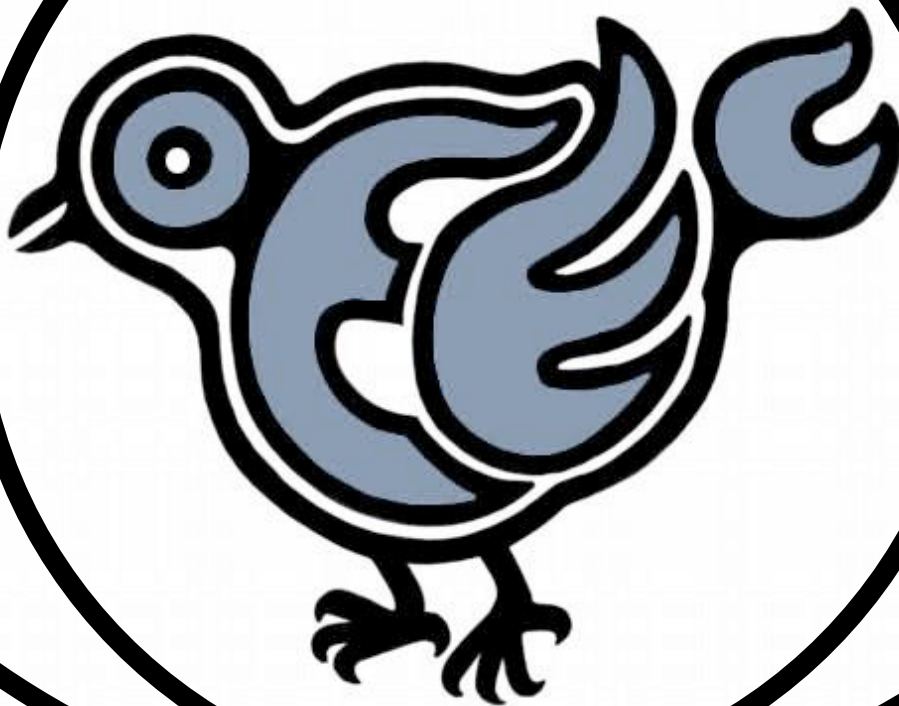


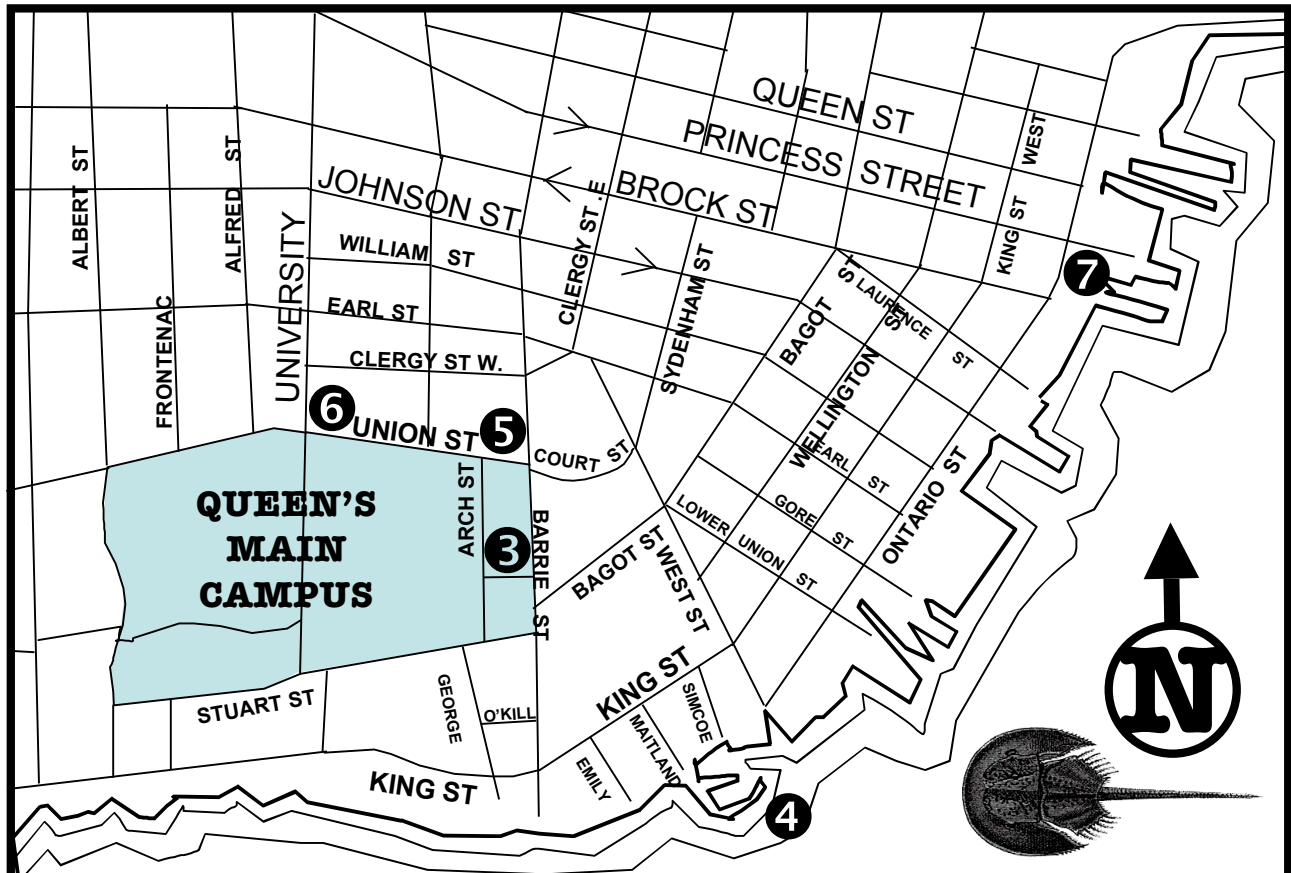
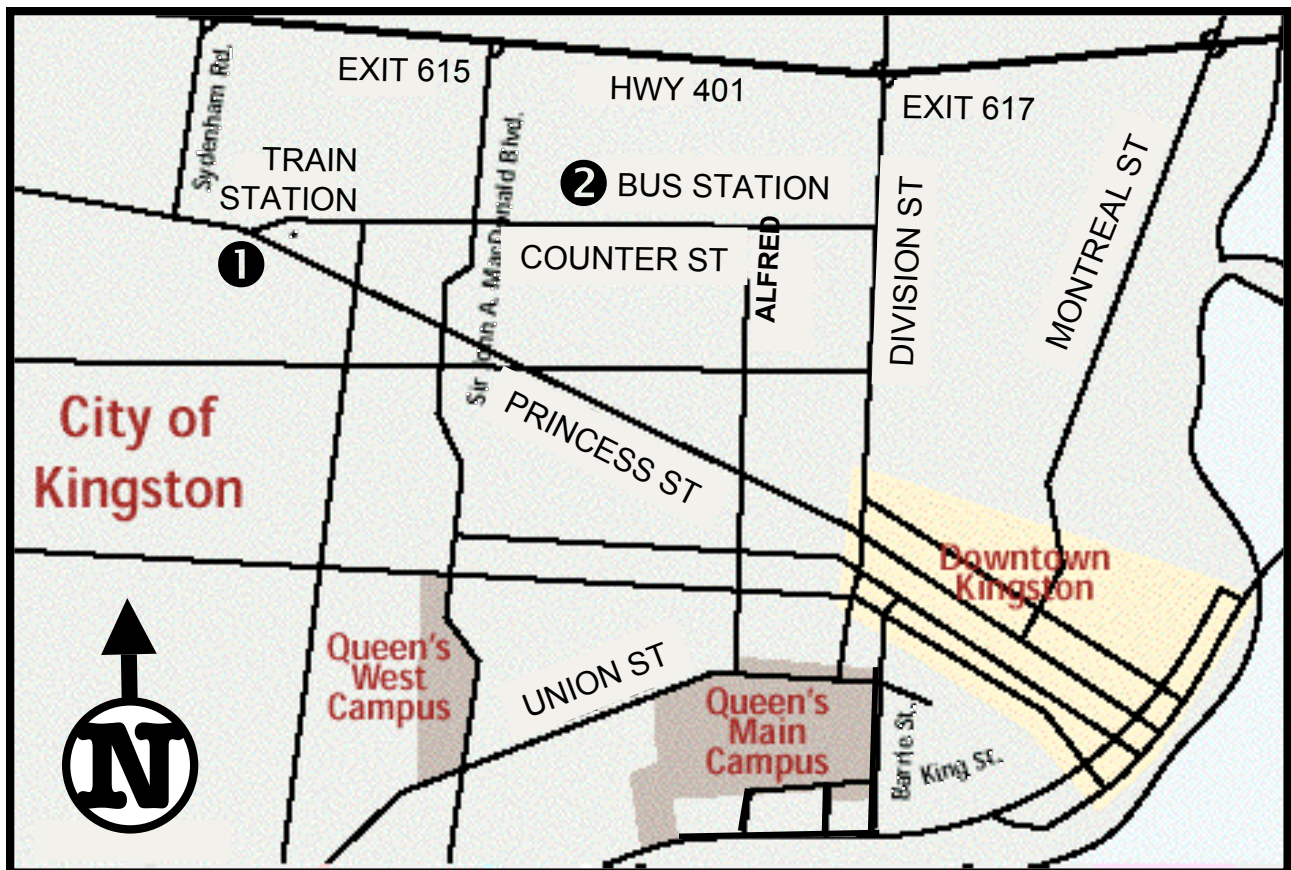
APRIL 21-23, 2002

QUEEN'S UNIVERSITY

**ONTARIO ECOLOGY
& ETHOLOGY
COLLOQUIUM**



PROGRAMME & ABSTRACTS



April 21-23

Left: Bioscience Complex,
Queen's University

Below: Biodiversity Centre,
Queen's University
Biological Station



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ACKNOWLEDGEMENTS

Many of the best features of this year's conference, including the lineup of keynote and plenary speakers, would not have been possible without the generous financial support of the Queen's Office of Research Services.

This conference was made possible through the hard work of many volunteers, who found time to help put this show on. We would like to take this opportunity to thank them all for their dedication.

- the 2002 oeec organizing committee

The oeec committee would also like to thank the following groups for their generous donations:

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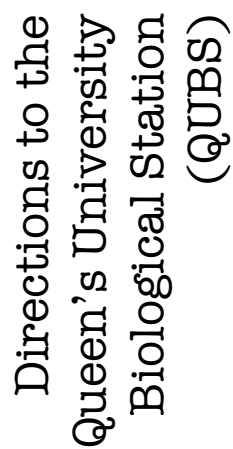
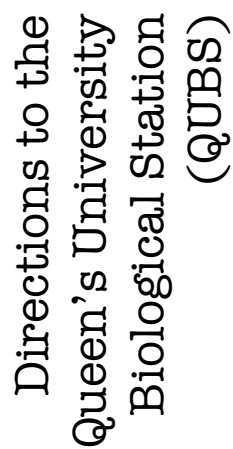
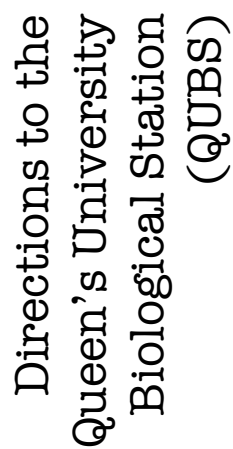


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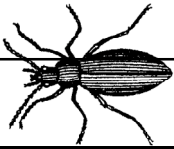



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Directions to the
Queen's University
Biological Station
(QUBS)

Saturday, April 20, 2002			
	Field trip to Queen's University Biological Station Departs from BioScience Complex at 2pm and 4pm		
Sunday, April 21, 2002			
pm	Return from QUBS field trip		
1800-?	Registration and welcome social mixer (cash bar) The Grad Club (corner of Union and Barrie)		
Monday, April 22, 2002			
0800	Registration/ Poster Setup - BioScience Atrium		
0830	Opening remarks: Queen's University Principal Dr. William C. Leggett Bioscience Room 1101		
0845	Dr. Irby Lovette,		
Room 1101	Dept of Ecology & Evolutionary Biology, Cornell University "The evolutionary origins of the latitudinal diversity gradient"		
0945	Coffee Break and Posters (30 minutes)		
	Species Interactions -Room 1102 Chair: R. Laird	Community & Evolutionary Ecology -Room 1103 Chair: K. Samis	Ecology I -Room 1101 Chair: S. Yakimowski
1015	Sylvester NE* & Smith BP - Divergent life history strategies in the mite, <i>Arrenurus manubriator</i> : viability of hybrids between forms with parasitic and nonfeeding larvae.	Pither J* - Explaining the range-size distribution of North American tree species.	Yakimowski SB* & Eckert CG - Geographic patterns of reproductive mode and population structure of a Canadian species-at-risk, <i>Vaccinium stamineum</i> (deerberry).
1030	Agrawal AA* - Plant-plant-herbivore interactions: phenotypic plasticity in response to plant competition affects herbivores of common milkweed	Mayo JS* & Jackson DA - Three-Dimensional Quantification of Habitat Structure and Habitat Use by fish in the Littoral Zone of a Freshwater Lake	Dunlop ES*, Shuter BJ, & Rodd H - Causes and Consequences of Individual Growth Rate Differences Between Two Populations of Smallmouth Bass
1045	Viswanathan DV* & Thaler JS - The community ecology of induced plant responses to herbivory: Priority effects on the abundance of multiple herbivore species	O P* - Growth and survival of <i>Festuca rubra</i> in artificially and naturally grubbed supratidal marsh	Dion DM*, Gosselin J-F, Hammill MO & Schreer JF - Foetal growth and maternal investment in the Northwest Atlantic grey seal (<i>Halichoerus grypus</i>)
1100	Thaler JS* - Herbivore damage and the attraction of predators to plants	Confer JL*, Canterbury RA & Lovette IJ - A review of the shifting distribution of the Golden-winged and Blue-winged Warblers: Effects of Habitat and Hybridization.	McLaren JR* - Soil degradation and plant re-establishment in coastal arctic salt-marshes of the Hudson Bay.

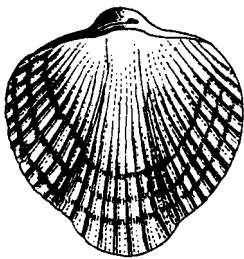
Monday, April 22, 2002 continued...			
1115	Moenting AE* & Brooks RJ - Investigations into Parasitism of the Eastern Chipmunk (<i>Tamias striatus lysteri</i>) by the bot fly (<i>Cuterebra emasculator</i> Fitch) in Algonquin Provincial Park, Ontario.	Lundholm JT* & Larson DW - Temporal resource heterogeneity and plant invasions: questioning "A general theory of invasibility".	Habib L* - Effects of sampling bias on estimates of historical species richness and faunal relaxation of mammals in Canadian national parks
1130	Lajeunesse MJ* & Forbes MR - Host range and local parasite adaptation	O'Hanlon-Manners D* - The impact of fungal pathogens on the survival of seeds of forest trees.	Hicks JL*, O'Hara Hines RJ, Schreer JF & Hammill MO - The use of time series analysis for detecting patterns in dive data
1145			Thompson FL & Eckert CG* - Experimental analysis of somatic, genetic and evolutionary trade-offs between sexual vs. asexual reproduction in an aquatic plant.
1200	Lunch (One Hour) Served in the Atrium!		
	Evolutionary Genetics -Room 1102 Chair: J. Austin	Conservation Biology -Room 1103 Chair: R. Norris	Behavioral Ecology -Room 1101 Chair: D. Mennill
1300	Austin J*, Loughheed S & Boag P - Is there congruent or independent phylogeographic pattern among spring peepers and bullfrogs?	Norris DR*, Theberge MT & Theberge JB - Forest composition around wolf (<i>Canis lupus</i>) dens in eastern Algonquin Provincial Park, Ontario	Mennill DJ*, Doucet SM, Montgomerie RD & Ratcliffe LM - Sex, rank, and individual identity in black-capped chickadees: It matters if you're black or white.
1315	Boulet M*, Gibbs HL & Hobson KA-Assessing migratory connectivity in yellow warblers using mitochondrial DNA genetic tags	Jaeger JAG* & Fahrig L - Road mortality and 'fence effect': which one is more harmful to population persistence?	Clotfelter ED, Schubert KA*, Nolan Jr. V & Ketterson ED - Mouth color does not signal hunger in nestling dark-eyed juncos (<i>Junco hyemalis</i>)
1330	Steeves T*, Kim M, McNally H, Anderson A & Friesen V - What role do physical barriers to gene flow play in the divergence of tropical seabirds?	Beresford D* & Sutcliffe J - A method for the control of stable flies, <i>Stomoxys calcitrans</i> L., on dairy farms in south-central Ontario.	Kamel S* - Investigation of the scatter-nesting hypothesis in leatherback turtles (<i>Dermochelys coriacea</i>)
1345	Loughheed SC*, Chek AA & Austin JD - Is there a tropical-temperate disparity in genetic diversity or taxonomy of vertebrates?	Sabara HA* & Winston ML - Assessing the management potential for honey bees as pollinators of greenhouse tomatoes	DesRosiers SA* Rau ME & Kavliers M - A Behavioural Re-assessment of the Effects of Infection with the Nematode, <i>Heligmosomoides polygyrus</i> , on Spatial Learning in Mice
1400	Brown JW*, Birt TP & Friesen VL - Taxonomic Status of the Yellow-Faced Amazon, <i>Amazona xanthops</i> .	Burgess KS* & Husband BC - The ecological impact of hybridization on small populations of red mulberry (<i>Morus rubra</i> L.) in Canada	Lapierre JL*, Schreer JF, Hammill MO & Burns JM - Effects of Diazepam (Valium®) on Cardiorespiratory Patterns of Nursing Harbor Seal Pups

Monday, April 22, 2002 continued...			
1415	Bogart J* - Are haploid <i>Hyla versicolor</i> <i>Hyla chrysoscelis</i> ?	Kasumovic MM*, Ratcliffe LM & Boag PT - Effects of habitat fragmentation and breeding synchrony on realized reproductive success in male least flycatchers.	Schmaltz G* & Giraldeau L-A - Scramble competition can induce a scanning-group-size effect in flocks of house sparrows.
1430	Mautner S* & Suchentrunk F - Local density differences and genetic variation in Grey Partridge (<i>Perdix perdix</i>) populations.	Kotanen PM - Testing whether escape from seed pathogens contributes to plant invasions.	Smith BP*, Muma KE & Forbes MR - To have and to hold, or, life history adaptations of <i>Arrenurus planus</i> , an ephemeral pool mite.
1445	Fitzpatrick MJ*, Mackay TFC & Sokolowski MB - Evolution of foraging behaviour in <i>Drosophila</i> .	Friesen V*, Birt T, Ibarguchi G & Poland V - Results of a Genetic Study to Aid in the Restoration of Murres, Guillemots and Murrelets to the Gulf of Alaska following the Exxon Valdez Oil Spill	
1500	Coffee Break and Posters in the Atrium (30 minutes)		
1530 to 1630 Room 1101	Conservation Genetics Plenary "Partnerships in conservation research" Kent Prior, Canadian Wildlife Service Stephen Woodley, Parks Canada		
1630 to 1800	Posters in the BioScience Atrium, (cash bar)		
1830- you're all rocked out!	OEEC Banquet Kingston Yacht Club 1 Maitland St (see # 4 on Map) Live Performance by "Luther Wright and The Wrongs"		



Tuesday, April 23, 2002			
Looking for Breakfast? Why not try the Grad Club?			Happy Birthday Natasha!
900	Dr. Geoffrey Hill		
Room 1101	Department of Biological Sciences, Auburn University "The signal content of carotenoid-based color displays"		
1000	Coffee Break in the Atrium (30 minutes)		
	Mating System Evolution Room 1102 Chair: M. Kasumovic	Evolutionary Ecology Room 1103 Chair: J.W. Brown	Ecology II Room 1101 Chair: F. Thompson
1030	Robertson A* - The origin of Unisexuality in <i>Ambystoma</i> : a new twist to an old story	Greaves DK*, Schreer JF, Hammill MO & Burns JM - Development of a Two-Speed Heart in Harbour Seal Neonates, <i>Phoca vitulina</i> .	Ngai J* & Jefferies RL - Effects of N and P fertilization on plant growth along an arctic saltmarsh successional gradient

Tuesday, April 23, 2002 continued...

1045	Stiver K, Gibbs HL, Dierkes P, Taborsky M & Balshine S - Genetic Support for Direct Benefits of Helping in a Cooperatively Breeding Cichlid	Robb TL, Jamieson IG and Forbes MR - Variation in immune response of two colour morphs of an alpine insect, the New Zealand Alpine Weta, <i>Hemideina maori</i> (Orthoptera: Anostostomatidae).	Smith K & Cyr H - The Distribution and Composition of Exopolymeric Substances in Littoral Sediments of Canadian Shield Lakes.
1100	MacDougall AK* & Montgomerie RD - Birds so bright, you gotta wear shades: plumage colour signaling in American Goldfinches	Hallett PE* - Dispersal of new nests within and across hives of solitary bees and wasps.	Kliber A* & Eckert CG - Genetic Examination of introduced and native populations of an invasive clonal plant: Effects of long distance colonization on the genetic diversity and sexuality of <i>Butomus umbellatus</i> (Butomaceae)
1115	Ramsay SM* & Tuttle EM - Mate choice and genetic relatedness in white-throated sparrows.	Soutar AR* & Fullard JH - Making the best of a bad situation: Lifestyle Adaptations of earless moths.	Henry HAL* & Jefferies RL - Uptake of organic and inorganic nitrogen in the arctic salt-marsh grass, <i>Puccinellia phryganodes</i> .
1130	Doucet S* & Montgomerie RD - Multiple sexual ornaments in satin bowerbirds: UV plumage and bowers signal different aspects of male quality.	Schnabel KE*, Hebert PDN - Life at the edge ? Resource-associated divergence in the arctic marine amphipod <i>Paramphithoe hystrix</i> Ross 1835.	Montague J* & Eckert CG - Is the Horticultural Industry Contributing to the Spread of Invasive <i>Butomus umbellatus</i> (Butomaceae)? A Geographical and Molecular Genetic Analysis
1145	Rathburn MK* & Montgomerie, RD - The role of ornamental traits in predicting breeding success.	Long TAF* & Falls JB - Isometric Scaling of Testes Size in a Promiscuous Rodent Species?	Laird RA* & Aarssen LW - Intraspecific competition leads to a 'tragedy of the commons' in <i>Brassica</i> .
1200	Routley M*, Bertin R & Husband B - Correlated evolution of dichogamy and self-incompatibility: A phylogenetic perspective.	Angulo A* - Environmental sources of selection on anuran acoustic signals in Amazonian habitats.	Bowman J* - Is dispersal distance of birds proportional to territory size?
1215	Herlihy, CR* & Eckert CG - Severe genetic cost of reproductive assurance in a self-fertilizing plant		Wins-Purdy A* - Does Nest Success Matter? Trends in Nest Success Over Time, and the Relationship Between Nest Success and Population Growth Rate for Five Species of Dabbling Ducks in the Prairie Pothole Region
1230	Closing Remarks from OEEC Committee & Book Raffle BioScience Room1101		



See you next year !

Presentation Abstracts - oeec 2002

Plant-plant-herbivore interactions: phenotypic plasticity in response to plant competition affects herbivores of common milkweed

Agrawal AA

Dept. Botany, Univ. Toronto

plant-animal interactions, phenotypic plasticity, herbivory

Phenotypically plastic responses to one environmental cue may have profound consequences for other members in the community (i.e., trait-mediated indirect effects). I studied the effect of grass-competition on the interaction between native milkweed plants and their herbivores. Early season competition for light from grasses resulted in 30% taller, 50% thinner milkweed plants that received 60% less herbivory by a specialist stem-inhabiting weevil. As observational and experimental data show that weevils prefer to oviposit on thicker stems, the reduction in herbivory on plants subject to competition was likely mediated by competition-induced thinner stems. Late season plant competition for underground resources reduced milkweed height by 15% and more than doubled herbivory by adult cerambycid beetles. As this monophagous (on milkweed) beetle requires grass stems for oviposition, the enhanced herbivory on milkweed plants subject to competition was likely a result of available resources (grass stems) for oviposition. Thus, competition with grasses resulted in altered milkweed phenotypes and properties of the neighborhood that affected herbivory. Given that most plants experience and respond to both competition and herbivory, I predict that diverse ecological consequences of binary interactions are a general outcome in natural communities.

Environmental sources of selection on anuran acoustic signals in Amazonian habitats

Angulo A

Department of Zoology, University of Toronto

advertisement call, acoustic communication, anurans, transmission, attenuation

Successful acoustic communication among conspecific individuals requires that the information contained in an emitted signal be efficiently transmitted to an intended receiver. In most species of anurans advertisement calls comprise a primary form of communication among members of the same species. Vocalizations act as reproductive isolating mechanisms and are also important in speciation processes. A number of factors shape the evolution of acoustic communication, one of them being the acoustic properties of the environment where the system takes place. Divergence in advertisement calls could occur if certain call properties were favoured over others for better transmission efficiency in different habitats. Therefore, the physical properties of the different habitats where signals are emitted may constitute important selection factors acting locally in the evolution of the signals. Experiments to assess the effects of environmental physical properties on leaf litter frogs' signal transmission were conducted in three different Amazonian habitats. Acoustic signals of a closely related group of frogs (members of the genus *Adenomera* (Anura, Leptodactylidae)) living sympatrically were broadcast and recorded at different distances in each habitat. Signals were then digitized and analyzed. In addition, background noise levels, temperature and humidity readings were taken over 24-hour periods for each habitat. As expected by the inverse-square attenuation law, the effect of distance in signal attenuation is significant in all three habitats. The interaction of distance and habitat is also significant, indicating that there are differences of signal attenuation at given distances among habitats. However, the interaction of distance, habitat and signal was not found to be statistically significant. Background noise levels also differed significantly over a 24-hour period, but followed much the same trend in all three habitats. Temperature and relative humidity also differed across the temporal axis, with temperature variation also differing between habitats. Signal attenuation and degradation are analyzed and discussed.

Is there congruent or independent phylogeographic pattern among spring peepers and bullfrogs?

Austin J, Loughheed S & Boag P

Dept. of Biology, Queen's University

Range shifts throughout the Pleistocene have left their fingerprints in the distribution of genetic variation across the landscape. Comparative phylogeography provides a means to determine whether species have responded to Pleistocene climatic cycles in a concerted or independent manner. We present data from two widespread, Eastern North American frog species (*Rana catesbeiana* and *Pseudacris crucifer*) which show both congruent and independent phylogeographic patterns at different temporal and spatial scales. Both species have cryptic mitochondrial lineages, although the depth and extent of the divergences is much greater in *Pseudacris crucifer*. In both species we see a pattern of secondary contact in Ontario populations, reflecting the role of The Great Lakes (and pro-glacial lakes) on structuring colonization. Overall, these two species show divergent phylogeographic patterns likely reflecting their differences in life history characteristics and evolution.

A method for the control of stable flies, *Stomoxys calcitrans* L., on dairy farms in south-central Ontario

Beresford D & Sutcliffe J

Biology Department, Trent University

stable flies, permethrin, dairy farms, population dynamics

Stable flies are important pests of dairy and cattle worldwide. In south-central Ontario, we have found that dairy farms are re-colonized each spring, with populations growing exponentially until frozen back in autumn. We reasoned that a small intervention in this process should be able to have a great impact on stable fly population growth by lowering the rate of increase. Two killing stations were set up on each of 3 dairy farms, constructed of intersecting attractive panels and covered with netting which had been soaked in a permethrin solution (1 part Ectiban and 10 parts water). The two killing stations were capable of reducing the population growth rate of stable flies on the 3 treatment dairy farms, targeting specifically young nulliparous females and males. This method reduced the impact on non-target organisms by attracting stable flies to the killing stations, segregated livestock from the pesticide, and limited the amount of pesticide released into the environment. More killing stations, as well as earlier application, should be able to reduce stable fly populations even more, by further lowering the population growth rate and delaying re-colonization.

Are haploid *Hyla versicolor* *Hyla chrysoscelis*?

Bogart J

Department of Zoology, University of Guelph

Polyploidy, development, chromosomes, gynogenesis

The Gray Treefrog in eastern North America consist of diploid *Hyla chrysoscelis* and tetraploid *Hyla versicolor* cryptic, sibling species. It is presumed that *Hyla versicolor* was derived from diploid *Hyla chrysoscelis*. Published data also suggest multiple origins of *H. versicolor*. The possibility exists, however, that all or some *Hyla chrysoscelis* could be haploid derivatives of the tetraploid. I induced haploid and gynogenetic tetraploid development of *H. versicolor* eggs using sperm from two species of Australian Litoria. Ploidy of the surviving offspring was confirmed by non-destructive karyotypic analysis of tadpoles. Results from repeated experiments using different males and females consistently show that haploid *H. versicolor* have very low viability. Gynogenetic tetraploid *H. versicolor* are more viable than the haploids but are not as viable as the controls. These data provide evidence that present *H. versicolor* are unlikely to be capable of producing *H. chrysoscelis* and that *H. versicolor* normally produce a relatively high frequency of unreduced eggs that can result in hexaploid *H. versicolor*.

Assessing migratory connectivity in yellow warblers using mitochondrial DNA genetic tags

Boulet M, Gibbs HL & Hobson KA

1 Dept. Biology, McMaster University, 2 Dept. EEOB, Ohio State University, 3 CWS

Yellow warblers, DNA markers, breeding and overwintering populations, migration routes

Linking breeding and overwintering populations is an important step in the conservation of neotropical migrant birds because this information identifies the different habitats used by migrants through their annual cycle. Based on variation in a 345 bp region of mitochondrial DNA Control Region 1, we have previously identified a major genetic division in haplotypes of migratory breeding populations of yellow warblers (*Dendroica petechia*, group *aestiva*) of eastern and western Canada, that included two fixed nucleotide differences. Here, we expand our survey of mt DNA variation to include additional breeding populations in Canada and the United States, and use genetic differences as a marker to link breeding and overwintering populations and to broadly define migration routes of this bird. Yellow warbler populations were structured throughout their breeding grounds: analysis of 510 samples from breeding birds revealed that eastern haplotypes were present from Newfoundland to Alberta in Canada and from Rhode Island to Montana in the US, while western haplotypes were present from Manitoba to Alaska and from Michigan (Upper Peninsula) to California. Overwintering populations were also structured: in Venezuela, only eastern haplotypes were found ($n = 23$), whereas in Mexico, only western haplotypes were found ($n = 30$). Finally, results from 391 spring/fall migrants indicate that birds captured at banding stations located between -77° to -107° long. had eastern haplotypes, while birds captured at stations located between -90° to -122° long. possessed western haplotypes. Our results suggest that eastern and western yellow warbler populations have different spring/fall migration routes and possibly overwinter in distinct areas.

Is dispersal distance of birds proportional to territory size?

Bowman J

Wildlife Research and Development Section, Ontario Ministry of Natural Resources

dispersal, bird, territory, spatial ecology, scale, allometry, isometry, cross-species relationship, body size

Recent research has demonstrated that dispersal distance and the square root of home-range size covary proportionately across mammal species independently of body size. I tested whether these findings could be generalized to another taxon. Breeding territories of some bird species are analogous to mammalian home ranges, so I tested whether dispersal distance and territory size in birds covaried and were proportional. Variables were log10-transformed prior to analysis. When considered independently of body size, median natal dispersal distance and breeding territory size were positively related ($F = 8.91$, $df = 1, 29$, $R^2 = 0.23$, $P = 0.005$). Median dispersal distance could be related to the square root of territory size by a multiple of 12. This relationship was especially strong for non-migrants ($F = 49.84$, $df = 1, 15$, $R^2 = 0.77$, $P = 3.87 \times 10^{-6}$). Maximum natal dispersal distance and breeding territory size also covaried when body size effects were removed, but this relationship was only significant when migrants were removed from the sample ($F = 5.66$, $df = 1, 24$, $R^2 = 0.19$, $P = 0.025$). Maximum dispersal distance did not have a proportional relationship with territory size. This could result from sampling error, or from real processes (e.g., relatively shorter dispersals by birds with large territories). The results of the study suggest that behavioural and physiological processes affect the vagility of birds independently of body size. The proportional relationship between median dispersal distance and territory size can be used as a cross-species scaling rule.

Taxonomic Status of the Yellow-Faced Amazon, *Amazona xanthops*.

Brown JW, Birt TP & Friesen VL

Department of Biology, Queen's University

New World parrots, systematics, DNA sequences, phylogenetics, conservation

The controversial systematic arrangement of parrots (order Psittaciformes) is based largely on various anatomical, behavioural, morphological characteristics. Molecular markers are a valuable means by which to evaluate the validity of current classifications. The Yellow-faced Amazon, *Amazona xanthops*, has an ambiguous relationship to other New World parrots. Though morphologically a characteristic Amazon, previous observations of behaviour, karyotype, and DNA sequence data have called its inclusion in the genus into question. The purpose of this research was to clarify the taxonomic designation of *A. xanthops* within the New World parrots. In this study we sequenced a total of 2206 bp for two mitochondrial genes (cytochrome b and 12S rDNA) and two nuclear introns for 11 species representing 4 New World genera: *Amazona xanthops*, *A. collaria*, *A. tucumana*, *A. autumnalis*, *A. aestiva*, *Pionus chalcopterus*, *P. maximiliani*, *P. fuscus*, *P. senilis*, and *Graydidasculus brachyurus*. A Scarlet Macaw (*Ara macao*), a long-tailed New World parrot, was used as the outgroup. Phylogenetic analyses using both distance and character based approaches revealed two interesting results. First, while the data yielded strong support for monophyly of both *Amazona* and *Pionus*, *A. xanthops* was consistently placed outside either clade. This indicates that *A. xanthops* is as distantly related to *Amazona* as is *Pionus*, and thus supports its exclusion from the genus. Second, *A. xanthops* was grouped with *G. brachyurus* in all trees, and with strong support in mitochondrial trees, suggesting that *G. brachyurus* is its closest phylogenetic relative. These results both indicate that *A. xanthops* represents a cryptic genus, and may have direct conservation applications.

The ecological impact of hybridization on small populations of red mulberry (*Morus rubra* L.) in Canada

Burgess KS & Husband BC

Department of Botany, University of Guelph

hybridization, hybrid fitness, small populations, RAPD, transplant experiment, culling experiment

Hybridization between rare species and more abundant congeners can have important genetic and ecological impacts. From a genetic perspective, hybridization can result in production of hybrids and genetic homogenization of the interbreeding populations. However the ecological impacts on offspring production, recruitment and population size of the rare species is less well studied. As part of a larger research program on the impacts of hybridization on the endangered red mulberry (*Morus rubra* L.), the objective of this study was to examine the ecological impacts of hybridization on the production of red mulberry offspring and their establishment. Red mulberry offspring production was measured in a culling experiment that compared plots containing a more abundant congener (white mulberry (*Morus alba* L.)) with those that had this species removed. Establishment of red mulberry, compared to hybrid and white mulberry, was measured in two transplant experiments with seedlings and juveniles into two contrasting environments. Results from the culling experiment showed no difference between culled and non-culled plots for # of seeds/fruit, % germination and % survival, however the production of hybrid offspring was higher in non-culled plots. Results from transplant experiments showed that red, white and hybrid mulberry are not ecologically differentiated and red mulberry is at a competitive disadvantage. Based on these results, hybridization is having an ecological impact on the production of red mulberry offspring, their establishment and population size. The conservation implications of these results include the immediate removal of white and hybrid mulberry from the close proximity of red mulberry as well as the careful consideration of habitat in supplemental planting programs. This study not only provides insight into the ecological impacts of hybridization on rare plant species, but also represents an opportunity to implement management strategies based on experimental approaches that contribute directly to the red mulberry National Recovery Plan.

Mouth color does not signal hunger in nestling dark-eyed juncos (*Junco hyemalis*)

Clotfelter ED, Schubert KA*, Nolan Jr. V & Ketterson ED

Providence College, The College of William and Mary, Indiana University & Indiana University

parental care, communication, mouth color, nestling begging, competitive signal, family conflict

Nestling mouth color has been shown to act as a signal to parents of offspring quality or need in many avian species. We investigated whether the red begging gape of three day-old dark-eyed junco nestlings (*Junco hyemalis*) is a competitive signal of hunger. We tested whether parents preferentially fed nestlings with experimentally-reddened gapes, and whether food-deprived nestlings had brighter red gapes than their satiated siblings. In a field manipulation of mouth color, parents did not respond to reddened nestling mouths with preferential feeding. In two laboratory experiments, mouth color changed significantly over a one hour experimental period, but was not affected by satiation or food deprivation. These results suggest that mouth color does not signal nestling hunger in the dark-eyed junco. However, they show that mouth color varies with some aspect of nestling condition, such as stress or body temperature. Parents may detect and respond to these changes in ways other than increasing feeding rates, such as by increasing brooding.

A review of the shifting distribution of the Golden-winged and Blue-winged Warblers: Effects of Habitat and Hybridization.

Confer JL, Canterbury RA & Lovette IJ

Biology Department, Ithaca College, Biology Department, Concord College, Laboratory of Ornithology, Cornell University

Vermivora, habitat, secondary succession, hybridization, behavioral dominance

Golden-winged and Blue-winged warblers have expanded into secondary succession habitat across eastern North America. Expansion continues in the northern portion of their range including northwestern Manitoba and extreme southeastern Quebec. Both species are declining in their historical range and in areas first occupied a century ago. Much suitable habitat was created by farmland abandonment and much of that habitat has been lost by reforestation. In some areas, Golden-winged Warblers (GWWA) have been extirpated following the invasion of Blue-winged Warblers (BWWA) where habitat appears suitable for both species. GWWA appear to dominate BWWA in north central New York, but perhaps not in Michigan. Removal of BWWA in north central New York was not followed by territorial expansion of adjacent GWWA nor by arrival of new GWWA in the vacated territories. Behavioral dominance is not likely to be the cause of GWWA decline, at least not in north central New York. The two species hybridize. Hybrids usually fail to attract mates. Hybrid crosses that do occur appear to be completely fertile. Two pilot studies of mtDNA provide contrary results in that one suggests nearly complete introgression and the other suggests only about 10% introgression. Patterns of mating may make hybridization more disadvantageous for GWWA. Male GWWA form pairs with female hybrids but male BWWA do not. Extra species, extra pair copulation may be frequent for male BWWA with female GWWA, but rare with male GWWA and female BWWA. Long-term, coexistence of both species is rare but does occur in southern New York. In this area, GWWA and BWWA co-occur in uplands while GWWA are segregated from BWWA in wetlands. Experiments are in progress testing if uplands with BWWA are sink habitats for GWWA due to hybridization while segregated wetlands are source habitats for GWWA.

A Behavioural Re-assessment of the Effects of Infection with the Nematode, *Heligmosomoides polygyrus*, on Spatial Learning in Mice

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Spatial learning, stress response, parasitic infection

It has been suggested that mild infections of mice with the intestinal nematode, *Heligmosomoides polygyrus*, can impair spatial learning. Using the Morris water maze task, whereby animals learn the position of a hidden, submerged platform, we re-examined the effects of sub-clinical *H. polygyrus* infections on the spatial learning ability of CD-1 male mice, 19 days after exposure to 100 infective larvae. During initial trials, uninfected mice displayed anxiety and stress-associated behaviours, such as swimming in close proximity to the walls and avoidance of the central areas of the maze. These mice consistently failed to land on the submerged platform within the 60-sec time limit (latency 60.00 \pm 0.00 sec). In contrast, infected mice manifested minimal anxiety-related behaviour, tended to explore the central maze area, and quickly landed on the platform (latency 22.60 \pm 10.50 sec). However, over the subsequent two trials, latency increased among infected mice (50.80 \pm 6.05 and 60.00 \pm 0.00 sec, respectively), whereas it remained high and unchanged among their uninfected counterparts (49.30 \pm 10.20 and 60.00 \pm 0.00 sec, respectively). Subsequently, latencies declined to low levels, suggesting that both infected (25.47 \pm 4.07 sec) and uninfected mice (23.40 \pm 3.95 sec) were acquiring the task. These findings indicate that although the overall effects of *H. polygyrus* infection on spatial learning are marginal, there are substantial differences between infected and uninfected mice in the patterns of task acquisition. These differences are likely related to alterations in the levels of anxiety and stress-related responses in the infected individuals.

Foetal growth and maternal investment in the Northwest Atlantic grey seal (*Halichoerus grypus*)

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energy, grey seal, foetus, placenta, maternal investment

Foetal growth and energetic cost of pregnancy were estimated from the reproductive organs and fetuses of 197 female Northwest Atlantic grey seals (*Halichoerus grypus*) collected from 1988 to 2000. The mean pupping date, within the southern Gulf of St. Lawrence, is January 9. From this we estimated a conception date of January 25, a period of suspended development of 85-96 days and a period of active growth of 259-270 days. Morphometric measurements and energy content, obtained from bomb calorimetry of both foetus and placenta, were used to estimate foetal growth rate at various stages during gestation. After implantation (mid-June), fetuses grew at a rate of 0.45 cm d⁻¹ - 0.50 cm d⁻¹ and increased in mass by 0.08 g 1/3 d⁻¹. Caloric density and caloric content increased linearly for both foetus (1.5 cal g⁻¹ d⁻¹, 132.7 cal 1/3 d⁻¹) and placenta (2.1 cal g⁻¹ d⁻¹, 36.2 cal 1/3 d⁻¹). Generally, a linear increase is not observed in mammals due to an increase in fat deposition in the last portion of gestation; however, this could be compensated for in grey seals by a high amount of fat transfer during the short 16-day lactation period. Using obtained foetal and placental caloric densities and an average birth weight of 16.5 kg, we calculated the investment by the mother during gestation to be approximately 155.72 Mcal, which is equivalent to half of the energy transferred during lactation.

Multiple sexual ornaments in satin bowerbirds: UV plumage and bowers signal different aspects of male quality

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Much attention has been devoted to understanding the evolution of elaborate male ornaments and how they may signal male quality. However, the evolution of multicomponent sexual signals remains poorly understood, and past research on this type of signaling was largely theoretical. Satin bowerbirds, *Ptilonorhynchus violaceus*, are polygynous, sexually dichromatic, and construct sexually selected display structures: a model system for investigating mechanisms of sexual selection and, in particular, the evolution and signal function of multiple sexual signals. We investigated the interrelationship between bower features, plumage coloration, and indicators of male quality in this species. To do this, we located the bowers of male satin bowerbirds in rainforest in Queensland, Australia, and quantified bower quality. We captured male bower owners and used reflectance spectrometry to objectively measure the plumage coloration of several body regions. We measured various indicators of male health and condition, including the intensity of infection from ectoparasites and blood parasites. Bower quality and male ultraviolet plumage coloration were significantly correlated. Using multiple regression analyses, we show that bower quality predicts ectoparasite load and body size, while ultraviolet plumage coloration predicts the intensity of infection from blood parasites, feather growth rate, and body size. Our findings support the multiple messages hypothesis of multicomponent signals: female satin bowerbirds should assess both male and bower features to choose the highest quality mates. Because male satin bowerbirds provide no parental care, our study also supports the Hamilton-Zuk hypothesis, a good genes model of parasite-mediated sexual selection.

Causes and Consequences of Individual Growth Rate Differences Between Two Populations of Smallmouth Bass

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smallmouth bass, growth, maturation, gonad, egg size, reproductive investment, diet

The variation in growth and maturity between two populations of smallmouth bass located in Algonquin Provincial Park, was examined. Field research conducted in 2000 and 2001 revealed that individuals in Opeongo Lake had more typical growth rates for the region, whereas individuals in Provoking Lake had extremely slow growth in comparison. Possible explanations and the consequences of the growth differences in relation to reproductive timing and investment were hypothesized. Field research helped to rule out genetic and temperature effects as the primary causes of the varying individual growth rates. However, diet differences were found between smallmouth bass in Opeongo and Provoking that could possibly be responsible for the observed growth patterns. Additional field research revealed that the gonadal mass in relation to the body mass was different across the two lakes as was the age and size at maturity. An analysis of mature ovaries found that egg sizes were larger in Provoking than in Opeongo possibly lending support to the theory that reproductive investment into egg size is higher in the lake with slower individual growth rates.

Evolution of foraging behaviour in *Drosophila*

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behaviour genetics, evolution, natural selection, SNP, QTL

Larval fruit flies, *Drosophila melanogaster*, employ one of two foraging strategies that are mediated largely by a single gene on the 2nd chromosome called foraging (for). This gene encodes a cGMP-dependent protein kinase (PKG), the levels of which are believed to influence foraging behaviour. "Rovers" (forR), typically move long distances while foraging in comparison to "sitters" (fors), which typically move short distances. We are currently sequencing the gene in a subset of individuals from a natural population to develop single nucleotide polymorphisms (SNP) that act as markers throughout the gene. The SNPs will allow us to screen a large population (ca. 500 individuals) to find the region(s) of the gene that are different between rovers and sitters. We hope to understand: 1) how these two foraging strategies evolved and 2) the evolution of the foraging gene in related *Drosophila*. Using a recombinant inbred population of *D. melanogaster* in which the individuals vary in their arrangement of stable genomic markers, we have also discovered a significant quantitative trait locus (QTL) on the X chromosome suggesting that another gene (or genes) work in concert with the foraging gene in the elicitation of the behavioural polymorphism.

Results of a Genetic Study to Aid in the Restoration of Murres, Guillemots and Murrelets to the Gulf of Alaska following the Exxon Valdez Oil Spill

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conservation, molecular markers, seabirds, Exxon Valdez Oil Spill

Seabirds such as common murres (*Uria aalge*), pigeon guillemots (*Cepphus grylle*) and marbled murrelets (*Brachyramphus marmoratus*) are highly vulnerable to marine pollution due to their marine diets and the large amount of time they spend at sea. All three species suffered heavy mortality from the Exxon Valdez Oil Spill; for example, the estimated mortality of common murres was in the hundreds of thousands. The population of murres breeding in the Gulf of Alaska has since returned to its original size, but murrelets and guillemots are slower to recover. We tested whether differences in recovery rates for these species may relate to differences in dispersal rates. Specifically, we compared variation in the mitochondrial control region, nuclear introns, and microsatellites among samples of each species from throughout the North Pacific. Analyses of molecular variance, nested clade analyses, coalescent methods, and assignment tests were used to identify genetic management units and estimate dispersal. Results revealed strong population genetic structure and restricted dispersal in pigeon guillemots. Pigeon guillemots probably constitute three or four management units, with guillemots in the Spill Area (Prince William Sound, Cook Inlet and the eastern Alaskan Peninsula) being part of a genetic unit that includes all of mainland Alaska. Population genetic structure in marbled murrelets is weaker and dispersal is higher than in pigeon guillemots, with murrelets in the spill area being part of a management unit that extends from the western Alaskan Peninsula at least to British Columbia. Population genetic structure is weakest and dispersal is probably highest in common murres. Results of these studies indicate that differences in dispersal rates among these species may explain at least part of the differences in recovery rates.

Development of a Two-Speed Heart in Harbour Seal Neonates, *Phoca vitulina*

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seal, *Phoca vitulina*, heart rate, development, diving

One of the main attributes that enable seals to be exceptional divers is a marked bradycardia (lowering of heart rate) during periods of apnea (breath holding), followed by tachycardia (increase in heart rate) while the animal is at the surface. This phenomenon presents an interesting case of a two-speed heart. Previous work has shown that, while the higher speed is observed in the foetus early in gestation, the bradycardia rate emerges only later in gestation. In this study, we observed the diving heart rate of neonate harbour seals (*Phoca vitulina*) aged two to 34 days. This is a species that eagerly swims and dives within hours of birth. We outfitted pups living in the St. Lawrence Estuary with remote time-depth and heart rate recorders in 2000 and 2001. Dives made by very young pups exhibited a marked diving bradycardia interrupted by periods of tachycardia. This tachycardia rate observed during dives was nearly indistinguishable from surface heart rate. As the pups gain more control over their heart rate, the amount of the dive spent in bradycardia increases while the time spent in tachycardia decreases. This work suggests that harbour seals are born with a two-speed heart and, as they age, they are able to reduce the occurrence of tachycardia during a dive.

Effects of sampling bias on estimates of historical species richness and faunal relaxation of mammals in Canadian national parks

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reserves, faunal relaxation, national parks

Many tests of faunal relaxation in reserves, particularly for mammals, have relied on estimates of species richness derived from historic range maps. These are prone to error because historic range maps are usually delimited by connecting the outer limits of species' point locations. Therefore, they may indicate that a species was historically present in locations where it actually was not. The effect of such 'false positives' may result in estimates of the extent of faunal relaxation in parks being more severe than is actually the case. For national parks within the Canadian portion of the Alleghenian-Illinoian mammal province, I evaluated the effect of this error on previous estimates of historic species richness. I simulated the effect of varying levels of error in historic range maps (species were actually only present in 25%, 75%, and 95% of the historic range) on estimates of historic species richness in areas that are currently reserves. Agreement with previous estimates of historic species richness was found to vary inversely with the degree of inaccuracy of historic species ranges according to a power relationship. Further, park size had a large effect on agreement between previous and corrected estimates of historic species richness at intermediate levels of error in historic range sizes; estimates for large parks were more likely to agree with the previous estimate than were those for small parks. Taken together, these results imply that past statistical tests for faunal relaxation in these reserves may have been less severe than previous studies estimated, especially in smaller parks.

Dispersal of new nests within and across hives of solitary bees and wasps.

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Hymenoptera, trapnesting, new methods, spatial statistics.

Hives of standardized transparent trapnests facilitate research and teaching (Amer. Bee J., 141, Feb-June). The mother insects build linear nests, in the "bores" (grooves or holes) of the trapnest blocks, that are immediately identifiable.

Three replicates (or hive stands) were fielded in Spring 2001, each consisting of one seeded hive and two initially empty hives. The seeded hive contained alternating nest blocks of two different sizes of overwintering species from the 2000 season. The empty hives held only empty nest blocks. In one of the three hive stands all bores were of the same size, in the other two any potential big/small interspecies competition was minimized by alternating nest blocks of two different bore sizes.

It was hypothesized that new nests would be preferentially located in or near the seed nests, so that there should be a trend across five categorical distances defined for the three hives of a hive stand. In order of increasing remoteness the categories were (i) the seeded bores, (ii) the other bores in seeded nest blocks, (iii) the bores in any unseeded nest blocks used to pack the seeded hive, (iv) all the bores of the second, contiguous, empty hive, and (v) all the bores of the third, slightly separate, empty hive. New nests were counted and categorized by species and distance.

Obvious repeatable trends in the density of new nests across distance categories were formally tested by comparing the observed binomial regressions against randomized reference distributions. An unexpected finding was that small species were more widely dispersed than big ones. Conceivable factors include limitations in visual acuity and flight power associated with body size.

Uptake of organic and inorganic nitrogen in the arctic salt-marsh grass, *Puccinellia phryganodes*

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amino acids, ammonium, nitrate, nitrogen cycling, root uptake

The uptake of amino acids and inorganic nitrogen by roots of the arctic salt-marsh grass, *Puccinellia phryganodes*, was examined to assess the potential contribution of soluble organic nitrogen to total nitrogen uptake. Short-term uptake experiments were performed using tillers grown hydroponically under controlled conditions in the field. Glycine uptake was up-regulated when tillers previously grown on inorganic nitrogen were grown on glycine. In contrast, ammonium uptake was up-regulated in response to ammonium starvation. Nitrate uptake was strongly down-regulated when tillers were grown on ammonium or glycine. Although glycine uptake was from two to five times faster than other amino acids, a mixture of six amino acids common in salt-marsh soils was taken up collectively as rapidly as glycine at external concentrations typical of soil solutions. Percent reductions in ammonium uptake at high salinity were double those of glycine, yet glycine uptake was more adversely affected than ammonium uptake by cold temperatures. Glycine uptake rates, both absolute and relative to rates of ammonium uptake, were higher at pH 5.7 than at neutral or alkaline pH. Uptake of intact amino acids in situ was suggested by the incorporation of both ¹³C and ¹⁵N into plant tissue following injection of ¹³C¹⁵N-labeled amino acids into salt-marsh cores. Overall, these results indicate that amino acids are likely an important supplementary source of nitrogen for the growth of *P. phryganodes* in goose-grazed arctic coastal marshes.

Severe genetic cost of reproductive assurance in a self-fertilizing plant

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self-fertilization, outcrossing, inbreeding depression, reproductive assurance, seed discounting

The transition from outcrossing to self-fertilization is one of the most common evolutionary trends in flowering plants. Reproductive assurance, where self-fertilization ensures seed production when pollinators and/or potential mates are scarce, is the longest standing and most widely accepted explanation for the evolution of selfing, but there have been few experimental tests of this hypothesis. Moreover, many apparently adaptive floral mechanisms that ensure autonomous production of selfed seed may use ovules that would have otherwise been outcrossed. This seed discounting will be costly if selfed offspring are less viable than their outcrossed counterparts, as is often the case. The fertility benefit of reproductive assurance has never been examined in light of the cost of seed discounting. We combine experimental measures of reproductive assurance with marker-gene estimates of self-fertilization, seed discounting and inbreeding depression to show that during 2 years in 10 Ontario populations of *Aquilegia canadensis* (Ranunculaceae), reproductive assurance through self-fertilization increased seed production, but this benefit was greatly outweighed by severe seed discounting and strong inbreeding depression.

The use of time series analysis for detecting patterns in dive data

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time series analysis, dive data, heart rate, biotelemetry, auto-correlation, spectral analysis

The use of archival and biotelemetric devices has become a common tool for the remote collection of data on individuals of various species over the last few decades. Traditional methods of statistical analysis are generally not suitable for this type of data, as it is usually auto-correlated and can be substantial in size. Methods in time series provide tools for the analysis of large datasets collected sequentially and at regular intervals to determine whether patterns over time are evident. Previously collected data from a 6 - 12 day old nursing harbor seal pup (*Phoca vitulina*) was used to assess the correlation and periodic properties of recorded depth and heart rate. Each variable was analyzed for patterns over time using auto-correlation and spectral analysis techniques and both were analyzed together to determine whether cross-correlation patterns exist between the two. As expected, depth and heart rate each exhibit auto-correlation patterns individually; however, preliminary results reveal no apparent periodicity within, or cross-correlation between these variables. Further analyses will determine whether similar results are evident from data collected on pups in older age classes.

Road mortality and 'fence effect': which one is more harmful to population persistence?

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animal dispersal, barrier effect, fences, fence effect, GRID model, landscape connectivity, landscape dissection,

Roads affect animals in three adverse ways. They act as barriers to movement ('fence effect'), enhance mortality due to collisions with traffic, and decrease habitat size. We study the relative importance of the first two effects using a spatially explicit individual-based model of population dynamics. We discuss our results with respect to the suitability of fences along roads as a measure to reduce road mortality. The results reveal a much stronger effect of road mortality than of the 'fence effect'; the influence of traffic mortality is always much more significant when the proportions of individuals avoiding the road and those that are killed on the road (in relation to the number of individuals encountering roads) in the two situations compared are the same. The results indicate that putting up fences along roads might be a useful interim mitigation measure until more suitable measures will be applied (such as ecoducts or removal of the road). However, fences must be used with caution because they could increase extinction risk for species that have large area requirements and small population sizes. In the second part of this paper, we outline a comparison of different configurations of road networks. We ask if different spatial arrangements of the same amount of roads (e.g., 'bundling' of roads) have consequences for the strength of both the 'fence effect' and road mortality. The model results indicate longer times to extinction in case of the 'bundling' of roads but the proportion of populations going extinct within 500 time steps does not change significantly when habitat abundance is 100%. However, this might change when habitat abundance is lower, especially when it is close to the extinction threshold.

Investigation of the scatter-nesting hypothesis in leatherback turtles (*Dermochelys coriacea*)

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nest choice, leatherback, repeatability, scatter-nesting, behaviour

For animals that lay their eggs in a nest, the selection of a nest site may strongly influence offspring survival and therefore have important consequences for the reproductive success of the adult. In sea turtles, there exist potential counter-balancing selection pressures, in that there are risks associated with nesting too close to the water as well as risks associated with nesting too close to the supra-littoral vegetation. This study quantitatively describes nest placement in leatherback turtles nesting at Yalimapo beach, French Guiana by monitoring individual females' nest placement patterns throughout the peak nesting season. It tests the hypothesis that in the face of unpredictable environmental conditions, leatherbacks have adopted a scattered pattern of nest placement, as safe nesting areas can change within and among seasons. The adaptive value and potential consequences of this behaviour within the realm of reproductive strategies will be discussed. Support came from the Natural Sciences and Engineering Council of Canada.

Effects of habitat fragmentation and breeding synchrony on realized reproductive success in male least flycatchers

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habitat fragmentation, breeding synchrony, realized reproductive success, least flycatcher

Male least flycatchers (*Empidonax minimus*) settle contiguously forming clusters of all-purpose territories that resemble leks. Previous research has shown that up to 60% of broods in clusters contain extra-pair young and that extra-pair young are more common in peripheral nests. In this study, we examined the influence of habitat fragmentation and breeding synchrony on male behaviour and realized reproductive success, by comparing a cluster with contiguous borders (contiguous) in 2000, to a cluster with dispersed territories (fragmented) in 2001. Males in both clusters exhibited a high variance in reproductive success, but extra-pair paternity rates were significantly greater in the contiguous cluster. In contrast, males in the fragmented cluster increased their reproductive success by becoming bigamous. We have shown that male interaction rates decrease as neighbour distance increases, therefore the increased neighbour distance is the most likely cause of the significant decrease in the interaction rate in the fragmented cluster. Males in fragmented clusters may alter their reproductive tactics from pursuing extra-pair copulations to attracting secondary females if the costs of pursuit of extra-pair copulations are higher when territories are situated further apart. Though breeding synchrony was different between years, extra-pair paternity occurred during times of greatest synchrony in each year indicating that breeding synchrony was probably not a factor in determining male tactics. This study demonstrates that habitat fragmentation may have a profound influence on male settlement patterns and therefore, male reproductive behaviour, and suggests that neighbour distances should be taken into consideration when examining correlates of male reproductive success.

Genetic Examination of introduced and native populations of an invasive clonal plant: Effects of long distance colonization on the genetic diversity and sexuality of *Butomus umbellatus* (Butomaceae)

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long distance colonization, RAPDs, ploidy, genetic diversity

Movement of species from one part of the world to another is often associated with significant evolutionary consequences, especially if the colonization event affects the species reproductive strategy. Changes in genetic variability are likely to affect the invaders ecological persistence and the extent of impact on the native flora. Yet, despite the potential threat to native ecosystems, and implications for management and conservation, the evolutionary genetics of plant introductions have received minimal attention. This study examines the effect of long distance colonization on the genetic diversity and the reproductive strategy in *Butomus umbellatus*, an emergent aquatic plant introduced from Eurasia to North America in the early 1900s. The species can potentially reproduce both sexually (through seed) and clonally (through rhizome and bulbils), and exhibits wide variation in reproductive strategy between populations and regions. Variation in sexuality has been linked to ploidy; fertile populations are diploid ($2n=26$), and sterile populations are triploid ($3n=39$).

There has been a major increase in the frequency of sexually fertile populations associated with the colonization of N. America. Large-scale population surveys suggest that, of the two cytotypes, diploid (sexual) *B. umbellatus* predominates in N. America but decreases markedly in frequency from southeast to northwest, whereas (sterile) triploid populations dominate in the native European range. Examination of variation in genotypic diversity among 43 N. American populations of *B. umbellatus* using molecular markers (RAPDs) suggest a strong genetic divergence between diploid and triploid cytotypes, but very little within cytotype diversity, despite the high frequency of sexual populations. On the other hand, preliminary results from genetic analysis of 77 widely distributed native European populations (only 13 of which were diploid) suggest considerable genetic variability within cytotypes and among geographically close populations. European cytotypes, however, unlike the N. American cytotypes, do not appear to be distinctly differentiated at RAPD loci.

Testing whether escape from seed pathogens contributes to plant invasions

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It has been hypothesized that low rates of attack by natural enemies may contribute to the invasiveness of exotic plants. My students and I have tested this hypothesis by investigating the influence of pathogens on survival during a critical life-history stage: the seed bank. We used fungicide treatments in a series of experiments to estimate the impacts of soil fungi on buried seeds of a taxonomically broad suite of natives and exotics, in both upland and wetland meadows. Seeds of both natives and exotics were recovered at lower rates in wetlands than in uplands. Fungicide addition reduced this difference by improving recovery in wetlands, indicating that the lower recovery was largely attributable to a higher level of fungal mortality. This suggests that fungal pathogens may contribute to the exclusion of upland species from wetlands. Assays of infected seeds revealed a wide array of soil fungi, including known pathogens. Inoculation trials confirmed that some of these species did reduce survival of seeds, and identified both specialist and generalist pathogens. The effects of fungicide on the recovery of buried seeds did not differ between natives and exotics. The lack of consistent differences in the responses of natives vs. exotics to fungicide suggests few aliens owe their success to low seed pathogen loads.

Intraspecific competition leads to a 'tragedy of the commons' in *Brassica*

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above-ground competition, below-ground competition, biomass, *Brassica*, root-to-shoot ratio

A common plant response to increased below-ground (root) competition intensity is to increase the relative allocation to root biomass at the expense of shoot (stems, leaves, and seeds) biomass. However, since root tissue is non-photosynthetic and thus cannot 'pay' for the cost of its own construction, the decrease in shoot tissue mass should exceed the (relative) increase in root tissue mass, decreasing total plant biomass per plant per unit soil volume. This reduced yield has been identified recently as a 'tragedy of the commons' effect, a situation that can be predicted to occur whenever competing parties (plants or otherwise) share a common resource. It is a tragedy in the sense that while these plant allocation patterns are evolutionarily stable, overall yield would be greater if only plants could 'agree' to not shift allocation below-ground in the face of competition. We examined the effects of intraspecific competition on root and shoot biomass allocation in five species of *Brassica*, grown in a greenhouse. Within species, genetically uniform individuals were planted either alone or in groups of four, with soil volume per plant kept constant between the two treatments (i.e. same nutrient availability per plant). Plants that shared soil volume with neighbours had lower total biomass (per plant) than plants that had their own exclusive soil volume. For all but one species this was accompanied by an increased root-to-shoot biomass ratio in competing versus non-competing plants, providing evidence for a tragedy of the commons. These trends persisted - and indeed became slightly stronger - through time, as evidenced by the analysis of allocation patterns of plants of different ages (i.e. harvest times). It is important to account for shifts in allocation patterns to above- and below-ground biomass when assessing the yield of competitive plant systems.

Host range and local parasite adaptation

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host range; item response theory; local adaptation; meta-analysis; parasites

Parasites may be expected to become locally adapted to their hosts. However, while many empirical studies have demonstrated local parasite adaptation, others have failed to demonstrate it, or have shown local parasite maladaptation. Researchers have suggested that gene flow can swamp local parasite-host dynamics and produce local adaptation only at certain geographical scales; others have argued that evolutionary lags can account for both null and maladaptive results. In this paper, we use item response theory to test whether host range influences the likelihood of parasites locally adapting to their hosts. We collated 32 independent experiments testing for local adaptation, where parasites could be assigned as having either broad or narrow host ranges (BHR and NHR, respectively). Twenty-five tests based on BHR parasites had a significantly lower average effect size than 7 NHR tests, indicating that studies based on BHR parasites are less likely to demonstrate local parasite adaptation. We argue that this may relate to evolutionary lags during diffuse coevolution of BHR parasites with their hosts, rather than differences in experimental approaches or other confounds between BHR and NHR studies.

Effects of Diazepam (Valium(r)) on Cardiorespiratory Patterns of Nursing Harbor Seal Pups

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Phoca vitulina, diazepam, valium, heart rate, respiration, marine mammals, mammalian physiology

Recently, diazepam has been gaining acceptance as a sufficient sedative for minimizing handling stress in phocid species due to its anxiety reducing properties. Numerous studies have investigated the effects of diazepam when administered in combination with other drugs; however, little quantitative data is available detailing the cardiorespiratory effects of diazepam when administered as the sole tranquilizer. Consequently, the aim of this study was to describe and quantify the effects of diazepam on the heart rate and respiration of nursing harbor seal pups (*Phoca vitulina*). Since diazepam is a depressant, we hypothesize it will cause a decrease in both heart rate and respiration and that the effects may be enhanced in these physiologically immature pups. Seals were monitored for 25 minutes prior to the administration of diazepam (~0.1mg kg⁻¹ I.V.) and for an additional 40 to 60 minutes thereafter. A multi-channel physiological recorder connected to subdermal needle electrodes and a portable computer was used to monitor electrocardiogram, heart rate, and respiration rate. Respiration data was also obtained through video recordings. Preliminary analyses indicate mean heart rate decreased by approximately 15% (from 166 bpm to 144 bpm) following the administration of diazepam. This decline is likely due to an increase in the amount of time spent in apnea (breath-holding) and concomitant decrease in respiration rate. Induction was rapid (<20 sec) and effects were apparent for up to 40 minutes following injection, with the greatest decrease occurring within the first 10 minutes. Diazepam provides sufficient sedation for long-term handling of seal pups but with cardiorespiratory function being impaired for upwards of an hour care must be taken when using this drug to sedate pups in rapid capture and release studies.

Isometric Scaling of Testes Size in a Promiscuous Rodent Species ?

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Reproductive strategy, testes size, ejaculate size, isometry, *Peromyscus maniculatus*

Intra-specific variation in testes size is an important, but rarely studied aspect of sperm competition research. Parker (1990, Proc. Roy. Soc. Lond. B: 242) hypothesized that in the face of intense competition for matings, small males should invest relatively more energy into their testes than larger males, in order to capitalize on their relatively infrequent copulations. We set out to test the predictions of this theory using morphometric data obtained from a long-term (1965-1987) collection of deer mice, *Peromyscus maniculatus*, a promiscuous rodent. Linear regression analyses revealed isometric, rather than allometric, scaling between testes length and body length, as well as between estimated testes mass and body weight. Contrary to theoretical predications, it does not appear that social role affects an individual's expenditure into testes. The consequences of this empirical evidence to previously developed Evolutionary Stable Strategies of ejaculation will be discussed.

Is there a tropical-temperate disparity in genetic diversity or taxonomy of vertebrates?

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biodiversity, genetic structure, species definitions, taxonomy

Disparity in species richness among regions is of central concern to ecology, evolution, and conservation biology. The Neotropics contain vastly more species than temperate regions including the Nearctic. Recent studies, including our own on both birds and frogs, suggest that Neotropical vertebrate taxa may also have deeper genetic subdivisions. We present the first substantive test of this suggestion, confirming that the pattern exists for passerine birds, arguably the world's best-known animal group. We discuss various explanations of this disparity including the possibility of taxonomic artifacts, and differences in the rate or history of genetic processes between regions. In contrast, a selection-based hypothesis emphasizes negative feedback of species richness upon further morphological, but not molecular, evolution in Neotropical species.

Temporal resource heterogeneity and plant invasions: questioning "A general theory of invasibility".

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invasion, plant communities, dominance, temporal heterogeneity, resource supply

A recent theory of plant invasion suggests that successful invasion can occur when a resource surplus is created and not taken up by the resident community (Davis et al. 2000). We examine some of the assumptions of this model and apply a theoretical approach to understanding the effects of environmental heterogeneity on both "establishment" and "dominance" phases of plant invasions. If periodic environmental fluctuations can contribute to the maintenance of species richness even when alien species have invaded, it follows that these fluctuations should also prevent the aliens from dominating the community. In contrast to the general theory of invasibility put forth by Davis et al., we suggest that factors allowing colonization may not be the same factors that control the subsequent spread and competitive performance of invaders. We propose two scenarios, the "Invader Swarm" and the "Invader Pest" to explain extremes of a continuum of invasion patterns. "Invader swarm" describes situations where many species contribute to high invader biomass; "invader pest" describes situations where a single invader species contributes overwhelmingly to high invader biomass. We argue that these scenarios are likely explained by different processes: Invader pests exemplify competitive superiority while invader swarms are permitted by the same processes that maintain diversity in native plant communities, including temporal heterogeneity in resource supply. It is predicted that, in the absence of "super-species" or ecologically novel species, the same conditions that promote invasion by many species should prevent high dominance of invader species.

Birds so bright, you gotta wear shades: plumage colour signaling in American Goldfinches

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plumage colour, quality, carotenoid, melanin, sex ratio, *Carduelis tristis*

The evolution of dimorphic plumage in birds can be explained in terms of sexual selection theory. Bright plumage ornamentation, particularly in seasonally and sexually dimorphic species, is thought to function in important intraspecific interactions, including female mate choice and male-male competition. Despite directional selection, variation in plumage colouration may be maintained if the cost of ornament production is such that only some individuals are capable of bearing the most developed traits. Thus, colour may honestly indicate specific characteristics and individual quality. However, various plumage colours result from distinct proximate sources, and thus, may be specific in which characteristics and aspects of quality they signal most directly. American Goldfinches (*Carduelis tristis*) exhibit striking seasonal and sexual colour dimorphism, with males displaying predominantly brilliant yellow, carotenoid-based plumage as well as a black, melanin-based forehead patch through the breeding season. We examined variation in male and female plumage colour using reflectance spectrometry as an objective measure of feather colour in 5 body regions. A number of colour measurements were combined into overall plumage scores using principal components analysis, with brighter yellow birds obtaining higher colour scores. We found that birds mated assortatively with each other based on colouration, and that brightest pairs initiated nesting earliest in the season. Brighter males had longer wings, lower body mass and a larger cloacal protuberance (sperm storage organ related to reproductive condition) than less bright males, and brighter females laid earlier clutches with male-biased brood sex ratios. Results are discussed in terms of specific signaling functions of plumage colours in American Goldfinches.

Local density differences and genetic variation in Grey Partridge (*Perdix perdix*) populations

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population genetics, density, *Perdix perdix*, microsatellites, inbreeding

Due to human activities such as intensive agricultural landuse, increasing habitat fragmentation and overhunting, densities of grey partridge (*Perdix perdix*) populations in Central Europe suffered a steady decline during the 1970s and 1980s. Regional hunting records reflect this general trend, showing a decline of more than 80% in the hunting bag numbers in Austria. Two molecular markersystems (allozymes and cross-species amplified microsatellites) were screened in order to gather information on whether or not possible inbreeding in isolated populations and subsequent genetic depletion could have contributed to population declines. Long-term density data were also taken into account when studying gene pool diversity and levels of inbreeding in 19 local partridge populations. Overall genetic variation was found to be moderate in both marker systems and total genetic differentiation between populations was rather low for a sedentary bird species like the partridge. We also found an increased inbreeding coefficient in local populations with long-term low density. Wild living grey partridges in Austria might not have lost genetic diversity due to gene pool fragmentation, but long-term low density in local populations might have lead to an increased risk of inbreeding.

Three-Dimensional Quantification of Habitat Structure and Habitat Use by fish in the Littoral Zone of a Freshwater Lake

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community ecology; fishes; littoral zone; multivariate analysis; habitat choice; Ontario; lake

Seasonal changes in environmental factors will affect community structure through changes in habitat structure and habitat use by aquatic animals such as fish. This study addresses the question of how three-dimensional littoral habitat structure changes throughout a season in a fresh-water lake and how fish use of habitat structure by fishes changes in response. The study focuses on the diversity offered by differing habitat structures, specific habitat use by fish, and influences of temperature. A novel method of quantifying habitat structure three-dimensionally was developed and used to measure fine-scale changes in littoral habitats. Quadrat sampling that incorporated a vertical component was used to collect fine-scale observations between late spring and early fall. Bi-monthly observations of environmental variables, habitat characteristics, and fish abundance were collected and used to test how seasonal changes influence fish behaviour and distribution in the water column. Multivariate analyses illustrate how differences in habitat variables influence habitat choice by fish. Seasonal changes need to be considered on a fine scale when attempting to unravel some of the complexity of aquatic communities and habitat selection. Understanding fine-scale habitat structure and habitat use by fish is important for understanding aquatic community interactions and potential responses to altered habitat conditions.

Soil degradation and plant re-establishment in coastal arctic salt-marshes of the Hudson Bay

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disturbance, revegetation, patch size, alternate stable state

Disturbance by herbivores can lead to irreversible plant community changes producing multiple stable states. Increases in goose foraging are changing salt marshes of the Hudson Bay coast into apparently stable bare mudflats largely devoid of vegetation. The loss of vegetation has led to changes in soil conditions, which affect plant re-colonization of disturbed areas. The objective of this study was to examine changes in soil properties as a result of grubbing by snow geese, and to determine impacts of these changes on plant re-establishment. I examined: (a) soil properties in undegraded and degraded areas; (b) the potential for re-establishment of *Puccinellia phryganodes* (the dominant grass species) and; (c) whether soil property changes and plant re-establishment are related to the patch size of the goose disturbance based on experimentally grubbed patches. Results indicate large differences in soil properties between vegetated and degraded areas. Degraded soil has a lower infiltration rate, higher bulk density, higher salinity and lower organic, nitrogen and carbon contents than values for soils where vegetation is intact. Transplants of *P. phryganodes* established well in vegetated sites, but establishment in degraded sites was highly restricted. Rapid decreases in soil nitrogen and carbon following experimental grubbing indicate the severity of changes in soil properties. Changes in soil physical properties and resource depletion result in salt marshes moving to an apparently stable degraded state (mudflats).

Sex, rank, and individual identity in black-capped chickadees: It matters if you're black or white

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Sexual selection; communication; male-male song contests; female eavesdropping

Many studies have investigated the signal function of plumage colour patterns with respect to cryptic sexual dimorphism, status signaling, and individual recognition. These signal functions are often studied in isolation and attention is rarely given to the interplay between them. We investigated plumage variability in black-capped chickadees, *Poecile atricapilla*, with respect to each of these signal functions. Chickadees are non-migratory songbirds that appear sexually monochromatic to the human eye; both sexes display bright white cheek patches, a black cap, and a black bib. Winter flocks consist of equal numbers of males and females, and within these flocks males exhibit stable, linear dominance hierarchies at winter food sources. Male rank is an important predictor of reproductive success during the breeding season, as females prefer high-ranking males as both social and extra-pair partners. We captured and colour-banded 73 chickadees and assessed winter flock dominance hierarchies by tabulating 4000 pairwise interactions at experimental feeders. We objectively measured plumage colouration for six body regions using a reflectance spectrometer and measured the area of melanin-based plumage badges (bib and black cap) using standardized scanned photographs of these body regions. We found considerable individual variation in plumage brightness and patch size. Males had brighter cheek patches and larger bib sizes than females. Males also exhibited greater contrast between light and dark plumage regions than females. High-ranking males had darker black caps than low-ranking males, despite considerable overlap between these groups. We discuss the potential for plumage variability in black-capped chickadees to reveal sex, rank, and individual differences.

Investigations into Parasitism of the Eastern Chipmunk (*Tamias striatus lysteri*) by the bot fly (*Cuterebra emasculator* Fitch) in Algonquin Provincial Park, Ontario.

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chipmunk (*Tamias striatus*), botfly (*Cuterebra emasculator*), parasitism, prevalence, incidence, intensity

I studied parasitism of the eastern chipmunk (*Tamias striatus*) by the bot fly (*Cuterebra emasculator* Fitch). From July 24 to August 26, 2001, 59.9% of the 152 live-trapped hosts were infected. I found no remarkable trends in the host-parasite relationship when factors relating to host abundance and biology were compared. Prevalence of *C. emasculator* parasitism is not related to *T. striatus* abundance. There were no differences in incidence and intensity of parasitism between and among sex and weight classes of *T. striatus*. Parasitism did not affect mass of the host. Resident *T. striatus* had a higher infection rate ($P = 0.0354$) than transient hosts, but this may be a misleading result due to inherent differences between the categories compared. Host biology and effect of the parasite on the host are important considerations when comparing among this type of parasite-host interaction. Previous studies' failure to find any consistent patterns in incidence of botfly parasitism among various small mammal populations may indicate that there is a need to study what determines trends in host-parasite systems from an alternate point of view. Further investigation may reveal that explanations for varying rates of parasitism lie in the discovery of the requirements of adult *Cuterebra*. Studying the interaction from this viewpoint might prove more effective in interpreting host-parasite interactions in this relatively unexplained area of mammalian parasitology.

Is the Horticultural Industry Contributing to the Spread of Invasive *Butomus umbellatus* (Butomaceae)? A Geographical and Molecular Genetic Analysis

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Butomus umbellatus, invasive plant, horticultural industry, vector, spread, RAPD markers

Invasive, non-indigenous plants can potentially have devastating ecological, evolutionary and economic impacts. Effective control of these species requires an understanding of the pathways through which their range expands and the vectors that facilitate movement along these pathways. The distribution of the two cytotypes of *Butomus umbellatus*, diploid and triploid, throughout North America contrasts sharply with their respective dispersal capacity. Diploids, with superior potential for widespread dispersal, exhibit a much more limited geographic range compared to triploids which are found sparsely scattered throughout the introduced range, despite their limited dispersal capacity. It has been suggested that this unusual distribution of cytotypes has been the result of the horticultural industry preferentially selling triploids and the plants escaping from cultivation. A broad geographic survey revealed that more than a third (38.7% of 261) of aquatic plant retailers sell *B. umbellatus*. Genetic assay using 12 highly repeatable RAPD loci revealed that 84.3% of the horticultural stock was triploid, 5.7% diploid and 10% was an intermediate genotype that could not be classified with any confidence. The results strongly indicate that the wider geographical distribution of triploids is a cause rather than an effect of the preponderance of triploids among horticultural stock. The abundance of triploids and rarity of diploids, as well as the geographical distribution of horticultural retailers, the origins of their stock and the predominance of triploids among retailers selling *B. umbellatus* for a long time directly supports the hypothesis that aquatic plant retailers are the vectors responsible for the widespread dispersal of these plants.

Effects of N and P fertilization on plant growth along an arctic saltmarsh successional gradient

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above-ground primary productivity, c:n:p ratio, nutrient limitation, site successional age

The role of nitrogen and phosphorus levels in limiting above-ground primary productivity was examined in an arctic salt marsh grazed by snow geese in order to determine (1) whether the marsh is nitrogen- or phosphorus-limited and (2) how successional age influences this limitation. Experimental plots were set up in younger and older marsh sites and fertilized with N and P in a factorial design. When either N or P was added alone, the above-ground biomass did not differ from that of the control plots. However, there were significant increases in above-ground biomass when nitrogen and phosphorus were added together, with the highest nitrogen treatment having the greatest response, irrespective of the amount of phosphorus added. In addition to above-ground biomass, tissue nutrient content was also determined for nitrogen, phosphorus and carbon for each treatment. The relative levels of these nutrients can indicate the extent to which the plants are nitrogen- or phosphorus-limited in each of the treatments. The results show that the marsh is primarily nitrogen-limited, although phosphorus rapidly becomes limiting when the nitrogen supply is supplemented. The results also indicate an interactive effect of N and P levels on plant growth and tissue nutrient status, which can be characterized as the C:N:P ratio and related to the foraging preferences of geese.

Forest composition around wolf (*Canis lupus*) dens in eastern Algonquin Provincial Park, Ontario.

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Wolf, *Canis lupus*, den, habitat selection, conservation, Algonquin Park

Den site selection is a poorly understood aspect of wolf ecology, particularly for populations in forested ecosystems. Using a Geographic Information System (GIS) and remote sensing imagery, we examined patterns of habitat use around wolf dens in Algonquin Provincial Park, ON. Sixteen den sites were sampled for eight habitat types in their immediately vicinity, as well as at radii of 500, 1000, 1500, and 2000 m. We used a resource selection ratio to determine whether specific habitat types were preferred or avoided at different radii relative to the total proportion of habitat types found within the study area. Wolves established dens in areas with significantly high proportions of pine forest up to and including a 1000 m radius and low proportions of tolerant and intolerant hardwoods within 500 m. We conclude that wolves establish den sites based primarily on the presence of pine forest, a habitat that is frequently logged within Park boundaries and subject to problems with regeneration after cutting. Den sites are likely not limiting in this population but our results suggest the need to protect current den sites at a relatively large spatial scale. These results also provide unique information to assess the potential for recolonization and reintroduction of wolf populations in other areas.

Growth and survival of *Festuca rubra* in artificially and naturally grubbed supratidal marsh

O P

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Akimiski Island, *Festuca rubra*, grubbing, habitat degradation, Lesser Snow Geese, revegetation

Long-term impacts by foraging Snow Geese have converted large areas of intertidal grazing pastures around their Hudson-James Bay colonies to mudflats, leading to loss of food resources for geese and ecosystem damage. Geese seek alternative feeding habitats once high quality intertidal pastures are no longer available. As a result, damage is now occurring in these alternative habitats, yet little is known about their ability to recover from the increasing foraging pressure exerted by geese. The goals of this research are to examine the potential for recovery of one such habitat, *Festuca rubra* pastures, after goose grubbing removes vegetation, and to determine whether *Festuca* transplants can facilitate revegetation in denuded areas. The hypotheses tested are (1) *Festuca* can re-establish in areas from which vegetation recently has been removed, but (2) this establishment becomes more difficult over time.

To test these hypotheses, a field experiment was established at Akimiski Island, Nunavut. Plugs of *Festuca rubra* were transplanted into intact *Festuca* pastures, areas from which *Festuca* was removed by hand (simulated grubbing), and areas where geese had removed *Festuca* in previous years (natural grubbing). Survival and growth of these transplants were monitored over the summer. Additionally, natural unassisted recruitment was recorded in both simulated and naturally grubbed plots.

First-season results indicated natural recruitment was negligible. Growth and survival of transplants in both intact and simulated grubbing plots were higher than in naturally grubbed plots. The explanation probably lies in the degradation of soil conditions in the years following damage. Revegetation may be possible immediately following disturbance, and in the presence of a reliable source of colonists, this "recolonization window" may remain open, even as soil changes make conditions increasingly hostile for recruiting plants.

The impact of fungal pathogens on the survival of seeds of forest trees

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fungal pathogens, gap dynamics, temperate forest trees, tree seeds

Many plant species suffer the majority of their mortality at the seed or seedling stage. Much of this mortality may be attributable to fungal pathogens, which may have habitat-dependent or species-dependent impacts. For example, studies in tropical forests suggest that pathogens prevent vulnerable species, particularly shade intolerant colonizing species, from establishing under heavy canopy where fungal activity is greatest. As a result, pathogens may contribute to the tendency of many species to recruit primarily in forest openings. However, the role of fungal pathogens has been little investigated in temperate forests.

In this study, the impact of fungal pathogens on the seeds of tree species was investigated in three different habitats: forest understory, forest gap (i.e., small openings) and oldfield (large openings). Experimental species consisted of matched pairs of shade and shade intolerant tree species, in order to determine whether shade tolerance and resistance to pathogen attack are related. Fungal pathogens were chemically controlled, allowing the survival and germination of experimental seeds to be compared in each habitat with and without the influence of fungi.

Results indicate that for both of the matched coniferous pair, the very shade tolerant eastern hemlock and the moderately tolerant eastern white pine, fungal impacts are not greater in the forest understory habitat than in openings. However, results for the matched deciduous pair, yellow birch and white birch, indicate that pathogen impacts are greatest in the forest understory for the shade intolerant white birch, while impacts on the shade tolerant yellow birch are similar in all habitats. Therefore, the early results of this study suggest that pathogenic fungi may contribute to restricting the recruitment of temperate shade intolerant trees to open habitats, but this effect is species specific.

Explaining the range-size distribution of North American tree species.

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biogeography, macroecology, range-size distribution, climate, Rapoport's Rule

No satisfactory explanation exists for the right-skewed distribution of range sizes common to many taxa, despite it being of interest to biogeographers and ecologists for over a century. Similarly, the mechanisms underlying latitudinal gradients in range size (Rapoport's Rule) remain unclear, despite numerous studies on the subject. The limited progress on both fronts may be attributable to a lack of explicit consideration of the spatial features of the study systems. Here I use spatially explicit analytical methods to show that 78% of the variation in range size in a large sample of tree species native to North America north of Mexico is explained by the coldest average January minimum temperature found within a species' geographic range (TMIN). A multiple regression including TMIN and other climatic variables explains 94% of the variation. Additional findings point to the capacity for freezing-tolerance as the mechanism underlying the efficacy of TMIN as a predictor variable. In conjunction with the history of the continent's climate and flora and its contemporary spatial pattern of minimum temperatures, the characteristic shape of the range-size distribution is largely attributable to interspecific variation in cold-tolerance.

Mate choice and genetic relatedness in white-throated sparrows.

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Mate choice and genetic relatedness in white-throated sparrows

White-throated sparrows are one of the few species in nature to exhibit strong negative assortative mating. The basis of the mating pattern in this species is an inversion on the second chromosome which is reflected in adult crown plumage; individuals with tan crown stripes have two normal copies of the chromosome, while white-striped individuals have one normal and one inverted chromosome. Over 95% of pairs are heteromorphic for crown plumage and the chromosomal inversion. This species has been suggested as a good case for mate choice based on heterozygous advantage (Tregenza and Wedell 2000, *Mol. Ecol.* 9:1013-1027): white-white pairings would suffer from deleterious alleles accumulated on the inverted chromosome while tan-tan pairs would suffer from competitive inferiority. The genetic compatibility hypothesis suggests that there is no single male who is the best partner for all females, rather categories of males who are best suited to certain females. In this paper we examine genetic similarity using polymorphic AFLP markers in social pairs of white-throated sparrows from a population breeding at Cranberry Lake, NY. We compared the relatedness of social partners to the background relatedness of the population as a whole, and to random pairs generated through resampling. We also compared simulated heteromorphic and homomorphic pairings. Because of the accumulation of deleterious alleles, we predicted higher levels of band sharing in simulated white-white pairs. Our results showed that actual pairs do not differ from the population as a whole or any of the simulated pairings. We also looked at relatedness and reproductive success. Clutch size did not vary with band-sharing, but pairs with unhatched eggs had higher levels of band-sharing than pairs with complete hatching success.

The role of ornamental traits in predicting breeding success.

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reproductive success, ornamentation, quality

It is widely accepted that ornamental traits, such as bright plumage, serve as honest indicators of individual condition. Sexual selection explains the evolution and persistence of such ornamental traits through intraspecific signaling. Males possessing brighter plumage or bigger ornaments tend to have lower parasite loads, larger territories, and higher reproductive success than other males in the population. Thus females can use these traits as indicator of males' physical and genetic quality, and alter their reproductive strategies accordingly. However, in many cases males have multiple traits that females can use to assess male quality. White-winged Fairy-wrens have three prominent traits that females may use in making mate choice decisions: testes size, tail length and plumage colouration. We evaluated each male trait individually and collectively and discuss our results in relation to males' reproductive success and nesting parameters.

Variation in immune response of two colour morphs of an alpine insect, the New Zealand Alpine Weta, *Hemideina maori* (Orthoptera: Anostomatidae).

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ecological immunology, density dependent prophylaxis

Pathogen resistance in insects uses mechanisms such as cellular and/or humoral melanotic encapsulation to isolate the pathogen from the host. Greater resistance has recently been associated with the melanic phase of phase polyphenic insects. The melanic black morph of the New Zealand Alpine Weta, *Hemideina maori* is found at lower altitudes (therefore the colour is likely not for thermoregulatory purposes) and low densities while the yellow morph is found at higher altitudes and higher densities. In this study we examined variation in immune response between the two morphs and how this relates to preference of temperature. Yellow morphs showed a greater immune response (melanization) to an injected foreign body but there was no variation in the number of hemocytes (involved in cellular encapsulation) between the two morphs. We suggest that higher density and increase susceptibility to pathogens (density dependent prophylaxis) is a better indicator of ability to respond to pathogens.

The origin of Unisexuality in *Ambystoma*: a new twist to an old story.

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Ambystoma, unisexuality, single origin

One of the major problems in the study the origin of unisexuality is in determining whether unisexuals have single or multiple origins. A phylogeny of the genus *Ambystoma* was derived from DNA sequences of the mitochondrial genes cytochrome b and 16S in order to test the hypothesis of single versus multiple origins of unisexuality within the genus. The resulting phylogenetic hypothesis, based on maximum parsimony analysis, is consistent with a single origin for unisexual hybrids and suggests that the hybrids share a most recent common ancestor with *Ambystoma barbouri*. Furthermore the moderate level of sequence divergence between the unisexual hybrids and *A. barbouri* suggests that these unisexual hybrids are older than unisexual fish or lizards. The basal relationships between some bisexual species of *Ambystoma* remain unresolved. A permutation tail probability (PTP) test shows that there is very little character covariance in the data to support these unresolved relationships indicating possibly an ancient rapid speciation event. Future research will focus on the relationships of *A. barbouri* and *A. texanum* to the hybrid lineages.

Correlated evolution of dichogamy and self-incompatibility: A phylogenetic perspective

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dichogamy, self-incompatibility, phylogeny, protandry, protogyny

Historically, dichogamy (the temporal separation of gender in flowering plants) was interpreted as a mechanism for avoiding inbreeding. However, a survey of the literature by Bertin found a correlation between dichogamy and self-incompatibility (SI). This suggests that dichogamy may have evolved for other reasons, particularly reducing interference between male and female function. Despite the importance and influence of this comparative study, proper phylogenetic information was not available to test this association between dichogamy and SI within a rigorous comparative framework. Recent well-resolved and comprehensive angiosperm phylogenies allowed us to reanalyse this dataset with phylogenetic comparative methods. Using several different approaches, we find that protandry (male function first) is correlated with SI and protogyny (female function first) with self-compatibility. We interpret these results as support for protandry evolving to reduce interference and protogyny to reduce inbreeding. Estimates of transition-rate parameters provide insights into potential ecological and physiological correlates with the evolution of dichogamy. Additionally, this reanalysis provides an important historical context for the evolution of dichogamy and demonstrates the importance of considering phylogeny when studying character evolution.

Assessing the management potential for honey bees as pollinators of greenhouse tomatoes

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Apis mellifera, *Lycopersicon esculentum*, pollination

Tomato flower vibration releases copious quantities of pollen from the anthers onto the stigma, resulting in the production of larger, higher quality fruits, and consequently a higher farm gate value obtained for greenhouse tomatoes. Diversifying pollination systems for greenhouse tomato production is a prudent management decision as the industry currently relies solely on commercially reared bumble bee colonies for crop pollination. Honey bees are the most feasible alternative or supplement to bumble bee pollination, as they are readily available and easily managed for pollination, however intensive management of honey bee colonies for greenhouse pollination has scarcely been explored. For my research I examined whether honey bees could pollinate tomato flowers and how colonies could most effectively be managed for pollination within the greenhouse. Pollination of greenhouse tomatoes by honey bees during the winter resulted in 98% fruit set and a 20% increase in tomato fruit weight compared to fruits from unvisited flowers. Bruise marks on the anther cone of the tomato flower, similar to those left by bumble bees, were visible after honey bee visitation, providing an indication of pollination for greenhouse growers. Honey bees actively foraged down the rows of tomato plants during the day, potentially transferring pollen between tomato flowers. We hypothesized that higher fruit quality resulting from bee pollination was the result of cross-pollination, however examination of cross-pollen and self-pollen on fruit quality showed no effect of pollen source on fruit quality in greenhouse tomatoes. Populations of larvae and pupae in small honey bee colonies in screened tomato greenhouses neared zero after three weeks. This suggested honey bee colonies were not able to sustain themselves in the greenhouse without management and therefore colonies should be rotated into the greenhouse every 21 days to maintain an adequate foraging force. Overall we demonstrated honey bees could be effective pollinators of greenhouse tomato crops in Canada.

Scramble competition can induce a scanning-group-size effect in flocks of house sparrows

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house sparrow foraging scramble competition scanning-group-size effect, anti-predation

Group foragers are commonly observed to reduce their scanning and increase their feeding rate when group size increases: the scanning-group-size effect. This effect is usually explained as a response to lowered predation hazards. The same effect, however, could also be explained as a response to increased scramble competition because an increasing group size reduces the share of any limited food source an individual expects to gain. To maximize their share of a limited resource individuals may choose to increase their pecking rates and reduce the time they spend vigilant. To determine whether scramble competition could account for the scanning-group-size effect we observed 15 marked house sparrows (*Passer domesticus*) as they forage for millet seeds in the field under conditions that minimized interference competition and danger from predation. The total number of pecks recorded during a trial was divided by total trial duration and by total duration less time spent scanning and in aggression, giving gross and net pecking rates, respectively. While both predation and scramble competition hypotheses predict an increased gross pecking rate with group size, only the competition hypothesis predicts an increased net pecking rate with group size. Moreover, only the competition hypothesis predicts an effect of social dominance status on an individual's scanning-group-size response. We found a significant increase in the net pecking rate with group size and the increase was due to a reduced handling time per peck as group size increased. Dominant birds exhibited the most pronounced scanning-group-size effect so that all the results indicate that scramble competition can in some circumstances contribute to the scanning-group-size effect.

Life at the edge ? Resource-associated divergence in the arctic marine amphipod *Paramphithoe hystrix* Ross 1835

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Paramphithoe hystrix, Amphipoda, molecular evolution, Arctic Ocean

Microhabitat association and host specialization are recognized to play an important role in the speciation of groups such as herbivorous insects and parasitic invertebrates. In this study, we examine the nature and implications of resource-use polymorphism in *Paramphithoe hystrix* Ross 1835, a common marine amphipod in the Arctic Ocean. This species occurs in association with varied invertebrates, including poriferans, hydrozoans and echinoderms, where it feeds on the tissue of its host. Here, we present the population genetic structure of, firstly, the two common morphs of this taxon - a white form exclusively found on the light-coloured sea star *Solaster endeca* and a red morph associated with the pink soft coral *Gersemia rubriformis*. Secondly, we included a single individual with a combined red and white coloration whose host is unknown. The two common morphs occur in microsympatry, sometimes occupying their alternate hosts just a few meters apart. Although colour variation in micropredators is sometimes a result of the ingested host-tissue, we present genetic evidence indicating that these three morphs are distinct. Mitochondrial (CO1) and nuclear (28S rRNA) gene sequences, as well as allozyme data show strong differentiation between all three morphs, demonstrating their reproductive isolation. These results suggest that *P. hystrix* is best represented as a complex of at least three species. Moreover, the genetic distance data suggest their divergence within the Pleistocene, possibly as a result of disruptive selection following differential host association or host switches.

To have and to hold, or, life history adaptations of *Arrenurus planus*, an ephemeral pool mite

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Biology Dept., Ithaca College (Smith & Muma) Carleton University (Forbes)

Arrenurus, mate-guarding, protandry, pheromones

Arrenurus planus is specialized for life in seasonally temporary pools. The post-diapause portion of the lifecycle is constrained by the time-limited availability of water, with growth to the adult and subsequent reproduction being completed very rapidly. Males develop much faster than females (i.e., protandry), taking an average of 12 days to adult compared to 16.5 days for females. Both the deutonymphal and tritonymphal stages are significantly shorter for males than females.

Males seek out and climb onto quiescent tritonymphs, contact mate-guarding until the adult mite emerges. Males are apparently attracted to pheromones emitted by the tritonymph: they respond to water exposed to tritonymphs (compared to unexposed water) and will attend *A. planus* tritonymphs but not *A. novimarsallae* tritonymphs or nylon spheres. Further, males will guard molted tritonymphal exoskeletons. Apparently they cannot distinguish between male and female tritonymphs and will guard both. Male *A. planus* also respond to water exposed to adult females, a pheromonal cue previously seen in other *Arrenurus* species.

Contact mate guarding of juveniles has not been recorded in any other *Arrenurus* species. While male-attractant female-emitted pheromones are known in other *Arrenurus*, a tritonymphal pheromone cue has not been previously reported.

The Distribution and Composition of Exopolymeric Substances in Littoral Sediments of Canadian Shield Lakes

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exopolymeric substances, littoral

In marine systems, exopolymeric substances (EPS) secreted by algae and bacteria have been shown to structure sediments, increase contaminant transfer to food webs, and affect nutrient dynamics at the sediment-water interface. In this study, we measured the composition and concentration of EPS at 20 shallow sites from the littoral zone of seven Canadian Shield lakes in Ontario, and tested the relationship of EPS to organic matter, porewater, and nutrient (total nitrogen, total phosphorus) content of the sediments. The concentration of EPS proteins and carbohydrates varied more than an order of magnitude between sites, up to values measured at some of the most productive marine sites. EPS protein and carbohydrate concentrations were most closely related to the organic matter content of the sediments. The protein to carbohydrate ratio and the proportion of loosely to tightly bound EPS did not vary systematically with sediment characteristics. The high concentrations of EPS at some of the sites suggest that, as in marine systems, EPS could play an important role in the littoral zones of lakes.

Making the best of a bad situation: Lifestyle Adaptations of earless moths

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moths, bats, co-evolution

As a result of the predatory pressure of foraging bats, most moths have evolved auditory systems that allow them to escape when they detect the echolocation signals of bats. Although the co-evolution of this predator-prey interaction has received much attention, less is known about the survival tactics of the substantial number of moth species that have remained earless (e.g. silkworm moths). Since echolocating bats have existed for at least 50 million years, the persistence of earless moths indicates that their survival strategies are also successful, but are poorly understood. Fullard and Napoleone (2001) found that earless moths could be characterized as having exclusively nocturnal lifestyles, compared to the more variable periodicity of most eared moths. This lifestyle seems maladaptive for insects that lack any obvious predatory defenses against nocturnally active bats. The purpose of my research is to examine the lifestyle adaptations used by earless moths to facilitate their nocturnal lifestyle in the presence of bats. Last summer, using infrared video-recording of nocturnal flight behaviours in a semi-natural enclosure, I found that the total amount of time spent flying by earless moths is significantly less than that of eared moths. Also tested was the prediction that earless moths rely more on visual cues than eared moths. Preliminary results have not supported this prediction, although a trend may be present. Research to be conducted during the summer of 2002 will examine possible secondary defenses earless moths may use to decrease profitability of capture such as larger size, and flight speed. Related to faster flight, I will also be looking at whether male earless moths, in searching for a mate, fly further over the course of a night to compensate for decreased amount of time spent active.

What role do physical barriers to gene flow play in the divergence of tropical seabirds?

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boobies, Eastern Pacific Barrier, Isthmus of Panama, mtDNA, phylogeography

Although several genetic studies of arctic and temperate seabird species indicate that physical barriers to gene flow (e.g. glaciers) played an important role in the divergence of many populations, research on tropical species is lacking. In this study, we examined mitochondrial DNA (cytochrome b) sequence variation in masked, red-footed and brown booby samples collected from islands in the Atlantic and the eastern and central Pacific Oceans. We found a different phylogeographic pattern for each species. Sequences from the Atlantic were distinct from those in the Pacific for both red-footed and brown boobies. Although most masked booby sequences were distinct, one sequence was shared across the Isthmus of Panama (IP). Within the Pacific, both red-footed and masked boobies shared the same sequence(s) across the Eastern Pacific Barrier (EPB). Brown booby sequences from the eastern Pacific, however, were distinct from those in the central Pacific. We estimate that the divergence of each of these populations occurred within the last 500,000 years. Thus, it appears that the IP is an effective barrier to (female-mediated) gene flow despite the fact that it has been breached by several species of tropical seabirds following its emergence approximately three million years ago whereas the EPB seems to have played less of a role in the diversification of these species.

Genetic Support for Direct Benefits of Helping in a Cooperatively Breeding Cichlid

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Microsatellite, *Neolamprologus pulcher*, Lake Tanganyika, genetics

Neolamprologus pulcher is a cooperatively breeding cichlid from Lake Tanganyika that lives in groups consisting of an alpha breeder of each sex along with 1 to 14 helpers of both sexes. It has been assumed that these groups form along familial lines; however, using microsatellite markers to estimate relatedness in this species, we have found that this is not true. Only 16% of the helpers could be categorized as offspring of one of the breeders. Mean relatedness to the alpha female (0.12 ± 0.02) was higher than to the alpha male (0.06 ± 0.02). We found that individuals unrelated to the alpha male perform more territory defense, while individuals unrelated to the alpha female visit the brood chamber more often. We review adaptive explanations for the observed patterns.

Divergent life history strategies in the mite, *Arrenurus manubriator*: viability of hybrids between forms with parasitic and nonfeeding larvae.

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Arrenurus manubriator, mites, life history, parasitism, hybrids, speciation

Typically, parasitengonine mites have complex lifecycles in which the first active stage (the larva) is parasitic on insects and subsequent stages are either predatory or non-feeding. Two different life history variations occur within *Arrenurus manubriator* (sensu lato): some lay small eggs that develop into parasitic larvae (P lineage) and some lay larger eggs that result in larvae that forego both feeding (NF lineage) and association with a mosquito host. Females lay only one type of egg throughout their life and only one life history strategy is found within a population. It is not clear whether these represent divergent populations, incipient species, or newly-diverged species. F1 hybrids of P females with NF males almost always fail, whereas the reciprocal cross almost always succeeds and is fully-fertile.

Egg size is an expression of the female's genome, and acts as a maternal effect on the resultant offspring. Hybrid females produce intermediate-sized eggs. Our purpose was to study the effect of egg size and genetics on the viability of resultant larvae. Hybrid females (NF female X P males) and NF females were crossed with either NF or P males, thus producing 4 crosses consisting of 2 different egg sizes, each with 2 different genetic makeups. Success of egg hatching appears to be unaffected, and while it is potential for larvae of all 4 crosses to transform to deutonymphs without parasitic feeding, the failure rate during transformation was higher in crosses involving intermediate-sized eggs. Only larvae resulting from hybrid females crossed with P lineage males showed any attraction to mosquito pupae. Larvae resulting from this cross would facultatively parasitize mosquitoes. This study indicates that these populations are sufficiently divergent that there is partial reproductive isolation because of reduced viability, however the populations are fully interfertile.

Herbivore damage and the attraction of predators to plants

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plant defense, induced resistance, tritrophic interactions

Plants damaged by herbivorous insects can release volatile compounds and become more attractive to the natural enemies of herbivores. This volatile release is an induced response, perhaps regulated by the same signalling pathway, the jasmonate pathway, that regulates production of direct defenses against herbivores. In field grown tomato plants, caterpillars feeding on plants with induced responses activated experienced higher rates of parasitism. The purpose of this study was to determine if this increase in parasitism was due to the production of volatile compounds regulated by the jasmonate pathway. Using a Y-tube olfactometer, we found that plants damaged by herbivores were more attractive to predatory mites than undamaged plants. This indicates that damaged plants release a volatile blend detected by the predatory mites. In addition, we tested whether the jasmonate pathway was responsible for this increased attractiveness by comparing the attractiveness of wild-type and jasmonate-deficient mutants. The wild-type plants were more attractive when damaged whereas the jasmonate-deficient mutants were not more attractive when damaged. The attractiveness of the damaged jasmonate deficient mutants was recovered when these plants were sprayed with exogenous jasmonic acid. This indicates that the jasmonate pathway is responsible for the production of volatile compounds attractive to predators.

Experimental analysis of somatic, genetic and evolutionary trade-offs between sexual vs. asexual reproduction in an aquatic plant

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sex, reproductive evolution, resource allocation, life-history evolution, punk rock

Trade-offs among traits competing for limited resources are central to the evolution of life histories. In plants that combine sexual and clonal asexual reproduction, it is widely expected that the allocation of resources results in a trade-off between reproductive modes. A somatic trade-off may also be associated with a genetic trade-off, which may constrain the evolution of the reproductive strategy. Yet, there has been limited experimental investigation of trade-offs at both levels in clonal plants. We investigated somatic and genetic trade-offs between sexual reproduction, clonal reproduction and vegetative growth in an aquatic plant, *Butomus umbellatus* (Butomaceae, flowering rush). We used hand pollinations to create three levels of investment in sex among clonal replicates of 20 genotypes and examined the consequences for clonal reproduction and vegetative growth in two nutrient regimes. Within genotypes, there was a strong somatic trade-off between sexual and clonal reproduction but not between sexual reproduction and vegetative growth, probably because most investment in vegetative structure precedes allocation to sexual structures. Contrary to expectations the somatic trade-off between reproductive modes was not more pronounced under low nutrients. Investment in sexual reproduction and vegetative growth varied significantly among genotypes, and multivariate profile analysis revealed that the relative allocation to the three functions also varied among genotypes. However, there was no allometric relation between sexual vs. clonal mass among genotypes in any of the six pollination x nutrient environments. Moreover, we did not detect a genetic trade-off between allocation to sexual vs. clonal reproduction. Because there does not seem to be any genetic constraint on the pattern of allocation, the reproductive strategy may be evolutionarily labile in *B. umbellatus*. This is supported by a major change in reproductive allocation between sexual populations and those which have been rendered sexually sterile by a change in ploidy.

The community ecology of induced plant responses to herbivory: Priority effects on the abundance of multiple herbivore species

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induced responses, herbivory, priority effects, herbivore community, *Solanum dulcamara*

Variation in plant phenotype may affect patterns of herbivore abundance in the field. Plant phenotypic responses induced by the feeding of herbivorous arthropods are one such source of variability: plant changes in structural, morphological, or chemical traits can typically be elicited by at least one herbivore species. Moreover, plant responses can be specific to an herbivore, and subsequent effects on herbivore preference and performance may vary with herbivore identity. Since these responses can be strong enough to affect the density of herbivores on a plant, there is potential for induced plant responses to influence the structure of herbivore communities. Using three specialist and two generalist herbivore species and the host plant *Solanum dulcamara*, we examined if the identity of the initial damager on a plant at the beginning of a growing season could have subsequent effects on herbivore abundance. A manipulative field experiment demonstrated that, over the course of the growing season, induced plant responses contributed to both short-term and long-term effects on herbivore abundance. These effects varied with initial herbivore identity. However, since priority effects were not similar for herbivore species within the specialist and generalist classifications, diet breadth assignments did not predict the outcome of these indirect, plant-mediated interactions between herbivores. Finally, all but one priority effect decreased subsequent herbivore abundance, suggesting that induced responses generally increased plant resistance to herbivores. Overall, this study demonstrates that induced plant responses and history of host plant colonization can be important determinants of patterns of abundance within herbivore communities.

Does Nest Success Matter? Trends in Nest Success Over Time, and the Relationship Between Nest Success and Population Growth Rate for Five Species of Dabbling Ducks in the Prairie Pothole Region

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Dabbling duck, nest success, Prairie Pothole Region

Between the mid-1950's and the late 1980's, declines in breeding population size and nest success of dabbling ducks in the Prairie Pothole Region (PPR) were hypothesized to be caused by both habitat alteration and climatic change. However, both precipitation levels and duck population sizes increased in the early 1990's. I tested the hypotheses that nest success in the PPR exhibits both spatial and temporal trends, that nest success is increasing in the 1990's, and that a positive correlation exists between nest success and the duck population growth rate in the following year. Using nest success data from 1935 to 1996, nest success over time was modeled using an information-theoretical approach, and the relationship between nest success and population growth rate was tested using linear regression. Nest success decreased between 1935 and 1992, but was higher in the U.S. than in Canada during this time. Nest success increased between 1992 and 1996, and was also higher in the U.S. than in Canada during this period. No significant relationship was found between nest success and population growth rate in the following year. The rebound in nest success rates between 1992 and 1996 suggests that a large-scale mechanism such as precipitation is driving the increase in nest success, and does not support the hypothesis that the Conservation Reserve Program in the U.S is significantly increasing nest success. This study urges managers to further explore the relationship between nest success and population growth rate as a means of evaluating the efficacy of management techniques geared solely toward boosting duck nest success

Geographic patterns of reproductive mode and population structure of a Canadian species-at-risk, *Vaccinium stamineum* (deerberry)

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peripheral populations, geographic range limits, mode of reproduction, population structure, *Vaccinium stamineum*

Properties of populations peripheral to a species' geographic range have important implications for both evolutionary theory and conservation practices: 1) Evolution - what constrains adaptive evolution by natural selection at range margins? 2) Conservation - understanding of demographic, ecological, and genetic properties of marginal populations is critical for managing populations and defining significant units of conservation for rehabilitation. However, very little is known about the properties of marginal populations relative to central populations. The goal of this study is to describe geographic patterns of reproduction and population structure for *Vaccinium stamineum* (deerberry) as a precursor to a large-scale genetic study. *V. stamineum* (which reproduces both sexually and clonally) occurs throughout the eastern USA and reaches its northern limit in southern Ontario. Shifts in mode of reproduction from sexual to asexual at northern range limits have been previously documented and may be associated with changes in population genetic structure. To explore geographic patterns of reproductive mode and population structure I surveyed 30 populations of *V. stamineum* from Ontario to North Carolina where I quantified: (1) Reproductive effort - flowering, fruiting, and seed set, (2) Parameters of population structure - density, area, and individual growth (height, diameter, and new growth), and (3) Geographic location - latitude, longitude, altitude, slope, and aspect. Field observations (2001) suggest that although there is no direct relationship between flowering or fruiting rate and latitude, fruit to flower ratio tends to be negatively associated with latitude. That is, northern populations achieve less success in the form of fruiting relative to their flowering effort suggesting pollen limitation or early-acting inbreeding depression upon pollination. In addition, observations of population demography suggest that patches are more dense and isolated in high latitude populations. This suggests increased clonal reproduction in northern populations, which may increase the probability of inbreeding when sex does occur.

Poster Abstracts - oeec 2002

The Influence of Leaf-Out on Song Post Selection by Male Cerulean Warblers (*Dendroica Cerulea*)

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Cerulean Warbler (*Dendroica Cerulea*), Song Post Selection, Leaf-Out, Microhabitat Association

In this study, I examined the influence of the degree of leaf-out on song post selection by male Cerulean Warblers (*Dendroica cerulea*) in an eastern Ontario temperate deciduous forest. Different rates of leaf emergence amongst different canopy tree species provide male Cerulean Warblers with numerous potential song posts with varying levels of foliage density, during early spring. Foliage is known to degrade propagated sound in a forested environment primarily through scattering, such that increasing levels of foliage density will cause increasing reverberations. The degree of leaf-out appears to have a large influence on song post selection: 73.3 % of song posts were relatively less leafed-out than neighbouring trees. Males appear to be selecting song post trees that have reduced levels of foliage densities compared to neighbouring trees. Male singing height from a song post was strongly correlated with the height of the song post tree. Song post tree sizes have a tendency to be larger than available neighbouring tree size, as inferred through DBH measurements. These results support other studies that show male Cerulean Warblers use large trees and sing from high perches. Cerulean Warbler song structure is not acoustically adapted to overcome sound degradation within its habitat. This study shows that males appear to be using behavioural adaptations - such as optimal song post selection that maximises song propagation while minimising sound degradation and improving sound reception, to possibly compensate for the lack of a song structure resistant to the acoustically degrading environment of their forested habitat.

Divergence of gill rakers in trophically polymorphic pumpkinseed sunfish (*Lepomis gibbosus*) from Ashby Lake

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pumpkinseed sunfish; gill rakers; divergence; trophic polymorphism; morphs; *Lepomis gibbosus*

Some populations of pumpkinseed sunfish (*Lepomis gibbosus*) are trophically polymorphic. The different morphs specialize on living in littoral (shallow water) or limnetic (open water) habitats. These specializations involve robust, deeper-bodied littoral morphs that feed on molluscs, and streamlined, fusiform limnetic morphs that specialize on zooplankton. Gill rakers are important mouth structures likely to influence the foraging performance. In this study, the gill raker morphology will be tested for variation between the two morphs from Ashby Lake, Ontario. Gill arches were extracted from 50 limnetic and 50 littoral pumpkinseed samples from Ashby Lake. Gill rakers were stained with alizarin red and stored in 70% ethanol. Digital pictures were taken of the gill arch and rakers, and morphological data was produced using thin-plate spline (TPS). Next, Discriminant Function Analysis (DFA) was performed on shape information. Significant differences were found in the littoral and limnetic gill raker morphs. Limnetic gill rakers had longer, ventrally tilted gill rakers, smaller gaps in apical and ventral arch and a longer gill arch across the back. The phenotypic variation in gill rakers suggests that diet is strongly linked with gill raker form, from Ashby Lake pumpkinseed samples.

Microsatellite analyses of relationship in eusocial sweat bees (*Lasioglossum malachurum*)

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relatedness, microsatellite, *L. malachurum*

Halictine sweat bees display variable social behaviour within and among species, with colony social organization ranging from weakly to strongly and classically eusocial. *Lasioglossum malachurum* has long been regarded as the paradigm of a strongly eusocial halictine, in which queens monopolize egg-laying and workers are altruistic, their behaviour being explained in terms of the inclusive fitness benefits of raising siblings instead of offspring. We used three highly polymorphic, microsatellite markers to investigate patterns of relatedness within colonies, specifically testing the predictions based on field observations, that queens mate only once, that there is only one queen per nest, and that female brood raised by workers are their full sisters, while male brood are brothers, sons, or nephews. Preliminary results for a Greek population of this apparently strongly eusocial species, reveal unexpected patterns of maternity and paternity: there is evidence of queens mating more than once, nests with two egg-laying queens, and worker production of gynes and males. Nests even contain workers or males with no obvious relatedness to their nestmates. So far, *L. malachurum* does not live up to its classical billing.

Evolutionary origin and genetic consequences of avian migration in a tropical kingbird

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migration, evolution, dawn song, flycatchers

The origin of avian migration is one of the most significant questions in ornithology. The Evolutionary Precursor Hypothesis proposes that migration between the Tropics of Cancer and Capricorn (intratropical migration) was the first ancestral step to long-distance Nearctic migration. Our primary goal is to reconstruct the evolutionary sequence of events that lead to migration out of the tropics by building a mitochondrial DNA phylogeography for populations of the Cassin's kingbird (*Tyrannus vociferans*). Cassin's kingbird populations have recently diverged in migratory behaviour at three levels: 1) sedentary (south-central Mexico), 2) Nearctic migrant (southwestern US), and 3) intratropical migrant populations (north-central Mexico). We are additionally assessing the genetic consequences of migratory behaviour by measuring genetic variation, comparing morphology, and comparing dawn song among Cassin's kingbird populations. We have recently completed blood sampling, morphological measurements, and dawn song recordings for 15 Cassin's kingbird populations (88 blood samples, 83 morphological samples, 137 dawn song recordings) across the species' range (USA and Mexico). Results from song and morphological analysis will be presented. Molecular analysis using both mtDNA and microsatellites are currently underway in Dr. S. Loughheed's laboratory at Queen's University.

Correlates of parental and offspring quality in the Black-capped Chickadee

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offspring quality, growth rate, nestling plumage colour, Black-capped Chickadee

Black-capped chickadees (*Poecile atricapilla*) are non-migratory songbirds that winter in flocks structured by linear dominance hierarchies. High-ranking pairs have significantly higher reproductive success than low-ranking pairs, but the importance of the early nesting environment is poorly understood. Chickadees tend to reduce the sex ratio of their brood as it increases in size, significantly so for low-ranking pairs. I measured the growth rates of chickadee nestlings from seven nests to determine whether high ranking parents confer growth benefits to their young through either genetic or material advantages, and to compare the relative production costs of sons and daughters. I found that nestlings with low-ranking parents were heavier from days 1 to 6, with no difference evident in days 7 to 12. Variation in growth rates among broods was substantial, but not related to parental rank. Male nestlings grew faster than females and were significantly heavier by day 10 of the 16 day nestling period. I also compared the plumage colour of nestlings across the avian visual range, which includes both the human visual spectrum and the ultraviolet spectrum. I found that nestlings had a drop in total plumage brightness at 400 nm, a pattern which is not seen in the adults and could potentially be a signal of juvenile status. Female nestlings tended to be brighter than males in several plumage regions, although none of the differences was significant; this is opposite to the patterns seen in adults. There were no differences in offspring plumage related to parental rank, but the sample size was small. Overall, it appears that the offspring of high ranking pairs do not enjoy growth benefits that afford them greater survival to fledging; however, sons seem to be more costly to raise, and so chickadees may be constrained to having proportionately fewer sons in large broods.

Are funny people attractive and prestigious? No, at least not in this study.

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sexual signals, dominance, humor

Two theories have been suggested for the evolution of the sense of humor in humans (*Homo sapiens*). One, humor serves as a courtship device to attract the opposite sex. Two, humor serves as a tool for status manipulation by temporarily depriving ridiculed individuals of access to group resources. In this study, we provide the first empirical investigation of these theories. Subjects were exposed to video stimuli of two humor conditions: self-ridiculing humor and other-ridiculing humor. We measured the effect of humor on the perceived attractiveness and status of both the humorous individual and the individual who was ridiculed. Utilizing self-ridiculing humor caused a decrease in the individuals relative attractiveness and perceived status. These results are discussed in relation to previous findings.

Physiological costs associated with dominance in *Neolamprologus pulcher*.

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social living, cichlids, Lake Tanganyika

Social living is expected to have both costs and benefits. One of the main costs of living in a permanent social group is the investment required to maintain a stable dominance hierarchy. This cost has not been examined before in cooperative breeders. We used groups of *Neolamprologus pulcher*, a cooperatively breeding cichlid fish from Lake Tanganyika, to examine the physiological costs of social dominance. We studied 10 groups of four fish (matched in size) and examined how dominance hierarchies affect growth rates, social behaviour, and concentrations of cortisol, ATP, lipids, proteins and glycogen. We found that dominant fish grew fastest and were most aggressive. We also report how a number of physiological parameters varied with social status. Our results support the notion that dominant individuals enjoy larger benefits and fewer costs in social groups.

Reproductive Ecology and Potential Impacts of an Introduced Species

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Round goby, Great Lakes, Lake Ontario, habitat preference, invasion

Following habitat destruction, the single largest contributor to the observed decline in global biodiversity is exotic species introductions. In the Great Lakes, of the 25 species of non-indigenous fish none has invaded so quickly as the round goby (*Neogobius melanostomus*). The round goby was accidentally introduced from Europe to the St. Clair River (between Lake Huron and Lake Erie) in 1990 and was first reported in Lake Ontario in 1997. To examine the effects of the invasion in Lake Ontario we began sampling an area known as Hamilton Harbour (the western tip). We found that round gobies have become the most abundant species in the littoral zone of Hamilton Harbour (mean of 50 per transect). During an extended breeding season (May to August), individuals are commonly found on sand, silt, gravel, cobble and boulders substrates. In laboratory preference tests males, females and juveniles all showed preferences for rock over sandy habitats. Although some species that share a similar diet and breeding requirements as the round goby seem to be in decline, others are increasing. We discuss the potential threat to native fish species, especially to those in the fragile breeding ground of the adjoining Cootes Paradise Marsh.

Scale dependence of the productivity-diversity relationship in northeastern U.S. lakes.

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productivity, diversity, scale

Recent reviews of the productivity-diversity (PD) literature have documented that variation exists in the form and strength of the relationship between productivity and diversity across spatial scales. These review studies are relatively new and have called for spatially explicit analysis of the PD relationship to fill in the 'gap' in knowledge of how diversity patterns are structured across scales. This study attempts to fill in some of these gaps by examining how both observational scale and analytical approaches influence the strength and form of the productivity-diversity relationship. A dataset of 236 well-studied lakes in northeastern U.S.A., for which productivity and diversity parameters were available, was selected to examine scale-dependence. The form of the PD relationship within this dataset was found to vary as a function of focus (level of data aggregation), extent (geographic area of samples) and taxonomic group, indicating that the PD relationship in lake systems is both scale- and taxa-dependent. When the focus was changed so that data were aggregated by ecoregions, the probability of detecting significant relationships at the regional extent was increased. The focus-dependence of the PD relationship is attributed to an increase in statistical power when small-scale heterogeneity is masked by data aggregation. Examination of smaller extents (within ecoregions) revealed that small-scale PD patterns do not seem to accumulate to the regional scale pattern as predicted by the 'pattern accumulation hypothesis.' This indicates that local scale processes such as competition play a role in structuring local scale diversity patterns.

Microsatellite Analysis of Parentage and Diversity in White Rhinoceros (*Cerathoterium simum*)

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microsatellites, white rhinoceros, genetic variability, paternity

Conservation managers require accurate behavioural data on the social systems of endangered mammals supported by genetic information on kinship relations. The white rhinoceros (*Cerathoterium simum*) has suffered severe reductions in population size as a result of intense poaching between late 1970's and early 1990's. The genetic variation measured to date in this species is low compared to other threatened mammals and other rhino species. The long-term persistence of these rhinos could be threatened by this reduced variability and the current population distribution may exacerbate the loss of genetic diversity. *C. simum* individuals live in small, fragmented populations, except for one large population in South Africa, which may be prone to continued loss of genetic variation. To enhance the survival of this species the remaining variation should be conserved. This project contributes to ongoing conservation efforts by assessing genetic variability in microsatellites and their ability to accurately assign parentage in a closely related population of white rhinoceros. In order to conduct kinship analyses and decipher the mating system and social behaviour of this species we developed fast evolving microsatellite markers. Specifically, we quantified the difference in microsatellite variability across 13 loci in 35 samples of white rhinoceros, belonging to four known pedigrees. The mean expected heterozygosity calculated was 0.376. We evaluated their use in kinship studies by conducting paternity assignments using CERVUS, a software that calculates the probability of exclusion and likelihood for each candidate father in the study population. Paternity was assigned correctly to only 7 of 13 calves when entire (35) population was pooled. In contrast, using one pedigree separately, assignment was correct for all calves sampled. In combination, these loci did not accurately assign parentage in all cases; but were reliable when used on a single pedigree. The extension of these data to field studies is discussed.

Conservation genetics of five-lined skinks of Ontario: Apportionment of genetic diversity in a fragmented landscape.

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five-lined skink, conservation, habitat fragmentation, microsatellites, *Eumeces fasciatus*

Genetic analyses are increasingly providing key inputs into species recovery programs, facilitating study of impacts of anthropogenic habitat changes, and permitting planning for long-term maintenance of genetic diversity, designation of management units or delineation of evolutionary significant units. The five-lined skink (*Eumeces fasciatus*), Ontario's only lizard, has shown dramatic declines in some populations, and is susceptible to local extinction via habitat destruction. It is currently found in two disjunct series of populations in Ontario, the conservation status of which are unclear. Our present study plans to use high-resolution microsatellite markers to quantify genetic connectivity and distinctiveness of these Ontario populations with the express purpose of providing explicit recommendations for conservation of this species.

Cenozoic biogeography and early diversification of Andean Birds: the seedsnipes (Aves: Tinamidae)

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Andes, speciation, alpine, vicariance, Tinamidae, genetic divergence, seedsnipes

The Neotropical family Tinamidae (seedsnipes) consists of 4 species (with 8 to 12 possible subspecies) of vegetarian, cryptically-coloured ground birds, classified within the shorebird order Charadriiformes. The family is restricted to the Andean Cordillera and Patagonia and the distribution of at least some of the species corresponds to areas of endemism of other vertebrates. Although seedsnipes have strong flight capabilities, these ground birds are sedentary and their movements are very localized, mostly involving descent into lower altitudes during severe weather. Populations of seedsnipes may be found in isolated habitat 'islands' such as scree slopes of individual mountain peaks, alpine grasslands or puna, or moist springheads. Although species may occur sympatrically, the larger species (genus *Attagis*) are high altitude specialists (e.g. >4000 m), while the smaller species (genus *Tinamotis*) prefer lower elevations or even arid lowlands (*T. rumicivorus*). Due to the restricted movement of seedsnipes, the isolation of some populations, the endemism of subspecies, and their adaptations, speciation in this family may be linked to mountain-building events. Thus seedsnipes can serve as a model to determine the importance that agents, such as the uplift of the Andes, glaciation and climate change, have had on the origin of species.

Mean selected temperature of hatchling snapping turtles (*Chelydra serpentina*) in a thermal gradient

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Chelydra serpentina, temperature choice, feeding status, incubation temperature

In turtles, conditions during incubation have been shown to have long lasting effects on many postnatal traits including sex, behavior, locomotion and survival. As well, there is often an optimal range of temperatures that ectotherms must achieve for effective metabolic function and food digestion. The purpose of this study was to determine if feeding status and incubation temperature affects temperature choice in hatchling snapping turtles and if an interaction exists between feeding status and incubation temperature. Hatchling turtles taken from naturally incubated nests were randomly assigned to one of two feeding regimes: satiated (fed daily) or hungry (fed 7 days prior to testing). The mean selected temperature for each individual turtle was measured in a thermal gradient (15-30°C) over a four-hour interval. The mean of temperatures selected by individual hatchling snapping turtles was 25.3 ± 0.6 °C. Hunger status, incubation temperature and their interaction did not significantly affect the temperatures selected by the hatchling snapping turtles. The lack of a post-feeding response in these hatchling snapping turtles was consistent with previous studies indicating that an increased body temperature may not be a prerequisite for efficient digestion in these turtles. Similarly, it appears that snapping turtles select temperatures optimal for their physiological processes irrespective of their past thermal history.

Determinates of differentiation in an Andean frog: isolation vs. selection

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differentiation, population genetics, morphometrics, *Hyla*

Speciation is ultimately responsible for generating the vast biological diversity found on the planet and the mechanisms that generate such diversity have been at the centre of heated debate for decades. The Andes Mountains contain the highest number of amphibian species, of which 95% are endemic to the region. High diversity and endemism have drawn researchers to examine factors which may promote speciation in this region. The distribution of *Hyla andina* in isolated river valleys and across ecological gradients within valleys provides an excellent opportunity to contrast roles of geographic isolation and diversifying selection in different habitats. A comparison of the patterns of differentiation in neutral genetic markers and patterns in morphology within and among valleys and habitats will reveal the relative importance of the two mechanisms in differentiation of populations. Preliminary results of morphological variation are discussed.

Using Pumpkinseed Sunfish (*Lepomis gibbosus*) Pharyngeal Jaw Morphology as an Indicator of Trophic Divergence in Ashby Lake

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External morphological divergence in populations of pumpkinseed sunfish (*Lepomis gibbosus*) has been previously observed in several lake ecosystems relating polymorphic forms to differences in habitat and diet (Robinson et al. 2000, Jastrebski, 2001). Littoral morphs that live among macrophytic vegetation tend to be robust in shape, commonly feeding on large hard-bodied macro-invertebrates. Pelagic morphs, which are more stream-lined, tend to live in the open-water feeding mainly on softer-bodied zooplankton. Since previous studies have related external morphology to foraging and diet, it is likely that internal oral cavity structures, like the pharyngeal jaw apparatus (PJA), will also exhibit morphological alterations between these two trophic forms. The PJA consists of a dorsal and ventral hard-toothed palate which manipulates and processes shelled invertebrates. Thus, this study wished to test if pharyngeal jaw (PJ) morphology was predictably divergent between littoral and pelagic pumpkinseeds from Ashby Lake. If PJ architecture differed morphologically between the two habitat zones, then it was expected that jaws would be shorter, wider and more robust in littoral dwellers and longer and narrower in pelagic dwellers. To test this hypothesis, numerical shape information generated using Thin-plate spline analysis compared 16 homologous landmarks on digitized photographs of lower PJs from Ashby Lake pumpkinseeds. This study found that significant differences exist in the lower PJ architecture between littoral and pelagic forms ($p < 0.001$). Thus, if divergent selection operates between littoral and pelagic lake habitats, then it may be operating on mouth traits directly related to feeding as well as body form traits related to swimming.

A previously unknown reproductive caste in eusocial Hymenoptera.

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Brock University

eusocial, caste, *Halictus sexcinctus*

Eusocial insects live in colonies which are families consisting of two generations. Classical eusocial insects have two castes, queens and workers. Castes are forms of females that perform different functions within a colony. Queens start nests, are mated and lay lots of eggs, are long lived, and selfish. Workers are the queens' daughters, are small, may be mated but lay fewer eggs, are short lived, and altruistic. *Halictus sexcinctus* is a large species of sweat bee whose geographical range extends across Europe and the Middle East. In southern Greece it is weakly eusocial whose life cycle consists of a queen founding a nest in the spring with two broods per year. However, a population of *Halictus sexcinctus* from Daimonia, Greece included females that founded new nests in the summer. This deviation from the normal colony cycle can be explained two ways. First, there may be a cryptic species pair, morphologically identical but genetically distinct; two species with different colony cycles and life history strategies. Virtually identical DNA sequences (COI) indicate that these bees are all members of the same species. Alternatively, the summer foundresses might represent a new reproductive strategy. Morphometric analyses suggest that not only are these summer foundresses a new reproductive strategy, they are also a new reproductive caste.

Utility of microsatellites for parentage analysis in polar bears, *Ursus maritimus*.

Saunders BL, de Groot PJvC & Boag PT

Department of Biology, Queen's University

microsatellite, CERVUS, paternity, probability of exclusion, likelihood, polar bear, Gulf of Boothia

The impact of trophy-based, sex-biased hunting on the mating system of polar bears is largely unknown. Tools that can clarify the variance in reproductive success among males are therefore needed to investigate this pattern. Microsatellites were assessed for use in parentage analysis of polar bears from the Gulf of Boothia management unit in Nunavut, Canada. One hundred and fifty individuals, including eighty-eight adult males, twenty-three mothers and thirty-nine cubs, were genotyped at twelve microsatellite loci. Using these data the calculated probability of exclusion was 99.9%, the mean number of alleles per locus was 8.42 and the mean expected heterozygosity was 0.748. The log likelihood ratio method in CERVUS was used to verify maternity within female-cub family units and to assign paternity to potential fathers. The candidate father pool of eighty-eight adult male bears from the Gulf of Boothia represented 24.8% of the estimated number of reproductively active adult male polar bears in the management unit. In this study thirty-seven of the thirty-nine cubs were assigned to the consorting female with 95% confidence. The paternity analysis assigned eight of the cubs to candidate fathers with greater than 80% confidence; however, a candidate father was identifiable as the most likely father for fifteen of the twenty-three cubs. Paternity could not be assigned unambiguously despite the high probability of exclusion likely because of the small proportion of candidate fathers sampled. The results of this investigation illustrate the utility of these microsatellite loci for parentage and mating system studies in polar bears and underline the need for a large proportion of the candidate parents to be sampled.

Voice Attractiveness and 2D:4D Ratio

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2D:4D ratio, attractiveness, voice, mate choice, testosterone

The ratio of lengths of the second digit to the fourth digit (2D:4D) in humans is negatively correlated with male testosterone levels, as well as with sperm properties. I investigated whether the perceived attractiveness of men's voices was related to this index of hormonal state during development. Human male secondary sexual characteristics, including body hair, jaw length, and depth of voice, develop under the influence of testosterone. Since testosterone is an immunosuppressant, individuals able to withstand its detrimental effects may have more adaptive genotypes. The exaggeration of certain sex-appropriate traits, such as vocal sex-typicality, may be used to honestly signal genetic fitness during mate selection. I hypothesized that the voices of males with low 2D:4D (i.e. high testosterone level) would be perceived as being more masculinized and attractive and would thus be preferred. I also hypothesized that the conditional nature of female reproductive strategies would emphasize the preference for low 2D:4D males during the follicular phase of the menstrual cycle when conception risk is high. I found that right hand 2D:4D was more strongly correlated to perceived male voice attractiveness than left hand 2D:4D. Moreover, perceived male voice attractiveness was positively, rather than negatively, correlated to right hand 2D:4D ratios of subjects. This trend suggests that the voices of males with high 2D:4D (i.e. low testosterone) were perceived as more attractive. There was no significant difference in the preference of male voices by females that were in the High-Conception-Risk phase of their menstrual cycle as compared to those in the Low-Conception-Risk phase of the cycle. Females may not be using conditional reproductive strategies when assessing vocal attractiveness of potential mates. The results of this study suggest that the assessment of male voice attractiveness may be used as a mate-selection cue that reflects "good parent" potential.

An Initial Assessment of Genetic Variability in Four Species of Rhinoceros using Microsatellite DNA Markers.

Scott C, van Coeverden de Groot P & Boag P

Department of Biology, Queen's University

Genetic variability, microsatellites, Rhinoceros

To date, there has been limited investigation using nuclear DNA markers to determine the levels of genetic variation within and among Rhinoceros species. By using microsatellites, this study made a preliminary assessment of genetic variability for each of four species of Rhinoceros: the Black rhinoceros (*Diceros bicornis*), the White rhinoceros (*Ceratotherium simum*), the Indian rhinoceros (*Rhinoceros unicornis*) and the Sumatran rhinoceros (*Dicerorhinus sumatrensis*). The overall set of microsatellite loci that was used to assess variability encompassed a selection of 9 Black rhinoceros microsatellite loci (Brown and Houlden 1999, Cunningham et al. 1999, Westoll 2000 and Gardiner 2001), 9 White rhinoceros microsatellite loci (Florescu 2002), 8 novel Indian rhinoceros microsatellite loci and 13 novel Sumatran rhinoceros microsatellite loci. Probability of Identity (PID), the chance that two randomly drawn individuals will exhibit the identical genotypes, was calculated for each species. Using all loci (conspecific and heterospecific) that amplified within a species, the Black rhinoceros had the highest variability ($1/1.68 \times 10^6$ for 34 loci) while the White rhinoceros had the lowest variability ($1/3.11 \times 10^9$ for 27 loci). We also conducted a preliminary comparison of observed heterozygosities (H_o) among Rhinoceros species using a subset of 18 variable microsatellite loci that amplified across all of the four study species. Although the null hypothesis that all rhinoceroses have the same level of variability was rejected (one-way ANOVA $P > 0.021$) when these 18 common loci were used, the only significant difference in observed heterozygosities was between the Black and Indian rhinoceros species (Tukey-Kramer HSD test).

Genetics and Behaviour Reveal Dispersal Patterns and Status Change in a Cooperatively Breeding Cichlid

Stiver K, Dierkes P, Taborsky M & Balshine S

Department of Psychology, McMaster University; Konrad Lorenz-Institut für Vergleichende Verhaltensforschung (KLIVV); Department of Behavioural Ecology, University of Bern; Department of Psychology, McMaster University

Microsatellite, Cichlidae, *Neolamprologus pulcher*, Lake Tanganyika, social dynamics

Cooperative breeding has been well studied in *Neolamprologus pulcher*, a cichlid fish from Lake Tanganyika. However, we still know little about dispersal patterns and changes in social position over time in this species and information is crucial to fully understand the trade-offs involved in cooperative breeding. In this study we combined genetic techniques with long-term behavioural observations on marked individuals to investigate these factors for the first time. Microsatellite analyses supported the assumption of a degree of natal philopatry. This was further confirmed by comparing allele frequency variation (F_{ST}) across subpopulations; fish in subpopulations that were closer together were genetically more similar than fish in distant subpopulations. We also found that helpers sometimes disperse to adjacent territories and retain their helper status. Helpers appeared to disperse farther (across many territories in a subpopulation or to new subpopulations) to achieve breeding status. Breeding vacancies may arise from natural death or successful eviction of the previous breeder; we confirmed that helpers can inherit their natal breeding spot and that male breeder replacement rates exceeded those of females. In light of the difficulty of permanently marking and tracking small fish over time, our results demonstrate that in philopatric species a combination of genetic sampling and long-term behavioural observations can be a successful way to glean information about fish life histories.

Conservation genetics of the eastern loggerhead shrike. A microsatellite case study.

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Department of Biology, Queen's University

loggerhead shrike, *Lanius ludovicianus*, genetics, DNA microsatellites

The loggerhead shrike (*Lanius ludovicianus*) is the only exclusively North American representative of the family Laniidae. In recent years, this small carnivorous bird species has shown both marked range contraction and dramatic decline in numbers especially in the northern part of its distribution. This is especially pronounced in *L. l. migrans* where, in the isolated Ontario population, documented numbers have been as low as 18 breeding pairs (in 1997). Here we report on, and discuss the conservation implications of, a survey, of DNA microsatellite diversity in Ontario *L. l. migrans*, and compare these to population samples from Colorado and Manitoba.

Interactive effects of *Tomicus piniperda* (L.) on native *Ips pini* (Say) (Coleoptera: Scolytidae) in red pine

Yakimchuk M & Smith SM

Department of Zoology, University of Toronto

Tomicus piniperda, *Ips pini*, invasive species, competition, entomology, forestry, Scolytidae

The exotic bark beetle, *Tomicus piniperda* (L.), has established rapidly in pine plantations throughout southern Ontario since it was first recorded in Canada during 1992. In the Great Lakes region, *Tomicus* competes for the same reproductive resources, dead and dying wood, as the native scolytid, *Ips pini* (Say). *Tomicus* is likely the superior competitor in this system early in the season because it emerges from overwintering sites and colonizes wood three to six weeks earlier than *Ips*. However, later in the season, when *Tomicus* produces sister broods and both can co-colonize woody material, it is less clear which species has the advantage, or why. Thus, the goal of our study was to examine the interaction between *Tomicus* and *Ips* in order to elucidate the competitive mechanisms operating and to provide some possible explanations for the rapid establishment of *Tomicus*. Under field conditions, we found that the reproductive galleries of both species overlapped on the same tree with the greatest densities of both (*Tomicus* = 178 +/- 41.58 galleries/m² and *Ips* = 26 +/- 8.718 galleries/m²) occurring at the base of the trees (at the largest DBH = 24 cm), and declining with tree diameter. In the field and laboratory, *Ips* produced 54% fewer offspring than *Tomicus* when the two co-colonized, whereas the number of progeny produced by *Tomicus* was unaffected (a non-significant decline of 12-15%). The body size of offspring of either species was not affected by co-colonization. These results suggest that interaction between the two scolytids results in reduced fitness for the native *Ips* when co-colonizing later in the season and this, combined with the rapid sequestration of woody resources by the exotic *Tomicus* early in the season, may partially explain the rapid establishment of the latter in North America.

Other Posters on Display in Atrium

These posters represent some past and current research performed at the Queen's Biological Station

"Eastern Bluebird (*Sialia sialis*)" by Gillian Glen-Worrall

"The Tree Swallow (*Tachycineta bicolor*)"

"Stressed Frogs, Incompetent Immune Systems, and the Big Bad Bacteria"

"GPS & GIS"

"Black Capped Chickadees: comparison of nestling growth rates" by Unknown

"Moth and Butterfly Sensory Physiology" by Dr. James Fullard, Amanda Soutar, Kit Muma, Tarah Harrison and Chrissy Belanger

"Snakes of the Rideau Lakes Area"

Linking Winter and Breeding Grounds in the American Redstart" by Ryan Norris, Dr. Laurene Ratcliffe, Dr. Peter Marra

"Red-winged Blackbird (*Agelaius phoeniceus*)" by Karen Cavey and Stephanie Doucet

Song and Pairing Success in the Male American Redstart (*Setophaga ruticilla*) by Laura Tourangeay, Ryan Norris, and Dr. Laurene Ratcliffe.

Sights

- As Kingston is the hometown of John A MacDonald, you'll see literally dozens of plaques celebrating his occupation of various houses and apartments. The best of the bunch is Bellevue House, a National Historic Site, complete with staff in period costumes. It is located at 35 Centre Street, and is open from 10 to 5 daily.
- The Agnes Etherington Art Gallery (situated on Queen's campus) is also worth checking out. There are eight galleries exhibiting a wide variety of art. One exhibit has a ping-pong table. Admission is on a donation basis.
- Fort Henry is a 19th century British military fortress and another National Historic site. Check out their website <http://www.forthenry.com>

Food

Kingston has far too many restaurants to list here, but I'll try...

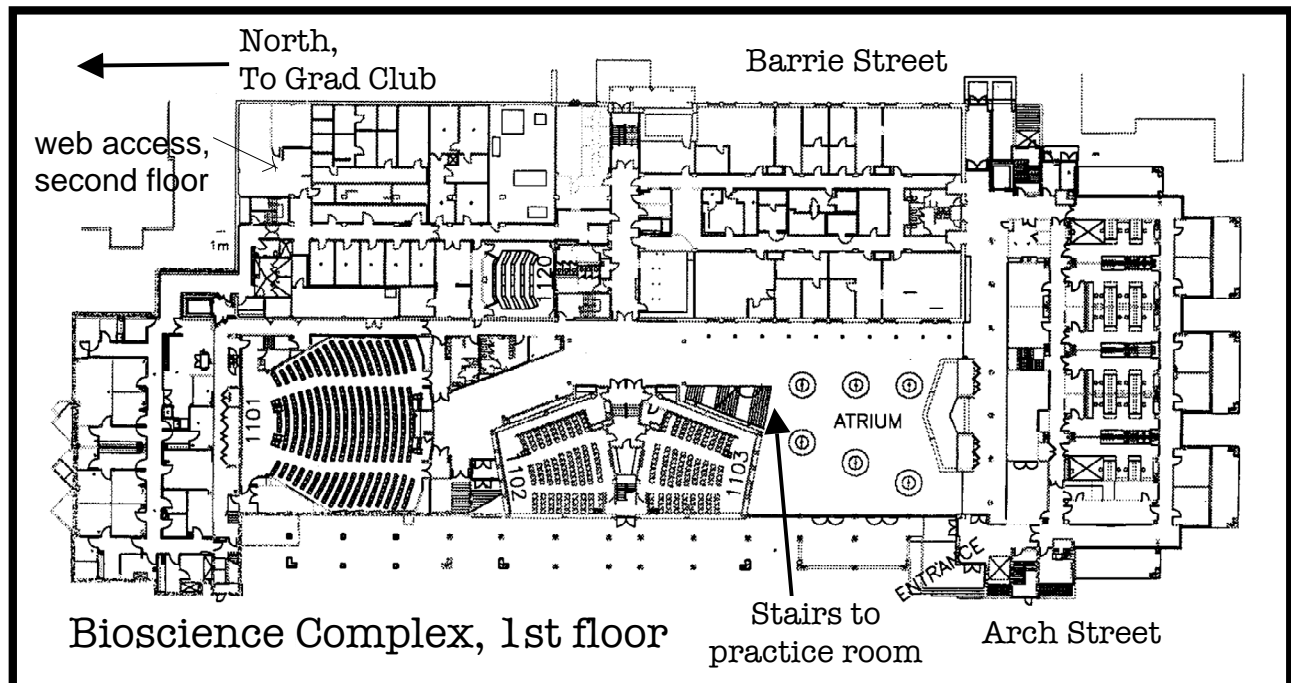
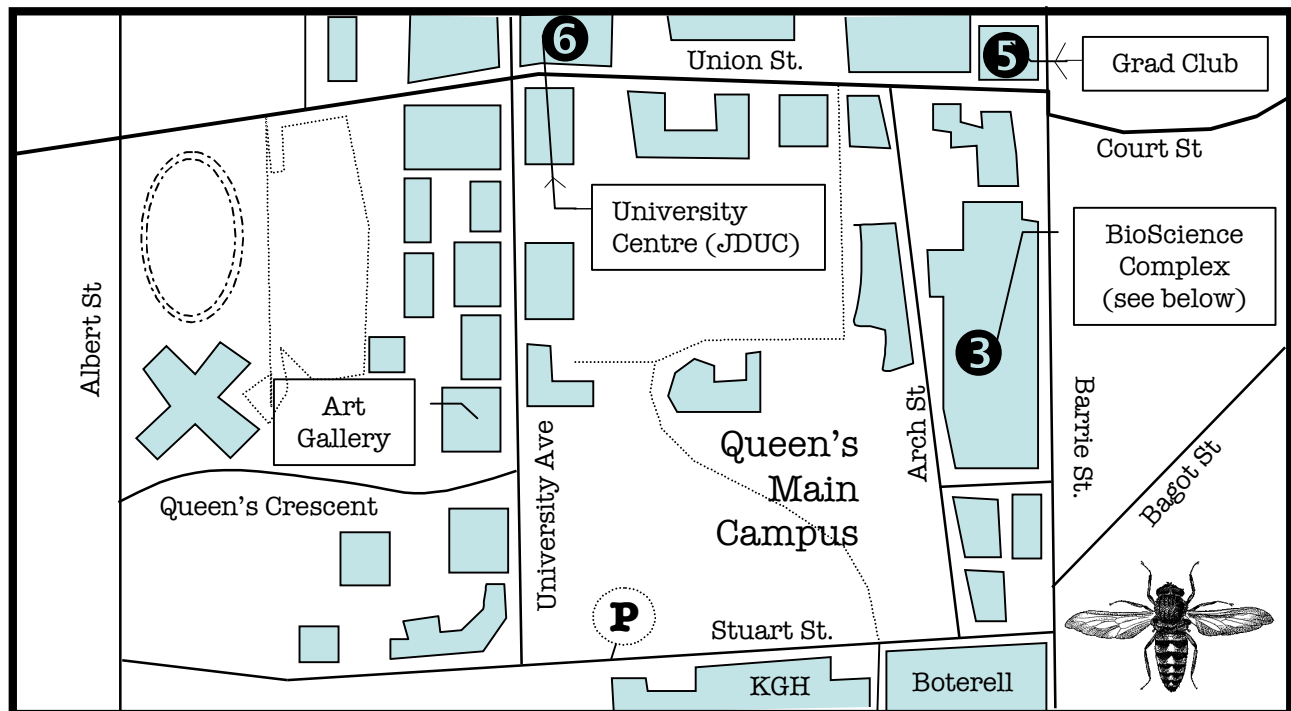
- Cambodian Village (347 King St. East) is a friendly restaurant that serves up delicious hot spicy Thai and Cambodian food. A grad student favorite.
- Dunn's Famous Delicatessen (110 Princess). For my money there is nothing finer than Dunn's for all my bacon needs. Big portions, casual atmosphere, and did I mention the bacon?
- Curry Village (169A Princess St) and Curry Original (9253A Ontario St) are two of the finest places in Canada to get Indian food. Pick either one. You will not be disappointed. Original is closed on Mondays.
- Woodenheads (192 Ontario St) specialized in gourmet pizzas and other fine Mediterranean food. You can't go wrong.

Bars

As Kingston is the hometown of John A MacDonald, it also has a lot of places to wet your whistle. Some local favorites:

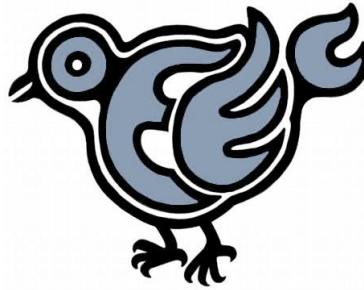
- The Grad Club (Union and Barrie) has exactly what you need : good drinks (9 brands of beer on tap), all types of pub food, pool (free on Monday nights), a pleasant atmosphere, and is situated just meters away from the BioScience Complex. Enough said.
- The Toucan (76 Princess St.) is a Irish Pub located right downtown. There are over 20 types of draught on tap and a courtyard patio where you can enjoy them all.





MAP LEGEND

- | | |
|---|---|
| 1 Train Station | 5 The Grad Club
Corner of Barrie and Union |
| 2 Bus Station
Counter Street | 6 John Deutsch University
Centre (JDUC) Corner of
University and Union Sts |
| 3 BioScience Complex
116 Barrie street | 7 Howard Johnson
Confederation Place Hotel . |
| 4 Kingston Yacht Club
1 Maitland Street | |



Sunday

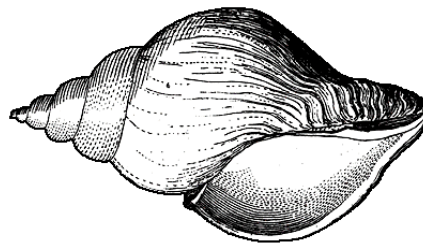
Registration and Welcome Mixer at Grad Club

Monday

- Dr. Irby Lovette,
"The evolutionary origins of the latitudinal diversity gradient"
- Sessions on Species Interaction, Behavioural Ecology, Conservation Biology, Community & Evolutionary Ecology, Evolutionary Genetics and Ecology I
- Conservation Genetics Plenary,
"Partnerships in conservation research"
- OEEC Banquet

Tuesday

- Dr. Geoffrey Hill
"The signal content of carotenoid-based color displays"
- Sessions on Mating System Evolution, Evolutionary Ecology and Ecology II
- Book Raffle



OEEC 2002