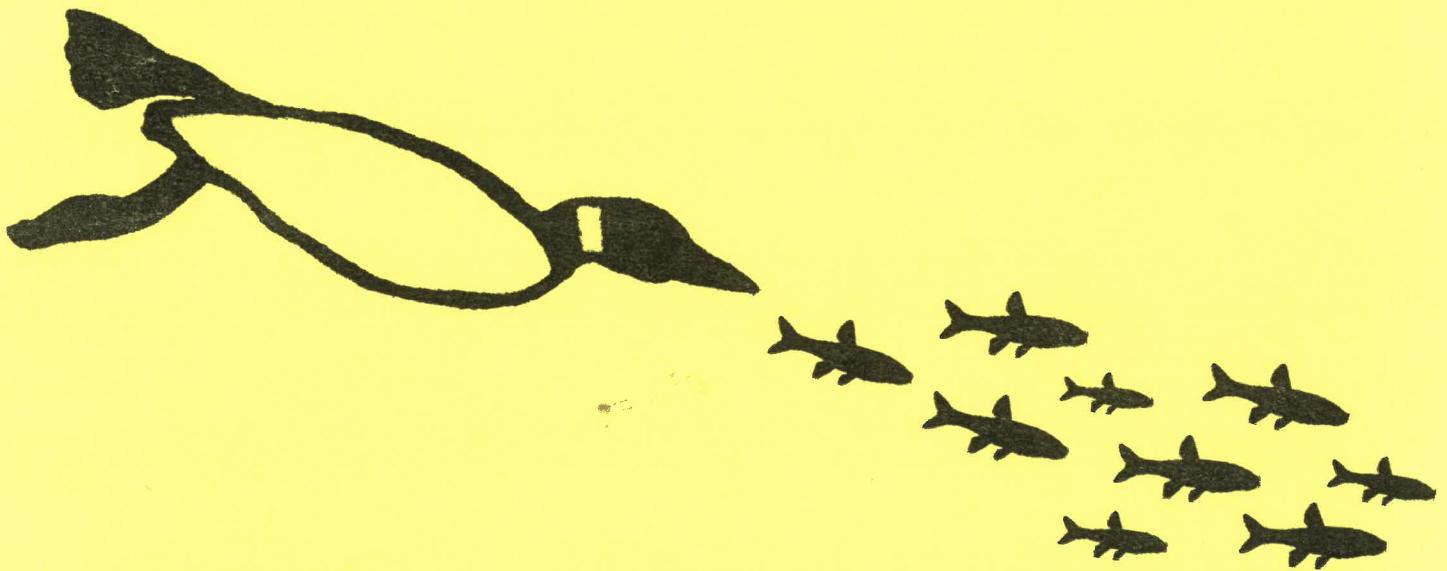

Ontario Ecology and Ethology Colloquium

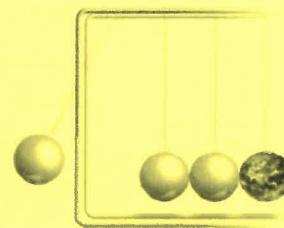


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OEEC 2009 - Schedule at a Glance

Sunday, April 26th

18h00 – 21h00: Registration and Opening Mixer at the Grad Club

Monday, April 27th

8h00 – 9h00: Registration (Coffee, tea, snacks provided)

9h00 – 10h00: Opening Remarks and Morning Plenary

10h00 – 10h15: Morning Break (Coffee and tea provided)

10h15 – 11h45: First Concurrent Session

11h45 – 12h45: Lunch Break (Lunch provided)

12h45 – 13h45: Afternoon Plenary

13h45 – 15h15: Second Concurrent Session

15h15 – 15h30: Afternoon Break (Coffee and tea provided)

15h30 – 17h00: Third Concurrent Session

17h00 – 19h00: Dinner Break

19h00 – 20h30: Poster Session and Mixer (Snacks provided, Cash bar)

20h30 – 24h00: Social event at Grizzly Grill

Tuesday, April 28th

8h30 – 9h00: Morning Coffee/Snacks

9h00 – 10h00: Morning Plenary

10h00 – 10h15: Morning Break

10h15 – 11h45: Fourth Concurrent Session

11h45 – 12h30: Lunch Break (Lunch provided)

12h30 – 13h30: Fifth Concurrent Session



OEEC 2009 - Expanded Schedule

SUNDAY, APRIL 26 2009

18h00 – 21h00	Registration and Opening Mixer The Grad Club (corner of Union and Barrie)
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MONDAY, APRIL 27 2009

8h00	Registration (Coffee, tea and snacks provided) Biosciences Atrium	
9h00	Opening Remarks and Morning Plenary Biosciences 1102 Dr. Christina M. Caruso (University of Guelph, Department of Integrative Biology) On the importance of evolutionary ecology: what we can learn from studying the agents of natural selection	
10h00	Morning Break (Coffee and tea provided) Biosciences Atrium	
1 st Concurrent Session	Sexual Selection – Biosciences 1102	Climate Change – Biosciences 1103
10h15	The effects of mating experience on competition in male black widow spiders (Stemberger, T.L.M. et al)	Has the Clean Air Act resulted in biological recovery from acidification?: A paleolimnological study of Big Moose Lake (NY, USA) using chrysophytes, diatoms, and cladocera (Arseneau, K.M.A. et al)
10h30	Courtship duration threshold of choosy females allow males to parasitize rival mating effort (Stoltz, J.A. , Andrade, M.C.B.)	Major shifts in diatom community structure suggest the influence of recent climate change on lakes in the boreal region of Canada (Wiltse, B.J. , Cumming, B.F.)
10h45	Quantitative genetic basis of female mate preferences across two environments (Delcourt, M. et al)	Evaluation of a community-based approach to environmental conservation and climate change mitigation (Dittmer, L.D. et al)
11h00	Robin's egg blue: testing whether egg colour is a sexual signal in <i>Turdus migratorius</i> (English, P.A. , Montgomerie, R.)	Interactive effects of warming and atmospheric nitrogen deposition on plant productivity and species composition in a temperate old field (Hutchison, J.S. , Henry, H.A.L.)

		Consequences of Environmental Contamination
11h15	Female choice in a fish with alternative male mating tactics (Berlin, N. et al)	Accumulation of contaminants in American eel, <i>Anguilla rostrata</i> , may be contributing to their recruitment decline (Kennedy, S. et al)
11h30	Alternative reproductive tactics in female kokanee salmon (<i>Oncorhynchus nerka</i>) in Meadow Creek, British Columbia (Warren, M.A., Morbey, Y.E.)	Elevated sediment metal concentrations in a UNESCO World Heritage Site: A paleolimnological perspective (LeBlond, S. et al)
11h45	Lunch Break (Lunch provided) Biosciences Atrium	
12h45	Afternoon Plenary Biosciences 1102 Dr. Lauren J. Chapman (McGill University, Department of Biology) Biodiversity lost and found: Faunal refugia and phenotypic change in the Lake Victoria Basin	
2nd Concurrent Session	Population Biology – Biosciences 1102	Consequences of Environmental Contamination – Biosciences 1103
13h45	Do humans differ from other animals in levels of morphological variation? (McKellar, A., Hendry, A.P.)	Potential consequences of altered behaviour and mortality of round gobies (<i>Apollonia melanostoma</i>) living in contaminated areas (Marentette, J.R. et al)
14h00	Experimental evidence for stronger selection on males, and its impact on the fitness of sexual lineages (Mallet, M.A. et al)	Impact of contaminants on competitive ability in a Great Lakes invasive fish (<i>Apollonia melanostoma</i>) (Sopinka, N.M., et al)
		Phylogeography
14h15	Looking for love: cost of reproduction in American black bears (<i>Ursus americanus</i>) (Castle, J.H., Obbard, M.E.)	Conservation genetics for a species in decline, the Cerulean Warbler (Deane, P.E. et al)
14h30	Are there ecological costs of secondary sex colouration in the ambush bug <i>Phymata americana</i> ? (Punzalan, D.)	Comparative phylogeography of brown (<i>Sula leucogaster</i>) and red-footed (<i>S. sula</i>) boobies: Does foraging range predict gene flow in pelagic seabirds? (Morris-Pocock, J.A. et al)
14h45	Assessing risks of Aleutian disease transmission from mink farms to wild American mink (<i>Neovison vison</i>) populations (Nituch, L.A. et al)	Asymmetric hybridization between closely related seabirds in the North Pacific (Taylor, S.A. et al)

15h00	Local adaptation or adaptive plasticity? Understanding differences in nest morphologies of the Yellow Warbler (<i>Dendroica petechia</i>) (Rohwer, V.G., Martin, P.R.)	Reconstructing phylogeographic relationships using chloroplast markers: The potentially confounding influence of hypervariable sequences (Vachon, N., Freeland, J.)
15h15	Afternoon Break (Coffee and tea provided) Biosciences Atrium	
3rd Concurrent Session	Animal Behaviour – Biosciences 1102	Plant Reproduction – Biosciences 1103
15h30	Effects of roads on landscape use by American black bears (<i>Ursus americanus</i>) in Algonquin Provincial Park, Ontario, Canada (Maxie, A.J., Obbard, M.E.)	Spatial structuring of genetic vs. morphological variation in <i>Aquilegia canadensis</i> (Sagar, S.P., Eckert, C.G.)
15h45	Is increased nutrition or decreased predation the reason for herbivore attraction to burned areas in Serengeti National Park, Tanzania? (Eby, S.)	Males taking advantage: Insights into the evolution of males in <i>Sagittaria latifolia</i> (Perry, L.E., Dorken, M.E.)
16h00	Thermal properties of tree cavities in winter and implications for flying squirrels (Coombs, A., Bowman, J.)	An abrupt shift from outcrossing to selfing in a Pacific coastal duna plant (Gieysztor, C., Eckert, C.G.)
16h15	Nest site selection and microclimate variation in two species of dwarf carpenter bee (<i>Ceratina dupla</i> and <i>C. calcarata</i>) (Vickruck, J., Richards, M.H.)	A cost-benefit analysis of mixed mating in <i>Aquilegia canadensis</i> (Wong, A.)
16h30	Rover/sitter variation in the foraging gene also influences oviposition preferences in female <i>Drosophila melanogaster</i> (McConnell, M. et al)	Pollen siring success and the evolution of polyploidy in <i>Chamerion angustifolium</i> : Insights from synthetic polyploids (Baldwin, S.J. et al)
16h45	Comparison of foraging effort between social and solitary <i>Xylocopa virginica</i> (Course, C., Richards, M.)	Evolutionary analysis of geographic variation in the mating system of <i>Camissoniopsis cheiranthifolia</i> (Dart, S., Eckert, C.G.)
17h00	Dinner Break	
19h00	Poster Session and Mixer (Snacks provided, Cash Bar) Biosciences Atrium	
20h30 – 24h00	Social Event at Grizzly Grill	

TUESDAY, APRIL 28 2009

8h30	Morning Coffee, Tea and Snacks Biosciences Atrium	
9h00	Morning Plenary Biosciences 1102 Dr. Paul R. Martin (Queen's University, Department of Biology) Latitudinal variation in patterns of evolution	
10h00	Morning Break Biosciences Atrium	
4 th Concurrent Session	Sexual Selection 2 – Biosciences 1102	Life History – Biosciences 1103
10h15	Female ornamentation and reproductive investment in the American Robin (<i>Turdus migratorius</i>) (Parker, L.D.)	Testing the impacts of multiple limiting factors (C+P) on growth and survivorship in <i>Daphnia pulicaria</i> : An empirical and theoretical approach (Ollek, S., Nelson, W.A.)
10h30	Male seismic signaling and female mate choice in a jumping spider (<i>Phidippus clarus</i>) (Sivalinghem, S. et al)	Leaf size/number tradeoffs and branching plasticity in herbaceous angiosperms (Scott, S.L., Aarssen, L.W.)
10h45	Behavioural and genetic assessment of mate choice in Brook Trout (<i>Salvelinus fontinalis</i>) (Robinson, T. et al)	Exploring the intersexual relationship for longevity in <i>Drosophila</i> (Kimber, C.M. et al)
		Community Ecology
11h00	Darker, longer, better? (Calhim, S. et al)	The effect of manufactured soil depth variability on the establishment of alvar vegetation communities in abandoned southern Ontario quarries (Stabler, C.D.)
11h15	The relative influences of weaponry and motivation on aggressive contests between male field crickets (Judge, K.A. et al)	Changes in large lake food web structures over several decades, as revealed by museum ichthyology collections (Poulopoulos, J., Campbell, L.M.)
11h30	The perils of sex: Do mobile females assume more predation risks than signalling males? (Ercit, K.L.)	Freeze-thaw resistance of soil microbial communities: Mechanisms of survival (Wilson, S. L., Walker, V.K.)
11h45	Lunch Break (Lunch provided) Biosciences Atrium	

5th Concurrent Session	Nutrient Cycling – Biosciences 1102	Animal Behaviour 2 – Biosciences 1103
12h30	The effects of litter consumption by the snail <i>Cepaea nemoralis</i> on plant responses to warming and nitrogen deposition (Moise, E.R.D., Henry, H.A.L.)	Can Black-capped Chickadees (<i>Poecile atricapillus</i>) determine social rank of unfamiliar individuals through transitive inference? (Toth, C.A., Ratcliffe, L.M.)
12h45	Herbivory and detritivory by the land snail <i>Cepaea nemoralis</i> in a temperate old field (Mensink, P.J., Henry, H.A.L.)	Ornamental plumage and parental care in a migratory bird, the American redstart (Germain, R.R. et al)
13h00	Shrub expansion: Does deeper snow result in enhanced nitrogen uptake by shrubs? (Vankoughnett, M., Grogan, P.)	Common Loons (<i>Gavia immer</i>) vary their vocal behaviour with the time of day and weather conditions (La, V.T., Mennill, D.J.)
		Invasion Ecology
13h15	Biomass removal in a black spruce ecosystem: Temporal dynamics of carbon loss and nutrient fluxes of coarse woody debris (Wiebe, S.A. et al)	Identifying patterns of dispersal and spread used by invasive species: A case study using North American <i>Phragmites australis</i> (Paul, J. et al)



OEEC 2009 – Plenary Abstracts

On the Importance of Evolutionary Ecology: What We Can Learn from Studying the Agents of Natural Selection

Dr. Christina M. Caruso, Department of Integrative Biology, University of Guelph

Natural selection is the most ecological of evolutionary mechanisms, and the only one that leads to adaptation. However, evolutionary biologists often measure selection without determining its ecological causes. I describe three studies that demonstrate what we can learn by examining the ecological agents of natural selection on floral traits. First, I demonstrate that antagonistic seed predators can be more important agents of selection on floral traits than mutualistic pollinators. This suggests that some floral traits are adaptations to reduce predation rather than enhance pollination. Second, I demonstrate that different agents exert conflicting selection on floral traits, which could contribute to the maintenance of variation in these traits. Third, I demonstrate that even when plants interact with both mutualists and antagonists, selection on floral traits is not necessarily diffuse. Instead, some floral traits can still evolve in response to strong, pairwise interactions with mutualistic pollinators. Overall, this work suggests that we need to test our implicit and explicit assumptions about the agents of natural selection.

Biodiversity Lost and Found: Faunal Refugia and Phenotypic Change in the Lake Victoria Basin

Dr. Lauren J. Chapman, Department of Biology, McGill University

Freshwater systems have suffered some of the most intense human impacts over the past century. The result has been a massive reshaping of fish communities, with the pace of change quickening in the tropics. In Africa, fish catches have declined drastically; forests, crucial regulators of surface water hydrology, are being rapidly cleared; and pollution of surface and ground water has become a serious threat. In addition, species introductions have led to unprecedented changes in freshwater communities, the most notable example being the introduction of Nile perch into Lake Victoria, Africa's largest inland fishery. In this presentation, I will review key lessons learned from the Lake Victoria region that highlight both the vulnerability and lability of native and introduced species in the face of environmental change. First, I will discuss mechanisms that have fostered persistence of native species, in particular the use of structural and physiological refugia. Second, I will explore cascading effects of Nile perch on the trophic structure of invaded systems. Finally, I will consider the consequences of faunal collapse and recovery on resurging species, highlighting evidence of phenotypic change in response to both Nile perch predation and refugial selection pressures.

Latitudinal Variation in Patterns of Evolution

Dr. Paul R. Martin, Department of Biology, Queen's University

In the 200 years since Darwin's birth, we have identified remarkable latitudinal differences in patterns of evolution. Below the species level, tropical populations are characterized by greater isolation through time, allowing independent evolutionary trajectories of populations and opportunity for divergent phenotypic evolution. The point at which reproductive isolation evolves in tropical populations has been difficult to determine, because many tropical populations remain allopatric for long periods of time. At higher latitudes, many populations are dynamic, shifting and mixing with Milankovitch Oscillations (e.g., glacial cycles). This shifting and mixing of populations may reduce population divergence and reproductive isolation, and occasionally promote rapid divergent evolution through reinforcement and character displacement. We continue to debate the evolutionary causes of high tropical diversity, in particular whether the tropics acts as a "cradle" for new species, a "museum" for old species, or both. Future advances towards understanding broad latitudinal patterns of evolution are limited by our poor understanding of both tropical biodiversity and the evolutionary dynamics of tropical populations.



OEEC 2009 - Oral Presentation Abstracts

(Listed alphabetically by presenter's last name)

Arseneau, Kristina M.A., Brager, L.M., Ross, K.A., Cumming, B.F.

Queen's University

Has the Clean Air Act resulted in biological recovery from acidification?: A paleolimnological study of Big Moose Lake (NY, USA) using chrysophytes, diatoms, and cladocera

The Adirondack region of New York (USA) has been significantly impacted by acid deposition. Since the implementation of the Clean Air Act Amendments, the area has begun to demonstrate improvements in water chemistry. However, little work has been done to assess biological recovery in the region. The goal of this investigation was to use paleolimnological techniques to assess whether or not biological recovery has followed chemical recovery in Big Moose Lake. Water chemistry measurements taken approximately once a month since 1982 show that the lake's current pH is approaching its pre-industrial diatom-inferred pH of 5.8. However, the lake's calcium concentration is declining and this may negatively impact calcium-sensitive taxa such as the cladoceran *Daphnia*. A 34-cm sediment core was retrieved from Big Moose Lake in 2007. Changes in chrysophyte, diatom, and cladoceran relative abundance from ca. 1760 to present were analyzed. This study demonstrated a shift from circumneutral to acid-tolerant diatoms and chrysophytes with the onset of acidification (ca. 1950). In contrast, cladoceran assemblages were resistant to change until ca. 1975. Recent (ca. 1995-present) changes in the chrysophyte assemblages demonstrate a decline in acid-tolerant taxa, providing evidence of biological recovery. However, a post-1995 increase in *Synura echinulata* suggests that chrysophytes are not returning to their pre-industrial state. Diatom assemblages showed a recent decline in acid-tolerant taxa but cladocerans remain unresponsive to pH recovery. This study demonstrates that biological recovery is underway in the Adirondacks but that recovered assemblages may not return to their pre-industrial state due to other environmental factors.

Baldwin, Sarah J., Kron, P., Husband, B.C.

University of Guelph

Pollen siring success and the evolution of polyploidy in *Chamerion angustifolium*: Insights from synthetic polyploids

Evolutionary biologists have a longstanding interest in the mechanisms that allow polyploids to arise and persistence in sympatry with their diploid progenitors. The herbaceous perennial plant, *Chamerion angustifolium*, consists of diploid and tetraploid individuals with overlapping distributions in the Rocky Mountains. Research suggests that polyploids may evolve because they have a pollen siring advantage over diploids in mixed pollinations. However, it is not known whether the siring advantage is associated with chromosome doubling or evolutionary change occurring after the polyploid event. The purpose of this study was to test if the siring success of naturally occurring tetraploids is also present in tetraploids recently synthesized from diploids. Colchicine was used to induce neotetraploid plants from diploid *Chamerion angustifolium* seedlings. Diploid, tetraploid and neotetraploid plants were crossed with pollen from diploids, tetraploids, neotetraploids as well as 1:1 pollen mixtures. Pollen size and number, seed set, and offspring ploidy were estimated for each cross. Pollen number/anther did not differ among neotetraploids, tetraploids and diploids. Pollen diameter was significantly larger in neotetraploid and tetraploid plants than in diploids. The ploidy of the resulting offspring varied depending on the ploidy of the maternal and paternal parents and the pollen mixture applied. Additionally, several seeds of unexpected ploidy were observed, which may suggest that a low frequency of unreduced gametes are being produced. Pollen from neotetraploid and tetraploid plants have different siring rates when applied in combination with pollen from diploids. Collectively, these results suggest that the siring advantage in tetraploids developed after the original genome duplication event.

Berlin, Noam, Balshine, S., Fitzpatrick, J., Mileva, V.

McMaster University

Female choice in a fish with alternative male mating tactics

Female choice is an important factor of mating systems, however insufficient attention has been devoted to the study of female choice in mating systems where Male Alternative Reproductive Tactics are displayed. *Porichthys notatus*, the plainfin midshipman, is an ideal model species for such systems since their nests remain above water during low tide and are thus easily surveyed. Midshipman nests were sampled on three different beaches and female preference was quantified as eggs laid per nest. Measurements for male size, nest neighbourhood densities, and distances from nests to water were all compared to reproductive success. Analysis showed that females chose larger males, but were uninfluenced by both neighborhood densities and distances from nests to water. Furthermore positive correlations were found between number of eggs present and male persistence in a nest. These results and explorations provide the groundwork for studying effects of female choice in alternative male reproductive tactic mating systems.

Calhim, Sara, Lampe, H.M., Slagsvold, T., Birkhead, T.R.

Queen's University

Darker, longer, better?

Theories regarding the role of sexual selection on the evolution of sperm traits are based on an association between pre-copulatory (e.g. female preference) and post-copulatory (e.g. ejaculate quality) male reproductive traits. In tests of these hypotheses, sperm morphology has rarely been used, despite its high heritability and intra-individual consistency. We found evidence of selection for longer sperm through positive phenotypic associations between sperm size and the two major female preference traits in the pied flycatcher, *Ficedula hypoleuca*. Our results support the sexually selected sperm hypothesis in a species under low sperm competition and demonstrate that natural and pre-copulatory sexual selection forces should not be overlooked in studies of intraspecific sperm morphology evolution.

Castle, James H., Obbard, M.E.

Trent University

Looking for love: cost of reproduction in American black bears (*Ursus americanus*)

The cost of sexual reproduction in mammals is an expensive process for females but may also be a significant investment for polygynous males. There has been longstanding debate concerning whether the asynchronous oestrus exhibited by female black bears (*Ursus americanus*) has led to a “roaming male tactic” employed by males in an attempt to consecutively breed all females residing within their home range. The aim of this study was to examine mate-searching as a cost of reproduction in American black bears. This is of particular importance for polygynous males, whose reproductive investment is often undervalued by evolutionary biologists as the comparatively small energetic contribution of sperm production. We captured male and female black bears in Algonquin Provincial Park and the City of Greater Sudbury, Ontario, Canada and fitted them with GPS radio-collars programmed to provide locations at 30-min intervals. These frequent locations allowed for a fine-scale analysis of seasonal movement rates and corresponding energetic costs. Preliminary results of movement rates of both sexes appear to contradict many prior studies on seasonal behaviour of black bears. In addition, initial results indicate that mate-searching, exercised by males, may contribute the highest known cost of their reproductive investments.

Coombs, Andrea, Bowman, J.

Trent University

Thermal properties of tree cavities in winter and implications for flying squirrels

Flying squirrels are common inhabitants of forests in Canada, and southern flying squirrels are moving farther north in Ontario with climate change. At their range boundary, northern and southern flying squirrels share the same habitat and therefore may experience competition as southern flying squirrels expand their range into areas that they have not previously inhabited. A potential source of competition between the two species is the selection of tree cavities for winter nests, when thermal properties of the cavities are likely especially important. Southern flying squirrels have been shown to be more aggressive than northern flying squirrels in obtaining nests, and this has led to the prevailing view that southern flying squirrels will outcompete northern flying squirrels for nest sites. We estimated the thermal properties of tree cavities with a range of characteristics to test the prediction that southern flying squirrels would use warmer cavities than northern flying squirrels at sites where the species were sympatric. We found that neither species selected cavities for their thermal properties, and concluded that both likely depend on social thermoregulation during the winter. This research furthers our understanding of flying squirrel ecology, and provides a greater understanding of tree cavities for bird, mammal, and forest researchers.

Course, Chris, Richards, M.

Brock University

Comparison of foraging effort between social and solitary *Xylocopa virginica*

For sociality to evolve, an individual's fitness must be higher living in a group, as opposed to living solitarily. Cooperation between animals gives access to new and/or more resources than living by themselves. Female Eastern Carpenter bees (*Xylocopa virginica*) forage for pollen, which is used to raise their offspring. The bees nest in wood and live by themselves or in nests containing several females. In a social nest, there can be one or multiple foragers. We investigated the hypothesis that multiple foragers living in a social nest foraged for longer durations and more times per day per nest, opposed to single foragers who live solitarily or in a group. We caught and marked 90 females and recorded daily provisioning time, flight time, handling time and the number of pollen trips, both per individual and per nest. We found that multiple foragers spent less flight time per bee than single foragers living by themselves or in a group. Multiple foragers also make fewer trips per nest per day than single foragers.

Multiple foragers also spend as much flight time as single foragers per nest, which indicates the same amount of resources are being collected in both solitary and social nests. Flight time was highest in single foragers in social nests, which indicates a possible fitness advantage of living in a small group.

Dart, Sara, Eckert, C.G.

Queen's University

Evolutionary analysis of geographic variation in the mating system of *Camissoniopsis cheiranthifolia*

The shift from predominant outcrossing to predominant selfing is one of the most common transitions in the evolution of flowering plants, and theoretical work has identified the likely selective forces and ecological conditions underlying this transition. Plant species that exhibit wide mating system variation among populations provide an excellent opportunity to test theoretical predictions. *Camissoniopsis cheiranthifolia* (Onagraceae), a coastal dune endemic distributed from northern Baja, Mexico to southern Oregon, U.S.A. includes plants that produce large, self-incompatible flowers, plants that produce self-compatible, obligately selfing cleistogamous flowers, and everything in between. We combined geographic surveys of floral traits, manipulative experiments and marker-gene analysis to test the hypothesis that higher levels of selfing have evolved in response to deteriorating outcross pollination in more northerly populations. The proportion of outcrossed seeds, estimated using allozyme polymorphism, varies from 0 to 1 and correlates strongly with floral morphology, but many populations, both large- and small-flowered exhibit mixed mating. Fruit set is lower and more variable in large- than small-flowered populations, but using supplemental hand pollinations, we found little evidence for pollen limitation in any population. Reproductive assurance is unlikely to explain the marked diversification of the mating system in this species.

Deane, Petra E., McCoy, K.D., Robertson, R.J., Birt, T.P., Friesen, V.L.

Queen's University

Conservation genetics for a species in decline, the Cerulean Warbler

The cerulean warbler (*Dendroica cerulea*) is declining throughout its range more rapidly than any other warbler in North America. Previous genetic work suggested that this migratory songbird has minimal population genetic structure, and for conservation purposes all sampled populations were assigned to a single genetic management unit. We expand this work to include populations from the entire breeding range of the cerulean warbler, in light of recent findings that suggest ecological differentiation between northern and southern populations. We investigate patterns of genetic diversity among cerulean warblers from Eastern Ontario, South-western Ontario, Illinois, Indiana, Pennsylvania, West Virginia, Tennessee and Arkansas by generating estimates of global and pairwise Φ_{ST} from the control region, and we use the “isolation with migration” coalescent method (IM) to reconstruct historical gene flow among populations.

Delcourt, Matthieu, Blows, M.W., Rundle, H.D.

University of Ottawa

Quantitative genetic basis of female mate preferences across two environments

An individual female's mate preference is a potentially complex function describing the relationship between variation in multiple male phenotypes and her probability of acceptance as a mate. Estimating the quantitative genetic basis preference functions within a population presents significant empirical challenges yet is key to understanding preference evolution, including any good-genes contribution. We employ a recently described approach that uses random-coefficient mixed models in the analysis of function-valued traits. Using a half-sib breeding design in *Drosophila serrata*, we estimate the genetic (co)variance function of female preference for male sexual displays composed of nine contact pheromones. The breeding design was performed across two environments: the food to which the population was well adapted and a novel food that reduced average female fitness by 35%. Significant

genetic variance in female preference for male pheromones was detected and the majority (64.2%) was attributable to a single genetic dimension (eigenfunction), suggesting that preferences for different pheromones are not genetically-independent. The second eigenfunction, accounting for 24% of the total genetic variance, approached significance in a conservative test, suggesting the existence of a second, independent genetic dimension underlying preferences. In contrast to results for fitness and male pheromones, there was no evidence that the genetic basis of female preference differed between the two environments, suggesting the absence of genotype-by-environment interactions and inconsistent with preferences being condition-dependent. A weak association (34.6%) was present between genetic variation in female preference and male pheromones, suggesting that the former may contribute to the maintenance of some variation in male display.

Dittmer, Livia D., Wicks, S.M., Riemer, M.

Wilfrid Laurier University

Evaluation of a community-based approach to environmental conservation and climate change mitigation

Reducing the threat of global climate change to the fragile ecological system requires significant efforts to conserve energy and the world's limited resources. The mission of the environmental organization Reduce the Juice (RTJ) is to empower youth to be agents of social change for the environment in their schools and communities. RTJ carries out their mission by fostering youth leaders and innovators who use their knowledge and skills to encourage a culture of conservation among their peers, families, and communities. For this purpose students are hired for summer employment as student auditors and trained in climate change mitigation strategies. Following this training, student auditors act as community educators engaging residents on their door steps and at community events in order to change social norms and encourage pro-environmental lifestyles. Through this experience it is hoped that youth develop environmental awareness, gain important skills, and feel empowered to be leaders in their communities for environmental causes. In the fall of 2008 we carried out an evaluation to assess the impact of the RTJ summer campaign in the Waterloo region on both the youth and the residents. For this purpose we conducted 7 qualitative interviews with student auditors and an online survey with 130 residents. The results of this mixed-method evaluation suggest that RTJ has developed a successful strategy for creating community-based environmental change. In this presentation we will describe the RTJ model, outline the methods and procedures of the study, summarize the results and discuss implications for research and policy.

Eby, Stephanie

Syracuse University

Is increased nutrition or decreased predation the reason for herbivore attraction to burned areas in Serengeti National Park, Tanzania?

Fire is an integral component of tropical grassland ecosystems and influences both the flora and fauna of these ecosystems. Previous studies have found that herbivores are attracted to burned areas, presumably because plant nutrient content is higher following fire. However, herbivores may also preferentially use burned areas to avoid predators because of increased sight distance. The relative benefits of plant nutrition and safety from predators maybe stronger for smaller herbivores that require more nutrient-rich diets and are more vulnerable to predation. This study was conducted in Serengeti National Park, Tanzania.

Herbivores were counted bi-weekly for a year on 14 paired burned and unburned sites. Vegetation height and forage nitrogen content was collected bi-monthly and a database of lion, *Panthera leo*, locations was obtained to assess predator distribution relative to fire. We found that overall, herbivores prefer burned areas. Lions were sighted more often than would be expected by chance in unburned areas. Smaller herbivores, such as Thomson's gazelles, *Gazella thomsoni*, preferred burned areas. Thomson's preference for burned areas was evident during the dry season, but disappeared during the wet season. Vegetation height, and presumably predation risk, was significantly lower in burned areas during the dry season, but

not during the wet season. In contrast, larger herbivores, which are less vulnerable to predators showed no preference for burned areas. Our data thus support burned area use by smaller herbivores to avoid predators.

English, Philina A., Montgomerie, R.

Queen's University

Robin's egg blue: testing whether egg colour is a sexual signal in *Turdus migratorius*

A recent hypothesis for explaining blue-green eggs in birds suggests that they may be a sexually selected signal of female (and nestling) quality that males use to make parental investment decisions. Although this hypothesis has found mixed correlational support in a variety of species, well-controlled experimental support has been lacking in non-cavity-nesting species with vivid blue eggs. In this study, we isolate the influence of egg colour on male behaviour by replacing natural American Robin (*Turdus migratorius*) clutches with four artificial eggs (all of the same colour) representing extremes in natural colour intensity. After incubation, three unrelated nestlings were fostered into each experimental nest immediately after hatching and parental behaviour was monitored when nestlings were 3, 6, and 9 days old. For the youngest nestlings, male provisioning rate significantly increased in the dark egg treatment; however, the effect of egg colour disappeared at the oldest nestling stage. This result remains significant when controlling for slight variation in nestling age as well as female behaviour. These results suggest that blue-green egg colour acts as post-mating sexual signal in at least some cup-nesting species, but it in no way excludes the possibility that the blue-green pigment also serves other adaptive purposes.

Ercit, Kyla L.

University of Toronto

The perils of sex: Do mobile females assume more predation risk than signalling males?

It is widely accepted that in mating systems involving long-distance signalling, the signalling sex, usually the male, accepts the most predation risk. However, a contrary viewpoint has emerged stating that if the signaller is stationary, the mobile sex accepts as much, if not more, predation risk. I suspect that this phenomenon occurs in some tree crickets that are hunted by solitary wasps. Recent research has shown that in the nests of several species of cavity-nesting wasps, there is a bias toward provisioning more female than male prey. To understand why this may occur, I have placed several trap-nests in rural areas around Toronto to entice wasps to provision them. The trap-nests have been designed to target *Isodontia mexicana*, a solitary Sphecid wasp that provisions its nests almost exclusively with the tree cricket *Oecanthus nigricornis*. As the summer progresses, I will monitor and remove the contents of *I. mexicana*'s nests. I will also be taking samples of *O. nigricornis* from the surrounding population of crickets that have avoided predation. I predict that the sex ratio of provisioned tree crickets will change to be less representative of the surrounding population and more female-biased as the season progresses. I expect that this change will correspond to the time when females are becoming sexually receptive and mobile, while the singing male will remain stationary. The results of my research may challenge the common belief that the displaying or courting sex assumes most of the predation risk.

Germain, Ryan R., Reudink, M.W., Marra, P.P., Ratcliffe, L.M.

Queen's University

Ornamental plumage and parental care in a migratory bird, the American redstart

Ornamental plumage in birds is widely considered to play an important role in signalling male quality. Females choosing a potential mate may use variation in plumage colour to assess both the direct (resource) and indirect (genetic) benefits that a male will provide her offspring. We examined whether male plumage colouration signals parental quality in the American redstart (*Setophaga ruticilla*), a highly ornamented, migratory warbler. We measured the relationship between both adult male arrival date and phenotype (morphology, and melanin and carotenoid-based plumage) and parental care levels of both

parents. Parental care was quantified by videotaping adult attendance at the nest and carotenoid-based plumage was quantified using reflectance spectrometry. Males with brighter flank feathers made more visits to the nest, and spent more time at the nest, consistent with the “good-parent hypothesis”. Female parental care was predicted by the redness of her mate’s tail feathers, and was positively associated with her mate’s parental effort, indicating that offspring of brighter males receive a larger net benefit of care from both parents. These results suggest that carotenoid-based plumage traits of male American redstarts play an important role in intersexual signalling, and add to our understanding of the evolution of multiple ornaments.

Gieysztor, Catherine, Eckert, C.G.

Queen’s University

An abrupt shift from outcrossing to selfing in a Pacific coastal duna plant

The shift in mating systems from outcrossing to selfing has happened many times in the plant world. Twice as much gene transmission, as well as reproductive assurance favours the evolution of self-compatibility (SC). There are also negative selective pressures, such as inbreeding depression and trade-offs with out-crossers in the form of seed and pollen discounting. Intraspecific geographic variation in mating systems is very useful, facilitating comparisons and increasing the chances that selective forces might still be acting. *Abronia umbellata* offers us this great opportunity. I will describe patterns of geographical variation, and try to understand ecological and demographical correlates. Selfers could be selected in areas of low site occupancy, and low density, where reproductive assurance would play an important role because of the lack of available mates and/or pollinators. Indeed, we found the Southern outcrossers occupied a higher proportion of sites deemed suitable. We also looked at fruit set, expecting to see a higher reproductive output in SC populations. Our results however, as for densities, were insignificant. Another goal of this thesis was to analyze geographical patterns of floral morphology, in particular co-variation in floral traits, hoping to get more insight into the evolution of SC. Assuming selection happened in two phases, we expected allometric relationships. Indeed, we found that SC flowers were not isometrically smaller than SI ones. It is clear that mating system evolution affects many aspects of plant life history, and much research is still needed to understand what might trigger such a transition.

Hutchison, Jennifer S., Henry, H.A.L.

University of Western Ontario

Interactive effects of warming and atmospheric nitrogen deposition on plant productivity and species composition in a temperate old field

Both climate warming and atmospheric nitrogen deposition are predicted to alter plant productivity and species composition over the next century; however, the extent to which their effects may interact is unclear. For example, warming-induced changes to soil freezing dynamics over winter may promote ecosystem nitrogen losses, limiting increases in productivity in response to warming, yet these losses would be compensated for by increased nitrogen deposition. I measured plant productivity and species composition in response to warming (winter-only or year-round) and nitrogen addition in a temperate old field. I used shoot allometric relationships and spectral data to estimate aboveground productivity non-destructively, and sampled root biomass destructively, throughout two growing seasons. In 2007, which featured an exceptionally dry summer, there were no treatment effects on plant growth. However, in 2008, both warming and nitrogen addition increased aboveground productivity, and these effects were additive, resulting in an approximate doubling in aboveground plant biomass. Warming increased belowground biomass but no nitrogen effect was evident. Conversely, nitrogen addition increased plot greenness but greenness did not respond to warming. Overall, my results do not support the hypothesis that warming-induced changes to soil freezing dynamics over winter reduce plant productivity.

Judge, Kevin A., Ting, J.J., Schneider, J.Z., Fitzpatrick, M.J.

University of Toronto

The relative influences of weaponry and motivation on aggressive contests between male field crickets.

Male success in agonistic encounters over females is a function of both his resource holding potential (RHP) and his motivation to fight, which is influenced by the value that he places on the contested resource. Few studies have examined the relative importance of RHP and motivation to fight in determining fighting success. We did so using *Gryllus pennsylvanicus*, a field cricket in which male RHP is determined in part by weaponry (enlarged head and mouthparts) and male motivation to fight is affected by recent mating experience. We created pairs of size- and age-matched males that varied in relative weapon size, and then we randomly assigned one of each pair to receive experimental treatment. Our treatment had two levels, where a female was allowed to either: 1) mount and copulate with the experimental male (MC), or 2) only mount the experimental male (M). We predicted that MC and M males would differ in motivation to fight and thus in fighting success against their unmanipulated competitors. As in previous work, males with larger weaponry (i.e. higher RHP) were more likely to win fights than males with smaller weapons. However, M males were more likely to win fights than MC males, suggesting that mating decreased males' motivation to fight. The effect of RHP on fighting success was stronger than the effect of our motivation treatment, and there was no significant interaction between these two factors. We discuss these results with reference to both the costs of fighting and sperm competition.

Kennedy, Sharilyn, Hodson, P.V., Casselman, J., Brown, R.S., Byer, J., Lebeuf, M., Backus, S., Keir, M., Alaee, M.

Queen's University

Accumulation of contaminants in American eel, *Anguilla rostrata*, may be contributing to their recruitment decline

The American eel (*Anguilla rostrata*) population in Lake Ontario has suffered a serious decline since the early 1980s. This has resulted in the closure of the fishery in 2004 and its listing as a “species of concern” under the Canadian Species at Risk Act in 2008. Due to its complicated life cycle, little is known about eels once they leave their freshwater habitats and migrate to the Sargasso Sea to mate. However, it is certain that American eels are experiencing severe population declines. There are many theories to explain this decline all of which may act cumulatively to produce the staggering present-day loss. My objective is to determine if dioxin and dioxin-like contaminants are in high enough concentrations in sexually mature silver eels to be embryotoxic to their offspring. We have compared the toxicity of tissue extracts of large eels to that of 2,3,7,8-TCDD, using the early life stages of Japanese medaka as a surrogate test species. By injecting eel extracts into embryonic medaka we can assess developmental problems associated with the maternal transfer of toxicants to her offspring. The ED₅₀ of the extracts should vary with the degree of chemical contamination, as influenced by the location of capture (contaminated and reference sites, eastern North America, 2007-08), and the year of capture (Lake Ontario archive (1985-2005)). This study will help determine whether eel extracts are toxic to fish early life stages, and contaminants that are candidates for causing toxicity. The results will be important for management plans for restoring the American eel population and for effective remediation of contaminated sites.

Kimber, Christopher, Bouchard, J.M.S., Chippindale, A.K.

Queen's University

Exploring the intersexual relationship for longevity in *Drosophila*

Tradeoffs within a lifecycle have been recognized as central to the evolution of ageing since the antagonistic pleiotropy model was first proposed. Comparatively little attention has been paid to the

possibility that sexual conflict over optimal life history strategies results in tradeoffs between the sexes that are equally important to the evolution of ageing. We used hemiclone analysis to measure genetic variation for longevity and mortality rate, as well as the intersexual genetic correlation for each character, in a lab-adapted population of *Drosophila melanogaster*. Hemiclones (haploid genomes comprising a nearly complete set of genes) were sampled from an outbred population and maintained under either a control or mutation accumulation (MA) regime. The latter consisted of single male population bottlenecking to maximize drift and relax selection against mutations with effects at any age. In mortality rate experiments, control or MA genotypes were expressed in both females and males. MA had concordant effects on mean longevity between the sexes, rapidly accelerating mortality rates in both. While there was no significant intersexual genetic correlation for longevity in the control lines, the MA lines show a significant positive correlation. Analysis of the effects of new mutations on the intersexual relationships of components of the Gompertz family of mortality models, such as senescence rate, will be presented, as will data on age and sex-specific effects of MA on longevity patterns at the population level. These data highlight a powerful new approach to the genetics of life history evolution, mutation, and sex differences in gene function.

La, Van T., Mennill, D.J.

University of Windsor

Common Loons (*Gavia immer*) vary their vocal behaviour with the time of day and weather conditions

For animals to communicate effectively, a signal must be detected and recognized by a receiver in order to evoke a response. As signals transmit further through the environment, the risk of masking and degradation increases substantially. This is especially true in long-distance signals, such as the calls of Common Loons (*Gavia immer*) whose vocalizations travel several kilometres to reach their intended receivers. As a consequence, Common Loons may change their singing strategies and choose vocalize less during times when abiotic conditions impair long-distance communication. In this study, we explore the diel rhythms of Common Loon vocal behaviour and evaluate the effects of weather on animal signalling strategies. To understand the extent of weather variation on loon vocal behaviour, we used an innovative long distance Acoustic Monitoring System that allows us to passively monitor the natural vocal behaviour of multiple animals across great distances over extended time periods. Our Acoustic Monitoring System consisted of a linear array of simultaneously recording microphones that allowed us to record across a 10km transect at Queen's University Biological Station. Our results show pronounced diel variation in the four types of vocalizations produced by Common Loons. We demonstrate that Common Loon vocal behaviour varies between day and night and that Loons change their signalling strategies with changing weather patterns. This study provides a foundation for a larger study on Common Loon communication networks and is a test of Acoustic Monitoring System being used as a novel technique to passively monitor vocal behaviour of nocturnal animals.

LeBlond, Shannon, Hamilton, K., Rutter, A., Campbell, L.

Queen's University

Elevated sediment metal concentrations in a UNESCO world heritage Site: A paleolimnological perspective

The Rideau River Waterway is comprised of a series of lakes connecting the Ottawa River to the Cataraqui River in Kingston. In 2006, a preliminary study evaluated metal concentrations in sediment and water from nine of these lakes. The mean sediment concentrations exceeded Canadian federal guidelines (in brackets) for Cd (0.6 ppm), Hg (0.17 ppm), Pb (35 ppm) and Zn (123 ppm) within each of the studied lakes and Cu (35.7 ppm) exceeded within all but one lake. In addition, Pb was found to exceed probable effect limits (91.3 ppm) in four of the nine lakes. To evaluate the extent and distribution of metal contamination, the three lakes with the highest overall metal concentrations were further sampled in 2007

and 2008. This study employs paleolimnological techniques to examine historical metal trends and attempt to identify potential contributing factors.

Mallet, Martin A., Feagan, S., Chippindale, A.K.

Queen's University

Experimental evidence for stronger selection on males, and its impact on the fitness of sexual lineages

The persistence of sexual reproduction despite an inherent advantage to asexual reproduction remains a puzzle. Two classes of hypothesis have recently been proposed, each being potentially widely applicable to animal taxa. One theory suggests that increased selection on males causes smaller mutation loads in females, whereas the other proposes that population subdivision causes smaller mutation loads by purging mutations through inbreeding. Interestingly, the combined effect of these factors has not been treated theoretically, and few empirical studies quantify the cost of mutations for each sex. We therefore carried out two experiments aimed at quantifying the sex-specific cost of mutations, both for new mutations and for those naturally segregating in a population of *Drosophila melanogaster*. The first was a mutation-accumulation experiment, which measured the sex-specific cost of new mutations on both juvenile viability and adult productivity. In the second experiment, we created inbred lines from naturally segregating genotypes to measure the cost of segregating mutations for each sex in both life-history stages. For adult fitness we found a higher cost of mutation to males, both among new mutations and for segregating mutations expressed homozygously. For juveniles, where sex-role differences are not as pronounced, we found no evidence of a sex-specific cost of inbreeding, despite finding evidence for a higher cost of new mutations to male viability. These data provide the first experimental evidence that stronger selection on males may be critically related to the mutation load of populations and the persistence of sex in the face of the advantages to asexuality.

Marentette, Julie R., Gooderham, K.L., Hynes, H., McMaster, M.E., Parrott, J.L., Slater, G.F., Stosic, A., Wilson, J.Y., Balshine, S.

McMaster University

Potential consequences of altered behaviour and mortality of round gobies (*Apollonia melanostoma*) living in contaminated areas

Contamination of aquatic systems can affect the integrity of local ecosystems in many ways. A recent invasive fish, the round goby, is frequently exposed to aquatic contaminants in the Great Lakes because of its benthic nature, site fidelity and diet of zebra mussels. The incorporation of the goby into Great Lakes foodwebs means that contaminants previously restricted to zebra mussel biomass are increasingly available to higher order carnivores. We examined changes in behaviour and physiology of round gobies collected from highly contaminated and relatively clean areas of Hamilton Harbour, a Canadian IJC Area of Concern with a history of industrial and urban pollution. Contaminated areas had smaller, more female and more intersex fish than clean areas. Contaminated gobies showed decreased activity and aggression, greater fin loss, heavier PCB body burdens and elevated monooxygenase (e.g., EROD) activity compared to gobies from cleaner areas. Contaminated gobies were also less likely to hide after a simulated predation event. Predictions of natural goby metapopulation dynamics in polluted waters will be affected by decreases in organism health, longevity and movement among source and sink habitats. An impaired ability to evade predators in contaminated fish may also accelerate bioaccumulation of toxins in higher trophic levels, including humans.

Maxie, Andrea J., Obbard, M.E.

Trent University.

Effects of roads on landscape use by American black bears (*Ursus americanus*) in Algonquin Provincial Park, Ontario, Canada.

Across Ontario, road networks have been rapidly expanding to accommodate human development. This has become an important concern for wildlife researchers and managers. Roads can have a wide range of both positive and negative effects on wildlife species. For American black bears (*Ursus americanus*), roads may increase fitness by providing plentiful food sources in the spring and summer or by acting as travel corridors. Alternatively, roads may increase the risk of mortality through vehicle collisions or may fragment habitat and become barriers to movement and dispersal. Previous studies investigating the effects of roads on black bears have yielded varying results, and to date, none have made use of fine-scale location data provided by GPS radio collars. We conducted this study in Algonquin Provincial Park in Ontario, Canada, where there is an extensive tertiary road network to facilitate timber extraction. Using data from 16 adult female black bears fitted with GPS collars, we investigated the effects of three road types on landscape use at two spatial scales. We used a Brownian bridge movement model to estimate individual home ranges, and modeled bear use versus road proximity at the 3rd order using a resource utilization function (RUF) approach. For 2nd order selection, we used Monte Carlo simulated home ranges to estimate average distance to roads across the study area. Preliminary results will be discussed.

McConnell, Murray, Sheffield, H., Fitzpatrick, M.J.

University of Toronto at Scarborough

Rover/sitter variation in the foraging gene also influences oviposition preferences in female *Drosophila melanogaster*.

Natural allelic variation in foraging (for) underlies the rover/sitter foraging behaviour polymorphism found in fruit flies, *Drosophila melanogaster*. for encodes a cGMP-dependent protein kinase (PKG), in which rovers have higher for-mRNA transcript levels and PKG activity levels than sitters. Recently, for has also been associated with stress tolerance, learning, metabolism, and lipid storage. Many of these pleiotropic effects are mirrored with the PKG encoding gene egl-4 in the nematode *Caenorhabditis elegans*. Here we explore the potential role of for-PKG in fruit fly oviposition preferences based on two observations: i) oviposition site selection involves foraging-like behaviours where females locate food patches but deposit an egg instead of feeding, and ii) mutations in egl-4 are known to affect egg-laying in nematodes. We assayed oviposition preferences in rovers and sitters and, when given a choice between patches of low and high quality resources, rovers prefer to lay significantly more eggs on the low quality patches than sitters. To experimentally confirm its role in oviposition, we are currently manipulating PKG levels using a pharmacological activator (8-Br-cGMP). This procedure is known to increase PKG in sitters to rover-like levels and indeed, preliminary evidence suggests that this treatment induces sitters to exhibit rover-like oviposition preferences. Showing oviposition preference is influenced by for provides further evidence that a single gene can influence multiple phenotypes.

McKellar, Ann E., Hendry, A.P.

Queen's University

Do humans differ from other animals in levels of morphological variation?

Variation is the raw material for natural selection and is ubiquitous within and among populations. Yet the balance between forces maintaining variation (mutation, recombination, gene flow) and forces eroding it (selection, genetic drift) likely differs among species. Indeed, the magnitude of morphological variation can vary widely among species. Humans qualitatively appear to show high morphological variation both within and among populations, but perhaps this perception is biased by our ability to recognize variation specifically among conspecifics. Using total body length (or height in humans) as our measure of comparison, we quantitatively compared levels of variation in 102 human populations and 848 animal

populations (218 species). We find that humans show remarkably low levels of body height variation within populations in comparison to length/height in other animals. Humans do not, however, show different levels of body height variation among populations. These results support the roles of natural and sexual selection in eroding human height variation within populations and promoting it among populations. We argue that humans may have evolved on a rugged adaptive landscape with strong local selection for particular height optima that differ among populations, as supported by Bergmann's rule.

Mensink, Paul J., Henry, H.A.L

University of Western Ontario

Herbivory and detritivory by the land snail *Cepaea nemoralis* in a temperate old field

Terrestrial molluscs can alter plant production and species composition both directly, as a result of herbivory, or indirectly, as a result of detritivory. The banded wood snail (*Cepaea nemoralis*) is a non-native species in North America but it has become widespread throughout the northeastern United States and southern Ontario over the last century. Populations thrive in a variety of habitats including woodlands, roadsides, disturbed, grasslands, and old fields. While these snails prefer feeding on dead plant material, they also exhibit a preference for certain live plants. We used snail exclosures to simultaneously investigate the effects of snail herbivory on transplants of a highly palatable forb species (*Cirsium arvense*) and the effects of snail detritivory on grass litter mass in a temperate old field. We also performed snail fecal analyses at frequent intervals to determine diet over the summer. Snail exclosures had no effect on the aboveground biomass of *C. arvense*. Likewise, the enclosure effect on litter mass relative to unexclosed plots was not significant. Fecal analyses revealed that green plant material comprised approximately 10% of the overall snail diet, with the remainder consisting of plant litter and soil. Juvenile and adult snails did not differ in their consumption of live material and there was no clear seasonal trend in the consumption of green material. Overall, our results reveal that presence of *C. nemoralis* had no direct effect on either live plant biomass or the litter layer, despite this species being highly conspicuous at our field site.

Moise, Eric R.D., Henry, H.A.L.

University of Western Ontario

The effects of litter consumption by the snail *Cepaea nemoralis* on plant responses to warming and nitrogen deposition

Numerous studies have characterized plant responses to global change factors, such as warming and nitrogen deposition, at the level of experimental plots in the field. In these experiments, however, it can be difficult to distinguish between direct effects of the treatments on plant productivity and species composition and indirect effects mediated through changes in herbivory or detritivory. We examined the extent to which litter consumption by a detritivorous land snail, *Cepaea nemoralis*, is altered by warming and nitrogen addition, either directly through changes in local microclimate, or indirectly through changes in litter tissue quality, in the context of a climate change experiment conducted in a temperate old field. We addressed the former using mollusc exclosures located within the experimental plots, and the latter using cafeteria-style feeding experiments on plant litter collected from the plots monthly. In all plots, litter mass outside of snail exclosures was significantly lower than litter mass inside the exclosures. No significant differences were observed when rates of litter removal were compared among treatments. In feeding trials, litter from warmed plots was preferred over litter from ambient temperature plots in August. In addition consumption of litter from ambient plots was significantly higher than consumption of litter from nitrogen addition plots. Overall, our results reveal that the snail detritivory varies in response to the experimental treatments. The resulting variation in litter layer thickness may influence plant productivity and species composition through changes in ground level shading, microclimate, and the physical obstruction of new shoots.

Morris-Pocock, Jamie A., Steeves, T.E., Estela, F., Anderson, D.J., Friesen, V.L.

Queen's University

Comparative phylogeography of brown (*Sula leucogaster*) and red-footed boobies (*S. sula*): does foraging range predict gene flow in pelagic seabirds?

To test the hypothesis that foraging range is correlated with population differentiation in tropical seabirds, we surveyed variation at the mitochondrial control region in 246 brown boobies (*Sula leucogaster*), which forage relatively close to shore, and 273 red-footed boobies (*S. sula*), which forage up to 150 km from the breeding colony. To determine the relative influence of historical and contemporary demographics on population structure, we used a recently developed statistical method based on coalescent theory and Bayesian inference (im) to estimate demographic parameters. We found that global population genetic structure was similarly high in both species, and that gene flow between ocean basins apparently has been restricted by major physical barriers such as the Isthmus of Panama, and the Sunda and Sahul Shelves in south-east Asia. In contrast, we found that population histories within ocean basins differed markedly between the species. In brown boobies, we found high levels of population differentiation and no contemporary gene flow among most colonies, even at spatial scales as small as 500 km. While red-footed booby colonies were also genetically differentiated within ocean basins, coalescent analyses suggested that many previously isolated populations have recently come into secondary contact due to high contemporary dispersal. We suggest that these contrasting patterns of gene flow within ocean basins may be explained by different habitat preferences of brown and red-footed boobies, and that these habitat preferences may be predicted by foraging range.

Nituch, Larissa A., Bowman, J., Schulte-Hostedde, A.I., Wilson, P.J.

Trent University

Assessing risks of Aleutian disease transmission from mink farms to wild American mink (*Neovison vison*) populations.

American mink (*Neovison vison*) are an ecologically and economically important species, yet populations in Canada appear to be declining. Factors previously implicated in their decline do not fully explain this decreasing population trend. Recent research has shown that domestic mink are escaping from mink farms and hybridizing with wild mink, which may result in the introgression of domestic alleles and a loss of local adaptation for the wild populations. Additionally, we propose that domestic mink may also be spreading Aleutian disease (AD) to wild populations, which could further reduce fitness in wild mink by reducing both productivity of adult females and survivorship of juveniles. We tested this hypothesis by conducting a large-scale serological survey of wild and feral mink across Ontario to assess the prevalence of AD infection in relation to mink farm density. Antibodies to AD were detected by counterimmunoelectrophoresis in 24% of mink tested (n=194); however, seroprevalence was significantly higher in areas closer to mink farms than in areas farther from farms (54% versus 0%). Initial PCR and sequencing results confirmed the presence of AD genetic material in 7 of 11 AD seropositive mink tested, and several different AD viral isolates were identified. Our results also suggest that striped skunks (*Mephitis mephitis*) may act as vectors and reservoirs of AD. In light of declining mink populations and the high seroprevalence of AD in the wild, improved biosecurity measures on mink farms are recommended to prevent further disease transmission between mink farms and wild mink populations.

Ollek, Sita, Nelson, W.A.

Queen's University

Testing the impacts of multiple limiting factors (C+P) on growth and survivorship in *Daphnia pulicaria*: an empirical and theoretical approach

Organisms in the natural environment are exposed food quantity (e.g. carbon) and food quality (e.g. nutrient) limitation and are periodically faced with both forms of limitation simultaneously. In this study, the impacts of multiple limiting factors on growth and survivorship in *Daphnia pulicaria* were studied by

raising individuals under three different food quantity levels and two different food quality levels. A dynamic energy budget (DEB) model was fit to the juvenile stage growth of each individual, which allowed the life history variation to be characterized under a single framework. Because the assimilation efficiency ($\hat{\mu}$) and maintenance rate (m) parameters were statistically non-unique, $\hat{\mu}$ was constrained to the maximum likelihood value for the entire population when fitting the model and a maximum likelihood value m was then estimated for each individual. The survivorship and estimates of m were found to differ significantly with food quality but not food quantity. Considerable overlap was found in the estimates of m between the food quality treatments and the distributions could be described well by a gamma distribution. The longevity and estimates of m were found correlate significantly. The correlations in all treatments fell along a single curve and the range of the longevity and estimates of m overlapped considerably among treatments. These findings suggest that life history variation due to multiple limiting factors can be characterized under a single framework and that food quantity and food quality may phenomenally affect life history variation in the same way. Furthermore, the results suggest that it may be possible to predict which individuals will die at a young age based on their growth rather than strictly on the food conditions under which they are raised.

Parker, Lori D.

Queen's University

Female ornamentation and reproductive investment in the American Robin (*Turdus migratorius*)

The function of ornamental traits in males has been the subject of intensive research for decades, and sexual selection is widely recognized as the foremost explanation for their evolution. The expression of such traits in females has received much less study. Female ornamentation has often been considered to be a non-adaptive, correlated response to selection on males. However, recent models predict that male mate choice, female competition and the evolution of honest signals in females occurs under certain circumstances, especially where male investment in offspring is high and female quality is variable. Male and female American robins (*Turdus migratorius*) both invest heavily into offspring, and both display chestnut red breast plumage and bright yellow bill colouration. Compared to males, female robins show a slightly subdued expression of these traits. However, considerable variation exists among females. I am using field data to assess whether female ornamentation in robins acts as a signal of individual quality, and whether variation in colour is correlated with capacity to invest into reproduction. I took colour measurements of the bill, head and breast of males and females using reflectance spectrometry. As proxies of reproductive investment I am analyzing clutch size, egg size, egg energetic investment (%lipid and %protein), yolk androgen and carotenoid deposition, and relative parental effort (nest vigilance and offspring feeding). Preliminary results suggest that aspects of maternal investment are mediated by condition, and that female colour may be a reliable indicator of condition and capacity for reproductive investment in this species.

Paul, Jennifer, Straka, J., Freeland, J.

Trent University

Identifying patterns of dispersal and spread used by invasive species: A case study using North American *Phragmites australis*

Life history traits can be key determinants of invasive success. Many invasive plant species can disperse and colonize new sites through either sexual or asexual means, and this may be closely linked to generalist versus specialist strategies. The common reed, *Phragmites australis*, is a top priority invasive species in Canada. Over the past 150 years, invasive lineages of *P. australis* have dramatically increased in distribution and abundance in North America. We have obtained genetic data from both invasive and native populations of the common reed in North America across >2000km of its invasive pathway. These data show a surprisingly high frequency of sexual reproduction and seed dispersal in the invasive lineage compared to the native lineages. Genetic diversity is highest within managed sites, suggesting that human activities may be facilitating seed dispersal and germination. Our data also provide the first intimation of

hybridization between native and invasive *P. australis* lineages in North America. We suggest that in this species, bioinvasions are facilitated by the genetic diversity that results from sexual reproduction and hybridization, both of which may be promoted by anthropogenic disturbance.

Perry, Laura E., Dorken, M.E.

Trent University

Males taking advantage: Insights into the evolution of males in *Sagittaria latifolia*

The evolution of separate sexes (dioecy) from hermaphroditism is a common evolutionary transition. Within the flowering plants, the transition is thought to have occurred at least 100 times, most commonly involving a gynodioecious (the co-occurrence of females and hermaphrodites) intermediate stage. While much is known about the first stage of the pathway, yielding gynodioecy, much less is known about the second phase: the evolution and spread of males. We are interested in developing experimental approaches to study the evolution of males and, in particular to examine the conditions that promote their invasion in gynodioecious populations. For males to invade a gynodioecious population, where hermaphrodites are the primary pollen producers, males must have a substantial advantage in siring success over hermaphrodites. This advantage could be achieved in a number of ways. For example, they may (a) produce larger flowers more attractive to pollinators, (b) have more attractive floral displays with more simultaneously open flowers, and/or (c) flower over longer periods in comparison with hermaphrodites. Observations made in natural populations of *Sagittaria latifolia*, a species comprised of both hermaphroditic (monoecious) and dioecious populations, indicate that males use two of these strategies: they have larger flowers and flower over an extended period in comparison to hermaphrodites. Experimental manipulation of artificial gynodioecious populations in *S. latifolia* is currently ongoing to assess how these strategies increase male siring success, as well as the environmental conditions that promote male invasion.

Poulopoulos, John, Campbell, L.M.

Queen's University

Changes in large lake food web structures over several decades, as revealed by museum ichthyology collections

Aquatic food webs have been altered by many disturbances over the last century, including non-native species, mercury contamination, construction of dams and other infrastructure, and changes in fisheries practices and management. However, it is difficult to fully gauge the degree of food web change because historical webs are not well understood. Many museums house large ichthyology collections that have the potential to fill this knowledge gap. We review the use of stable isotope analysis in the study of archived fish, and discuss the assumptions and limitations of this technique. We also present results from our stable isotope and mercury analyses on archived fish from Lakes Nipigon, Simcoe, and Champlain, large lakes in the Great Lakes/St. Lawrence River region. These results show that food web structures have largely maintained the same “shape”, but this shape has become more compressed, meaning that species’ diets overlap today more than in the past. Also, some species’ diets have noticeably shifted, while others have not, revealing a species-specific effect of the disturbances on the food web components. Museum ichthyology collections have the potential to provide important new insights into food web change, and have broad applications in the management of large lakes.

Punzalan, David

University of Ottawa

Are there ecological costs of secondary sex colouration in the ambush bug *Phymata americana*?

Sexually selected traits, while advantageous in terms of mating success, are expected to carry considerable costs in terms of viability selection. The ambush bug *Phymata americana* exhibits a peculiar sexual dimorphism in colour pattern where males express sex-specific patches of dark colour

pattern. Previous work has demonstrated that this dimorphism can be accounted for by a combination of sexual selection favouring dark males and the energetic costs of colour pattern (i.e. dark colouration is strongly resource-limited). However, given that colour pattern is thought to be important in terms of visual crypsis of these insects in their natural habitat, exaggerated dark colouration might also carry ecological costs by increasing conspicuousness to predators and/or prey, or by disrupting any potential function in intraspecific signaling. In a field experiment where dark colour pattern was manipulated in females, I found no evidence that “male-like” colour pattern resulted in a selective disadvantage via increased predation risk, decreased foraging success, or suboptimal mating rates.

Robinson, Terin, Freeland, J., Wilson, C.

Trent University

Behavioural and genetic assessment of mate choice in brook trout (*Salvelinus fontinalis*)

The complex processes involved in mate choice may best be investigated using multifaceted approaches. We investigated the mechanism(s) of mate choice in a stocked population of brook trout (*Salvelinus fontinalis*) with known ancestry, using a combination of genetic data (microsatellite and MHC loci) and behavioural observations to better understand how relatedness influences mate choice in this species. We introduced brook trout of families with known ancestry (relatedness) and with known genotypes into a semi-wild environment, using offspring genotypes to infer parental mate choice. Introduced families included maternal and paternal half-sib families, as well as unrelated family pairs. Successful reproduction was investigated by two consecutive years of sampling newly hatched fry and determining parentage via microsatellite genotyping. Our findings will be relevant to future management and conservation of brook trout, as they will improve our understanding of maintenance of genetic diversity and evolutionary potential within populations.

Rohwer, Vanya G., Martin, P.R.

Queen's University

Local adaptation or adaptive plasticity? Understanding differences in nest morphologies of the Yellow Warbler (*Dendroica petechia*)

In order for organisms to evolve local adaptations through natural selection, three conditions must be met. First, there must be variation in the trait upon which selection can act. Second, the local variant of the trait must receive a fitness advantage in the local environment. And third, local variants of traits must be heritable, transmitted from parents to their offspring. Here, we examine the variation in Yellow Warbler nests from Churchill, Manitoba and the Queen's University Biology Station (QUBS), in southern Ontario, to see if differences in nest morphologies represent local adaptation or adaptive plasticity in birds. These two sites are separated by over 1500 km, exhibit dramatically different habitat, and experience about a 10°C difference in temperature during the breeding season. Comparing nests from these two locations, we found that nests from Churchill are on average thicker, made of materials that provide better insulation, and lose heat at slower rates than nests from QUBS. To test the fitness benefits of different nest morphologies, we conducted nest transplant experiments in Churchill Manitoba and found that southern nests from QUBS are on average 10% (~3°C) colder than local northern nests in Churchill. These preliminary results suggest that Yellow Warblers build nests that are well suited to the different environmental conditions of these breeding locations. Determining if different nest morphologies represent heritable local adaptation or plasticity awaits captive breeding experiments.

Sagar, Stephen P., Eckert, C.G.

Queen's University

Spatial structuring of genetic vs. morphological variation in *Aquilegia canadensis*

Aquilegia canadensis presents an enigma. Self fertilization seems to be highly disadvantageous for the fitness of an individual yet it remains at a high frequency. Certain morphological traits such as herkogamy

should be under strong selection to lower the amount of selfing but seem to maintain a large amount of variation within populations. By comparing the distribution of variation for 4 floral traits (sepal length, pistil length, herkogamy and spur length) to that of putatively neutral genetic markers it becomes possible to separate the effects of genetic drift and gene flow from that of selection. Both the floral traits and the genetic markers showed significant variation among plants within plots yet little differentiation among outcrops within outcrops and among outcrops. These results indicate high gene flow, and little influence of genetic drift. Opposing selective forces may be maintaining the large amount of variation in floral traits despite the presence of strong selective forces for traits minimizing selfing. The genetic markers also show a significant amount of within plant variation indicative of high heterozygosity and therefore a highly outcrossed reproductive stage. Apparent high outcrossing at the reproductive stage may be explained by the strong inbreeding depression causing selfed individuals not to mature to this stage.

Scott, Stephanie L., Aarssen, L.W.

Queen's University

Leaf size/number tradeoffs and branching plasticity in herbaceous angiosperms

The majority of plant species have relatively small leaves. However, this need not imply that relatively small leaf size is a directly adaptive trait. Instead advantage may lie in the greater total number of leaves a plant can produce when each leaf is smaller. This is associated with a greater number of axillary meristems available per unit of shoot growth. Isometric tradeoffs between leaf size and leaf number have been reported in both woody and herbaceous plant species. Meristems (buds) can be deployed as branches, flowers, or they may be left inactive. A relatively large “bud bank” therefore, may allow increased flexibility of branching architecture; species with smaller leaves may show more plasticity in branch display, thus conferring potential to respond adaptively to gradients in light availability. We tested this hypothesis across 27 herbaceous angiosperm species collected in the Kingston, Ontario area. Species with more, smaller leaves are expected to be more variable in their branching architecture than species with fewer, larger leaves. These results may have implications for the evolution of leaf size, as selection for increased leafing intensity (conferring greater potential plasticity) would result in smaller leaf size as a trade-off.

Sivalinghem, Senthurran, Elias, D.O., Kasumovic, M.M., Andrade, M.C.B., Mason, A.C.

University of Toronto

Male seismic signaling and female mate choice in a jumping spider (*Phidippus clarus*)

Sexual selection via female choice can result in elaborate display traits in males used for competition and mate attraction. Male jumping spiders use a variety of signals to communicate with females, and thus provide a good model system to investigate the influence of complex signal on female choice. The jumping spider *Phidippus clarus* has been shown to use vibrational signaling during male-male competition and courtship, however, the effects of these types of signals on female choice and mating success have not been determined. In this present study, I measured the occurrence and rate of male vibrational signals and determined: 1) the effect of female mating status on male vibratory signals; 2) which factors predicted successful copulation; and 3) if these factors changed with female mating status. Males produced two forms of substrate-borne vibrations during courtship: 1) courtship vibrations and 2) aggressive courtship vibrations. I found that courtship vibration rates were related to male mating success when courting virgin females, while aggressive vibrations were more likely to be produced when courting non-virgin females. Although the functions of these aggressive signals are unclear, I hypothesize that they are part of a complex system that enables males to overcome resistance from mated females.

Sopinka, Natalie M., Marentette, J.R., Balshine, S.

McMaster University

Impact of contaminants on competitive ability in a Great Lakes invasive fish (*Apollonia melanostoma*)

Adding to the growing concern over the depletion of natural resources is the problem of environmental contaminants, which are a significant stressor on aquatic systems and their resident biotas. Contaminant exposure can affect animal populations by disrupting reproductive and social behaviours performed during the establishment of social dominance hierarchies. An individual's place in a hierarchy can determine the time it spends fighting, its access to food, shelter and mating opportunities. Thus, animals exposed to pollutants may have disadvantages if their social interactions are modified. Individuals of the invasive round goby (*Apollonia melanostoma*) were collected from contaminated and relatively clean sites in Lake Ontario. Fish were subjected to a resource contest to determine the effects of environmentally relevant levels of contaminants on aggressive behaviours. Pairs of fish from contaminated sites performed many more assessment displays during initial interactions, however, had fewer aggressive bouts over all. Dominance hierarchies between contaminated fish had a tendency to be more unstable than hierarchies formed between clean pairs of fish. These results suggest that the costs of contaminant load can shape behavioural repertoires. Contaminated fish appear to adopt altered conflict resolution strategies that may reflect impaired cognitive function, sensory perception and/or metabolism. Future work will tease apart these possible mechanisms for the observed contest behaviours. This study provides support for the idea that changes in behaviour can be used as an ecologically relevant measure of contaminant exposure.

Stabler, Cassandra D.

University of Guelph

The effect of manufactured soil depth variability on the establishment of alvar vegetation communities in abandoned southern Ontario quarries

Aggregate extraction in Ontario has left the landscape populated with abandoned quarries. Previous research found that quarries exhibit similar environmental characteristics to alvars (rare, naturally occurring limestone-pavement ecosystems) making alvars ideal restoration targets. In alvars, soil collects in cracks and divots in the bedrock; vegetation communities exist in these high-stress conditions. Manufacturing these conditions in abandoned quarries prior to vegetation establishment will promote restoration efforts. In October 2007 and May 2008, 144 plots all composed of 14 alvar indicative vegetation species were planted in three quarries. Soil depth variability treatments (no change, minimal, and maximal variability) and life stage treatments (seed and adult addition) were randomly applied to the plots. The plots were surveyed four times from May 2008 to August 2008. Communities established from seed in plots with increased variability (minimal and maximal) had higher diversity ($p=0.0369$, $p=0.0026$), richness ($p=0.0068$, $p=0.0014$), evenness (0.0253 , 0.0012), and cover ($p=0.0001$, $p<0.0001$) than communities established in unchanged plots. Communities established from adults in plots with increased variability (minimal and maximal) had higher diversity ($p=0.0135$, $p=0.001$), evenness ($p=0.0374$, $p=0.0043$), and richness ($p=0.0085$, $p=0.0004$) than communities established in unchanged plots. There was no difference in cover in plots established from adults. At the endpoint, all communities in plots with manufactured variability had more positive increases in diversity ($p=0.0002$), richness (0.0083), evenness (0.0002), and cover ($p=0.0262$) than communities established in plots with no change. The success of restoration efforts in abandoned quarries will improve by understanding if manufactured variability impacts the establishment of alvar vegetation communities.

Stemberger, Tanya L.M., Modanu, M., MacLeod, E.C., Andrade, M.C.B.

University of Toronto at Scarborough

The effects of mating experience on competition in male black widow spiders

Male Western Black Widow spiders (*Latrodectus hesperus*) are generally not cannibalized during copulation, and despite the loss of their apical sclerite, are able to mate with multiple females. This study examined the effects of previous experience on later performance when in competition with a size-matched virgin male for a female. Each experienced male was paired with a virgin male and both were allowed to court and copulate with a virgin female overnight. One of the males was irradiated (to determine paternity after the trial), and the first 6 hours of mating trials were filmed for subsequent analysis of aggressive behaviour. The results suggest that despite undergoing genital mutilation and securing a previous mating, experienced males were still able to compete as well as their virgin counterparts for new mates and achieve copulations.

Stoltz, Jeff A., Andrade, M.C.B.

University of Toronto at Scarborough

Courtship duration threshold of choosy females allow males to parasitize rival mating effort

Empirical demonstrations of threshold-based decision rules are rare in the literature. Further, exploitation of reproductive efforts by rival males after female threshold values have been attained have not been suggested or known to occur. We show that female choice criteria in redback spiders (*Latrodectus hasselti*) includes a courtship duration threshold. Previous work shows that female redbacks discriminate against competing males that minimize courtship effort. We use these data (Stoltz et al. 2008) to predict a threshold for female choice (approximately 100 minutes of courtship prior to a copulation attempt). Next, we staged competitions between pairs of males on female's webs, allowing "resident" males to exceed the courtship threshold before introducing a size matched or size mis-matched "intruder". Premature sexual cannibalism by females biases paternity against the cannibalized male and was less frequent if resident males courted past the putative threshold than in situations where rivals were introduced simultaneously and courtship was truncated. Surprisingly, intruding males, which arrived on the web after the putative courtship threshold was surpassed by the resident males, were able to mate with females with very little courtship effort and did not suffer female mediated-decreases in their reproductive success suggesting an exploitation of the reproductive efforts provided by residents. Taken together, these results show that females have a threshold courtship requirement below which there is strong discrimination against males. However, it is also clear that intruding males can parasitize the efforts of residents, as, once the threshold is reached, any male that attempts mating avoids female-mediated costs seen in other trials.

Taylor, Scott A., Patirana, A., Birt, T. Piatt, J., Friesen, V.L.

Queen's University

Asymmetric hybridization between closely related seabirds in the North Pacific

Hybridization between taxa has important implications for their evolution, and potentially for their conservation and management in the case of rare or economically important species. The extent of hybridization between common murres (*Uria aalge*) and thick-billed Murres (*U. lomvia*) has been the subject of debate. In a recent survey of variation in mitochondrial DNA (mtDNA) in common and thick-billed murres sampled from throughout the North Pacific, twelve of 327 common murres (~4%) were found to possess DNA sequences characteristic of thick-billed murres. Surveys of variation in three nuclear introns and three microsatellites in 339 common murres and 56 thick-billed murres revealed that these hybrids carried various combinations of alleles from common and thick-billed murres. Analyses using the programs NEWHYBRIDS and STRUCTURE indicated that these individuals contain high proportions of thick-billed murre nuclear DNA. Given the apparently rare nature of hybridization between thick-billed and common murres, it is unlikely that these are F1 hybrids and this allele sharing is potentially the result of historical hybridization events. Analyses also revealed two common murre

individuals that possessed conspecific mtDNA sequences but predominantly thick-billed murre nuclear alleles, suggestive of ancient hybridization. We propose that the asymmetric mtDNA introgression we observed is most likely the result of mate choice at mixed colonies based on differences in male mating behaviours. Our results highlight that hybridization between thick-billed and common murres is more prevalent in the North Pacific than previously thought. This may have important implications for conservation and management.

Toth, Cory A., Ratcliffe, L.M.

Queen's University

Can Black-capped Chickadees (*Poecile atricapillus*) determine social rank of unfamiliar individuals through transitive inference?

Transitive inference (TI) is a cognitive ability once thought to be exclusive to humans, but three decades of research has slowly provided evidence that some animals can demonstrate it in laboratory experiments. Transitive inference is the ability to observe a linear series of relationships between objects (i.e. A>B, B>C) and then correctly infer the relationship between any of the objects not compared directly (e.g. A>C). This process requires the ability to learn the relationships between pairs and subsequently use this information to infer a relationship when presented with a novel pairing; processes which are believed to originate in the hippocampus and surrounding cortices. Social living may select for enhanced cognition and consequently the development of TI capabilities due to the need to track relevant information about group members. Black-capped chickadees (*Poecile atricapillus*) are an ideal species for studying TI in free-living animals, as their winter flocks utilize linear dominance hierarchies, and social rank affects multiple components of lifetime reproductive success. Thus it is reasonable to predict that individual chickadees may be able to infer relative social rank via transitive relationships. I propose to carry out a series of field aviary trials using male chickadees, where focal birds will observe a series of pairwise dominance encounters between individuals, and then given an opportunity to demonstrate TI by observing a novel pairing. If TI can be demonstrated it would provide the first study to do so with wild animals, and would provide evidence for a natural use of this ability.

Vachon, Nicole, Freeland, J.

Trent University

Reconstructing phylogeographic relationships using chloroplast markers: the potentially confounding influence of hypervariable sequences

Combining chloroplast markers with differing patterns of evolution can confuse interpretations of plant phylogeography. We illustrate this by recreating parsimony networks of the common reed, *Phragmites australis*, using previously published genbank sequences from around the world, plus additional sequences that we obtained throughout North American and the United Kingdom. These sequences included two hypervariable minisatellite regions that had not been excluded from analyses in earlier work. Once the minisatellites were removed, networks revealed that *P. australis* in North America is more closely related to lineages in other parts of the world than was previously believed. A particularly widespread lineage is central, and hence ancestral, to networks from all regions sampled except North America. This lineage is thought to have been recently introduced to North America, where it is now highly invasive. Our reanalysis of the data suggest that it has actually been introduced to North America at least twice in recent years, and may be viewed as a continuation of the global expansion of a very widespread haplotype with high ecological amplitude. This study highlights the importance of removing unusually variable data in studies of phylogeography.

Vankoughnett, Mathew, Grogan, P.

Queen's University

Shrub Expansion: Does deeper snow result in enhanced nitrogen uptake by shrubs?

Increasing shrub biomass and dominance in arctic tundra vegetation could have profound implications for regional climate, carbon balance, and biogeochemical cycling. Winter processes may be important in enhancing shrub growth because dense tall shrub areas accumulate relatively deep snow that is known to raise winter soil temperature minima and therefore may enhance nitrogen mobilization from organic matter. However, it has not yet been demonstrated that shrubs can take up this winter-mobilized nitrogen more than the rest of the tundra plant community, and therefore that their growth would benefit from this feedback. The objective of this research was to investigate whether annual nitrogen uptake by shrubs is greater in shrub-dominated plots, and whether shrub uptake is enhanced with deeper snow cover. To test these questions, inorganic ^{15}N tracer was added to birch hummock tundra plots with ambient and deepened snow, and to shrub-dominated tundra plots. Two years after tracer addition birch shrub (*Betula glandulosa*) located in tall shrub-dominated tundra had greater ^{15}N enrichment pool sizes in proportion of their new shoot biomass than shrubs located in the control birch hummock plots. In addition, we found that deepened snow alone had no effect on birch plant ^{15}N uptake and shoot biomass production.

Vickruck, Jess, Richards, M.H.

Brock University

Nest site selection and microclimate variation in two species of dwarf carpenter bee (*Ceratina dupla* and *C. calcarata*)

Ceratina dupla and *C. calcarata* are closely related, morphologically similar dwarf carpenter bees that nest in the exposed pith of twigs and stems. We investigated the nesting biology of both species in the Niagara Region to examine possible costs and benefits of nest site selection. Nest collections took place from 14 April to 30 September 2008. *Ceratina dupla* was collected most often from teasel (*Dipsacus* sp.), while *C. calcarata* dominated raspberry (*Rubus* sp.) collections. Both plants are common invasives, teasel being a biennial old-field weed found in full sun, whereas raspberry, being a perennial shrub, is most common at shaded wood margins. The daily temperatures experienced by bees nesting in teasel were much hotter and more variable than those nesting in raspberry. Clutch size and nest tunnel length did not differ between substrates, however brood were parasitized more in raspberry than they were in teasel. Brood raised in raspberry also had significantly faster development times than those in teasel. This suggests that *Ceratina* can employ different juvenile developmental strategies to capitalize on available niches in their local environment, and may help to explain why their preferred nesting substrates consist of non-native plants.

Warren, Margaret A., Morbey, Y.E.

University of Western Ontario

Alternative reproductive tactics in female kokanee salmon (*Oncorhynchus nerka*) in Meadow Creek, British Columbia

In Meadow Creek, British Columbia, a small proportion of the early-arriving female kokanee salmon (*Oncorhynchus nerka*) appear at the spawning grounds and are still “silver” in colour. Silvers are smaller and younger than the typical “red” females and delay their reproductive maturation and spawning by 18–28 days. This apparently novel alternative reproductive strategy for females has not yet been fully described or explained but seems to relate to size-specific costs associated to migration and/or spawning. My research aims to further describe the silver tactic and test the hypothesis that smaller females adopt the silver tactic in order to minimize costs associated with migration, including energy expenditure and predation risk. An important criterion to be an alternative reproductive tactic is that phenotypic variation must be bimodal. In 2008, I collected some preliminary data to test this. The frequency of silvers in the population was 1–2%. Digital photography was used to objectively quantify variation in body coloration

among females and to test for bimodality. Continuation of the study in 2009 will further investigate the possible costs and benefits associated with these silver females during their migratory phase.

Wiebe, Scott A., Luckai, N.L., Morris, D.M.

Lakehead University

Biomass removal in a black spruce ecosystem: temporal dynamics of carbon loss and nutrient fluxes of coarse woody debris

Coarse woody debris (CWD) in the boreal ecosystem has been hypothesized to play an important role following stand-replacing disturbances such as fire or harvest. After such an event, nutrient-rich leaves, small branches and roots are quickly decomposed (or burned in the case of fire) and CWD, with its slow and steady decomposition, provides essential nutrition to the emerging stand until litterfall and throughfall inputs stabilize again at crown closure (15-20 years). This study, which is approaching crown closure, was established in 1994 and focuses on carbon loss and nutrient fluxes of coarse woody debris (CWD) at four levels of biomass removal from a mature black spruce forested stand. The response variable, site productivity, will be measured using Above-ground Net Primary Productivity (ANPP), but has not yet been applied to the data. Two soil types (shallow loamy, dry sandy) were targeted to test if CWD is a source or sink for nutrients, (especially N and P) and if decay patterns can be associated to soil type. Preliminary results suggest that N and P concentrations increase over time, and for N, this is especially apparent in dry sandy sites. Actual amounts (content) of these nutrients are largely unchanged for the 15 year sampling period, suggesting immobilization (or at least unavailability) of nutrients as carbon is lost from CWD. The biomass removal treatment with the greatest carbon loss and fastest CWD decay rate had the highest initial mass of CWD, indicating possible synergistic decay dynamics.

Wilson, Sandra L., Walker, V.K.

Queen's University

Freeze-thaw resistance of soil microbial communities: mechanisms of survival.

Microbes have a wide range of adaptations to freeze stress including antifreeze proteins (AFPs) and ice-nucleation proteins (INPs). AFPs can delay freezing and prevent the formation of large ice crystals that occur during freeze-thaw cycles, leading to membrane damage. INPs initiate ice formation external to the cell, offering protection by increasing the intracellular solute concentration. Global warming is predicted to increase freeze-thaw conditions, particularly in high latitudes. Therefore, an increased understanding of the effects of this stress on soil microbial communities and possible resistance mechanisms is necessary. To this end, we assessed the microbial diversity of two soil samples (Daring Lake, NWT and Gould Lake, ONT) on the basis of 16S rDNA sequencing. Cultures were subjected to 2 sets of 48 freeze-thaw cycles, and monitored for viability. Survivors were identified and characterized with respect to AFP and INP activity. Quantitative PCR was used to determine the frequency of the resistant microbes in the original communities. As expected, freeze-thaw treatment greatly decreased the diversity and abundance of both soil communities; 8 isolates (6 genera) were recovered. The resistant microbes were infrequent in the original communities, demonstrating the stringency of the treatment protocol. Remarkably, over 60% of the isolates had AFP or INP activity, and another is a spore former. Overall, the vast majority of the microbes did not survive freeze-thaw conditions, and those that did may have done so by the production of AFPs or INPs.

Wiltse, Brendan J., Cumming, B.F.

Queen's University

Major shifts in diatom community structure suggest the influence of recent climate change on lakes in the boreal region of Canada

Various studies throughout North America have shown that ice-free periods of lakes are increasing. These changes have largely been attributed to a warming climate in these regions. The IPCC predicts that

temperatures in North America will warm at a rate higher than the global mean. It has been suggested that the greatest degree of warming will be observed during the winter months, and that the snow and ice season will decrease with time. Previous studies at the Experimental Lakes Area (ELA) have shown large increases in planktonic diatoms over the past century. A similar trend has been observed in arctic lakes where warming is of a much higher magnitude. The most notable change has been in *C. stelligera*, which is a planktonic diatom that requires well stratified water columns. ELA lakes have been populated with *C. stelligera* for many centuries, although recently *C. stelligera* has started to increase in relative abundance. Previous work has shown widespread increases of *C. stelligera* over 20 ELA lakes, suggesting a regional forcing factor. It is believed that longer ice-free periods are allowing greater degrees of stratification which is favoring *C. stelligera*. We have looked at two lakes at ELA in much greater detail than previous studies. Two sediment cores were analyzed for changes in diatom community structure and dated using Pb-210 radioisotopes. We found a notable shift in the diatom community towards more planktonic forms; particularly *C. stelligera*. This suggests a major shift in the ecology of these lakes.

Wong, Andy

Queen's University

A cost-benefit analysis of mixed mating in *Aquilegia Canadensis*

Mixed mating is often thought to be evolutionarily unstable because often mating systems are driven to purely outcrossing or purely selfing by transmission advantage or inbreeding depression. Here I will present a cost-benefit analysis of mixed mating for a common plant in eastern central North America (*Aquilegia canadensis*).



OEEC 2009 – Poster Presentation Abstracts

(Listed alphabetically by presenter's last name)

Bouchard, Jessica M. S., Kimber, C.M., Chippindale, A.K.

Queen's University

An investigation of sex, mutation and longevity in *Drosophila melanogaster*

Though research on ageing and longevity has expanded considerably over the past decade, many questions still remain. Two remaining issues are the existence of age-specific effects of mutation and the maintenance of high levels of genetic variation for longevity. Currently there are very little experimental data directly addressing these issues. Thus far, most experiments have used methods of mutation accumulation which involve inbreeding, which may confound the observed effects on longevity. In order to generate sex-specific data we will be using a unique system called cytogenetic cloning. This system provides many benefits such as the ability to create mutation accumulation lines without inbreeding and the ability to express cloned haploid genomes as males and females. This system allows us to measure the sex-specific effects of mutation directly, as well as determine the intersexual genetic relationship for longevity. Longevity was measured for 20 pairs of mutation accumulation (MA) and control clone lines. In both control and MA clone lines mean female longevity was significantly greater than mean male longevity. Mutation accumulation caused a similar significant decline in mean longevity in both sexes. Males showed a significant increase in intrinsic mortality rate, whereas females showed a significant increase in extrinsic mortality rate as a result of mutation accumulation. Mutation-induced increases in mortality rates were limited to early-life in both males and females. There was significant genetic variation, but no intersexual genetic correlation for mean longevity in the control lines. For MA lines

there was a strong positive intersexual genetic correlation, and genetic variation for mean longevity was greater than in control lines, especially for females. Mutations seem to affect mean longevity similarly in both sexes, but due to differing underlying mechanisms. These results indicate some degree of sexual conflict with regard to ageing and longevity.

DiLeo, Michelle F., Row, J.R., Lougheed, S.C.

Queen's University

Comparative landscape genetics of two sympatric snake species in southwestern Ontario

In this study we investigate the effects of a fragmented southwestern Ontario landscape on the genetic population structure of two sympatric snake species that differ in habitat preference. We were most interested in comparing the relative number and location of both natural and human-created barriers to gene flow between the species. The eastern garter snake (*Thamnophis sirtalis*) is a common species and a habitat generalist, whereas the eastern foxsnake (*Elaphe gloydi*) is less common, geographically insulated, and a marsh-specialist. Bayesian spatial assignment revealed three genetic clusters for garter snakes and five genetic clusters for foxsnakes. Each individual garter snake had a near equal probability of membership to two or more clusters with none of the clusters mapping onto a discrete geographic region, indicating that in reality *T. sirtalis* in southwestern Ontario exists in a single genetic population. The five identified foxsnake clusters correspond to geographically circumscribed locations on the southwestern Ontario landscape. Slopes of pair-wise isolation by distance between individuals were significantly different from zero, but extremely weak, for both species. Isolation by distance was found to be greater in foxsnakes compared to garter snakes. The results of this study indicate that foxsnakes experience more barriers to gene flow than garter snakes across southwestern Ontario.

Dombroskie, Sarah L., Aarssen, L.W., Scott, S.L

Queen's University

The leaf size/number trade-off within species and within trees for woody angiosperms

Between-species leaf size variation in woody species has been previously interpreted mainly in relation to environmental adaptation associated with physical and biochemical properties of particular leaf sizes. An alternative interpretation is that leaf size variation is a trade-off of variation in leafing intensity – number of leaves produced per unit shoot – with the latter being the principal target of natural selection, linked to the effects of leafing intensity on ‘bud bank’ size, i.e. the bank of axillary meristems available for deployment in shoot growth or reproduction. This study examines the relationship between leafing intensity and individual leaf mass at the within-species and within-tree levels using 16 species of woody angiosperms. Both isometric and allometric trade-off relationships were common and linked to variation in light availability within tree canopies. We propose that these trade-offs associated with leaf deployment can be interpreted in terms of different optimal strategies for harvesting light. High light conditions were associated with greater individual leaf mass, longer terminal shoot length, greater total shoot dry mass, and higher branching intensity. Low light conditions, however, were associated with higher leafing intensity, higher leaf to shoot biomass allocation ratio, and higher shoot girth to length ratio.

Fang, Tian, Campbell, L.M., Wang, Y.X., Aronson, K.

Queen's University

Assessing human exposure from mercury and other metals in fish from east China lakes

Mercury is a commonly known neurotoxin and is able to cause a series of adverse effects on humans under acute high exposure or long-term exposure. Pregnant women, young children and children and frequent fish consumers are vulnerable to mercury contamination through fish consumption. Because of the rapid industrial development and the importance of freshwater fish in the Chinese diet, concerns on the contaminations of mercury and other metals are increasing. Preliminary studies indicate elevated total

mercury concentrations in four key species from Qiandao Lake, a 50-year-old reservoir in east China. Two catfish species also exceed the Chinese mercury concentration limit (0.3 ng/g). Since fish is important in local dietary patterns and to the regional tourism industry, the extent to which fish consumption could be a potential health risk to the population was evaluated. To determine the relationship of fish consumption patterns and mercury levels in female residents of reproductive age (17–44 years) from Qiandao Lake, a cross-sectional epidemiological study using hair samples and dietary interviews was carried out in a fishing lakeside town. Hair samples were collected from local female residents for laboratory analysis of mercury and other metals.

Jenkin, Sarah., Laberge, F.

University of Guelph

Does it matter if it's black or white? An investigation of visual discrimination learning in the fire-bellied toad (*Bombina orientalis*)

It is often held that amphibians are ineffectual learners limited to performing innate behaviours. This study explored the visual discrimination learning ability of fire-bellied toads (*Bombina orientalis*). Two groups of toads were trained by selective food rewards to snap at video footage of either black crickets on a white background (Black toads) or white crickets on a black background (White toads) displayed simultaneously on a computer screen. Training took place over ten sessions, each scheduled three days apart. Results show that incorrect snapping (S-) was reduced to zero in both groups. However, this result was statistically significant only for the White toads, which executed significantly more incorrect snaps than Black toads. The latency to correct snap (S+) was significantly decreased in the Black toads after 4 trials, but this was not the case for White toads. The computation of meaningful statistical measures was complicated by the occurrence of many ‘false trials’ where toads did not show any motivation to snap at the stimuli. Toads would often take a ‘pause’ in snapping for one or more trials before snapping again. As a result, sample sizes were often small at any given trial, which complicated the assessment of temporal trends in behaviour. The number of such false trials did not differ between Black and White toads (20 and 30% of all trials, respectively). Despite the above caveat, the results show that toads can learn a true instrumental task. This elaborate form of learning appears to be conserved among vertebrates.

Kwan, Lucia

University of Ottawa

Sexual conflict and the evolution of genomic imprinting: an exploration using *Prochyliza xanthostoma* (Diptera: Piophilidae)

Intralocus sexual conflict occurs when males and females experience divergent sex-specific selection on a shared genome. This creates conflict when the same allele has opposite effects on the relative fitness of each sex, leading to genotypes that are optimized for neither sex and a reduction in the average fitness. The evolution of sexual dimorphism, where the sexes independently evolve towards their fitness optimum, provides the ultimate resolution of intralocus sexual conflict. Recently, it has been suggested that genomic imprinting may be one of the several genetic mechanisms by which sexual dimorphism may evolve. This hypothesis is based on the intralocus sexual conflict model, which predicts sons will be more likely to inherit high male-fitness alleles from their father and daughters will be more likely to inherit high female-fitness alleles from their mother for some traits under sex-specific selection. This would permit both sexes to approach their optimum more closely and thus, mitigate intralocus sexual conflict. Despite theoretical and limited empirical support, a direct test of the intralocus sexual conflict model is needed. I plan to evaluate the degree to which sexually dimorphic imprinting evolves in response to experimentally generated intralocus sexual conflict in the piophilid fly *Prochyliza xanthostoma*. Here intralocus sexual conflict will be generated de novo by imposing artificial sexually antagonistic selection on antenna length. Antenna length, used directly in male combat and courtship, is the most strongly dimorphic sexual trait and heritable only through the same-sex parent in offspring of both sexes.

Laliberté, Sarah M., Rundle, H.D.

University of Ottawa

The effects of deleterious mutations on sex-specific viability and female fecundity in *Drosophila melanogaster*

The vast majority of mutations are deleterious, reducing the fitness of individuals in which they are found. The selective removal of these mutations takes time, meaning that a low frequency of deleterious mutations may be segregating at any given locus within a population. The reduction in mean fitness of a population caused by deleterious mutations is termed the mutation load and its precise magnitude depends on sex-specific effects of the individual mutations on various components of fitness. In many species, population mean fitness depends primarily on the survival and fecundity of females. If deleterious mutations tend to have a larger net effect on male than female fitness, mutation load will be reduced through stronger selection on males. As part of a larger project investigating the effects of sex-specific selection on mutation load in *Drosophila melanogaster*, we estimated the effects of 10 visible recessive mutations on the relative viability of males and females, and on female fecundity. Consistent with previous results, we found no evidence of sex-specific viability effects for any of the 10 mutations, suggesting that mutation load is unlikely to be reduced via stronger viability selection in males. In no cases was female fecundity significantly reduced relative to the wild-type population lacking the mutation and for two mutations, female fecundity appeared to be increased. Although weak fecundity selection against a set of dominant visible mutations has previously been found in *D. melanogaster*, there is some indication that population-specific environmental effects may not have been sufficiently controlled in our case.

MacIagan, Laura, Taylor, S.A., Anderson, D.J., Zavalaga, C. Friesen, V.L.

Queen's University

Population genetics of the blue-footed booby, *Sula nebouxii*

Seabird population genetic studies have generally found that tropical species exhibit high levels of population genetic structure, whereas temperate species show low levels of population genetic structure. Blue-footed boobies, *Sula nebouxii*, are tropical seabirds that inhabit the eastern Pacific Ocean from Mexico south to northern Peru. Unlike most tropical seabirds that show high levels of population genetic structure, previous research, using mitochondrial DNA (mtDNA), found that blue-footed boobies exhibit only weak population genetic structure throughout their range ($\Phi_{ST} = 0.05$, $P < 0.0001$ Taylor, unpublished). We analyzed blue-footed booby population genetic structure using 4 neutral microsatellite loci and found weak but significant global population genetic structure, congruent with results from mtDNA ($F_{ST} = 0.041$, $p < 0.001$). Further, when colonies were collapsed into three geographic groups, comparisons showed significant weak to moderate genetic structure. The low levels of population genetic structure exhibited by blue-footed boobies may be attributed to the relatively young age of the species, the absence of physical barriers to gene flow throughout their range, and relatively high levels of migration between colonies.

Menon, Nandini, Mileva, V., Wong, M., Balshine, S.

McMaster University

Modulators of resource contests in a social fish

Although body size differences between contestants are often stated as an important factor influencing aggressive interactions, the dynamics of such interactions remain poorly understood. Here we used cooperatively breeding African cichlid fish (*Neolamprologus pulcher*) that forms size hierarchies to investigate the dynamics of resource contests. We formed sex matched pairs in the laboratory that varied in the degree of size difference between contestants (0-5%, 10-15% and 25-30% difference in standard length). Overt, contact aggression was observed most frequently in group of fish that had small size differences between the contestants (0-5% group). Both intensity and duration of the contest were greatest

for fish in the 0-5% group. Sex did not affect the frequency, intensity or duration of the contest. These observations suggest that size differences between contestants affect key components of contests over resources. Future studies will investigate whether there is a precise size difference threshold at which aggression decreases.

**Mileva, Viktoria R., Fitzpatrick, J.L., Marsh-Rollo, S., Gilmour, K.M., Wood, C.M., Balshine, S.
McMaster University**

The stress of being at the top

In many group-living species, dominant individuals frequently aggress towards subordinates. Socially induced chronic stress can lead to depression of growth, reproduction, and immune function, which in turn can decrease fitness. Normally subordinates have higher levels of cortisol, however in many cooperatively breeding species dominants exhibit the higher levels. In this study, we investigated the relationship between social status and stress in groups of the cooperatively breeding African cichlid, *Neolamprologus pulcher*. We explored the effects of social status on levels of circulating plasma cortisol both at baseline and following an acute stressor. Dominants had higher cortisol concentrations than subordinates. Dominants' cortisol concentrations were not related to social behaviour, but subordinate males who performed more social acts had higher cortisol concentrations relative to those that did not. Interestingly, there was no status dependent differential response to acute stress, suggesting that strong stress responses are adaptive for both social classes. By combining behavioural and physiological data with molecular data in future studies, we hope to further elucidate the stress responses of this unusual group-living species.

Morbey, Yolanda E., Marklevitz, S.A.C., Quach, K.

University of Western Ontario

Naturalized populations of Chinook salmon in Lake Huron

Decades of overfishing, sea lamprey predation, and habitat degradation lead to the extirpation of most populations of lake trout in the Great Lakes by the 1940s and 1950s. Without top predators, the invasion and subsequent expansion of non-native alewife put further strain on the ecosystem. In an effort to control alewife and at the same time provide recreational angling opportunities, large-scale stocking of hatchery-reared Chinook salmon began in the Great Lakes in the late 1960s. These Chinook salmon originated from Green River, Washington and have subsequently established wild populations in Lakes Michigan, Huron, and Ontario. In particular, Lake Huron appears to be the most favourable environment for supporting wild Chinook salmon. Here we review the status of wild populations of Chinook salmon in Lake Huron, and discuss how this system can be used to study rapid evolution.

Mosher, Heather H., Mallet, M.A., Chippindale, A.K.

Queen's University

When the whole is not the sum of its parts: Testing for evidence of synergistic epistasis in *Drosophila melanogaster*

The question of why sexual reproduction is so prevalent despite the two-fold cost of sex remains one of the most puzzling quandaries in evolutionary biology. Determining how deleterious mutations interact to reduce fitness is important both for population studies and to potentially help explain sexual reproduction. In this study, we used *Drosophila melanogaster* to test for evidence of synergistic epistasis, the phenomenon in which deleterious mutations interact so that the negative impact of a large number of mutations is much greater than would be predicted if mutations acted independently. When synergistic epistasis occurs, recombination acts to increase variance in fitness, thereby making selection more efficient at eliminating deleterious mutations. We crossed lines of *Drosophila* and compared the mean log fitness of the recombinant offspring to that of their parents. Fitness measurements in this experiment were not consistent with previously measured values, and though the data show some suggestion of

epistasis, there is no indication that either synergistic or antagonistic epistasis is generally prevalent. These results, taken together, indicate that by designing this experiment to control for dominance interactions, we may have inadvertently introduced widespread epistasis in trans between the controlled sets of chromosomes in experimental flies. We conclude that synergistic epistasis is not widespread and is therefore unlikely to explain the prevalence of sexual reproduction. Further study is needed to determine the nature and extent of these genetic interactions.

Nabeta, Kyra K., Graham, L.A., Davies, P.L.

Queen's University

Evolution of the antifreeze protein gene family in Pleuronectidae

Antifreeze proteins (AFPs) protect marine teleosts from freezing in icy seawater by binding to nascent ice crystals and preventing their growth. Flatfish of the Pleuronectidae family possess type I AFPs, which are alanine-rich, amphipathic, alpha-helical proteins that occur as three different isoforms. The liver isoform is expressed in the liver and is secreted into circulation, the hyperactive isoform is larger, more active and also thought to be expressed in the liver, and the skin isoform is expressed primarily in peripheral tissues. Preliminary evidence indicates that each isoform is encoded by multiple genes, but specific details regarding the organization of each gene family remain unknown. In this study, genomic cloning of DNA from the starry flounder (*Platichthys stellatus*) revealed close linkage of genes for different isoforms. This was confirmed by genomic Southern blotting, where hybridization patterns indicated that the majority of genes were present in tandem repeats. The sequence diversity of all three isoforms was sampled by PCR in genomic DNA from starry flounder, American plaice (*Hippoglossoides platessoides*) and yellowtail flounder (*Limanda ferruginea*), and all coding sequences derived for the skin and liver isoforms were consistent with the proposed structure-function relationships for this AFP. The greater sequence diversity in the skin and hyperactive isoforms compared to the liver isoform suggests that the latter evolved recently from one of the other two. Currently, the diversity of type I AFPs in related right-eyed flounders is being sampled using genomic PCR primers to test this hypothesis.

Patterson, Samantha A., Morris-Pocock, J.A., Friesen, V.L.

Queen's University

A multi-locus phylogeny of an avian family: species trees from multiple gene trees

The use of multiple nuclear genes for phylogenetic inference offers many advantages over traditional methods utilizing a single mitochondrial gene. Traditionally concatenation has been used to combine multi-gene data into a single species tree. However, all genes do not necessarily share the same evolutionary history, and concatenated trees do not always reflect this incongruence between gene trees. These problems can be remedied through the use of the Bayesian hierarchical model known as a Bayesian Estimation of Species Trees (BEST). This method estimates the species tree directly from multiple gene trees, while allowing for independent evolution of each of the genes. Here we use both concatenation and BEST to construct a multi-locus phylogeny in the Sulidae. Our aim was to not only compare these two methods, but also to resolve some of the controversy surrounding the relationships within the family, particularly among the gannets. We found concatenation and BEST performed similarly, potentially because the gene trees themselves showed little topological conflict. Although we were able to resolve the relationships among the gannets, nodal support was low, indicating population genetic approaches may be more appropriate with these recently diverged species.

Straka, Jason, Paul, J., Freeland, J.

Trent University

What puts the 'might' in *Phragmites*?

Range-expansions are of major concern due to changes that increased human activities have wrought on the biosphere. Long-distance transportation networks have facilitated dispersal of some invasive species,

and climate change is altering historical limits of species' ranges, forcing sessile organisms such as plants to move and/or adapt. *Phragmites australis* (Poaceae) has recently undergone a rapid range-expansion throughout North America, but the details of its genetic diversity, mating systems, and methods of dispersal are not well-understood. Invasive *Phragmites* was collected from 20 sites in northeastern North America during the summer of 2008. 189 shoots were genotyped at eight nuclear microsatellite loci in order to identify clones through matching genotypes. Most stands of *Phragmites* had high clonal diversity, with the highest diversity being found in disturbed sites. 145 unique genotypes were used to compare patterns of heterozygosity, inbreeding, and differentiation within and between stands. Most measures of diversity indicated a mixed mating system. Stands of *Phragmites* also showed high genetic differentiation, but no isolation-by-distance. This was interpreted as evidence for local outcrossing followed by local seed recruitment, and punctuated by rare long-distance dispersal events: a strategy that allows *Phragmites* to reap the benefits of multiple methods of reproduction. Further work might focus on comparison of these results to systems found in invasive *Phragmites*' source populations in Eurasia.

Szepanacz, Jacqueline, Rundle, H.D.

University of Ottawa

The effects of deleterious mutations on sperm competitive ability in *Drosophila melanogaster*

The vast majority of mutations are deleterious, reducing the fitness of individuals in which they are found. The selective removal of these mutations takes time, meaning that a low frequency of deleterious mutations may be segregating at any given locus within a population. The reduction in mean fitness of a population caused by deleterious mutations is termed the mutation load and its precise magnitude depends on sex-specific effects of the individual mutations on various components of fitness. In many species, population mean fitness depends primarily on the survival and fecundity of females. If deleterious mutations tend to have a larger net effect on male than female fitness, mutation load will be reduced through stronger selection on males. As part of a larger project investigating the effects of sex-specific selection on mutation load in *Drosophila melanogaster*, we estimated the effects of 5 visible recessive mutations on the postcopulatory sexual fitness of males using sperm competition assays. Sperm offense was lower on average in mutant than stock males for four of the five mutations, although this difference was not significant overall ($P = 0.169$). There was no evidence that these mutations reduced sperm defense ($P = 0.99$) but samples sizes for this assay were limited. Our results suggest that a decrease in sperm competitive ability may help reduce the mutation load, although additional data are needed.

Thorpe, Joelle B., Wynne-Edwards, K.E.

Queen's University

Naturally paternal male dwarf hamsters do not respond to progesterone receptor antagonism as predicted by experiments in PRKO mice

Male dwarf hamsters (*Phodopus campbelli*) are alloparental as juveniles and highly paternal as fathers, but go through a period during naïve adulthood of enhanced infant-directed aggression. The hormonal basis for this transition is unknown, although recent experiments have suggested that neither estrogen nor prolactin is required for the activation of paternal responsiveness. Male PRKO mice and wildtype mice with antagonized progesterone receptors (PR) have enhanced paternal behaviour and reduced infant-directed aggression, suggesting an inhibitory role for progesterone in paternal behaviour. Progesterone is present in adult male *P. campbelli* serum at concentrations around 0.75 ng/ml. This study was performed to determine if PR antagonism results in enhanced paternal behaviour and reduced infant-directed aggression. Naïve adult and juvenile *P. campbelli* males were tested because previous studies suggest that hormones administered in the juvenile period might affect the later expression of paternal behaviour. Treatment with RU486 effectively blocked early pregnancy in *P. campbelli* females, and did not alter testosterone or progesterone concentration in males. However, treatment with RU486 during adulthood or during puberty neither increased paternal behaviour nor decreased infant-directed aggression. Thus,

naturally paternal male dwarf hamsters do not respond to progesterone receptor antagonism as predicted by experiments in PR knockout mice.

Zamin, Tara, Grogan, P.

Queen's University

Caribou- vegetation interactions in a changing climate

Arctic ecosystems are highly vulnerable to climate change. Experimental climate change simulation indicates that tundra vegetation composition may dramatically change, leading to positive feedbacks on warming. These experiments, however, consider climate change impacts on vegetation in complete isolation from other trophic levels. Herbivory is known to be an important determinant of vegetation community structure and function, and yet surprisingly has been excluded from studies on projected tundra vegetation change. Under present conditions, herbivory decelerates nutrient cycling in the tundra by reducing net primary productivity and promoting a vegetation community that has a more recalcitrant litter pool. However, increased soil nutrient levels, as are anticipated with climate warming, have the potential to change the direction of this feedback by altering the competitive advantage of browsed plants as well as their investment in secondary metabolites. This work will explore how changes in climate may alter the interactive relationships between caribou herbivory and vegetation composition, thereby contributing to a more thorough understanding of Arctic ecological change.



OEEC 2009 – Sustainability Initiatives

Whenever we could, the Local Organizing Committee of the 2009 Ontario Ecology and Ethology Colloquium made green choices for the conference this year. From environmentally friendly USB keys to biodegradable name badges and native wildflower seeds, we put extra effort into creating a green conference.

Below is some extra information on a number of the green initiatives, including information on how to get your wildflower seeds to sprout!

We hope you enjoy the conference and the green products we were able to provide.

Local Organizing Committee
OEEC 2009

Wood USB keys - earthimprints.com

Reusable and useful, USB keys make a great conference gift. Made from sustainably harvested maple, these keys are also free of lead soldering.

BIOTECH name badge holders – produced by KLEERTECH these are both recyclable and biodegradable

“**KLEERTECH**, makers of **BIOTECH™ Badge System**, received a 2008 Innovation Award from Trade Show Executive, for offering the ultimate in disappearing name badge holders for the green-minded trade show organizers.”

Native Wildflower Seeds

The seed packages provided in your registration package contain seeds collected from the native wildflower gardens maintained by the Kingston Chapter of the Society for Conservation Biology. These gardens, located along Arch Street outside of the Biosciences Complex, have been in place for 5 years and contain species native to the province of Ontario. Whenever possible, the plants in these gardens come from local native plant nurseries and are part of the genetic stock of Eastern Ontario.

Before they'll germinate the majority of our native wildflowers must undergo cold stratification (they need to suffer through a Canadian winter!). You can mimic this event by planting the seeds in moist earth and refrigerating them for 6-8 weeks. Alternatively you can plant these seeds in your garden this fall and watch them sprout in 2010.

We encourage you to visit the website of the Kingston SCB for more information about native wildflowers, the benefits of having them in your gardens, and the species you received.

<http://biology.queensu.ca/~scb/>



OEEC 2009 - Notes



OEEC 2009 - Notes



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- put in slide of RHP and resource value



OEEC 2009 - Local Organizing Committee

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Thank you all for attending OEEC 2009 at Queen's University.
We hope you enjoyed the conference!

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