

Ontario
ecology and
ethology
congress

Programme

and

Abstracts

UNIVERSITY
of GUELPH

2-4 May 2001

ACKNOWLEDGEMENTS

The OEEC 2001 Organizing Committee at the University of Guelph consisted of: Megan Andrews, Craig Blackie, Therese Brimner, Margy de Gruchy, Mark Drever, Suzanne Gray, John Holmes, Seanna McTaggart, Professor David L Noakes, Matt Routley, marie Rush, Robert Scott, Vanessa Turner, and Dylan Weese.

Planning space, mailing costs, treats and coffee for regular Friday meetings were provided by the Axelrod Institute of Ichthyology. Special thanks to the students who volunteered their time to assist with registration, convening and audiovisuals. We also thank all the participants who submitted abstracts and made this meeting a success!

OEEC 2001 gratefully acknowledges the support for this meeting provided by the following individuals and offices at the University of Guelph:

Professor Alastair Summerlee - Vice President Academic

Professor Larry P. Milligan - Vice President Research

Professor Isobel Heathcote - Dean, Graduate Program Services

Professor Robert G. Sheath - Dean College of Biological Science

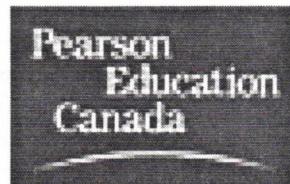
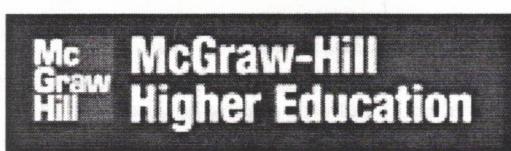
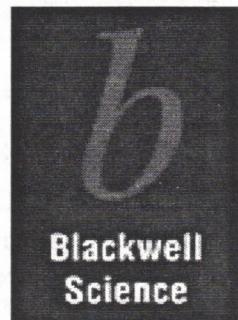
Professor Michael R. Moss - Associate Dean, Faculty of Environmental Sciences

Professor Richard J. Reader - Chair, Department of Botany

Professor Glen Van Der Kraak - Chair, Department of Zoology

Professor David Noakes - Director, Axelrod Institute of Ichthyology

The OEEC 2001 Organizing Committee also acknowledges the contributions of the following book publishers to this meeting:



Wednesday MAY 2

1800-? - Registration and social mixer (cash bar); Graduate Students Lounge, 5th Floor, University Centre
 (use North Elevators)

Thursday, MAY 3

ALL CONFERENCE ACTIVITIES ARE IN THE AXELROD BUILDING			
0800	Registration - outside Room 200, Axelrod Building Poster Setup - Room 282, Axelrod Building		
0830	Opening remarks - Axelrod Building, Room 200 Megan Andrews - OEEC 2001 Organizing Committee Professor Isobel Heathcote, Dean of Graduate Studies, University of Guelph Professor Robert Sheath, Dean, College of Biological Science, University of Guelph		
0900	Below-ground biodiversity and ecosystem function Professor John Klironomos. Department of Botany, University of Guelph		
0920			
0940	Molecular evolution and mate recognition systems: Plants can be interesting too Professor Barbara Mable. Department of Botany, University of Guelph		
1000			
1020	Coffee (Rm 265A) and Posters (Rm 282)		
1040	Biocomputation - The Future of Both Biology and Computer Science? Professor Deborah Stacey. Computing and Information Science, University of Guelph		
1100			
1120	The behavioural ecology of intermittent locomotion Dr. Robert L. McLaughlin. Department of Zoology, University of Guelph		
1140			
1200	Lunch - University Centre		
	Species Interactions - Rm 259 Chair: Rob McLaughlin	Community Ecology - Rm 117 Chair: Margy de Gruchy	Evolutionary Ecology - Rm 309 Chair: Megan Andrews
1300	Williams* and Day - Interactions between sources of mortality and the evolution of parasite virulence	James* - Niche relations in four sympatric lizards on the Colorado Plateau	Ratcliffe* - Conditioned taste aversion in four species of Microchiropteran bat
1320	Benoy* - Using large-scale field experiments to test for food inhibition in migratory waterfowl during the breeding season	Kjoss* and Litvaitis - A comparison of two methods to sample snake communities in early successional habitats	Freedman* - Why are there no really, really big teleost fishes?
1340	Guiasu* and Dunham - Aggression in the surface water <i>Cambarus</i> crayfish species of Ontario: intraspecific and interspecific contests	McLaren*, Wilson and Peltzer - Plant growth-form effects on the spatial and temporal heterogeneity of soil moisture	Blahut* and Richards - Compositional bias and codon usage patterns among hexapods
1400	Cheng* and Rowe - Anti-predator behaviours, condition dependence and predator acclimation in guppies, <i>Poecilia reticulata</i>	Tagliavia*, Bazely and Koh - Oak savanna plant communities in southern Ontario: assessing plant community composition, the effect of prescribed burn, and deer pellet distribution (Pinery Provincial Park, Rondeau Provincial Park and Pelee National Park)	Rathburn* and Montgomerie - Effects of parental condition and group size on offspring sex ratio in white-winged fairy-wrens (<i>Malurus leucopterus</i>)

	de Kerckhove* - A bioenergetics/daily-growth model for brook charr (<i>Salvelinus fontinalis</i>)	Taylor* and Bailey - Reciprocal transplant experiments to determine the resistance and resilience of benthic macroinvertebrate communities in Yukon streams	Youth*, Forbes and Smith - Immune expression in a damselfly is related to time of season, not to asymmetry or host size
	Burgess*, Husband and DeVerno - Hybridization between the endangered red mulberry (<i>Morus rubra L.</i>) and the introduced white mulberry (<i>Morus alba L.</i>) in Canada: molecular and morphological evidence	Turner* and Klironomos - Changes in abundance of soil organisms along a successional gradient in southern Ontario gravel pits	Koen Alonso*, Crespo, Pedraza, and Garcia. Resource overlap among top predators and the hake fishery in Patagonia, Argentina
Coffee (Rm 265A) and Posters (Rm 282)			
	Species Interactions - Rm 259 Chair: Mark Drever	Community Ecology - Rm 117 Chair: Vanessa Turner	Contaminant Effects - Rm 309 Chair: John Holmes
	Spender*, Stevens and Petersen - Effects of phosphorus availability on the growth and mycorrhizal colonization of the emergent aquatic <i>Lythrum salicaria L.</i> under flooded conditions	Andruskiw* and Fryxell - Landscape fragmentation thresholds for habitat usage	Lauder*, Yauk and Quinn - Minisatellite mutagens: What can we learn from herring gulls?
	Beinekoff* and Lima - Testing for peripheral vigilance: Do birds value what they see out of the corners of their eyes?	Chui* and Jones - Spatially structured models of two-species communities of coral reef fishes	Elshayeb*, Feisthauer, Stephenson and Brooks - Avoidance behaviour of <i>Eisenia andrei</i> in response to benomyl treated soils
	Aarssen and Keogh* - Conundrums of competitive ability in plants: What to measure?	Laird* and Aarssen - Rank abundance distributions for old field vegetation	Beaton* and Dudley - Adaptation to high salinity and manganese toxicity in roadside vegetation
	Richardson*, Gunzberger, and Travis - Mortality due to sunfish predation in the least killifish: effects of predator species and vegetation	Pither* and Aarssen - Species evenness and the spatial organization of biomass within plant communities	Somers* and Quinn - Environmental pollution and germline DNA mutation: What can lab mice tell us about wildlife management?
	Sister* and Fullard - The possible role of the Vogel's Organ in predator detection in the common wood nymph butterfly (<i>Cercyonis pegala</i>)	Schamp* and Aarssen - Can habitat rarity explain the humped-back richness/productivity relationship?	Watson* - Pond invertebrate community response to increasing chloride levels from road salt input
Posters and Barbeque at the Arboretum			
	Conservation - Rm 259 Chair: Lynne Gray	Mating System Evolution - Rm 117 Chair: Bob Scott	Population Differentiation - Rm 309 Chair: Jonathan Witt
	Diamond* and Firemark - The effects of landscape composition on forest breeding birds	Xvon Ompteda* and Gross - Benefits of mate choice in captive breeding protocols	Shaw*, Soares, Michaud and White - Development of genetic profiles to assess variability and population structure of St. Lawrence beluga whales (<i>Delphinapterus leucas</i>)

0920	✓ Miyanishi* and Johnson - A re-examination of the effects of fire suppression on the boreal forest <i>✓ of ✓</i>	✓ Ophir* and Galef - Male Japanese quail avoid a female after seeing her mate, but are attracted to females that look like her	✓ Gregory* and Gibbs - Microgeographic population structure of the eastern Massasauga rattlesnake (<i>Sistrurus c. catenatus</i>) as revealed by microsatellite DNA markers
0940	Johnson*, Finklestein and White - Geographical distribution of <i>Canis</i> mitochondrial haplotypes across eastern North America	✓ Scott* - Sexual selection and speciation in threespine stickleback from Washington State	✓ Hollett*, Brooks and Congdon - The sonoran mud turtle leaves the desert behind and hangs its hat on the jutting appendages of the Chiricahau Mountains: thesis plan in defence
1000	Samson* and Brooks - On the importance of studying stable population of a common species in conservation biology	✓ Fitzpatrick* and Gray - Divergence between the courtship songs of the field crickets <i>Gryllus texensis</i> and <i>G. rubens</i> (C)	Bourguerat*, Gauthier and Pardel - How to estimate stopover length of migrating birds in a staging area? The example of the greater snow goose in Quebec
1020	Coffee (Rm 265A)		
	Conservation - Rm 259 Chair: Ron Brooks	Mating System Evolution - Rm 117 Chair: Seanna McTaggart	Population Differentiation - Rm 309 Chair: David Noakes
1040	✓ Sinclair* and Catling - Recovery of the threatened economic plant, goldenseal (<i>Hydrastis canadensis</i>): evaluation of population trends, limiting factors, and transplanting with simulated disturbance	MacDougall*, Joseph, MacDougall-Shackleton, Hahn and Ratcliffe - The relationship between blood-borne parasites and plumage in the pine siskin (<i>Carduelis pinus</i>)	Blackie* - Morphology of lake charr, <i>Salvelinus namaycush</i> , from Great Bear Lake, Northwest Territories, in relation to diet and spawning location
1100	Smith*, Fryxell and Lynn - Evaluating the consequences of alternate harvesting strategies: an experimental approach	Wyman* and Richards - An examination of the degree of cooperation by workers of the obligately eusocial sweat bee, <i>Lasioglossum (Evylaeus) malachurum</i> Kirby (Hymenoptera: Halictidae) in southern Greece	✓ Gray* and Robinson - Habitat-specific foraging efficiency in diverging stickleback species
1120	✓ Stockton*, Allombert, Martin and Gaston - The trouble with Bambi	Doucet* - Structural plumage colouration is an indicator of male body size and condition in the male blue-backed grassquit, <i>Volatinia jacarina</i>	Smith* - Geographical variation in body size and cranial morphology of the muskox, <i>Ovibos moschatus</i>
1140	Simard* and Fryxell - Effects of selective logging on terrestrial mammal and arthropod communities	✓ Agres Kliber* and Eckert - Regulation and adaptive significance of within-inflorescence variation in allocation to reproduction in <i>Aquilegia canadensis</i> (Ranunculaceae)	Weese* - Growth of lake charr, <i>Salvelinus namaycush</i> , from Great Bear Lake, Northwest Territories, in relation to diet and spawning location
1200	Lunch - University Centre		
	Conservation - Rm 259 Chair: Mart Gross	Mating Systems Evolution - Rm 117 Chair: Matt Routley	Behavioural Ecology - Rm 309 Chair: Therese Brimner
1300	Robertson* and Gross - Recovering ancient fish: demographic analyses of sturgeon	✓ Muis* and Eckert - Experimental estimation of biparental inbreeding in a highly selfing plant, <i>Aquilegia canadensis</i> (Ranunculaceae)	Lapierre*, Schreer and Burns - Ontogeny of diving behaviour in Weddell seals

✓ 19.2.98 - biparental inbreeding
✓ 19.2.98 - selfing

1320	Berends* and Gross - Trading natives for aliens? Fish species biodiversity in the Great Lakes	Routley* and Husband - The functional significance of dichogamy	Janoscik*, Lester and Collins - Seasonal differences in lake trout gillnet catchability
1340	Yakimowski*, Hager and Eckert - The role of propagule pressure in causing variation in the invasion of purple loosestrife within and between wetlands	Smith*, Nol and Gilchrist - The breeding ecology of the red phalaropes (<i>Phalaropus fulicaria</i>) of Southampton Island, Nunavut	Guiasu*, Punzalan and Dunham - Habitat selection and the preference for conspecific-built mud chimneys in the burrowing crayfish <i>Fallicambarus fodiens</i> (Decapoda, Cambridae)
1400	Wiersma* - Landscape ecology and GIS: Research in national parks without putting on your hiking boots	Snell* and Aarssen - Why are most selfers annuals? Comparing life history traits in selfing and outcrossing annuals	Greaves*, Schreer, Hammill and Burns - Ontogeny of diving behaviour and physiology of harbour seal pups
1420	Craine* and Gross - Colonization of Lake Ontario by introduced Pacific salmon	Thompson*, Lui and Eckert - Evolutionary loss of sexual characters in asexual populations of an invasive aquatic plant, <i>Butomus umbellatus</i> (Butomaceae)	Little* - The influence of carpeting on airborne fungal spore concentration
1440	Drever* - Climate change and waterfowl nesting success: Ducks in hot water?	Viswanathan* and Aarssen - Why biennials are so few: Habitat availability and the species pool	Muir* - Taking off the birthday-suit: unmasking some of the key uncertainties in fish aging through digital image analysis
1500			Pentilla* and Noakes - The changing roles of women in ichthyology
1520	Closing remarks (Rm 200) and book raffle The following publishers have supported OEEC 2001 by providing books for the raffle: Academic Press, Blackwell Scientific, John Wiley and Sons, McGraw-Hill, Pearson Educational, and Sinauer		
1540?	GO HOME AND HAVE A PRODUCTIVE SUMMER		

* Indicates the author who will present the paper.

POSTERS - Room 282 (Thursday) and the Arboretum

- I. Beattie* and M.H. Richards. Increased evolutionary rates in haplodiploid vs. diploid insects.
- II. Bednarczuk* Population Growth of Reintroduced Southern Flying Squirrels (*Glaucomys volans*) at Point Pelee National Park.
- III. Browning*, Ashpole and Brooks. Assessment of gross morphological deformities in the common snapping turtle (*Chelydra serpentina serpentina*) from Algonquin Provincial Park.
- IV. Dawson, Reinhardt*, and Savino. Use of Electrical Barriers to Limit Movement of Eurasian Ruffe.
- V. Dekar and McLaughlin.* Going Down: Can Downstream Drift Predict Low-Head Barrier Impact?
- VI. Edwards*, Galbraith and White. A geospatial analysis of the effects of land-use on the local distributions of reptiles and amphibians in the Hamilton area.
- VII. Feduszcak* and Kolasa. Comparison of various models of the species-area relationship for prediction ability in highly structured ecosystems.

8. Fenske*, Schmelzer, and Nudds. The wandering porcupine: Seasonal differences in home range use in a northern vs. southern population.
9. Gardiner*, DeGroot and Boag. A comparison of microsatellite variability in two subspecies of black rhinoceros, *Diceros bicornis minor* and *D. b. bicornis* and an evaluation of these loci for in situ paternity studies in *D. b. bicornis*.
10. Holmes*, Crawford, Noakes, and Wismer. Sounding out fish: the distribution and abundance of whitefish near Douglas Point, Lake Huron.
11. Holt* and Brooks. Fast and hot: What drives development rate in turtles?
12. Horne*, Lojek, Kott, and Rutherford. A longitudinal study of the invertebrate and fish communities in riffles of the middle reaches of the Grand River, Ontario.
13. Kristjánsson, Skúlason, and Noakes,* Parallel divergence of four Icelandic lacustrine population of threespine sticklebacks (*Gasterosteus aculeatus* L.) towards two unique bottom types.
14. Long*, Fryxell, and Falls. Of mice, mothers and mirror images: Testing the relationship between fluctuating asymmetry and fitness in a long-term collection of deer mice (*Peromyscus maniculatus*).
15. Mui*, Holt and Brooks. The effect of cool incubation temperatures on hatchling snapping turtles (*Chelydra serpentina*)
16. Noakes*, Baylis, Carl, Hayes, McLaughlin, and Randall. Impacts of low-head dams on sea lamprey and nontarget fishes in Great Lakes streams.
17. Noakes*, Sakakura, and Cole. Growth and sexual development in the self-fertilizing hermaphroditic mangrove killifish.
18. Pomeroy.* Hutchinsonian ratios in shorebirds: Artifact or assembly rules?
19. Scott,* Noakes and Beamish. East meets west: The cold water stream war over spawning rights in Wilmot Creek.
20. Scott,* Noakes and Beamish. Nest site selection in the wild by hatchery raised Atlantic salmon.
21. Simeunovic* and Lovett-Doust. Growing alternative greenhouse crops in hydroponics.
22. Stewart* and Lovett-Doust. Optimization of growth, yield and quality of active constituents of the medicinal plant *Calendula officinalis* L. (P)
23. Tindall.* The effect of traffic noise on bird abundance in the dairy bush.
24. Woodward* and Richards. Sexual selection, parental investment and human mate choice.

INVITED SPEAKERS

Below-ground biodiversity and ecosystem function

Professor John Klironomos. Department of Botany, University of Guelph, Guelph, Ontario, N1G 2W1.

It has been speculated that the forces driving global change, such as atmospheric CO₂, will also alter the diversity and distribution of organisms within ecosystems. Direct effects of CO₂ on vegetation may work to enhance or reduce biodiversity in natural ecosystems. Such changes in diversity are, in turn, expected to alter ecosystem functioning, such as primary productivity and the cycling of nutrients. In my lab we have investigated the effects of elevated atmospheric CO₂ on the species diversity of mycorrhizal fungi. Plants and soil collected from different sites across North America were subjected to elevated CO₂ levels. Fungal diversity was drastically reduced in response to elevated CO₂. Further studies determined that such changes in fungal species diversity may negatively affect plant biodiversity, productivity and nutrient capture in ecosystems. Overall, this data shows that CO₂ global change can seriously impact below-ground diversity of mycorrhizal fungi, which can in turn affect ecosystem productivity.

Molecular evolution and mate recognition systems: Plants can be interesting too

Professor Barbara Mable. Department of Botany, University of Guelph, Guelph, Ontario, N1G 2W1.

My research focuses on the general question: What happens when genes are duplicated? As data have accumulated from the genome sequencing projects on a variety of organisms (e.g., yeast, humans, plants, worms) it has become increasingly apparent that a vast number of genes exist in more than one copy. The processes by which these "gene families" arise are not always clear but one mechanism is through duplication of the entire genome (polyploidy). My research is concerned both with the molecular evolution of duplicated genes at the DNA level and in the resulting consequences at the whole organism level, particularly with respect to mate recognition and breeding systems. My most recent work has been on molecular evolution in the gene family involved in an important mate recognition process in plants (genetically controlled self-incompatibility), using natural populations of a species in the mustard family (Brassicaceae: *Arabidopsis lyrata*) as a model. I will describe this research and discuss how self-incompatibility is affected by polyploidy, which is extremely common in flowering plants.

The behavioural ecology of intermittent locomotion

Dr. Robert L. McLaughlin. Department of Zoology, University of Guelph, Guelph, Ontario, N1G 2W1.

Most physiological and ecological approaches to animal locomotion are based on steady state assumptions, yet movements of many animals are interspersed with pauses lasting from milliseconds to minutes. Thus, pauses, along with changes in the duration and speed of moves, form part of a dynamic system of intermittent locomotion by which animals adjust their locomotor behavior to changing circumstances. Intermittent locomotion occurs in a wide array of organisms from protozoans to mammals. It is found in aerial, aquatic and terrestrial locomotion and in many behavioral contexts including search and pursuit of prey, mate search, escape from predators, habitat assessment and general travel. In our survey, animals exhibiting intermittent locomotion paused on average nearly 50% of their locomotion time (range 6 - 94%). Although intermittent locomotion is usually expected to increase energetic costs as a result of additional expenditure for acceleration and deceleration, a variety of energetic benefits can arise when forward movement continues during pauses. Endurance also can be improved by partial recovery from fatigue during pauses. Perceptual benefits can arise because pauses increase the capacity of the sensory systems to detect relevant stimuli. Several processes, including velocity blur, relative motion detection, foveation, attention and interference between sensory systems are probably involved. In animals that do not pause, alternative mechanisms for stabilizing the perceptual field are often present. Because movement is an important cue for stimulus detection, pauses can also reduce unwanted detection by an organism's predators or prey. Several models have attempted to integrate energetic and perceptual processes, but many challenges remain. Future advances will require improved quantification of the effects of speed on perception.

Biocomputation - The Future of Both Biology and Computer Science?

Professor Deborah Stacey. Computing and Information Science, University of Guelph, Guelph, Ontario, N1G 2W1.

Current and future directions of biocomputation at the University of Guelph will be outlined. Biocomputation is defined as the study and application of those computational techniques necessary for the simulation, classification, understanding, and utilization of data indicative of biological phenomena. Specific examples from biologically-inspired robotics, biodiversity networking, and the use of artificial neural networks for biomedical signal processing will be discussed.

ORAL PRESENTATIONS

Following the title of each presentation is a code in brackets (1, 2) indicating the type of presentation and visual aids for oral presentations

1 - Type of presentation: O - oral and P - poster

2 - Visual aids: O - overhead transparencies, S - 35 mm slides; D - digital projector

Conundrums of competitive ability in plants: What to measure? (O, S)

Aarssen, Lonnie W., and Teri Keogh* Department of Biology, Queen's University, Kingston, Ontario, K7L 3N6

A survey of recent literature indicates that competitive ability in plants has been measured, in most studies, only in terms of the relative intensity of size (i.e., growth or biomass) suppression experienced by competitors within one growing season. These differences in size suppression are usually assumed to reflect differences in the relative abilities of the competitors to deny each other resources. Far fewer studies have recorded relative success under competition in terms of survival, and even fewer in terms of fecundity. Most previous studies have also failed to control or account for other sources of variation in the size suppression that plants experience under competition, i.e., variation in the resource supply/demand ratio (approach to carrying capacity), variation in the degree of fundamental niche overlap between competitors, or variation in the intensity of concurrent facilitative interactions between competitors. For future studies, therefore, much greater caution is required in recognizing these inherent limitations of traditional measures of competitive ability and, hence, guarding against unfounded conclusions or predictions about potential for competitive success or competitive exclusion that are based on these measures. There is also a significant challenge for future studies to adopt empirical approaches for minimizing these limitations. Some initial recommendations are considered here based on an emerging view of competitive ability measured in terms of traits associated with all three conventional components of Darwinian fitness; i.e., not just growth (biomass production) but also survival and fecundity allocation (offspring production per unit plant size).

Landscape fragmentation thresholds for habitat usage (O, D)

Andruskiw, M.A.,* and J.M. Fryxell. Department of Zoology, University of Guelph, Guelph, Ontario, N1G 2W1.

Man is ruining the world. Or is he? Human disturbance appears to leave the boreal landscape a fragmented mess. But fragmented landscapes, of which we see only the physical connectivity, may remain functionally connected from the perception of animals capable of crossing gaps. Increasing fragmentation may have little effect on a species until a critical level is reached. Ecological thresholds are transition ranges where small changes in spatial patterning of resources produce abrupt, dramatic, ecological responses. I hypothesize that there exists thresholds in fragmentation processes, or critical values of fragmentation parameters, beyond which habitat is no longer useable by animals. Most studies of animal movement across fragmented landscapes involve

insects, and extrapolation of results to other taxa may not be valid. I will investigate the degree to which an economically important forest carnivore, the marten, uses landscapes fragmented by commercial clear-cut logging. Live-trapping, radio-collaring, and snow-tracking of martens will provide information on the utility of patches, residence time, hunting and denning success, and gap-crossing ability. Comparing results from landscapes along a gradient of fragmentation parameters may identify threshold values of landscape fragmentation beyond which marten can no longer use habitat. Knowledge of such thresholds will facilitate landscape planning toward minimum effect on target species, and contribute to sustainable timber harvest practices.

Adaptation to high salinity and manganese toxicity in roadside vegetation (O, S)

Beaton, Laura L.* and Susan A. Dudley. Department of Biology, McMaster University, 1280 Main Street West, Hamilton, Ontario, L8S 4K1.

Plants inhabiting roadside environments are impacted by a unique combination of evolutionary forces. Smog, particulate pollution, air turbulence, and contamination of the soil by several metals exert strong selection pressures. In this study, we consider the evolutionary effects of two contaminants; high salinity (from the use of de-icing salts) and high manganese levels in the soil (from the use of methylcyclopentadienyl manganese tricarbonyl as an anti-knocking agent in gasoline). Evolutionary responses to environmental contaminants can be demonstrated by comparing the ability to tolerate the contaminants in populations from impacted sites with populations from control sites. *Dipsacus sylvestris* (common teasel) and *Hesperis matronalis* (dames rocket) are herbaceous plants common to both roadside and old-field habitats. Seeds of each species were collected from three sites adjacent to a major highway (impacted sites) and three sites located in old-fields (control sites). Seeds were placed in solutions of 70 mM NaCl, 3mM MnSO₄, and distilled water and permitted to germinate. The root length of each emerging seedling was used as a measure of performance. The results indicated that roadside populations of *D. sylvestris* have developed not only a tolerance to high salinity, but some populations appeared to benefit from the addition of salt. Neither roadside nor old-field populations of *D. sylvestris* were able to tolerate high manganese concentrations. Preliminary analysis of *H. matronalis* indicated that roadside populations were better able to tolerate manganese than old-field populations, but did not differ in their ability to tolerate salt.

Testing for peripheral vigilance: Do birds value what they see out of the corners of their eyes? (O, S)

Bednekoff, Peter A.^{1,*} and Steven L. Lima². 1. Biology Department, Eastern Michigan University, Ypsilanti, Michigan, 48197. 2. Department of Life Sciences, Indiana State University, Terre Haute, Indiana, 47809.

We tested whether what animals can see while their heads are lowered affects their pattern of raising their heads to scan their environments for predators. Barriers prevented dark-eyed juncos (*Junco hyemalis*) from seeing to the side while pecking, but not when they raised their heads. When the barriers were present, birds generally took longer scans but spent similar periods between scans. Also, scanning patterns were less variable when the barriers were present. The results suggest that juncos peripheral detection and that scanning patterns are affected by interactions between peripheral detection and overt scanning behaviour.

Using large-scale field experiments to test for food limitation in migratory waterfowl during the breeding season (O, D)

Benoy, Glenn.* Department of Zoology, University of Guelph, Guelph, Ontario, N1G 2W1.

When and where migratory waterfowl experience population bottlenecks remains a controversial issue in wetland management. Organismal studies have yielded insights regarding body condition and nutrient reserves in the breeding and wintering grounds but they provide for only limited inferences at broader spatial and temporal scales. There is sufficient evidence for and against food limitation during all phases of a bird's annual cycle to warrant a novel approach by investigating community-level patterns. By installing large (100 m²) exclosure structures in a series of prairie potholes (Minnedosa, Manitoba) the relationship between waterfowl and wetland

macroinvertebrates can be isolated and evaluated. Trophodynamic theory predicts that if waterfowl compete for limited prey, then in the absence of waterfowl foraging, macroinvertebrates should be released from top-down predation pressure. This prediction was borne out as macroinvertebrates were found to be longer and more abundant (paired t-tests, $p < 0.05$) in enclosure areas. Further, salamander abundance, converted to density per unit area, explained 44% of the difference between macroinvertebrate biomass inside and outside of the exclosures. These results are consistent with the hypothesis that waterfowl compete for food resources on the breeding grounds and that they strongly interact with other consumers. Additional results will be presented that consider the influence of primary productivity (water column chl a) and habitat heterogeneity (open water : vegetation ratio) on observed patterns.

Trading natives for aliens? Fish species biodiversity in the Great Lakes (O, D)

Berends, Michael. P.,* and Mart R. Gross. Department of Zoology, University of Toronto, 25 Harbord St. Toronto, Ontario, M5S 3G5.

The Great Lakes are a model system for what is happening to fish species biodiversity throughout North America. The Great Lakes currently have 151 species, of which 17% (26) are established aliens. Fish stocking has been the single major source of aliens, accounting for 32%, and canals have been the next most important source (25%). There are multiple sources of aliens, but government sponsored stocking and aquatic transportation programs have made principal contributions. The Great Lakes were once managed for natives, but after alien Pacific salmon were stocked to control the canal-entered alien alewife, government management plans shifted to preserving alewife and Pacific salmon for the sports fishing industry. Although the direct cause-and-effect are poorly known, four native species that were endemic to the Great Lakes are now globally extinct and an additional 11 native species are extirpated. However, at the species level, across the entire Great Lakes system, fish biodiversity experienced an overall increase of 11 species (26 established aliens minus 15 natives lost from the system). The Great Lakes is thus a larger-scale example of the famous Clear Lake, California, situation cited in many conservation biology textbooks, showing a decline in natives and an increase in total species.

Compositional bias and codon usage patterns among Hexapods (O, D)

Blahut, J.,* and M. Richards. Department of Biological Sciences, Brock University, St. Catharines, Ontario.

I have investigated trends in compositional bias and codon usage bias among eleven insect orders and one entognathan order. To examine whether or not these trends exist according to phylogenetic classification of insect orders proposed by Gullan and Cranston (2000), I calculated biases by order in each of four genes. Three of the four genes were of the mitochondrial (mt) genome, cytochrome b (cyt b), cytochrome c oxidase I (COI) and cytochrome c oxidase II (COII). The nuclear elongation factor-1 alpha (EF-1 α) was the fourth gene evaluated. Available gene sequences were obtained from Genbank and multiple alignments were produced using ClustalW. I selected gene segments that maximized both the number of species representing each order and the number of codons within the gene segments. DAMBE was used to generate nucleotide and codon usage frequencies for aligned gene segments. The following patterns were found with respect to nucleotide and codon usage frequencies: mitochondrial genes have a greater range in compositional bias than the nearly unbiased nuclear gene, all orders show a mitochondrial bias for AT over GC, codon usage of mitochondrial genes is different from that in the nearly unbiased nuclear gene, there exists consistent third position preferences for A or T in a given mitochondrial gene, there exists a direct correlation between overall AT-bias and third position AT-bias in mitochondrial genes and, finally, bias for AT at the third codon position (70%-94%) is higher than overall AT-bias (65%-80%) for mitochondrial genes of all orders.

Morphology of lake charr, *Salvelinus namaycush*, from Great Bear Lake, Northwest Territories, in relation to diet and spawning location (O, S)

Blackie, Craig.* Department of Zoology, University of Guelph, Guelph, Ontario, N1G 2W1.

Lake charr (*Salvelinus namaycush*) were sampled from Great Bear Lake, Northwest Territories, Canada, from June 30 to August 28, 2000. Samples were used to test whether morphological diversification observed for *Salvelinus* spp., in other large lakes, was present in Great Bear Lake. The fish were photographed and linear distances measured from the photographs to assess different morphological adaptations for feeding and locomotion. These measurements were compared to diet and spawning area of individual fish. Significant differences were found in the morphology of insect-eating charr and fish-eating charr, based on t-tests comparing Principle Component factor 1 scores. The charr differed in mouth morphology, pectoral fin length and caudal-peduncle length and depth. Using the same statistical tests, spawning shoal data showed no significant morphological difference between fish spawning on different shoals. While this was a preliminary study, there is evidence to suggest distinct morphs may be present and future work is needed to assess whether resource polymorphism is occurring in this lake.

How to estimate stopover length of migrating birds in a staging area? The example of the Greater Snow Goose in Quebec (O, D)

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Migrating geese are known to move frequently and to disperse long distances to find food. Under such conditions, it is almost impossible to get a complete follow-up of marked individuals. Therefore, very few authors have managed to obtain unbiased estimates of individual stopover length in a staging area. Our objective was to apply and expand recent developments in capture-recapture methods to obtain unbiased estimates of stopover lengths in Greater Snow Geese (*Chen caerulescens atlantica*) staging along the St. Lawrence estuary in fall. We also examined annual variations in length of stay over the short term (recent years) and the long term (since mid-80s) to test the hypothesis of a decrease in stopover duration. Intensive observations of neck-banded individuals were conducted during 1985-1987 (N individuals = 1,134; N observations = 5,718) and 1994-2000 (N individuals = 4,530; N observations = 11,007). Survival analyses using classical encounter histories were performed to estimate the time spent by the geese in the estuary after an observation based on emigration probabilities. Recruitment analyses using reverse encounter histories were performed to estimate the time spent by the geese in the estuary before an observation based on immigration probabilities. We estimated that geese spent on average 19.2 ± 0.9 , 23.4 ± 0.4 and 27.4 ± 0.9 days in the estuary in falls 1985, 1986 and 1987, respectively whereas they spent 28.2 ± 0.7 , 20.8 ± 0.9 and 17.6 ± 1.1 days in falls 1998, 1999 and 2000, respectively. These preliminary analyses suggest that the method may yield reliable results and may confirm a decrease in stopover duration for the last decade.

Hybridization between the endangered red mulberry (*Morus rubra* L.) and the introduced white mulberry (*Morus alba* L.) in Canada: molecular and morphological evidence (O, D)

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Hybridization, which results in the gene flow between populations, can diminish differentiation among populations and ultimately lead to the extinction of recognized taxa. This is thought to be especially true when a rare population hybridizes with a more abundant congener. Red mulberry (*Morus rubra* L.) is potentially Canada's most endangered tree and is suspected of being threatened through hybridization with the more abundant and introduced white mulberry (*Morus alba* L.). In sympatric populations, individuals with intermediate leaf morphology have been observed, however their parentage is yet to be confirmed using molecular techniques. In this study we use molecular (RAPD) and morphometric analyses to: (1) confirm if hybrids occur in sympatric populations of red

and white mulberry in southern Ontario, and (2) investigate the relationship between parentage and leaf morphology. Of all the individuals screened with species specific RAPD markers, 20% were found to be hybrids with the majority having a predominance of white mulberry RAPD fragments. Red, white and hybrid mulberry differed in 3 of the 4 morphological characters measured and parentage of hybrids was correlated to measures of leaf size. These results suggest hybridization could potentially be a cause of endangerment in red mulberry.

Spatially-structured models of two-species communities of coral reef fishes (O, D)

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Computer models are important tools in understanding interactions in ecological systems. This study uses a Cellular Automata Model to explore the effects of habitat geometry on the distribution and abundance of two-species communities of coral reef fishes. The species used in the model are representative species of highly social fishes, the wrasses (family Labridae), and aggressively territorial fishes, the damselfishes (family Pomacentridae). Parameters for the model are based on previous empirical data of labrid and pomacentrid populations along the coral reefs of St. Croix, U.S.V.I., and supplemented by literature findings. Coral reefs have high degrees of spatial heterogeneity on multiple spatial scales, from topographically complex habitats (e.g. branching corals) to topographically simple ones (e.g. sand). Five main habitat types are modelled in this study, each representing different patterns of habitat complexity. Pomacentrids have been observed to prefer habitats with high topographic complexity, and settle next to conspecifics; whereas labrids prefer heterogeneously patchy or homogeneous simple habitats, and settle away from pomacentrids. Such species-specific settlement affinities are incorporated in the model. When the effects of habitat geometry and location of prior residents on model communities of labrids and pomacentrids are firmly established, changes in other parameters may be explored, such as species-specific larval supply and mortality rates, to investigate their effects on reef fish patterns of distribution and abundance.

Anti-predator behaviours, condition dependence and predator acclimation in guppies, *Poecilia reticulata* (O, D)

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Predator avoidance and foraging are behaviours that often present conflicting demands on an organism. Researchers examining such behaviours over a long time period may intend to measure predator acclimation, but, in fact, measure an effect due to a decline in condition. I examined the behavioural responses of guppies, *Poecilia reticulata*, which were given the choice of an open or refuge habitat in the presence or absence of the predator, *Crenicichla alta*. Individual guppy condition was either high (fed) or low (unfed). The proportion of time spent: (i) in the open habitat vs. refuge habitat, (ii) close to predator vs. far away from predator, and (iii) moving vs. staying still were scored. To examine the effects of predator acclimation and condition dependence, the same experiment was repeated over three days. Results indicated that only fed individuals utilized the open habitat in the presence of the predator. Both fed and unfed individuals increased their distance from the predator. Fed and unfed individuals significantly decreased their activity with increasing predation risk and this was condition dependent. For the latter experiment, results indicated some acclimation to predators. More interestingly, results indicated that, over time, fed individuals behaved similar to unfed individuals by increasing their activity rates to a level akin to unfed individuals. The results from these experiments suggest that guppies use several anti-predator defense tactics. Furthermore, experiments conducted over time should consider not only the effect of predator acclimation, but also the effect of individual condition over time.

Colonization of Lake Ontario by Introduced Pacific Salmon (O, D)

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Non-native Pacific salmon released from hatcheries have been a major component of the Lake Ontario recreational fishery for 30 years. The hatchery-produced Chinook and Coho were not anticipated to colonize because they lacked the stream-specific environmental cues that would drive them to return to their natal streams to reproduce. Recently, however, thousands of mature adults have begun entering the stream watershed to spawn. In addition, juveniles have been found in streams. Thus, it is possible that alien Pacific salmon are now colonizing Lake Ontario. The history of stocking alien species into Lake Ontario is well documented and we have good data on the environmental changes occurring in the watershed over that period, including changes in the biotic community induced by exploitation and invasions by other species. We relate the recent pattern of colonization by Pacific salmon to a variety of environmental factors, including changes in the levels of disturbance, pollution, community dynamics and watershed rehabilitation. We predict that natural reproduction by Pacific salmon will increase to the point where it will have a significant impact on fisheries management and affect restoration efforts to restore native biodiversity in the Lake Ontario ecosystem.

A bioenergetics/daily-growth model for brook charr (*Salvelinus fontinalis*) (O, D)

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I formulated a bioenergetics model characterizing the differences in foraging behaviour of newly emergent brook charr, *Salvelinus fontinalis*. Newly emerged brook charr in still water pools forage mainly at the surface for adult and pupae insects or the bottom for crustaceans. The former behaviour requires actively searching for prey whereas the latter behaviour involves holding one position and waiting for prey. It is known that growth rates differ depending on the proportion of each prey type in the diet of charr. The model accounts for energy costs and benefits from differences in time spent moving, forage attempts, prey type, prey capture success and the swimming speed between individuals from field data taken from studies done on the Credit River. I am testing whether individuals exhibiting a mixture of the two behaviours incur a lower growth rate than ones exhibiting mainly one of the two due to energetic tradeoffs between food consumption and the costs of procuring food.

Structural plumage colouration is an indicator of male body size and condition in the male Blue-black Grassquit, *Volatinia jacarina*. (O, D)

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Structural colours are ultraviolet, blue, and green in birds originating from feather microstructure rather than pigmentation. Structural plumage colouration may be maintained by sexual selection, yet there is only limited evidence that structural colours can honestly signal individual quality. In this study, I found considerable individual variation in the deep blue to ultraviolet colouration of the wing coverts and rump of male Blue-black Grassquits (*Volatinia jacarina*), thereby revealing the potential for sexual selection on structural plumage colouration in this species. I used a principal component analysis (PCA) of four calculated colour characteristics to combine reflectance data into a single colour score. Birds with high colour scores have brighter, more intensely coloured and more spectrally pure blue-black feathers. There was a significant positive relationship between colour scores for both body regions and male condition. There was also a positive trend between the colour score of the rump region and male body size. Analysis of individual colour characteristics revealed that there was a significant positive relationship between the intensity and the brightness of rump colouration and male body size. Blue coverage on the birds was also significantly positively related to body size. These results support recent findings that structural colouration is condition-dependent, and this type of colouration may be an honest signal of male quality in the Blue-black Grassquit.

Climate change and waterfowl nesting success: Ducks in hot water? (O, D)

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Recent quantitative analyses rigorously demonstrated that nest success of prairie ducks has slowly decreased over time since the 1930s. Further, nest success of prairie ducks declined at similar rates at sites with and without predator control, strongly suggesting that predators, although they account for variation in nest success, cannot be the cause of the decline. I propose to examine the impact of climate change on nest success over time. Nesting ducks in the prairies feed primarily on insect prey whose timing of development and emergence is largely linked to temperature. Declining nest success might occur if increases in spring temperatures have affected the availability of prey at a faster rate than ducks' ability to respond, resulting in a mismatch between prey availability and duck breeding effort. I propose to test this hypothesis in three ways: (1) the increase of spring temperatures has not been uniform across the landscape, with some areas warming faster than other areas. Therefore, if climate change has affected nest success, then ducks nesting in areas with greater rates of warming should have greater rates of decline in nest success. (2) This hypothesis relies on the assumption that ducks time their breeding in relation to food availability. I plan to test this assumption by examining the relation between timing of breeding (e.g., nest initiation date) and timing of insect emergence derived from temperature-linked development models (e.g., date to reach biologically meaningful number of degree-days) based on long-term data from two field sites. Under the mismatch hypothesis, increasing divergence between these two dates should result in decreasing nest success. (3) I will combine these two approaches by increasing the spatial scale of question 2, and looking at the temporal trends of nest initiation date over the whole prairie region. I will compare the slope of this relation to the slope of the time to reach a prescribed number of degree-days in the spring. An increase divergence of these two slopes would be evidence of a potential mismatch between prey availability and breeding effort.

The effects of landscape composition on forest breeding birds (O, S)

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Deforestation has led to massive native forest habitat loss in eastern North America, resulting in smaller forest patches amidst a mosaic of anthropogenic landuses including agricultural land, urban development, and commercial forestry. The field of landscape ecology incorporates the study of the effects of such spatial patterning and compositional change of natural habitat on organisms within the landscape. The effects of decreasing forest fragment area and forest cover on forest breeding birds have been well documented for many species, but few studies have addressed how a mosaic of landuses surrounding forest fragments may affect forest bird assemblages and reproductive success. The purpose of this study is to assess whether landscapes with differing amounts of agriculture and urbanization will affect forest breeding bird species richness, abundance, or reproductive success while statistically controlling for the effects of forest fragment area and forest cover. Twenty-three forest fragments located near Ottawa, Ontario, were surveyed by point counts to assess species richness and abundance. Pairing and nesting success were determined for the American Robin, Wood Thrush, and Ovenbird. Nesting success was also estimated through artificial nests containing wax eggs. The percent cover of agricultural and urban areas was measured within a 2 km radius around each forest fragment. The relationship between landscape composition and forest bird species dynamics and the resulting implications for conservation will be discussed.

Avoidance behaviour of *Eisenia andrei* in response to benomyl treated soils (O, D)

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Earthworms are a representative species of the soil fauna and are sensitive to chemicals found within soil environments. Because of these qualities earthworms have been chosen to test the toxicity of contaminants within soils. Traditionally acute (7-14 days) lethality and chronic reproduction (35-65 days) tests have been used to assess the toxicity of contaminants in the soil to earthworms. The advantage of a 72-hr avoidance behaviour test

developed in the early 1990's might be its ability to provide results similar to those of a 65-day reproductive test. The avoidance behaviour test was tested with three different types of soil, with benomyl as the contaminant and *Eisenia andrei* as the earthworm test species. *E. andrei* was given the choice between uncontaminated and treated soils such that an avoidance response could be detected. The pooled EC₅₀ values for earthworms exposed to benomyl were different depending on the soil type. When the pooled EC₅₀ values derived from the clay loam soil were compared to the lowest effect concentration of the reproductive test similar results were found. The 72-hr avoidance response test was able to detect levels of contamination that elicited an avoidance response in *E. andrei*. In clay loam soil the results of the avoidance response test was predictive of the results of the reproduction test where adverse effects in earthworm reproduction were observed. The avoidance response test could therefore be a powerful tool for environmental planners and managers such that more immediate decisions could be made regarding contaminants in soils and their risk to terrestrial organisms.

Divergence between the courtship songs of the field crickets *Gryllus texensis* and *G. rubens* (C) (O, D)

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Acoustic mating signals are often important as both inter-specific pre-zygotic isolating mechanisms and as sexual selected traits in intra-specific mate choice. Here we investigate the potential for cricket courtship song to act as an isolating mechanism by assessing divergence between the courtship songs of *Gryllus texensis* and *G. rubens*. These crickets are broadly sympatric cryptic sister-species with strong pre-zygotic isolation via the calling song and little or no post-zygotic isolation. We found significant species-level differences in the courtship song, but the courtship song has not diverged to the same extent as the calling song, and considerable overlap remains between these two species. Only two related song characters are sufficiently distinct to play a possible role in pre-zygotic species isolation.

Why are there no really, really big teleost fishes? (O, D)

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The largest teleost, or true bony fish, is the ocean sunfish (*Mola mola*) which reaches approximately 1,500 kg in mass. The next largest teleosts are billfishes such as marlins, which may reach 1,000 kg. In contrast, cartilaginous fishes such as whale sharks (*Rhincodon typus*) reach in excess of 15,000 kg and great white sharks (*Carcharodon carcharias*) grow to over 3,000 kg. Marine mammals can exceed 100,000 kg and ancient marine reptiles such as Ichthyosaurs reached 10,000 kg or more. This study investigated this size discrepancy and attempted to determine what constraints limit maximum body size in teleosts. Several potential hypotheses regarding the lack of large teleosts were examined through a combination of published literature and direct communication with researchers. Hypotheses which were investigated include physiological constraints (such as metabolic rate and bioenergetics), anatomical constraints (gill size, trade-offs between bone and cartilage), ecological limitations (lack of available niches), and ontogenetic/life history traits (viviparity and oviparity, direct and indirect development, growth rates). While no definitive answers have been reached, maximum teleost size appears to be limited by life history traits, probably in conjunction with one or more other factors.

Habitat-specific foraging efficiency in diverging stickleback species (O, S)

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In a series of lakes in northern Ontario, brook (*Culaea inconstans*) and ninespine (*Pungitius pungitius*) sticklebacks coexist. Both reportedly use benthic resources found in littoral zones and may therefore compete for resources. Preliminary analyses indicate that brook sticklebacks have morphologically diverged to a more benthic form in the presence vs. absence of the ninespine and that there is evidence of competition between the species. We predict that brook sticklebacks are more efficient foragers on benthic prey items than are ninespines (which have a more pelagic body form), and vice versa on pelagic zooplankton. We tested this hypothesis using a reciprocal foraging experiment in the lab in which the efficiency of acquiring prey was determined for each species in artificial benthic and pelagic habitats. If the expected results are obtained, then a functional relationship exists between divergent phenotypes and habitat specific foraging efficiency, a prerequisite for testing ecological character displacement.

Ontogeny of diving behaviour and physiology of harbour seal pups (O, D)

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All seal neonates are born on land or ice and are physiologically similar to terrestrial mammals. During the nursing period and a subsequent fasting period, seal pups must develop behaviourally and physiologically so that they can forage successfully before their energy reserves become depleted. An important adaptation that enables seals to be efficient divers is a reduction in heart rate (bradycardia) during periods of breath holding (apnea). In the present study, we monitored heart rate and diving behaviour (depth/time) of freely diving, preweaned harbour seal pups (*Phoca vitulina*) to determine how they develop cardiovascularly, and how these developments are linked to diving behaviour. The precocious diving ability of this species allowed us to track the development of diving behaviour and cardiac control during the first part of the transition stage from nutritional dependence to independent foraging. In May/June 2000, nine seal pups living in the St. Lawrence River Estuary were outfitted with time-depth and heart rate recorders for approximately six days. Preliminary analyses indicate that the magnitude of a bradycardia and mean dive depths do not increase with age, but that average dive duration does increase. However, there was considerable variability across individuals. This work will lead to a better understanding of some critical mechanisms that may influence juvenile survival.

Microgeographic population structure of the eastern massasauga rattlesnake (*Sistrurus c. catenatus*) as revealed by microsatellite DNA markers (O, O)

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Geographically separated populations (< 50 km) of Eastern Massasauga Rattlesnakes (*Sistrurus c. catenatus*) have been shown to be strongly genetically differentiated, but less data are available on the degree of structure at more local geographic scales. Here I used 10 microsatellite DNA loci to determine the genetic differentiation

between snakes from two subpopulations in Killbear Provincial Park, Ontario, which were approximately 2 km apart. These were Blind Bay ($N = 43$) and Twin Points ($N = 29$). There were between 3 and 13 alleles at each locus with expected heterozygosities ranging from 0.24 to 0.85. The results show that 1) there are significant non-random associations of alleles (overall $F_{IS} = 0.138$ for Blind Bay and 0.143 for Twin Points, $P < 0.001$); 2) there are significant differences in allele frequencies between the 2 subpopulations for eight of the ten loci (overall $F_{ST} = 0.049$, $p < 0.001$); and 3) in each subpopulation many individuals had high numbers of close relatives present. This suggests that local inbreeding and high variability in individual reproductive success leading to small effective population sizes may contribute to this fine-scale differentiation.

Aggression in the surface water *Cambarus* crayfish species of Ontario: intraspecific and interspecific contests (O, S)

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Cambarus bartonii and *Cambarus robustus* are the only two surface water crayfish species of their genus found in Canada. Six types of agonistic contests (interspecific and intraspecific) between evenly size-matched males of these two species were analyzed and compared. These analyses revealed the presence of a clear dominance hierarchy among the males of *C. robustus* and *C. bartonii*. Adult Form I (reproductive form) *C. robustus* males dominate adult Form II (non-breeding form) conspecific males. Juvenile Form II *C. robustus* males overwhelmingly dominate adult Form I and Form II *C. bartonii* males. A comparison among these types of contests showed that the species and male form are important variables which should be taken into account during the analysis of aggression in cambarid crayfishes.

Habitat selection and the preference for conspecific-built chimneys in the burrowing crayfish *Fallicambarus fodiens* (Decapoda, Cambaridae) (O, S)

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Fallicambarus fodiens is a species of semi-terrestrial burrowing crayfish which can build mud chimneys on top of elaborate tunnels. In Canada, at the extreme northern edge of its range, this vulnerable species is restricted to only a few suitable locations in southern Ontario wetlands. The vast majority of tested juvenile *F. fodiens* crayfish preferred conspecific-built chimneys over similar-looking human-built chimneys. When the chimneys were surrounded by transparent acetate sheets, the crayfish no longer discriminated between the two types of chimneys. In the absence of chimneys, significantly more crayfish chose mud saturated with conspecific water over mud saturated with distilled water. The results suggest that visual cues are not important, and that chemical cues are important in allowing these crayfish to discriminate between different types of mud chimneys.

The sonoran mud turtle leaves the desert behind and hangs its hat on the jutting appendages of the Chiricahua mountains: Thesis plan in defence (O, D)

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Imagine climbing the hot, dry and dusty drainages of the Chiricahua mountains in southeastern Arizona, USA. The small pools of water collected in the "rock bowls" are hundreds of meters to kilometers apart. This habitat, strangely enough, is the home of a primarily aquatic species of turtle, the sonoran mud turtle (*Kinosternon sonoriense*). A mark-recapture study of *K. sonoriense* was initiated and continues to this day in Turkey and Rock creek drainages, resulting in the collection of data from over 1000 marked turtles. Information collected includes: body size, age and size at sexual maturity, population sex ratio, clutch size, egg size, clutch frequency, age-class distribution, individual exchange between populations and various relationships between these factors. The long-term nature of this study allows for the development of a dynamic life table which can be compared and applied to existing models regarding life histories of long-lived organisms. These models assume that older individuals should have traits that increase reproductive success as a result of either increased reproductive output or through increased survivorship, relative to younger individuals. Although *K. sonoriense* display significant longevity, preliminary data analysis suggests that the study population does not fit well into models of life histories for long-lived organisms. Furthermore, I plan to investigate apparent demographic differences and phenotypic variations between populations residing in streams of various orders. What questions should be asked and how do we answer them? How might the answers to these inquiries contribute to the successful management of long-lived organisms in the wild? I hope we'll talk soon.

Niche relations of four sympatric lizards on the Colorado Plateau (O, D)

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How do similar species coexist? Many studies have shown that sympatric species tend to separate in 3 niche dimensions: habitat, food and time. Resource use in these dimensions was examined for four sympatric Phrynosomatid lizards (*Sceloporus graciosus*, *S. undulatus*, *Urosaurus ornatus*, and *Uta stansburiana*) in 2 macrohabitats within the pinyon-juniper woodland of Colorado National Monument, U.S.A., during August 2000. For each lizard observed, body size and microhabitat features were recorded. All species were active at the same time and thus did not differ in the time dimension. Discriminant function analysis of microhabitat features extracted four significant roots which explained 98.2% of the variation observed among species and between habitats. Despite apparent microhabitat differences among species revealed through planned comparisons of canonical scores, the DFA classification matrix could only classify 45.3% of the cases correctly, indicating broad overlap in the microhabitat niches of these species. Species did not appear to vary their microhabitat niches between macrohabitats. Planned comparisons within MANOVA of body size revealed significant differences in body size, which is correlated with prey size, among species. The smallest of the two lizards, *U. stansburiana* and *U. ornatus*, did not differ in body size but did differ with respect to vertical microhabitat. My conclusions are similar to past studies that invoke niche complimentarity: sympatric species that are similar in the horizontal habitat dimension differ in a complimentary dimension such as food or vertical habitat. Such ecological differences may reduce the potential for competition and thus allow similar species to stably coexist.

Seasonal differences in lake trout gillnet catchability (O, D)

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The Ontario Ministry of Natural Resources currently uses a spring gillnetting protocol to assess the abundance of adult lake trout (*Salvelinus namaycush*) in Ontario lakes. A summer sampling period is desirable, as it would allow more time to survey lakes after thermal stratification. Netting catch-per-unit-effort (CUE) is related to the density of adult lake trout (D) by the catchability coefficient (q). Catchability refers to the proportion of the fish stock caught per unit of sampling effort ($CUE = q*D$). We hypothesize seasonal differences in the spatial distribution and movement of lake trout will affect the probability that a fish encounters the gear, and thus the catchability. We conducted depth-stratified gillnet sampling during the spring and summer on Lake Opeongo, Algonquin Park, Ontario to compare seasonal catch rates. The overall CUE was found to be greater in spring compared to summer by a factor of 2, indicating spring catchability is greater than summer catchability in Lake Opeongo. Here, we present a physical model to examine hypotheses for this observed difference in catchability.

Geographical distribution of *Canis* mitochondrial haplotypes across eastern North America (O, D)

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The distribution and divergence of mitochondrial haplotypes in present day populations can be used to determine the historical range and path of migration of a population. The aim of my study was to determine the range of the Eastern Wolf (*Canis lycaon*) and the Coyote (*C. latrans*) in the late 19th Century. A total of 285 samples, which represented 18 populations and 39 distinct haplotypes, were plotted using a Geographical Information System across Eastern United States and the Great Lakes Basin. Kernel estimation was used to delineate the range of haplotypes of each species. Haplotypes which clustered closely with Red Wolf mitochondria in the phylogenetic tree were found in Algonquin Park as well as north, east and west of the park. Haplotypes which clustered with Coyote mitochondria were found from Texas to Ohio and through southern Ontario into the Adirondack region. The present day phylogeographic pattern of Eastern Wolf and Coyote mitochondrial haplotypes support a range expansion model of Coyotes through Southern Ontario and a northward shift of the range of the Eastern Wolf.

A comparison of two methods to sample snake communities in early successional habitats (O, S)

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Landscape changes can affect species richness, population density, and body condition of animals. We predicted that snakes in southeastern New Hampshire would be responsive to recent land-use changes. To compare community parameters, including species richness, relative abundance, and size distributions of snakes in different habitat patches, we required a means of sampling them. We considered various capture methods and compared the effectiveness of plastic cover sheets and drift fence-trap configurations to sample local snake populations. More species were initially captured with drift fence-trap configurations, but this was likely a result of

more intense effort. Size distributions of snakes differed by method of capture, with cover sheets yielding proportionately more small-bodied individuals. Cover sheets were less expensive to construct, maintain, and remove than were drift fence-trap configurations. Additionally, fewer mortalities of snakes and non-target vertebrates were associated with cover sheets. Microclimates under sheets likely attracted potential prey and snakes to cover sheets. Although cover sheets were effective in sampling snakes in early successional sites, multiple techniques may be needed in more heterogeneous habitats.

Regulation and adaptive significance of within-inflorescence variation in allocation to reproduction in *Aquilegia canadensis* (Ranunculaceae) (O, S)

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Understanding how organisms strategically allocate resources among competing functions is a central goal of evolutionary ecology. In sequentially flowering hermaphrodites allocation to reproduction (flowers, pollen, ovules, seed) commonly declines across the flower sequence within an inflorescence. Although proximate causes such as resource and pollen limitation have been examined, the selective factors have rarely been explored. Using experimental manipulations, we investigated both proximate and ultimate causes of the within-inflorescence decline in allocation in natural populations of *Aquilegia canadensis*. Results suggest that the decline in seed production is partly due to architectural effects on gamete production and flower size. However, experimental manipulations also suggest that both inter-floral competition for resources and overall resource availability influence the decline in seed set. Experimental reduction of seed set by first flowers greatly increased seed set by subsequent flowers. Induction of resource limitation by defoliating plants caused a steeper decline in allocation. Hand-pollinations demonstrated that the decline is not due to temporal variation in pollination. The disproportionate allocation of resources to early flowers seems adaptive. The likelihood of herbivory increased with flower sequence. Mating parameters estimated using allozyme markers and progeny array analysis indicated that first flowers were more likely to produce outcrossed seed than later flowers. Because inbreeding depression is very strong in this species, progeny fitness would be much higher in early than later flowers. These results indicate that both herbivory and the mating system may act as selective factors favouring a decline in allocation with flower sequence.

Resource overlap among top predators and the hake fishery in Patagonia, Argentina (O, D)

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The objectives of this paper were to characterize trophically some top predators of the Patagonian marine community and evaluate the trophic overlap among them and with the hake fishery. The top predators considered were marine mammals (Southern sea lion and dusky dolphin) and elasmobranchs (beaked skate, spiny dogfish and school shark). The diet of these predators was studied by stomach content analysis. The main prey species were the hake and the shortfin squid, two of the most abundant and common species in this community. Because intraspecific diet differences were found, trophospecies were defined based on them. Also, a relationship between trophic diversity and habitat utilisation was found. Higher trophic diversities corresponded to coastal and benthic habitats and lower diversities corresponded to pelagic and offshore habitats. This trend agrees with observed diversities of the communities themselves. Our results indicate that these marine mammals and elasmobranchs are generalist predators. Regarding the overlap with the fishery, the analysis indicated that the overlap of the fishery with the top predators was intermediate, while the overlap of the top predators with the fishery was low.

This suggests that top predators have a wider trophic breadth than the fishery. Also, the study of the sizes consumed indicated that the fishery tends to catch the main prey species in larger sizes than top predators. Based on these results, the probability of competition between the top predators and the fishery appears to be low. However, this analysis considers only the direct effects. A more comprehensive analysis needs to consider the indirect effects that occur through the food web.

Rank abundance distributions for old field vegetation (O, D)

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One immediately apparent feature of old field plant communities is that species vary widely in relative abundance. This information can be expressed quantitatively as a rank abundance distribution ("RAD"), a plot of the log-abundance of each species in a community versus its respective abundance rank. Often, the data from a community's RAD is summarized using a measure of species evenness (e.g., Simpson's index), however, this results in a loss of information - the particular shape of the RAD is lost. Is there a consistent shape which best describes the shape of RADs for natural vegetation? Does the shape change across a successional gradient? Do the RAD shapes vindicate or refute the various niche apportionment models that have been proposed to explain them (e.g., "broken-stick", "dominance preemption" and others)? We attempt to answer these questions by applying Monte Carlo procedures to RAD data collected from an old field at the Queen's University Biological Station. Results and ecological interpretation are discussed.

Ontogeny of Diving Behaviour in Weddell Seals (O, D)

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Previous studies on the development of diving behaviour in Weddell seals (*Leptonychotes weddellii*) have focused separately on pups, yearlings, and adults. We reanalyzed time-depth recorder data using identical methods to facilitate across-group comparisons. Data were analyzed using a shape-fitting algorithm, which compares each dive to four simple geometric shapes (square, V, skewed-left, skewed-right) and assigns each dive a probability of belonging to each shape. The proportion of dives within each shape category was determined and compared across age classes (non-foraging pups, foraging pups, yearlings, and summer and winter adult females). For each age class, square- and V-dives combined to form >70% of all dives. For pups and yearlings, the proportion of square-dives decreased with age, while the proportion of V-dives increased, possibly representing a transition to independent foraging. Young seals appeared to be pushing their physiological limits during this time because >60% of V-dives exceeded their aerobic dive limit (ADL). In contrast to pups and yearlings, adults performed more square-dives, that likely represent optimal foraging, due to their greater diving capacity and submergence ability (only 10% of square-dives > ADL). The proportion of square-dives was greater for winter adults because gestating females intensely forage over winter to rapidly increase fat reserves for the upcoming pupping season whereas summer adults only forage opportunistically between periods of nursing. These findings support prior studies that have indicated Weddell seals of all ages perform similar types of dives but that their proportions and functions vary with age and life-stage.
