tymbal (with B. Heller - University of Western Ontario)

The sound-producing structure of arctiid moths is the tymbal located above the metathoracic leg. The motor nerve branch muscles associated with this structure were investigated with microdissection and cobalt lysine whole-nerve staining techniques on the tiger moths, Cycnia tenera, Euchaetias egle, Halysidota tessellaris, Apantesis virgo, Spilosoma virginica and Pyrrharctia isabella. These studies revealed that a branch of the main metathoracic leg trunk (IIIN2a) innervates three muscles that insert on various locations on the tymbal frame. Considering the buckling action of the tymbal, we propose that the largest muscle (pv2) is the main effector with the two smaller muscles (pv1 and pv6) acting as accessory muscles.

Cobalt backfills of the IIIN2a reveal 7 motoneurone cell bodies located along the anterior margin of the metathoracic ganglion. These cells have extensive arborizations to the ganglionic midline but are ipsilateral to their respective tymbal. We had expected that the pv2 motoneurone would be considerably larger than the others and that we could identify it as the tymbal motoneurone but this was only evident in E. egle. The relatively huge size of this cell in this species will be explored at the Erindale laboratories as a possible candidate for individual intracellular studies.

Assistant: Rohini Kumar

II. Functional Organization of the Auditory System in the Noctuid Moth (with G. Boyan, Australian National University)

We have identified a number of interneurons within the CNS of noctuid moths involved with the processing of auditory information leading to the evasive flight manoeuvres these insects perform as a defence against attacking bats. One of the cells (504) appears to act as a noise-filter allowing the moth to discriminate bat sounds from other high-frequency sounds (e.g., leaves rustling). These cells form part of an ascending neural network that influences the operation of the flight neural pattern generator. Cobalt backfills of the tympanic nerve and neck connective (that carries the axons of the auditory interneurons) were done this summer with Catocala spp. moths. The histology of the nerve tract stainings will be performed at the Australian National University and from these neuroanatomical surveys we plan to construct an atlas of the moth CNS with particular attention to the circuitry of the ascending auditory pathway.

Assistant: Rohini Kumar

III. Auditory Characteristics of the Northern Bog Katydid (with H. Romer, University of Bochum)

The northern bog katydid (Metrioptera sphagnorum) possesses an unusual

calling song that consists of two modes, and audible one at 15-17 kHz and an ultrasonic one at 34-40 kHz. These two components have been hypothesized as functioning to allow females to localize a singing male while recognizing him as conspecific. The auditory system of this katydid was studied in the field by Glenn Morris of Erindale College and Heiner Romer of the University of Bochum (Bundesrepublik Deutschland) in sphagnum bogs near Thunder Bay. Dr. Romer spent two weeks in the lab at QUBS determining the auditory sensitivity curves of identified auditory interneurons. From these examinations we tentatively conclude that this insect's auditory system shows no pronounced neural adaptations to its unusual song. It remains to be seen what factors in M. sphagnorum's environment have contributed to the evolution of such a song.

Assistant: Rohini Kumar

IV. CNS Projections of Auditory Homologues (with J. Yack, Erindale College, University of Toronto)

As a follow-up study to Jayne's examinations of the peripheral structures of auditory precursors, we have made a series of cobalt lysine backfills of the tympanic nerve homologue (IIIN1b) in the inauditive lasiocampid moth, Tolyte vellida. These fills will be sectioned to investigate the central projections of the mechanoreceptors that we propose to be the auditory precursors. We predict a similar sensory projection pattern in support to the idea that these primitive cells possess the appropriate CNS connections to act as auditory cells affecting flight patterns in moths.

V. Dietary Preferences of the Dogbane(?) Tiger Moth (with R. Kumar, Erindale College, University of Toronto)

The main species of my neuroethological studies, Cycnia tenera has been variously referred to as the dogbane tiger moth and/or the milkweed tiger moth. We endeavoured to determine on which foodplant this supposedly monophagous insect grew better in order to maximize our production of adult moths. We grew laboratory-reared first generation larvae on dogbane, milkweed and indian hemp (a dogbane-related plant) and recorded their survival rates, growth trends and weights at pupation. Initial data analysis suggests that while larvae were successfully reared on all three plants the indian hemp diet produces significantly heavier pupae than milkweed or dogbane. This summer the first field collection of a wild larva was made and it was feeding upon on indian hemp further suggesting that, regardless of the moth's common name, this is the species favoured food in our part of its range.

Edward McLean - "The Sensory Ecology of the Predaceous Waterstrider, Gerris remigis (Heteroptera: Gerridae): surface wave discrimination and prey selection" - M.Sc. Thesis

Waterstriders are predators of insects caught in the surface film of many diverse aquatic habitats. Presumably waterstriders use both visual and mechanoreceptive sensory systems for localization of struggling prey. A field survey suggested that adults of the stream dwelling waterstrider, Gerris remigis, are size-selective predators and that the larger and more robust females select a greater size range of prey than the males.

Carpenter ants (Camponotus spp.) of various sizes (5 to 50 mg) were presented to blinded G. remigis in the laboratory to determine the potential role of surface waves produced by struggling prey in size selection. My results suggest a relationship between prey size and predator responsiveness. Both sexes more readily orient towards and attack small prey items. However, the larger females were more responsive to and most successful in subduing all prey size classes. Spectral analyses of Camponotus spp. struggles, recorded with a galvanometer and float sensor, were also carried out to determine if parameters of surface wave stimuli changed with prey size. This in turn may account for the observed discrimination by these predators.

Publications:

Boyan, G.S. and J.H. Fullard (1988) Auditory processing at an identified synapse in a moth interneurone. J. Comp. Physiol. A (in press).

Yack, J. (1988) Seasonal partitioning of atympanate moths in relation to bat activity. Can. J. Zool. 66:753-755.

DR. M.R. GROSS - Department of Zoology, University of Toronto, Toronto, Ontario.

"Evolutionary Ecology of Fish Reproduction"

We are conducting long-term studies on fish reproductive strategies including the evolution of mating systems, parental care and life histories. Work on alternative life history evolution is conducted in collaboration with Dr. David Philipp and his group from the Illinois Natural History Survey.

Isabelle Cote - "Coloniality in Fishes: Individual Decisions and their Effects on Breeding Dispersion" - Ph.D. Thesis

The objective of this project is to develop a theoretical framework for understanding individual breeding decisions, and to test this theory with the bluegill sunfish, a colonial nester. This year, Isabelle monitored spawning of tagged males in colonies on Birch Bay bar. The data on body condition and reproductive success collected are being used in a dynamic optimization model to predict what are the optimal sequences of breeding decisions individual male bluegill can make. The predictions of this model will be tested in the field in 1989.

Assistant: Peter Emtage

Dr. Tim Ehlinger - "Trophic Polymorphism in Sunfish" - Postdoctoral Associate, Michigan State University

The purpose of this seasons' field work was to test whether a trophic polymorphism Tim discovered in Michigan bluegill is in any way related to the cuckolder/parental reproductive polymorphism discovered in Lake Opinicon. Preliminary analysis suggests that cuckolder and parental males differ morphologically and probably occupy different feeding niches. Cuckolder males appear to be more "risk prone" in their foraging. These

results form the basis for a two-year study of the trophic variation beginning in 1989.

Publications:

Kindler, P., D. Philipp, M. Gross and J. Bahr. Serum 11-ketotestosterone and testosterone concentrations associated with reproduction in male bluegill. General and Comparative Endocrinology: in press. (accepted 21 Nov. 1988).

DR. GLENN MORRIS & DR. DARRYL GWYNNE - Department of Zoology, Erindale College, University of Toronto

John Tuckerman - "Mate Selection in the Curve-Tailed Katydid" - M.Sc. Thesis

My work involves looking at sexual selection in a local Phaneropterine katydid, Scudderella curvicauda. This particular group of katydids is unusual among Orthopterans in that the females, as well as the males possess an acoustic signal with which they respond to certain male calls. Males are only able to locate females through the use of the female signal. I recorded songs of individual wild caught males and have found that each male has his own unique signal, length of signal being the discriminating feature. I hope to test in the future whether females respond more readily to the calls of certain males. (There are some indications that they do so.) As well, my field work revealed that at the peak of the mating season a large proportion of males were parasitized resulting in an early death. The likely parasite is an acoustically orienting fly. Next season I hope to more closely examine the costs and benefits of certain male song types with respect to female choice and parasite pressure.

DR. DAVID P. PHILIPP- Aquatic Biology Section, Illinois Natural History Survey, 607 E. Peabody Dr., Champaign, Illinois

"Genetic Aspects of Fish Reproduction"

Our long-term research has been aimed at determining the spawning dynamics of the bluegill population in Lake Opinicon, and the various factors that affect male reproductive success. We are also conducting studies that center on assessing the genetic, physiological, social, and environmental factors that influence alternative reproductive behaviors among male bluegill. In addition, we are studying the relationship between hormones and behavior, both spawning and parental care, among male bluegill. Finally, we are studying why and how the two species of Lepomis in Lake Opinicon hybridize.

Assistant: Dave Philipp

Julie Claussen - "The Dynamics of Bluegill Reproduction"

1988 was the fourth year of this study. We continued to monitor the spawning activity of all colonies formed in a 2 km study area throughout the spawning season. We assessed how reproductive success varied spatially

among nests in 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, we performed an experiment to test investment decisions based on energy budgets. By providing a food supplement to nesting males, we attempted to influence current and future decisions regarding nesting and parental care investments within a breeding season.

Pawel Kindler - "Hormonal Analysis of Male Bluegill Reproductive Behavior"

1988 was the third year of this study. We continued to assess the effects of exogenous hormonal implants (testosterone, 11-ketotestosterone, and cyproterone acetate, an androgen blocking agent) on the spawning and parental care behaviors of parental male bluegill. In addition, we took blood samples from both parental and cuckolder male bluegill during spawning in Lake Opinicon to compare natural hormone levels among the two types of males. We are assessing the roles that these hormones play in influencing both the life history decisions made by the young males, as well as the resultant reproductive behaviors.

Blake Konkle - "Interspecific Hybridization of Bluegill and Pumpkinseed"

1988 was the second year of this study. A large, multi-seasonal population survey of the sunfish population in the lake was initiated in August, using standardized electrofishing procedures. This survey will determine the relative numbers of the two pure Lepomis species, as well as the percentage of F1 and Fx hybrids, that make up the Lake Opinicon population. A combination of protein electrophoresis and restriction fragment length polymorphism analysis of mtDNA is being used to determine the relative contribution of the two different possible reciprocal hybridization events to hybrid production.

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

"Water Mite Parasitism of Aquatic Insects"

During 1988 I continued investigating the influence of differential parasitism by mites on two species of water strider. Gerris comatus carries a nine-fold heavier burden of larval Limnochares aquatica than does Gerris alacris, both in nature and in laboratory infestations. The two species of water strider co-occur in shoreline habitats during spring, but G. comatus disappear from shorelines in early summer, just before the period of intense parasitism by L. aquatica. During summer months, G. comatus can only be found on off-shore mats of floating vegetation. Two experiments were conducted to determine whether populations of G. comatus were eliminated from shoreline habitats by parasitic mites, or whether the water strider dispersed, preferring offshore habitats where mites would likely be less abundant. Research also continued on the patterns of host-utilization by larval Arrenurus species mites within the aquatic insect community.

Dr. Bill Redmond (Dept. of Biology SUNY - New Paltz) and I began studying whether feeding tubes (stylostomes) secreted by larval Arrenurus danbyensis mites cause tissue damage in flight muscles of Coquillettidia perturbans mosquitoes. Preliminary examination of sections prepared for transmission electron microscopy are in progress.

Assistant: Lori Laughland

Wanda Cook - "Parasitism of Dragonflies by the Water Mite Limnochares americana" - M.Sc. Thesis

I examined the interaction of the water mite, Limnochares americana, with a community of dragonflies. I surveyed the adult dragonflies at Hebert Bog for the presence of mites to determine whether parasitism was related to dragonfly behaviour. Species of dragonflies that spend most of their time perching are much more likely to be hosts than those that spend most of their time flying, because the mites locate hosts by climbing emergent vegetation. I also conducted an extensive mark-recapture study of the small libellulid, Leucorrhinia frigida, to determine the distributional patterns of the mite on this host. Territorial male L. frigida carry the vast majority of the larval mites, which they encounter while defending territories, while females and teneral males have very few mites.

Thesis:

Laughland, L.A. 1988. Stimuli inducing detachment of larval Arrenurus danbyensis Mullen mites from adult Coquillettia perturbans (Walker) mosquitoes. B.Sc. Thesis, Department of Biology, University of New Brunswick, Fredericton, New Brunswick.

Publications:

Cook, W.J., Smith, B.P., Brooks, R. 1989. Allocation of reproductive effort by female Arrenurus spp. (Acari: Hydrachnidia; Arrenuridae). Oecologia, In press.

Smith, B.P. 1987. New species of Hydrachna (Acari: Hydrachnidia; Hydrachnidae) parasitic on water boatmen (Insecta: Hemiptera; Corixidae). Canadian Journal of Zoology. 65(11): 2630-2639.

Smith, B.P. 1988. Host-Parasite Interaction and Impact of Larval Water Mites on Insects. Annual Review of Entomology. 33: 487-507.

Smith, B.P. 1989. Hydrachnidia, in Aquatic Macroinvertebrates of Northeastern North America, edited by B. Peckarsky, Cornell University Press, In press.

Smith, B.P. 1989. Impact of parasitism by larval Limnochares aquatica on juvenile Gerris comatus, Gerris alacris, and Gerris buenoi (Insecta: Hemiptera; Gerridae). Canadian Journal of Zoology. In press.

Smith, B.P., Laughland, L.A. 1989. Stimuli inducing detachment of larval Arrenurus danbyensis Mullen (Hydrachnidia: Arrenuridae) from adult Coquillettia perturbans (Walker) (Diptera: Culicidae). Experimental and Applied Acarology. In press.

Smith, B.P. 1989. A description of the larva of Rhyncholimnochares kittatinniana Habeeb (Acari: Hydrachnidia; Limnocharidae). Canadian Entomologist. In press.

Smith, B.P. 1989. Descriptions of larval Arrenurus bartonensis Arrenurus birgei, Arrenurus neobirgei, and Arrenurus rotundus (Acari: Hydrachnidia; Arrenuridae). Accepted by Canadian Entomologist.

DR. S.P. VANDER KLOET - Department of Biology, Acadia University, Wolfville, N.S.

"Demography of Vaccinium corymbosum in the Hebert Bog".

In 1979, 50 plants of Vaccinium corymbosum were permanently tagged so that vegetative growth and propagation as well as reproduction could be monitored for a 10-year period. Preliminary analysis of the data show that, although none of the plants died, they nevertheless have lost about 45% of their standing crop. This loss can be attributed to three events (i) a severe cold snap in December of 1980 which killed many perennating buds (ii) invasion of a small colony of beavers with a predilection for high-bush blueberry stems (iii) browsing of young stems by snow-shoe hares. Reproduction has also been very erratic with <35% of the plants producing seed in any year. Usually no more than two plants had more than 500 berries. Conversely 17 plants did not produce any seed at all during this 10-year period.

Publications:

Vander Kloet, S.P. 1988. The genus Vaccinium in North America. Agriculture Canada Publication #1828. 201 pp. Ministry of Supply and Services, Ottawa, Ontario.

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

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

This project, now in its fourth year, has two general objectives. The first is to use molecular biological techniques to determine the "genetic" mating system of red-winged blackbirds. This species has been the focus of many mate choice and sexual selection studies and to date, no one has successfully explained how females choose their mates and therefore the factors responsible for the high levels of polygyny observed. It is possible that the "phenotypic" mating system (in whose territory a female nests) may poorly reflect with whom females mate. By collecting blood from all breeding birds and their offspring, our intention is to use the DNA from the blood to determine the rates of cuckoldry and the factors that influence those rates. Related to the question of mate choice, the second objective of this study is to test the Hamilton and Zuk parasite hypothesis of sexual selection. By collecting blood smears for parasite analysis, we will be able to determine whether a male's parasite load influences either its plumage or behaviour and in turn, whether these influence female mate choice.

Collaborators: Dr. Peter Boag and Dr. Brad White (Queen's)
Dr. Gordon Bennett (Memorial)

Assistants: Drew Hoysak, Kit Muma, Linda Dupuis.

"Ecology and Behaviour of Black Rat Snakes"

This was the eighth year that we have been marking and measuring all black rat snakes encountered at the biology station. We will continue this long-term data collection in the future since it represents the only such study undertaken of this endangered snake. In addition to collecting general population data, several specific studies have been undertaken. In 1988 we completed the study of behavioural thermoregulation by placing snakes in a thermal gradient to determine their preferred temperature. Even though our field data indicate that black rat snakes are largely thermoconformers, when given a choice they show a strong preference for temperatures around 26°C.

Assistants: Ian Robertson

"Pre- and Post-Fledging parental Care in American Robins"

To broaden the study conducted last year by Sue McRae for her B.Sc. thesis, we again monitored the spatial activities of robins breeding around the biology station. Video taping at nests confirmed that parents do not divide the brood prior to fledging. However, after fledging, partial or complete brood division is the norm. Occasionally broods are reunited after a week or more so that males can care for all the fledgings while females start new nests. Once the young have left the nest the parents forage over much wider areas than they used prior to the fledging.

For related projects on robins, see research summary for Dr. Montgomerie.

Assistants: Sue McRae, Karen Metz, Linda Dupuis

"Decoy Trap Biases in Brown-headed Cowbirds"

This study added a second year of data to the B.Sc. thesis research of Kevin Dufour. Our objectives were to determine whether a bird's condition affects its vulnerability to being caught in a decoy trap. Our data confirmed our findings from 1987 that decoy traps preferentially capture birds in poorer condition and also disproportionately capture males. We again found the curious result that among recaptures, there is evidence that birds in better condition when first captured are more likely to reenter the trap. Although this phase of the study is now complete, that traps will be operated for one or two more years to study recapture and survival patterns between years, particularly in relationship to the strongly biased adult sex ratios in this species and to individual parasite loads, which were sampled in 1988.

Assistants: Kevin Dufour, Drew Hoysak

Dave Shutler - "Rules of Territory Acquisition by Red-winged Blackbirds" - Ph.D. Thesis

Approximately half of all male red-winged blackbirds do not hold territories and thus have little or no opportunity to breed. We expect therefore, that competition among these "floaters" to acquire a territory will be intense. The aim of this research is to determine the strategies employed by floaters to establish territories, and the rules that shape those strategies. Factors of interest include resource holding potential

(RHP) (competitive ability), site familiarity and site dominance. A series of removal experiments revealed that original territory owners retain their ability to reestablish their territories, even after a long time in captivity. In addition, RHP determined in aviary dominance hierarchies appears to have little influence on the outcome of competition for territories. Additional removal experiments and radio-telemetry study of floaters area planned for 1989.

Assistant: Linda Dupuis

Ian Robertson - "Thermal Constraints and Habitat Use by the Northern Water Snake (Nerodia sipedon) - B.Sc. Thesis

The body temperature of ectotherms is determined by their environment. Because of their close association with water, a much better thermal conductor than land or air, northern water snakes may be influenced in their behaviour and habitat selection by relative air and water temperatures. In a controlled thermal gradient, water snakes showed a strong preference for temperatures around 28°C. In outdoor enclosures the snakes showed a preference for microhabitats closest to their preferred body temperature, particularly when that microhabitat was water. In the field, water snake distributions appeared to be determined much more by thermal considerations than by prey distribution. These and other aspects of the thermal biology of water snakes will be investigated in 1989.

Publications:

- Montgomerie, R.D. and P.J. Weatherhead. 1988. Risks and rewards of nest defence by parent birds. *Quarterly Review of Biology* 63: 167-187.
- Teather, K.L., Muma, K.E. and P.J. Weatherhead. 1988. Estimating female settlement from nesting data. *Auk* 105: 196-200.
- Weatherhead, P.J. 1988. Adaptive disposal of fecal sacs? *Condor* 90: 518-519.
- Weatherhead, P.J. Nest defence by song sparrows: methodological and life history considerations. *Behavioral Ecology and Sociobiology*, in press.
- Weatherhead, P.J. Temporal and thermal aspects of hibernation of black rat snakes (Elaphe obsoleta) in Ontario. *Canadian Journal of Zoology*, in press.
- Weatherhead, P.J. and D.J. Hoysak. Spatial and activity patterns of black rat snakes (Elaphe obsoleta) from telemetry and recapture data. *Canadian Journal of Zoology*, in press.
- Weatherhead, P.J. and R.K. Prosper. Thermal ecology of a northern population of black rat snakes (Elaphe obsoleta). *Canadian Journal of Zoology*, in press.

Thesis:

- Robertson, I.C. 1988. Thermal constraints and habitat use by the northern water snake (Nerodia sipedon). B.Sc. Thesis, Department of Biology,

Carleton University, Ottawa.

DR. R.C. WYNDHAM - Department of Biology, Carleton University, Ottawa.

Roberta Fulthorpe - "Bacterial Adaptation to Chloro-aromatic Chemicals in Natural Water Systems" - Ph.D. Thesis

The toxicology facility at the station was again used this year for the study of chloro-aromatic degradation by bacteria in lake water microcosms. Improvements in the systems for water and contaminant delivery to the microcosms in this facility made it possible to finely regulate the amount of chemical received by each microcosm. This allowed the quantification of the relationship between the survival of a chlorobenzoate degrader, Alcaligenes sp. BR60, and the concentration of its substrate, chlorobenzoate. Microcosms were set up that received CBA from levels as low as 10nM to 25uM. Only those receiving greater than uM were able to support a healthy population of chlorobenzoate degraders, a finding that suggests that selection for these types of organisms will not take place when contamination levels are very low. In addition studies this year confirmed an observation from the previous summer - DNA probes provide more reliable estimates of the BR60 population than do selective plating techniques, presumably because of phenotypic changes in BR60 in lake water or because of transfer of chlorobenzoate catabolic genes to other bacterial strains.

Further studies involved the exposure of microcosms to more toxic pollutants, chlorobenzene and chlorophenol, concomitant with exposure to chlorobenzoate. Because of the similarity in degradation pathways of these chemicals it was expected that system adaptation to chlorobenzoate would enhance degradation of the other two chemicals. While chlorobenzoate degrading organisms did go on to attack chlorobenzene and chlorophenol, they did not use the plasmid carried genetic information available from BR60. Investigations into the differences between the chlorobenzoate degrading species and those that were selected for chlorobenzene and chlorophenol degradation are underway.

Assistant: Caroline MacIntyre

Table 4: Summary of Research use at Queen's University Biological Station 1987.

Project Supervisor and Affiliation	Project Title	Students and Affiliation	Residency
Dr. L. Aarssen (Queen's)	Competitive Ability and Coexistence in plants	Doug Taylor (Queen's)	Occasional
	Competition in Grassland Plants	Garry Epp (Queen's)	Occasional
Dr. P.W. Colgan (Queen's)	Field Ethology of Fishes		Occasional
	Habitation of Killifish to Predatory Stimuli	Carolyn Welch (Queen's)	Occasional
	Behavioural Comparisons of different Killifish Populations	Liane Gabora (Queen's)	Occasional
	Foraging and Predator Avoidance in Centrarchids	Vytenis Gotceitas (Queen's)	Occasional
Dr. A. Crowder and Dr. R. Harmsen (Queen's)	Effects of Grazing on Old Field Succession		Occasional Occasional
	Population Biology of the European Skipper	Bruce Henderson (Queen's)	Occasional
	Host Plant Specificity in <u>Trirhabda</u> Beetles	Kathy Kraulis (Queen's)	May 9-29 Occasional
	Life Strategy Comparisons between Two Species of <u>Lygus</u>	Mary Stockdale (Queen's)	Occasional
Dr. A. Forsyth (Adjunct-Queen's)	Behavioural Ecology of Insects		Occasional
	Maternal Care in Lacebugs	David Bell	Jul 5-Aug 31
Dr. P.H. Johansen (Queen's)	Aquatic Toxicology		Occasional
		Andrew Samis	Occasional

	Effect of Pentachlorophenol on Centrarchids	(Queen's)	
		Janice Frame (Queen's)	Occasional
Dr. J.A. Keast (Queen's)	Bird and Fish Communities		Apr 29-Aug 15
		Sari Saunders (Queen's)	May 6-Aug 13
	Growth and Survival of Walleye in Rearing Ponds	Michael Fox (Queen's)	May 5-Aug 18
	Sunfish in Beaver Ponds	Christine Watters (Queen's)	May 15-Aug 12
		Katie McMahon (Queen's)	Occasional
Dr. R.D. Montgomerie (Queen's)	Behavioural Ecology of American Robins		Occasional
	How Do Robins Find Worms?	Linda Dupuis (Carleton)	May 1-Aug 11
	Do Robins Have Song Dialects?	Tarmo Poldmaa (Queen's)	Apr 28-May 29
		James Briskie (Queen's)	Apr 15-29
		Karen Holder (Queen's)	Occasional
		Ian Jones (Queen's)	Apr 12-17
		Adele Mullie (Queen's)	Apr 11-16 May 7- 8
Dr. L. Ratcliffe (Queen's)	Acoustical Communication in Birds		Occasional
	Neighbour - Stranger Recognition in Chickadees	Susan Lempriere (Queen's)	Jan 21-Jun 30 Jul 16-17 Sep 16-17/Occasional

	Lesley James (Queen's)	Apr 17-Jun 6
	Andy Hurly (Queen's)	Occasional
	Ingrid Johnsrude (Queen's)	Occasional
	Tina Chin (Queen's)	Occasional
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Dr. R.J. Robertson (Queen's)	Evolution of Breeding Strategies in Birds	May 9-Sep 10
	Behavioural Ecology of Tree Swallows	Lisa Venier (Queen's) May 1-Aug 10
		Sarah Kalff (Queen's) Apr 24-Jul 31
		Larissa White (Queen's) Apr 29-Jul 23
	Reproductive Effort in the Eastern Phoebe	Kelvin Conrad (Queen's) Apr 18-Aug 3
		Jennifer Magwood (Carleton) Apr 30-Aug 15
	Parental Care in Eastern Bluebirds	Sue Meek (Queen's) Apr 20-Jul 31
		Caroline Tomlin (Queen's) May 1-Jul 31
	The Flight Display of Bobolinks	Monica Mather (Queen's) May 4-Jul 23
		Ivan Grabovac (Queen's) Occasional
	Mixed Reproductive Strategy in Tree Swallows	Scott Morrill (Queen's) May 1-Aug 20
	Response of Nesting Eastern Phoebes to Cowbirds	Jessie Deslauriers (Queen's) Apr 30-May 1 May 7-15
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Dr. J. Smol (Queen's)	Aspects of Limnology	Occasional

Diatom Distribution in S. Ontario Lakes	Cathy Christie (Queen's)	Occasional
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Seasonal Succession in Phytoplankton	Michael Agbeti (Queen's)	Occasional
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Dr. R. Baker
(U of T - Erindale)

Occasional

Effect of Mites on Reproductive Success of Damselflies	Mark Forbes (Erindale)	May 4-Aug 28
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Dr. Spencer Barrett
(U of Toronto)

Occasional

Ecological Genetics of Mating System Variation	Chris Eckert (U of T)	Jul 31-Sep 4 Occasional
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Dr. J. Fullard
(U of T - Erindale)
Toronto)

Insect Sensory Physiology and Neuroethology		May 15-Sep 17
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Neuromuscular Organization of the Arctiid Tymbal	Rohini Kumar (Erindale)	Jun 1-Aug 30
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Auditory Characteristics of the Northern Bog Katydid	Heiner Romer (U of Bochum)	Aug 17-18
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Sensory Ecology of Waterstriders	Ed McLean (Erindale)	May 21-Aug 30 Sep 16-17
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Dr. M.R. Gross
(U. of Toronto)

Evolutionary Ecology of Fish Reproduction		Jun 12-Jul 11
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Breeding Dispersion in Colonial Fishes	Isabelle Cote (U of T)	May 22-Jul 20
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	Peter Emtage (U of T)	May 22-Jul 20
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Trophic Polymorphism in Sunfish	Tim Ehlinger (Michigan State)	Jun 13-Jul 10
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	Anna Toline (U of T)	Jun 22-Jul 3
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	Ron Coleman (U of T)	Jul 6-10
Dr. Glenn Morris and Dr. Darryl Gwynne (U of T - Erindale)		Occasional
	Mate Selection in the Curve-tailed Katydid	John Tuckerman (Erindale) Jul 15-Aug 29
Dr. D.P. Philipp (Illinois Natural History Survey)	Genetic Aspects of Fish Reproduction	Jun 10-Jul 4 Aug 27-Sep 1
	Dynamics of Bluegill Reproductive	Julie Claussen (INHS) Aug 27-Sep 1
	Hybridization of Bluegill and Pumpkinseed	Blake Konkle (INHS) Aug 27-Sep 1
		Davey Philipp Occasional
		John Epifanio (INHS) Jul 1-31
Dr. B.P. Smith (U. of New Brunswick)	Water Mite Parasitism of Aquatic Insects	Apr 27-Aug 8
		Lori Laughland (U.N.B.) Apr 27-Oct 10
	Dragonfly Parasitism by Water Mites	Wanda Cook (U.N.B.) May 24-Jul 31
Dr. S. Vander Kloet (Acadia)	Demography of Pitch Pine and High-bush Blueberry	Occasional
Dr. P. Weatherhead (Carleton)	Sexual Selection in Red-winged Blackbirds	Apr 14-15 May 4-7 May 18-Jul 24
		Kit Muma (Carleton) Apr 1- Aug 8
	Parental Care in American Robins	Susan McRae (Carleton) Apr 29-Jul 31

	Karen Metz (Carleton)	Occasional
Decoy Trap Biases in Cowbirds	Kevin Dufour (Carleton)	Apr 1-Aug 15
	Drew Hoysak (Carleton)	Apr 1-Aug 15
Rules of Territory Acquisition by Red- winged Blackbirds	Dave Shutler (Carleton)	Apr 1-Jul 17
	Linda Dupuis (Carleton)	May 1-Aug 11
Thermal Regime of Northern Water Striders	Ian Robertson (Carleton)	Apr 29-Aug 15

Dr. Wyndham
(Carleton)

Occasional

3-Chlorobenzoate degrading Bacteria in Natural Waters	Roberta Fulthorpe (Carleton)	May 21-Sep 20
	Caroline MacIntyre (Carleton)	Occasional

Other Visitors to QUBS 1988

Charlotte Beschel
Ian Jones (Queen's)
Jim Briskie (Queen's)
Jeff Koppelman (Missouri Fish and Game)
Dick Free (Missouri Fish and Game)
Morgan Hull
Jennifer Smith
T. Michael Harrison & Family
Jim Complak
Maryanne Bradley
Gary Tetzlaff
Jane Watson
Nancy Gerrish
Dr. Tom Dickinson (University of Toronto)
Nancy Flood
Tracey Wood
Jim Hoyle (MNR)
W. Garry Smith (Rideau Lakes Assessment Unit)
Gary Ridout (Rideau Lakes Assessment Unit)
Geoff Waddington
Scott Meskis
Darrell Dietrich
Valerie Palda
Heather Dewar
Caren Furlonger
Scott Grant (Trent)
Tracey Burton
Dave Osborne
Milton and Margaret Shutler
Jhil Kar (Carleton)
Linda Langille (Carleton)
Pam Krannitz (Queen's)
Dr. H. Lisle Gibbs (Queen's)
Jennifer Truemner
Katherine Thiessenhausen
Sylvia Mather
Gord De Vries
Dan Soluk (Erindale)
Li Shiyu (Queen's)
Brian King (Queen's)
Bruce Henderson (Queen's)
Kathy Kraulis (Queen's)
Tina Roeder (Queen's)
Tom Quinn (Queen's)
John Davison
Andre Rudnicki
Dr. Joe Brown (Memorial)
Nav Sharma
Yves Lariviere
Pat McRae
Dorothea McRae
Johanne Ranger (Parks Canada)
Charles Francis (Queen's)

Marianne Douglas (Queen's)
Dr. Andy Hurly (Oxford)
Peter Mather
Ruth, Wayne, Trudy Connor
Scott Eckert
Patty Johnson
Mark Spackowski
Michele Flatters (Princeton)
Seth and Rowan Barrett
Ron & Susan Vinkle & Family
Wally Rendell (Queen's)
Edna Clark
Bob & Linda Wells & Family
Alex McKirdy
Rodolphe & Marguerite Cote
Ruth Fulthorpe
Trish Hayes
Cathy Rogers
Marilyn Chow
Bernard Landry
Pam Sinclair
Andy Smith
Jayne Yack (Erindale)
Myron Smith
Don & Mona Phelan
Barb Heller (U. of Western Ontario)
Linda Vanderlee
Heather Procter (Erindale)
David Flowers
Al & Linda Dupuis
Bill Kraemer
Turid Forsyth
Dawne Smith
Don Franklin
Jessie Tuckerman
Chris Palmer
Janet Sheridan (Rideau Lakes Assessment Unit)
Tina Chin
Sharon Wilkie
Andrew Mason (Erindale)
Lindsay Penney (MNR)
Linda Whittingham (Queen's)
Bill Dushenko (Queen's)
Doug Menard
Barb Hilder
Dr. Jane Baldock
Bob and Crystal Taylor
Sue Warren
Jean Greig (Queen's)
Caroline Ford
Carol-Anne Albertson
Ian Warkinton
Stan & Kathleen Magwood
Dr. Jiri Gaisler (Inst. Syst. & Ecol. Biology, Brno, Czechoslovakia)
Karen Brown (Fisheries and Oceans)

Brian Cummings (Queen's)
Anne Davies (Queen's)

Table 5: Documentation of Research Use for 1988

<u>Internal:</u> Queen's	User Days				
	Supervisor	Post-Doc	Graduate Student	Assistant	Total
Colgan	1	0	5	10	16
Crowder	2	0	0	6	8
Forsyth	5	0	0	50	55
Harmsen	31	0	0	56	87
Keast	89	0	105	281	475
Montgomerie	22	0	0	96	118
Ratcliffe	3	0	131	60	194
Robertson	168	0	272	656	1096
Smol	0	0	3	3	6
Total Internal	321	0	516	1218	2055
<u>External</u>					
U. of Toronto					
Baker	3	0	118	3	124
Barrett	2	0	57	0	59
Fullard	116	0	95	91	302
Gross	18	28	73	42	161
Gwynne	5	0	0	0	5
Morris	3	0	46	0	49
	147	28	389	136	700
Carleton					
Weatherhead	74	0	108	683	865
Wyndham	2	0	108	3	113
	76	0	216	686	978
U. New Brunswick					
Smith	99	0	71	65	235
Ill. Nat. Hist. Survey					
Phillipp	31	0	6	50	87
Acadia					
Van der Kloet	3	0	0	0	3
U. of Bochum					
Romer	12	0	0	0	12

Royal Ont. Museum

Darling	5	0	0	11	16
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SUNY

Redmond	4	0	0	0	4
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Total External	377	28	682	948	2035
Grand Total	698	28	1198	2166	4090 (up 19% over 87)
% Queen's	46	0	43	56	50
% External	54	100	57	44	50

User days in teaching activities	1856 (up 26% over 1987)
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Conference, Field trip use	334
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Other	1013
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Total User Days	7293 (up 18% over 1987)
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Table 6: Summary of Conference, Meeting and Field Trip Use of Queen's University Biological Station - 1988.

Organizers	Function	No. of Participants	Duration
Weatherhead Lab (Carleton)	Station reunion	38	Jan 15-17
Mrs. P. Bark (Queen's)	Italian Club Italian Immersion Weekend	11	Jan 23-24
Dr. R. Harmsen (Queen's)	Bio 439 (Population Ecology) Weekend	15	Jan 29-Jan 31
Dr. R. Harmsen (Queen's)	Bio 439 (Population Ecology) Weekend	19	Feb 5-7
Dr. D. Bastianutti (Queen's-Spanish)	Spanish Club Spanish Immersion Weekend	16	Feb 12-14
David Orfald (O.P.I.R.G.)	Ontario Public Interest Research Group Meeting	18	Feb 18-21
John Keith (Queen's History)	History Group Outing	8	Feb 23-25
Jocelyne Devi-Leyton	Yoga Retreat	6	Mar 19
Dr. P. Stokes (Toronto Envir. Bio)	Shield Lakes Acidification Network Telegraph Conference	42	Apr 8-10
Paul Davidson (Queen's-History)	Thompson Course Seminar Sessions	10	Apr 17-18
Dr. W. Reeve (Queen's-German)	German Language Immersion Field Camp	17	Apr 30-May 8
Bruce Cameron (Queen's-Biology)	Scuba Course	15	Jun 4-5
Dr. P. Weatherhead (Carleton-Biology)	Parks Canada Park Warden Conference Tour	8	Jun 8 - 4
Bob Bell (Queen's Safety)	Fire Extinguisher Training Course	40	Jun 13
Bob Hamilton	Ministry of Natural Resources Provincial Fisheries Policy Committee	9	Jun 23
Dr. Pierre DuPrey (Queen's-Art)	Art Department Retreat	6	Jun 27-28

Table 6 (continued)

Organizers	Function	No. of Participants	Duration
Dr. S.R. Brown (Queen's-Biology)	Elder Hostel Limnology Course Tour	48	Jul 21
Colin Gaskell	Ottawa Field Naturalists Field Trip	31	Aug 14
Dr. Ed Kott (Wilfrid Laurier-Bio)	Bio 491 Wilfrid Laurier University Field Course	15	Aug 28-Sep 10
Dr. John Smol (Queen's-Biology)	Limnology course Field Trip	40	Sep 24-25
Dr. R.J. Robertson (Queen's-Biology)	Bio 202 Ecology Field Trip	86	Oct 1-2
Rose Jones (Lasalle High School)	Limnology/Succession Field Trip	26	Oct 4
Roger Lupton (Lasalle High School)	Environmental Biology Field Trip	21	Oct 5
Sean Sharpe (Queen's-Biology)	Bio 202 Ecology Field Trip	84	Oct 22-23
Jocelyne Devi-Leyton	Yoga Retreat	5	Nov 12

Table 7: Queen's University Biological Station Seminar Schedule 1988.

12 May	Dr. Martin Wells Cambridge	"Biology of Nautilus"
23 May	Dr. John Craig University of Auckland	"Behavioural ecology of Pukekos"
24 May	Terence Dickenson	"Cosmology and Astronomy"
8 June	Kevin Dufour Carleton	"Trapping Bias in Cowbirds Revisited"
	Lori Laughland Univ. of New Brunswick	"Ask Me I Mite"
15 June	Kelvin Conrad Queen's	"The evolution of odonate mating systems: Dragons & Demoiselles"
22 June	Dr. Hans Damman Carleton	"Predators, plants and plant feeding insects"
3 July	Dr. James Fullard U of T - Erindale	"Into a Moth (the Australian Way)"
6 July	Mark Forbes U of T - Erindale	"Asynchronous hatching in grebes"
13 July	Wanda Cook University of New Brunswick	"Odonates parasitized by a water mite: Consequences of territoriality"
20 July	Ian Robertson Carleton	"Behavioural Thermoregulation in Snakes"
	Sue MacRae Carleton	"Division of labour by robins feeding fledged young"
27 July	Scott Morrill Queen's	"Extra Pair Copulations in Tree Swallows"
8 August	Mike Fox Queen's	"Environmental Influences on Pumpkinseed Sunfish Life History"
10 August	Roberta Fulthorpe Carleton	"The Selfish Plasmid"
17 August	Ed McLean U of T - Erindale	"Effects of Body Armor on Antipredator Behavioural Tactics in Freshwater Fishes"
18 August	Darryl Gwynne U of T - Erindale	"Reproductive behaviour in Katyids"
24 August	Sean Sharpe	"Nest-site relocation by female <u>Peromyscus maniculatus</u> : influence of breeding condition"
25 August	Dr. Heiner Romer U. of Bochum	"Auditory Characteristics of the Northern Bog Katydid"

Table 8: Fee Schedule for 1988

Accommodation - Room and Board

\$265/mo	-	includes obligation for chores on a rotating schedule
\$400/mo	-	no obligation for chores
\$140/wk	-	including weekend, eg. Field courses (includes a lab fee)
\$ 19/day	-	24 hr. room and board (includes meals & overnight, no chores)
\$ 3.50	-	breakfast only
\$ 3.50	-	lunch only
\$ 7.00	-	dinner only
\$ 8.00	-	overnight accommodation - academic purposes - no food - Queen's
\$ 13.00	-	overnight accommodation - academic purposes - no food - non-Queen's
\$ 13.00	-	overnight accommodation - nonacademic purposes - no food - Queen's
\$ 21.00	-	overnight accommodation - nonacademic purposes - no food - non-Queen's

Fees for conferences are negotiated directly with the manager or director.

Accommodation Surcharges (applied as additional % to above charges).

<u>Surcharge</u>	<u>Accommodation Type</u>
0%	Whitehouse (Dormitory, Curran Cottage (multi)
5%	Cabins 1-7, 9, 10, 12, 13 and Shaker
10%	Cabins 8, 11 and White House apartment
15%	Keast, Earl, and Sumac Cottages

Boat Rental

\$165/mo, \$75/wk	- includes maintenance on boats and motors - gas and oil not included in rental fee
\$ 35/day	- includes gas and oil for one day rental

Bench Fees

\$4.00/day	- Non-Queen's staff or major researcher (M.Sc., Ph.D. candidate, project coordinator or Post-doctoral Fellow)
\$1.38/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.