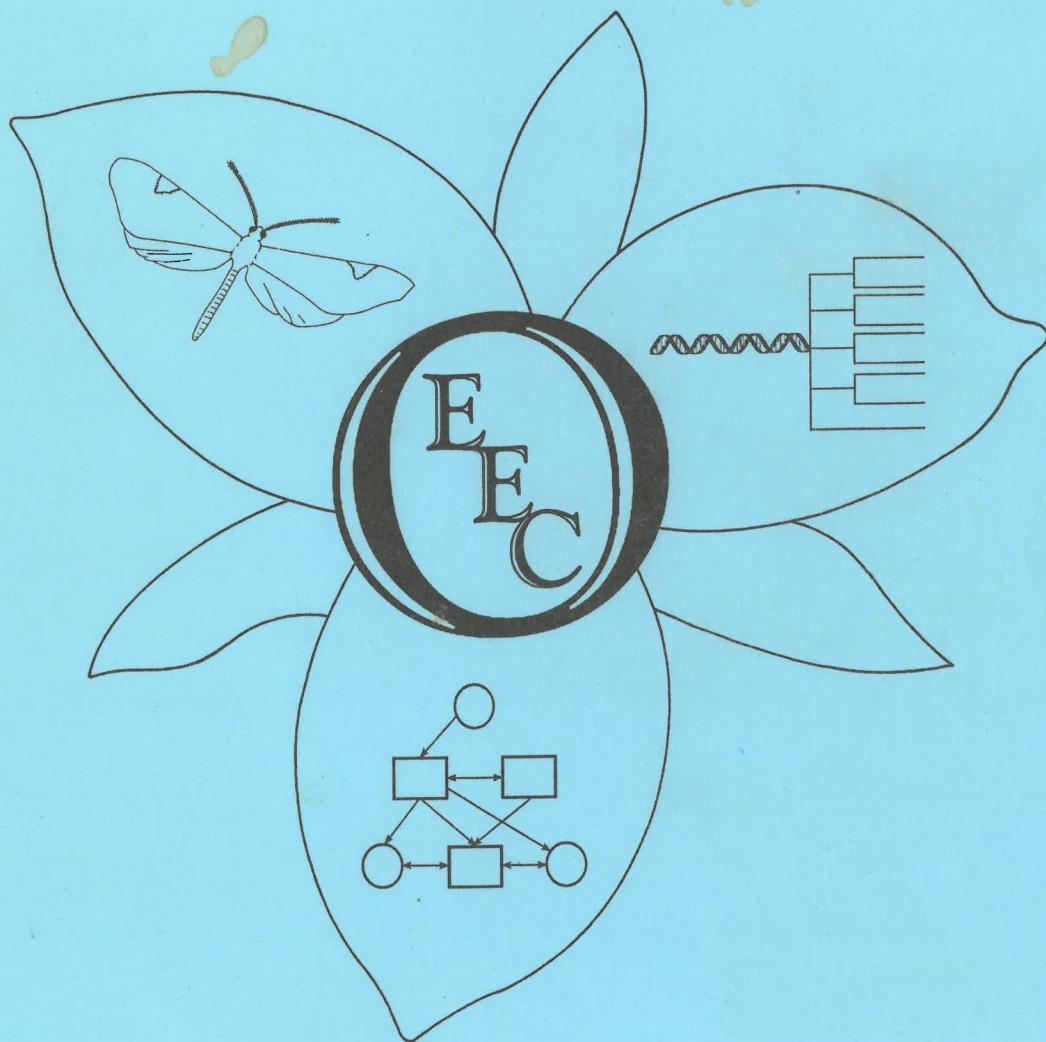


ONTARIO ECOLOGY & ETHOLOGY COLLOQUIUM 2005



Carleton
UNIVERSITY
Canada's Capital University

MAY 7-9
OTTAWA, ONTARIO

Kevin Judge

Errata for Program/Schedule

Unfortunately, there are few small errors that made it into the printed program. Here they are, with our apologies :(

Schedule – Oral Presentations:

Session 2: J.T. Kerr and M. Ellis. The title of this talk is:

Rapid and convergent responses of butterfly species richness to broad-scale global changes over 120 years.

Session 4: L. Massengale and B.P. Smith. Intrasexual competition for mates: is there active interference among male *Arrenurus manubriator* mites?

-Will not be given. It will be a poster instead.

Session 6: T.A. Timbers & J.E. Yack. Vibration as a means of creating “personal space” in the hook-tip moth caterpillar (Lepidoptera: Drepanidae)

-Will not be given. It will be a poster instead.

Schedule – Posters:

There are two extra posters:

L. Massengale and B.P. Smith. Intrasexual competition for mates: is there active interference among male *Arrenurus manubriator* mites?

T.A. Timbers & J.E. Yack. Vibration as a means of creating “personal space” in the hook-tip moth caterpillar (Lepidoptera: Drepanidae)

Presentation Abstracts:

-Two abstracts should be under ‘Poster Presentation Abstracts’ rather than ‘Oral Presentation Abstracts’:

L. Massengale and B.P. Smith. Intrasexual competition for mates: is there active interference among male *Arrenurus manubriator* mites?

T.A. Timbers & J.E. Yack. Vibration as a means of creating “personal space” in the hook-tip moth caterpillar (Lepidoptera: Drepanidae)

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GENERAL INFORMATION

Registration:

The registration table will be set up during the following times to give out conference packages, download oral presentations, and answer any questions you may have.

Saturday, May 7	4:00pm – 10:00pm	Nesbitt building foyer
Sunday, May 8	7:30am – 6:00pm	Tory building foyer
Monday, May 9	7:30am – 2:00pm	Tory building foyer

Please see the map on the back cover to locate the Nesbitt and Tory buildings. The Registration fee includes admission to all presentation sessions (oral and posters), a conference package, coffee breaks, and lunch on Sunday and Monday. In an effort to reduce waste, we are requesting that you please bring your own coffee mugs, pens and notebooks.

Oral Presenters:

Each oral presentation is 20 minutes in length (15 min. for the talk plus 5 min. for questions). Computer presentations must be in PowerPoint (.ppt, .pps) or Adobe Acrobat Reader (.pdf) format to run on Windows, since these are the only formats that will run on the equipment in the presentation rooms. Latest versions of the software will be installed and should be compatible with all previous versions of PowerPoint and PDF files.

We encourage you to bring your PowerPoint presentation in both .ppt and .pps formats. The .pps format is a PowerPoint Show that encapsulates all aspects of your presentation, including fonts that might not be available on the conference computers. You can generate a .pps version of your presentation by using **Save As...** and selecting **PowerPoint Show** as the format.

Please bring your presentation on a CD or a flash drive (USB memory key), and give it to us at the registration table. If you are presenting in the mornings, please get your presentation to us the afternoon/evening before. If you are presenting in the afternoons, please get your presentation to us by 9am of the day you are presenting.

Slide and overhead projectors are available, but you must let us know in advance that you'll need this equipment. We will NOT have one dedicated to each room and need time to get them where they are needed.

Poster Presenters:

A poster board measuring 4 feet by 5 feet will be provided to each presenter. You have the entire poster board to use as you wish! Please remember to bring pins/etc to attach your poster. Internet/power outlets will NOT be provided. Please contact us well in advance if you think you'll need these and we'll see what we can do. The poster session will be on Sunday from 4:30pm to 5:30pm in the foyer of the Tory building. Setup for the poster session will be during the coffee breaks, 10:00am to 10:30am and 3:00pm to 3:30pm on the same day.

Parking:

Parking on the Carleton campus is free on weekends. A parking pass for Monday is available from the registration desk for \$8.00. All parking meters on campus charge \$1.20 per half hour. The pay & display lots charge the same rate to a daily maximum of \$10.00, with the exception of P6, which has a daily maximum of \$8.00.

Meals and Banquet:

Coffee and snacks will be available during the coffee breaks in the Tory building lobby. Lunch on Sunday and Monday will be served from 12:00pm to 1:00pm in the Residence Commons (see the map on the back cover). The banquet will be occurring Sunday at 6:30pm at the RA Centre (see the second map on the back cover). For those who would like to attend the banquet but haven't yet purchased a banquet ticket, extras will be available at the registration desk for \$29.99. Please make be sure to inform your server at the banquet if you have any allergies or special dietary requirements.

Housing Accommodations:

Those who opted for on-campus accommodation will be staying at Stormont/Dundas House (see the map on the back cover). Keys will be available for pick-up at the registration desk Saturday afternoon/evening as well as on Sunday for those staying only the one night. Check in time at the residence is 3:00pm and check out time is 11:00am. No-shows will be charged the full rate of the first night's accommodation. Carleton alumni are eligible for a housing discount if they present their alumni card upon check-in at the housing desk in Residence Commons.

The accommodation fee includes all applicable taxes for the room plus a full hot and cold breakfast buffet with unlimited servings. Bed linen is provided and fresh towels are provided daily. Luggage can be stored at the Tour and Conference Centre in Residence Commons for early arrivals or late departures. Internet access is available in the rooms (dial-up service) and is also available at the internet café or computer lounge for a rate of \$2/day. Delegates will require a log-in name and password, which will be provided (upon payment) by the housing desk in Residence Commons.

Phone numbers

Emergency Police/Fire/Ambulance	911
Carleton University Emergency Services	4444 (on campus)
Carleton University Information Line	(613) 520-7400
Blue Line Taxi	(613) 238-1111
Organizing Committee Emergency Contact (cell)	(613) 255-2260

Dear Colleagues:

I am delighted to welcome you to Carleton University for OEEC 2005! Nine years ago, the OEEC was held jointly between Ottawa University & Carleton University's Departments of Biology. Since that time, both departments have undergone a 'boom and transition' phase & Ecology & Evolution has figured prominently in departmental hires, CFI infrastructure funding, provincial infrastructure funding, & research funding from NSERC & elsewhere. Our Department is co-member with University of Ottawa's Department of Biology in the Ottawa-Carleton Joint Institute of Biology (OCIB).

Some of our more recent successes include:

- the relocation of the National Wildlife Research Center (NWRC) to Carleton,
- the formation of a joint graduate program (Chemical and Environmental Toxicology),
- the CFI-funding of a new Geomatics Facility shared between Geography and Biology @ Carleton and NWRC,
- the formation of the Center for Advanced Research in Environmental Genomics (CAREG, University of Ottawa).

In the OCIB, we advertise three major areas of research: Physiology and Biochemistry; Ecology, Behavior, and Systematics; and Cell and Molecular Biology. We have 28 adjunct and regular faculty whose research interests lie within the realms of ecology and/or evolution. Of the ~160 graduate students currently at the OCIB, approximately 1/3rd are addressing basic and applied research questions in Ecology and/or Evolution. The sub-disciplines include Arctic Ecology, Applied Ecology, Behavioral Ecology, Evolutionary Ecology, Ecological Parasitology, Conservation Biology, Invasion Biology, Landscape Ecology, Plant-Animal Interactions, Macroecology & interdisciplinary forays (e.g., Molecular Ecology, Physiological Ecology, Risk Assessment).

Our location in Ottawa makes us well suited for forging collaborations with government and non-governmental organizations. In a 2002 survey, 76 of our graduate students have continued in academia (ca. 50%) or to more specialized degrees (ca. 10%, Teachers College, Veterinarian Degrees). Most others have found employment with government and non-governmental agencies (remaining ~ 40% - Environment Canada, Parks Canada, Canadian Forestry Service, Health Canada, Canadian Museum of Nature, Canadian Parks and Wildlife Society, and Ministry of the Environment, etc.). We are proud of our accomplishments & always planning future research thrusts in E&E in the OCIB.

I hope you enjoy the OEEC. It is my great pleasure to welcome our plenary speakers from near & afar and to thank the team (<http://www.oeec.ca>) who are your hosts.



Mark Forbes, Director - OCIB

THE ORGANIZING COMMITTEE

We are proud to be organizers of this year's Ontario Ecology and Ethology Colloquium. This could not have taken place without the hard work and dedication of our enthusiastic planning members, and the support and patience of our supervisors. We extend our profound thanks to our organizing team for making this such a wonderful experience.

We hope you enjoy this year's colloquium!

Sincerely,

Arash Rashed and Yemisi Dare
Co-chairs OEEC 2005 Organizing Committee.

Budget Administrator	Sandy Dare	Other Members
Logo	Tiffany Timbers	
Committee Organization	Chairs	
	Yemisi Dare	Tiffany Timbers
	Arash Rashed	Atif Kukaswadia
Audio/Visual	Chris Beatty	Martha Mullally
Food/Social	Sarah Brown	Leif Olsen
	Shannon Mahoney	Kathleen Cook
Fundraising/Advertising	Hume Douglas	Arash Rashed
	Chris Beatty	Yemisi Dare
Housing/Parking	Tonia Robb	
	Pamela Rutherford	
Program/schedule	Sara Gagne	Hannah mir-Rashed
	Felix Eigenbrod	Rebecca Tittler
Registration/Logistics	Amanda Dam	Yemisi Dare
	Shannon Mahoney	Arash Rashed
Website	Felix Eigenbrod	Kathryn Norman
		Ann Jose
		Sarah Brown
		David Lowe
		Jerry Lam
		Carissa Brown
		Alex Duong

SPONSORS

We gratefully acknowledge the following organizations and companies for their support. Their donations allowed us to keep costs down and therefore keep registration fees as low as possible.

Sincerely,
OEEC 2005 Organizing Team

SPONSORS WHO PROVIDED FUNDING, SERVICES OR MATERIALS:

College of Natural Sciences
@ CARLETON UNIVERSITY



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Graduate Studies and Research



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SPONSORS WHO PROVIDED PRIZE BOOKS:



Department of Biology

**Naomi Cappuccino•Lenore Fahrig•Mark Forbes•Ashkan Golshani
Stewart Peck•Pamela Rutherford•Thomas Sherratt**

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Biology, Neuroscience, & Psychology



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UNIVERSITY PRESS

SCHEDULE OF EVENTS

Saturday, May 7

<i>19:00 onwards</i>	Registration mixer	Nesbitt foyer
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Sunday, May 8

<i>8:00 onwards</i>	Registration	Tory foyer
<i>8:30 - 9:00</i>	Opening Remarks	Azrieli Theatre
<i>9:00 – 10:00</i>	Plenary 1: Dr. David Wilson “Rethinking the theoretical foundations of sociobiology”	Azrieli Theatre
<i>10:00 – 10:30</i>	Coffee break/ poster set-up	Tory foyer
<i>10:30 – 12:00</i>	Sessions 1-4: <ul style="list-style-type: none"> ❖ Behavioural ecology 1-4 ❖ Conservation biology 28-31 ❖ Evolutionary biology and phylogenetics 41-44 ❖ Behavioural ecology 19-22 	Tory 202 Tory 204 Tory 206 AT 102
<i>12:00 – 13:00</i>	Lunch	Residence cafeteria
<i>13:00 – 14:00</i>	Plenary 2: Dr. Lenore Fahrig “Effects of roads and traffic on wildlife populations”	Azrieli Theatre
<i>14:00 – 15:00</i>	Sessions 5-8: <ul style="list-style-type: none"> ❖ Behavioural ecology 12-14 ❖ Behavioural ecology 65-67 ❖ Evolutionary biology and phylogenetics 45-47 ❖ Molecular biology and genetics 58-59 	Tory 202 Tory 204 Tory 206 AT 102
<i>15:00 – 15:30</i>	Coffee break/poster set-up	Tory foyer
<i>15:30 – 16:30</i>	Sessions 9-12: <ul style="list-style-type: none"> ❖ Behavioural ecology 5-7 ❖ Plant ecology 60-62 ❖ Evolutionary biology and phylogenetics 48-50 ❖ Behavioural ecology 26-27, 73 	Tory 202 Tory 204 Tory 206 AT 102
<i>16:30 – 17:30</i>	Poster session (74-89)	Tory foyer
<i>18:30</i>	Banquet	RA Centre

Monday, May 9

9:00 – 10:00	Plenary 3: Dr. Jayne Yack “Beyond our senses: exploring acoustic communication in butterflies and caterpillars ”	Azrieli Theatre
10:00 – 10:30	Coffee break	Tory foyer
10:30 – 12:00	Sessions 13-16: ❖ Behavioural ecology 8-11 ❖ Conservation biology 32-35 ❖ Environmental science 37-40 ❖ Ecology 68-71	Tory 202 Tory 204 Tory 206 AT 102
12:00 – 13:00	Lunch	Residence cafeteria
13:00 – 14:00	Plenary 4: Dr. Patricia Chow-Fraser “Improving the relevance of ecology in biodiversity conservation: getting science to the people”	Azrieli Theatre
14:00 – 15:00	Sessions 17-19: ❖ Behavioural ecology 23-25 ❖ Evolutionary biology and phylogenetics 51-53 ❖ Plant ecology 63-64 & Evolutionary biology and phylogenetics 54	Tory 202 Tory 204 Tory 206
15:00 – 15:30	Coffee break	Tory foyer
15:30 – 16:30	Sessions 20-22: ❖ Behavioural ecology 18, Conservation biology 36 & Parasitology 72 ❖ Landscape ecology 55-57 ❖ Behavioural ecology 15-17	Tory 202 Tory 204 Tory 206
16:30	Closing Remarks	Azrieli Theatre

SCHEDULE OF PRESENTATION SESSIONS

SUNDAY MORNING ORAL PRESENTATIONS

Session 1 Behavioural ecology Tory 202

* 10:30	1	E. Clare and B. Neff	Alternative reproductive tactics in pumpkinseed sunfish
10:50	2	J. L. Fitzpatrick, J. K. Desjardins, K. A. Stiver, R. Montgomerie, and S. Balshine	Reproductive suppression in the cooperatively breeding fish <i>Neolamprologus pulcher</i>
11:20	3	A. Price and H. Rodd	The effect of social environment on male-male competition in guppies (<i>Poecilia reticulata</i>)
11:40	4	J. Stoltz and B. Neff	Sperm competition and mechanisms of fertilization success in a fish with external fertilization

Session 2 Conservation biology Tory 204

10:30	28	A. C. Algar and J. T. Kerr	Using protected areas to model natural ecosystem function in Canada reveals widespread human-induced deficits
10:50	29	R. Desrochers and J. T. Kerr	Is the ability of Canadian national parks to conserve species richness at risk?
11:20	30	J. T. Kerr and M. Ellis	
11:40	31	P. White and J. T. Kerr	Temperature and human population density as predictors of butterfly species richness in Canada analyzed across spatial and temporal scales

Session 3 Evolutionary biology & phylogenetics Tory 206

10:30	41	W. W. Cole, B. Anderson, and S. C. H. Barrett	Mating and genetic consequences of polymorphism in floral-tube length in <i>Lapeirousia anceps</i> (Iridaceae)
10:50	42	J. Friedman and S. C. H. Barrett	Is wind pollination an inefficient process?
11:20	43	K. Hodgins and S. Barrett	The evolution of mating type frequencies in a tristylous plant
11:40	44	R. W. Ness and S. C. H. Barrett	Consequences of self-fertilization for molecular evolution in <i>Eichhornia paniculata</i>

Session 4 Behavioural ecology AT 102

10:30	19	A. Thibaudeau, M. Wu, and L.-A. Giraldeau	Alternative foraging modes: an exploration of individual flexibility and tactic use in the nutmeg mannikin (<i>Lonchura punctulata</i>)
* 10:50	20	M. J. Fitzpatrick, E. Feder, L. Rowe, and M. B. Sokolowski	Frequency-dependent selection and the evolution of foraging strategies
* 11:20	21	R. Montgomerie and S. Doucet	Sexual selection on thievery in satin bowerbirds
11:40	22	L. Massengale and B. P. Smith	Intrasexual competition for mates: is there active interference among male <i>Arrenurus manubriator</i> mites?

SUNDAY AFTERNOON ORAL PRESENTATIONS

Session 5 Behavioural ecology Tory 202

14:00	12	K. Abbott	The evolutionary effect of predators in pollination systems
14:20	13	J. Kimball and B. P. Smith	Bright coloration in mites - a warning to newts?
14:40	14	A. Rashed and T. N. Sherratt	Evolution of mimicry in hoverflies (Diptera: Syrphidae)

Session 6 Behavioural ecology Tory 204

14:00	65	T. A. Timbers and J. E. Yack	Vibration as a means of creating "personal space" in the hook-tip moth caterpillar (Lepidoptera:Drepanidae)
14:20	66	F. Montealegre-Z., G. K. Morris, and A. C. Mason	Wing deformation powers ultrasonics in a rainforest katydid: a comparative analysis
14:40	67	N. Elfeki, G. K. Morris, and F. Montealegre-Z.	Comparative Study of sound generation in the Genus <i>Cyphoderris</i>

Session 7 Evolutionary biology & phylogenetics Tory 206

14:00	45	R. D. H. Barrett and G. Bell	Experimental evolution of <i>Pseudomonas</i> in complex environments of substitutable resources
14:20	46	T. A. Clark and J. B. Anderson	Ploidy determines evolvability in filamentous basidiomycetes
14:40	47	G. G. Perron, G. Bell, and S. Quessy	Population Structure of <i>Salmonella Typhimurium</i> DT104

Session 8 Molecular biology & genetics AT 102

14:00	58	C. Reaume and C. Wilson	Population Genetic Structure of Southern Ontario Brook Trout (<i>Salvelinus fontinalis</i>)
14:20	59	C. J. Weadick, D. Kolovos, S. Lazic, H. Rodd, and B. S. W. Chang	Characterization of guppy LWS opsins: multiple opsins found in a single individual
14:40	71	T. Replansky and G. Bell	Ecology of <i>Saccharomyces cerevisiae</i>

Session 9 Behavioural ecology Tory 202

15:30	5	J. K. Desjardins, M. R. Hazelden, G. Van Der Kraak, and S. Balshine	Females but not males provide support for the 'Challenge Hypothesis': Steroid hormones and territoriality in a cooperatively breeding fish
15:50	6	M. Pink, T. C. Pratt, and M. G. Fox	Changes in cyprinid habitat use and school size in response to the introduction of brook trout (<i>Salvelinus fontinalis</i>) in two oligotrophic lakes in northern Ontario
16:10	7	A. D. M. Wilson and R. L. McLaughlin	Perceptual worlds of individual young of the year brook charr: a behavioural and neurological perspective

Session 10 Plant ecology Tory 204

15:30	60	J. M. Biernaskie and E. Elle	A disciplined view of sexual selection in flowering plants
15:50	61	C. Brown and C. Boutin	The effects of historical land use on vegetation in woodlots of eastern Ontario, Canada
16:10	62	E. A. Nelson and R. F. Sage	The Costs of Commitment: Functional Convergence in CAM plants

Session 11 Evolutionary biology & phylogenetics Tory 206

15:30	48	M. J. Lajeunesse,	Constraints on correlated evolution of specialization and body size in avian brood parasites
15:50	49	J. L. Montague and C. G. Eckert	Rapid evolutionary change in flowering phenology, reproductive output and size in invasive <i>Lythrum salicaria</i>
16:10	50	S. Stefanovic and R. G. Olmstead	Phylogenetic position and plastid genome evolution of the plant parasitic genus <i>Cuscuta</i> (Convolvulaceae)

Session 12 Behavioural ecology AT 102

15:30	26	E. Cameron and T. Day	Sperm competition and the evolution of ejaculates
15:50	27	J. C. Perry and B. D. Roitberg	Competition escalates cannibalism among siblings
16:10	73	A. A. Volk and V. L. Quinsey	Influence of age on child facial cues

MONDAY MORNING ORAL PRESENTATIONS**Session 13 Behavioural ecology** Tory 202

10:30	8	C. D. Beatty and T. N. Sherratt	Conspicuous colouration in males of the damselfly <i>Nehalennia irene</i> (Zygoptera: Coenagrionidae): do males signal their unprofitability to other males?
10:50	9	K. A. Judge and V. Bonanno	Butting heads: sexual dimorphism in head size in field crickets and its influence on male-male competition
11:20	10	C. D. Kelly	Fighting for resources: the assessment of asymmetries during male-male contests in the sexually dimorphic Wellington tree weta
11:40	11	D. Lowe	The cost of sexual dimorphism: are colourful male damselflies more likely to be a dragonfly's lunch?

Session 14 Conservation biology**Tory 204**

10:30	32	J. Hamilton and C. Eckert	Conservation implications of geographic disjunction in a widespread prairie species isolated on Great Lakes alvars
10:50	33	L. A. Smith, D. M. Burke, and E. Nol	The Impacts of silvicultural practices on the Rose-breasted Grosbeak (<i>Pheucticus ludovicianus</i>) in the woodlots of southern Ontario, Canada
11:20	34	N. Taraban-Lagois, M. Gunderman, and P. Chow-Fraser	Baseline flying insect survey for Ruthven National Historic Park
11:40	35	R. Tittler, L. Fahrig, and M.-A. Villard	Large-scale links between songbird populations: A study of dispersal and source-sink dynamics

Session 15 Environmental science**Tory 206**

10:30	37	N. Grochowina, R. D. Evans, and B. Hickie	Examining the role of diet and its relationship to mercury contamination in <i>Lutra canadensis</i> , River Otter Central Ontario
10:50	38	E. O'Connor and P. Dillon	Mercury mass balances and accumulation in fish for remote lakes of the Muskoka River Watershed
11:20	39	K. Stammiller, R. McLaughlin, and N. Mandrak	Do agricultural drains provide fish habitat?
11:40	40	V. Tkatcheva, N. M. Franklin, G. McClelland, R. Smith, I. J. Holopainen, and C. M. Wood	Lithium Chloride subacute toxicity to Rainbow trout gills

Session 16 Ecology**AT 102**

10:30	68	H. Diéval, J.-F. Giroux, and J.-P. L. Savard	Habitat selection during brood-rearing: the adventure of Common Eider
10:50	69	M. Doiron and J.-F. Giroux	How habitat selection influences growth of Giant Canada Goose goslings in a suburban environment
11:20	70	E. Koen	Survival and Home Range Characteristics of Fishers in Eastern Ontario

MONDAY AFTERNOON ORAL PRESENTATIONS**Session 17 Behavioural ecology****Tory 202**

14:00	23	A. Edwards and G. Blouin-Demers	Using <i>Chrysmeis picta</i> as test of the Cost Benefit Model of Thermoregulation
14:20	24	J. Row and G. Blouin-Demers	Thermal quality influences investment in thermoregulation, habitat use, and behaviour in milksnakes
14:40	25	P. A. Smith, H. G. Gilchrist, and J. N. M. Smith	Factors affecting nest site selection and reproductive success of tundra nesting shorebirds

Session 18 Evolutionary biology & phylogenetics Tory 204

- | | | |
|-------|---|---|
| 14:00 | 51 R. I. Colautti and S. C. H. Barrett | Evolution and quantitative variation in purple loosestrife (<i>Lythrum salicaria</i>) along a latitudinal gradient in North America |
| 14:20 | 52 A. I. Schulte-Hostedde | Climatic determinants of sexual size dimorphism in the chipmunks (<i>Tamias</i> spp.) |
| 14:40 | 53 S. Yakimowski and C. Eckert | Life on the edge - relating demography, population structure, and genetic structure in a broad geographic context |

Session 19 Plant ecology, Evolutionary biology & phylogenetics Tory 206

- | | | |
|-------|----------------------------------|--|
| 14:00 | 63 N. Cappuccino | Herbivory, secondary chemistry and invasiveness of exotic plants in North America |
| 14:20 | 64 P. M. Kotanen | An American in Paris: Ragweed (<i>Ambrosia artemisiifolia</i>) escapes its enemies in France |
| 14:40 | 54 H. Douglas and S. Peck | The phylogeny and sister group relationships of the click beetle subfamily Cardiophorinae (Coleoptera: Elateridae) |

Session 20 Behavioural ecology, conservation biology, and parasitology Tory 202

- | | | |
|-------|---|--|
| 15:30 | 18 E. Vander Wal and A. R. Rodgers | Do the drivers of disproportionate space use result in core areas occurring at a unique spatial scale for moose? |
| 15:50 | 36 C. Halpenny and M. Gross | Epidemiological issues in a conservation hatchery: British Columbia's living gene bank |
| 16:10 | 72 O. Dare, P. Rutherford, and M. Forbes | Rearing density of <i>Rana pipiens</i> influences cercarial establishment in metamorphs |

Session 21 Landscape ecology Tory 204

- | | | |
|-------|--|---|
| 15:30 | 55 A. Dam and L. Fahrig | Landscape and its affect on eastern Ontario anurans: A tale of two landscape structures and multiple scales |
| 15:50 | 56 F. Eigenbrod, S. Hecnar, and L. Fahrig | Effect of the configuration of habitat relative to roads on anuran species richness |
| 16:10 | 57 S. A. Gagné and L. Fahrig | The relative effects of forested, agricultural and urban landscapes on amphibian communities in eastern Ontario |

Session 22 Behavioural ecology Tory 206

- | | | |
|-------|--|---|
| 15:30 | 15 A. Clark | Cues of receptivity influence judgements of attractiveness |
| 15:50 | 16 T. Kiyonari and P. Barclay | Selective incentives for cooperation: second-order punishment vs. second-order reward |
| 16:10 | 17 D. B. Krupp, L. M. DeBruine and P. Barclay | A cue of kinship affects human cooperation |

POSTER PRESENTATIONS: SUNDAY AFTERNOON

16:30 - 17:30

Tory foyer

74	S. Prager, A. Rutgers-Kelley, and M. Richards	Unusual phenology in a solitary bee species
75	D. Ladd and N. Cappuccino	A field study of seed dispersal and seedling performance in the invasive exotic vine <i>Vincetoxicum rossicum</i>
76	E. Vander Wal and A. R. Rodgers	Designating seasonality: a rate of movement model
77	J. Allison, N. Cappuccino, and P. Mason	Oviposition and feeding preference of the leek moth on native eastern Ontario plants
78	J. Andrews and A. Simons	Live long or prosper? The evolutionary tradeoff between longevity and reproduction in three plant species
79	S. B. Hill, A. U. Mallik, and H. Y. H. Chen	Response of understory plant communities to gap disturbance in trembling aspen forests
80	K. Peiman and B. Robinson	Competition and the evolution of heterospecific aggressive behaviour in brook stickleback
81	M. den Hollander	Genital allometry in two species of bruchid beetle (Coleoptera: Bruchidae)
82	D. Skandalis, S. Prager, and G. Tattersall	Wintering strategies of the large carpenter bee, <i>Xylocopa virginica</i>
83	A. J. Zeller	Using landscape indices to model environmental gradients within the Mixedwood Boreal Forests of northwestern Ontario, Canada
84	A. L. White and C. Boutin	Photosynthesis and plant performance are affected by sub-lethal herbicide exposure
85	K. Bowers and C. Boutin	Floristic quality in riparian habitats within an agricultural landscape
86	E. M. Brown, J. Fitzpatrick, R. Smith, C. Wood, and S. Balshine	Effects of status change on behaviour and physiology in cichlid fish
87	E. Feder, M. J. Fitzpatrick, M. B. Sokolowski, and L. Rowe	Investigating the maintenance of the rover-sitter polymorphism in <i>Drosophila melanogaster</i>
88	A. Feswick and J. Kerr	Will rare species stop cropping up? Patterns and mechanisms of species decline in agricultural landscapes
89	I. Wagner and A. Simons	A comparison of life-history characters of arctic and alpine populations of the annual <i>Koenigia islandica</i>

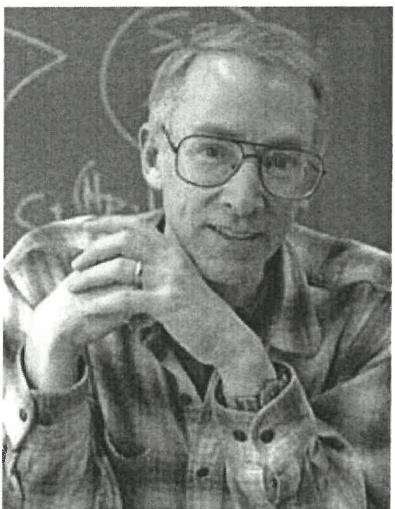
- Root's idea about measuring specialization could provide index of synchrony of rep.
- defn of group \rightarrow groups are porous

1. selfish beats altruistic within group,
2. altruistic beats selfish between groups

PLENARY SPEAKERS

(Listed in order of presentation)

- how do you measure the relative strength of selection at ind. vs groups?



- despite
psychopath
do good egg
layers leave
more eggs

DR. DAVID WILSON

Binghamton University

- TREE
article
on

Rethinking the theoretical foundations of sociobiology

It is now forty years since group selection became a central issue in evolutionary thought, first with V. C. Wynne-Edwards' ambitious claims and then with G. C. Williams' seemingly decisive rejection that set the tone for the rest of the 20th century. As with the rest of evolutionary biology, enormous strides have been made in the study of group selection during the last 40 years, but sociological progress has not kept pace with scientific progress. Group selection is still often represented in textbooks and other secondary sources as a theory that failed long ago and does not need revisiting, creating a lingering atmosphere of heresy that is inappropriate against the background of current knowledge. I will provide a contemporary overview, starting with what appeared to be at stake in the 1960s and ending with how

multilevel selection has become an empirically validated theory with an extraordinary range of applications in biology and the human sciences.

- genes of major effect have strong between-ind. interactions (allow them to be focus of group selection?)



DR. LENORE FAHRIG

Carleton University

Effects of roads and traffic on wildlife populations

Wildlife biologists have been noting and tabulating road-killed animals for more than a century. However, the impact of this mortality and other effects of roads on wildlife populations have been very rarely studied. In addition to direct mortality, roads and traffic may result in loss and degradation of habitat, and fragmentation and isolation of wildlife populations from each other and from important resources such as water bodies. The impacts on a particular population will depend on the location, size, and traffic volume of the road(s), and on the behavioural responses of the animals to roads and traffic. I summarize road-effects research conducted in my lab over the past several years.

Using a combination of modelling and field work, we ask: do roads and traffic significantly affect wildlife populations, and what types of species in what situations are most vulnerable to the effects of roads and traffic?

- effect of traffic variability ie rush hour?
- variance in velocity?

mortality, habitat loss, resource use, habitat fragmentation



DR. JAYNE YACK

Carleton University

Beyond our senses: exploring acoustic communication in butterflies and caterpillars

The broad goal of our research is to explain how animals use their sensory systems to detect and process information from their natural environments to promote adaptive behaviours. Specifically, we focus on the neural mechanisms underlying acoustic communication in insects. Acoustic signals, defined broadly as mechanical vibrations transmitted by air, water, or solid substrates, are widely used by insects for purposes of mating, predator and prey detection, and social interactions. Insects have developed an amazing diversity of specialized sensory organs for detecting a wide range of sound and vibration frequencies and intensities. Research on insect auditory systems contributes to our knowledge of animal behaviour, the organization and evolution of neural networks, and the principles of mechanosensory transduction. Practical applications for research on insect acoustics include pest management and innovative designs for miniature microphones and robots. This talk focuses on two groups of insects previously thought to lack an acoustic sense: butterflies and caterpillars. We use multiple lines of evidence (acoustical, behavioural, electrophysiological, and anatomical) to explain how both adults and larvae use air- and solid-borne vibrations to promote their survival.

Butterflies (Papilioidea, Hesperoidea, Hedyloidea), are known to possess keen visual and chemical senses, but until recently, a functional sense of hearing had not been demonstrated in these insects. I will present experimental evidence for hearing in two species representing diverse taxa: (1) *Macrosoma heliconiaria* (Hedyloidea), possesses ultrasound sensitive ears on their wings that function as bat detectors, and (2) *Hamadryas feronia* (Papilioidea) uses the Vogel's Organ, also located on the wing, to communicate with conspecifics. I will also discuss our recent findings on the taxonomic distribution of hearing organs in butterflies, which has led to important insights into the prevalence and evolutionary origins of acoustic behaviour in this important group of insects.

Caterpillars are key constituents of most terrestrial ecosystems and include some of the most serious pests of crops and forests. Many species live gregariously at some stage of their development, and interactions between individuals for purposes of aggregation, competition, and foraging are crucial for their survival. However, the sensory modalities used for communication in general remain largely unexplored. Recent studies from my laboratory have revealed that air- and solid-borne vibrational communication may be widely used by caterpillars, but has not been investigated rigorously. I will provide experimental evidence for larval acoustic communication in different Lepidoptera taxa. Late instar larvae of the hook-tip moth, *Drepana arcuata* (Drepanoidea), defend solitary leaf shelters from intruding conspecifics using ritualized acoustic displays. Interestingly, the early instars, which are gregarious, also signal acoustically, but for different reasons, possibly related to recruitment and spaced out gregariousness. Finally, I will discuss the role of acoustic communication in different taxa, for purposes of defense against predators. Our results on larval acoustic communication have broad implications for studying caterpillar 'social' behaviour and defense.



DR. PATRICIA CHOW-FRASER

McMaster University

Improving the relevance of ecology in biodiversity conservation: getting science to the people

Current efforts to conserve biodiversity include restoration of degraded systems as well as acquisition and/or protection of pristine systems. Both of these strategies require the guiding principles of ecology. But because conservation is a young science, decisions tend to be made without the benefit of complete knowledge of the situation or ramifications of management actions. Our survey of practitioners shows that a systematic review of scientific literature is generally considered less important than other factors in achieving success, even though incorporation of adaptive management is highly valued, and regular access to publications is essential for its implementation.

In this presentation, I will discuss how my experience in the restoration of a degraded urban marsh (Cootes Paradise in Hamilton, Ontario) first made me aware of the need for public education and involvement, activities that are crucial for successful restoration of ecosystems, but which are not generally considered appropriate for academics. The lack of scientifically defensible approaches to track and evaluate the effectiveness of the Cootes restoration led me to devote the past 7 years of my research program to the development of ecological indicators, another difficult-to-fund research activity. Current efforts to conserve biodiversity requires a better linkage among academics, citizens and environmental agencies, and a paradigm shift in how relevant research should be funded, carried out and published.

ORAL PRESENTATION ABSTRACTS

(Abstracts are listed alphabetically by first author)

The evolutionary effect of predators in pollination systems

K. Abbott

McMaster University

Session 5

Much work has been done on the co-evolution of plants and their pollinators. Similarly, much work has been done on the co-evolution of predators and their prey. Relatively little, however, has been done to combine these two fields of research. In other words, little is known about how pollinator-plant interactions affect predator-prey interactions or vice versa. Data is presented that suggests that predators may directly and indirectly affect the fitness of plants through their effect on the population density and behaviour of the pollinators. This idea is developed into a game theoretic model of plant evolution that incorporates an indirect effect of predators. The model considers two plant strategies that compete for pollinators by producing (costly) nectar at different rates. Pollinators are assumed to distribute themselves between the two plant strategies with respect to the relative frequency of the two plant strategies, the nectar production rate of the two plant strategies, and the way in which predators distribute themselves between the two plant strategies. The fitness of the plants of each strategy should therefore depend on the relative frequency of the two plant strategies and the way in which pollinators distribute themselves between the plants of these two strategies. I will discuss predictions of this three-player evolutionary game among plants, pollinators and predators.

Using protected areas to model natural ecosystem function in Canada reveals widespread human-induced deficits

A. C. Algar and J. T. Kerr

University of Ottawa

Session 2

Humans are altering ecosystems across Canada and worldwide. While patterns of human impact on ecosystems, such as deforestation, are often obvious, anthropogenic effects on ecosystem function are much more cryptic. Identification of these effects has important implications for conservation. Remotely sensed measures, such as the Normalized Difference Vegetation Index (NDVI), can be used to evaluate current levels ecosystem function at broad-scales. Unfortunately, data documenting historical levels of ecosystem function are non-existent, making detection of ecosystem function deficit difficult. We used protected areas nation-wide as ecological baselines to model natural levels of ecosystem function in Canada. Using land within protected areas, a multiple regression model utilizing temperature, precipitation and elevation data was created to predict NDVI. Predicted NDVI was then compared to the mean growing season NDVI across Canada for the years 1993-2000 to identify areas of altered ecosystem function. Patterns of ecosystem function loss in Canada were consistent with patterns of anthropogenic land use, suggesting that human activities are having a detrimental effect on essential ecosystem processes.

Experimental evolution of *Pseudomonas* in complex environments of substitutable resources

R. D. H. Barrett and G. Bell

McGill University

Session 7

In complex environments that contain several substitutable resources, lineages may become specialized to consume only one or a few of them. Previous studies examining the evolution of specialization in complex environments, however, have either been confounded by spatial heterogeneity, or were conducted in chemically undefined

environments. Here we investigate the importance of environmental complexity in determining the evolution of niche width over ~900 generations in a chemically defined experimental system. We propagated 120 replicate lines of the bacterium *Pseudomonas fluorescens* in environments of different complexity by varying the number of carbon substrates in each environment. We then assayed the growth of the evolved lines and their ancestor on each of these substrates individually. Genotypes from populations selected in complex environments evolved greater mean and variance in fitness than those from populations selected in simple environments. Thus, lineages were able to adapt to several substrates simultaneously, without any appreciable loss of function with respect to other substrates present in the media. There was greater genetic and genotype-by-environment interaction variance for fitness within populations selected in complex environments. It is likely that genetic variance in populations grown on complex media was maintained because the identity of the fittest genotype varied among carbon substrates. Our results suggest that evolution in complex environments will result neither in narrow specialists nor in complete generalists but instead in overlapping imperfect generalists, each of which has become adapted to a certain range of substrates but not to all.

Conspicuous colouration in males of the damselfly *Nehalennia irene* (Zygoptera: Coenagrionidae): do males signal their unprofitability to other males?

C. D. Beatty and T. N. Sherratt

Carleton University

Session 13

Damselflies in the family Coenagrionidae (Insecta: Odonata) are characteristically sexually dimorphic, with conspicuously coloured males and predominantly drab females. This sexual dimorphism is commonly explained as a consequence of selection on traits that increase male attractiveness to females. However, males of coenagrionid damselflies are nonterritorial and do not engage in displays, with male competition for mates resembling a "scramble". One alternative explanation for the sexual differences in colouration within these species has been suggested: that sexual dimorphism has evolved in this group primarily as a form of sex-related warning colouration. Here we test this suggestion by comparing the survivorship of males of the species *Nehalennia irene* that have been painted in such a way as to make them look similar to an unaltered male (painted blue), simply different from the male (painted orange) or more like the gynomorphic female (painted black). Preliminary results indicate that in cage experiments with painted males and females that blue-painted males have significantly lower harassment by other males than black-painted males, and that under some conditions blue-painted males have higher survivorship than black-painted males. These results suggest that males are differentially harassed based on their colouration and that this harassment could equate to differential survivorship.

A disciplined view of sexual selection in flowering plants

J. M. Biernaskie and E. Elle

University of Toronto

Session 10

What is a secondary sexual character in animal-pollinated plants? We suggest that secondary sexual characters function in a competitive game to attract pollinator visits, meaning that the optimal investment to such characters depends on what other plants are doing. We use a mathematical model to find the evolutionarily stable investment strategy. The result is fundamentally similar to what one would expect of "extravagant" signaling traits in animals. Our disciplined approach to sexual selection in plants requires a careful investigation of the frequency-dependent nature of pollinator attraction.

The effects of historical land use on vegetation in woodlots of eastern Ontario, Canada

C. Brown¹ and C. Boutin²

Carleton University¹, National Wildlife Research Centre²

Session 10

Eastern Ontario, once dominated by mixed deciduous forest cover and a variety of wetlands, has become a fragmented agricultural landscape. The remaining forest cover has primarily taken the form of small, privately owned woodlots. Vegetation in these woodlots has been influenced by many factors, e.g., edge effects, isolation, connectivity and size. One not well-understood factor is the influence of past land use on current biodiversity patterns. The objective of this study was to investigate the effect of land use history on current vegetation biodiversity, and to understand how that knowledge can aid conservation efforts in eastern Ontario. Woodlots (n=30) in the Ottawa region were selected for study based on several parameters including size, adjacency to intense agriculture, accessibility, and soil type. The current vascular plant abundance was surveyed using transects throughout the sites. Past land use was determined by examining historical aerial photographs, field observations, and interviewing landowners. Additionally, trees were cored to age the stand and to investigate the sequence of tree establishment on the site. Preliminary results, using a Detrended Correspondence Analysis (DCA), indicated that woodlots separate based on a disturbance gradient and a moisture gradient. Analysis of covariance (ANCOVA) was used to investigate the relationship between land use history and species richness while controlling for the effect of area. While disturbance history has an effect on species distribution in the DCA, no significant relationship has been found, thus far, between historical land use and overall species richness. However, a relationship between the number of introduced species and past land use was uncovered.

Sperm competition and the evolution of ejaculates

Erin

E. Cameron and T. Day

McGill University

Session 12

- is the value of second mating dependent on mating status of females

- how much variance is there in investment?

Male ejaculates are complex structures that contain both sperm and seminal products. These seminal products are known to mediate a number of different reproductive responses, but they have been almost exclusively ignored in previous models of sperm competition. We take a more holistic approach here by presenting a model of sperm competition that incorporates both sperm and non-sperm parts of the ejaculate. We explore how seminal products influence the evolution of reproductive strategies in each of the two sexes and investigate how these strategies affect the outcome of sperm competition. Our results indicate that the ejaculate allocation patterns predicted by previous models may vary depending on which part of the ejaculate affects reproductive processes. Our results also show that coevolution between male ejaculates and females could be responsible for the patterns of high sperm precedence observed in some groups (i.e. *Drosophila*). Thus, in general, we suggest that substances in the ejaculate other than sperm may have important effects on the outcome of post-copulatory interactions, including the resolution of sperm competition.

- damping

Herbivory, secondary chemistry and invasiveness of exotic plants in North America

N. Cappuccino

Carleton University

Session 19

Of the thousands of plant species introduced to North America, only a small proportion have become invasive pests of natural areas. The remaining naturalized species have little impact, and become minor members of their new communities. For the past two years, students in my lab have been involved in comparative studies of invasive exotics, non-invasive exotics and native plants. We found that highly invasive plants suffered significantly less herbivory than non-invasive exotics. We then hypothesized that highly invasive plants possess defensive chemical compounds that are unique or under-represented in the native North American flora. A survey of the Napralert phytochemical database

supported this hypothesis; the dominant secondary compounds of highly invasive exotic plants have been recorded from significantly fewer native species, representing fewer genera and families, than the dominant compounds of non-invasive exotics. Some of these chemical constituents also have allelopathic, antibacterial and antifungal activities, conferring multiple advantages on the exotic plants that possess them. Phytochemical uniqueness could be used to predict which new exotics might become major natural-area pests, thus allowing pro-active control strategies to be initiated before emerging invaders have spread far from their points of entry.

Alternative reproductive tactics in pumpkinseed sunfish

Elizabeth

E. Clare and B. Neff

University of Western Ontario

Session 1

Diversity within the sexes often takes the form of alternative reproductive tactics and fish provide some of the best systems to study such tactics. In this study, we provide a novel description of pumpkin seed sunfish (*Lepomis gibbosus*) males that use alternative reproductive tactics in Lake Opinicon, Ontario. Some males called "parentals" construct nests, court females and provide sole care for the young. Other males called "cuckolders" invest proportionately more into gonads than parentals and use either a sneaking tactic to dart into a nest or a female mimic tactic to gain access to the nest during spawning. Behavioural and genetic data reveal that there is seasonal variation in cuckoldry rates, with rates being highest during the middle of the breeding season. Overall, cuckolders fertilized an average of 39% of the eggs and because they represent 33% of males, cuckolders may have similar fitness to that of parentals. Based on back-calculation of growth rates, evidence does not indicate that alternative reproductive tactics are due to differences in life history. Within the sunfish family (Centrachidae), parental and cuckolder life histories have been described in the bluegill.

Cues of receptivity influence judgements of attractiveness

A. Clark

McMaster University

Session 22

Receptivity cues may influence men's judgements of female attractiveness because they indicate a high probable rate of return for mating effort but women may pay attention to cues of receptivity because they prefer men who display non-threatening behaviour. If this is so, men may be more sensitive to the direction of these cues than women because cues directed at other men do not predict what will be directed toward them. To test these predictions I made use of video stimuli composed of mock interviews with actors. Each actor did one proceptive and one unreceptive interview. Each interview was presented as being directed toward participants or toward an opposite sex interviewer. Proceptivity enhanced the attractiveness of the actors in the eyes of both male and female participants, but an interaction between the state and direction of receptivity was only found when male participants rated female actors. However, the patterns of interaction varied between actors when analyzed separately; it appears to be mediated by physical attractiveness for the female actors but this relationship is less clear for the male actors. Overall, the results support the idea that both men and women monitor cues of receptivity, but in different ways and for different reasons.

Ploidy determines evolvability in filamentous basidiomycetes

T. A. Clark and J. B. Anderson

University of Toronto

Session 7

The relative advantages and disadvantages of haploidy and diploidy have long been of central interest in evolutionary biology. In fungi, the dikaryon represents a novel alternative to diploidy in that both gametic genomes are present, but are maintained in two separate haploid nuclei in each cell. The objective of our research was to evaluate the adaptive

and evolutionary implications of dikaryosis, relative to those of haploidy and diploidy. Laboratory populations of *Schizophyllum commune* have been maintained over long-term evolution (24 months or ~17,500 generations) to determine (a) if haploid monokaryotic and dikaryotic mycelia adapt to novel environments under natural selection, (b) if the haploid components of the dikaryon adapt reciprocally to one another's presence over time, and (c) if genetic exchange occurs between the two nuclei of a dikaryon. The fitness of the experimental lines was also evaluated in 20 different environments to determine the extent of changes in phenotypic plasticity over time. The results strongly suggest that the dikaryotic phase of the lifecycle has the greater potential for expressing phenotypic change than the haploid stage. Additional experiments have been conducted to compare the adaptive potential of the dikaryon with the isogenic diploid. The dikaryons and diploids differ with respect to their patterns of gene by environment interaction. They had an equivalent response in 24 treatments (48%), the dikaryons grew better in 15 treatments (30%) and the diploids grew better in 11 treatments (22%). The results clearly show that dikaryons and diploids have differences in the expression of their phenotype associated with the spatial distribution of equivalent genomes within a cell.

Evolution and quantitative variation in purple loosestrife (*Lythrum salicaria*) along a latitudinal gradient in North America

R. I. Colautti and S. C. H. Barrett

University of Toronto

Session 18

Evolution may play an important role in the establishment, spread and impact of biological invaders. Moreover, biological invasions represent 'natural' experiments and therefore may afford insight into evolutionary processes occurring over ecological timescales. Purple loosestrife (*Lythrum salicaria*) is an invasive wetland plant that has rapidly increased its range in North America. Its current distribution (In eastern North America) extends from Maryland, USA to Timmons, Ontario; representing a range of about 10 degrees latitude. This corresponds to a gradient in abiotic factors, such as length of growing season and day-length variation, which should impose strong selection on life-history characteristics. Using a common greenhouse environment, we grew eight individual loosestrife plants from each of 17 families from each of 20 populations (2,720 plants total) to look for evidence of genetic differentiation in life-history traits along this latitudinal gradient. Populations differed both in the mean days to first flower (mean: 77.7 days; range: 63.6-97.9 days) and in broad-sense heritabilities of this trait (mean: 0.596; range: 0.08-1.10). A regression of mean days to first flower against latitude of origin revealed a significant, negative relationship ($P < 0.0001$, R^2 0.57), supporting a scenario of local adaptation to a gradient in climatic conditions. Heritability estimates did not correlate significantly with latitude ($P = 0.37$), as would be expected if northern (i.e., peripheral) populations were more recently founded or experienced stronger selection than southern populations. Nevertheless, our results support a scenario of rapid evolution along a latitudinal gradient for purple loosestrife.

Mating and genetic consequences of polymorphism in floral-tube length in *Lapeirousia anceps* (Iridaceae)

W. W. Cole, B. Anderson, and S. C. H. Barrett

University of Toronto

Session 3

The ecological and evolutionary mechanisms responsible for the maintenance of polymorphism represent an important question in evolutionary biology. *Lapeirousia anceps* (Iridaceae) is a South African plant that is endemic to the Cape region of South Africa. The white to pink flowers of this species have a narrow elongate floral tube and are pollinated by exceptionally long-tongued flies (*Moegistorhynchus longirostris*, Diptera: Nemestrinidae). Geographic variation in floral-tube length is a characteristic feature of populations. Here we examine an unusual population of *L. anceps* near Mamre, Cape Province that exhibits extreme variation in floral-tube length and investigate the mating biology and patterns of phenotypic and genetic differentiation of floral morphs. Floral-tube length was strongly bimodal with individual plants easily classified into long or short floral-tube morphs (long tubes mean=49.53mm se=5.04; short tubes mean=27.08 mm se=1.92). Analysis of genetic markers (allozymes and ISSR), indicate that the two morphs were genetically differentiated from one another and estimates of mating within the population indicate little gene flow between the morphs. We propose that the bimodal distribution in floral-tube length has most likely resulted from

secondary contact between populations that have diverged in allopatry rather than divergent selection in situ by different pollinator guilds.

Landscape and its affect on eastern Ontario anurans: A tale of two landscape structures and multiple scales

A. Dam and L. Fahrig

Carleton University

Session 21

Many species of anurans (frogs and toads) are experiencing declines in abundance. Research suggests that landscape alteration, particularly the loss of forest and the insertion of roads in landscapes, are important factors contributing to these declines. Our objective was to determine whether landscape structure (forest amount and paved road density) affects eastern Ontario anurans at different spatial scales. This question was addressed by measuring population abundance of seven anuran species endemic to eastern Ontario at 34 ponds surrounded by landscapes of varying forest cover and road density. The amount of forest and density of paved roads within different distances of the ponds - 150 m, and 250 m to 2000 m at 250m intervals - were estimated from digitized 1: 50,000 National Topographic Data Base (NTDB) maps and the National Road Network, Canada, Level 1 maps, respectively. The questions that will be addressed are 1) Are the abundances of different species of anurans in eastern Ontario affected by landscape structure at different scales?, 2) Does the scale at which each species responds to landscape structure reflect its dispersal distance?, 3) Does each species respond at different scales to different landscape structures (forest cover and paved road length)?, and 4) Is the scale of response to percent forest cover or cumulative paved road length a better indicator of species dispersal distance? Knowledge of how and at what distance landscape structures affect wildlife populations should help determine appropriate management policies to ensure preservation.

Rearing density of *Rana pipiens* influences cercarial establishment in metamorphs

O. Dare, P. Rutherford, and M. Forbes

Carleton University

Session 20

Current theory postulates that high resource acquisition confers strong immune response to parasitic infection. Crowding creates a limited resource environment that should result in increased susceptibility to infection. Digenetic trematodes are common indirectly-transmitted parasites of amphibians. Trematode infection is often host-stage specific and appears timed to metamorphosis in some amphibian hosts. However, timing of metamorphosis can be altered by density or crowding in tadpoles. We investigated the degree to which rearing densities of *Rana pipiens* larvae influenced timing of metamorphosis and establishment of trematode cercariae in metamorphs. As expected, metamorphosis of larval hosts reared in experimental mesocosms was delayed and mass was reduced under moderate to high rearing densities. Cercarial establishment was also higher in those metamorphs reared under higher density treatments. However, more tadpoles failed to metamorphose in the moderate to high rearing treatments by the time cercariae were no longer available from natural collections of first intermediate *Physa* snail hosts. Thus, larval amphibians under moderate to high densities in nature may benefit from delaying metamorphosis thereby reducing exposure to cercariae, but suffer from increased susceptibility to trematode establishment.

— could snail host or parasite in snail respond in a correlated way to whatever is driving frog density?

Females but not males provide support for the 'Challenge Hypothesis': Steroid hormones and territoriality in a cooperatively breeding fish

J. K. Desjardins, M. R. Hazelden, G. Van Der Kraak, and S. Balshine

McMaster University

Session 9

The idea that territorial aggression is regulated by androgens and that aggression itself can modulate androgen levels is well established in males. In many species, females also display aggressive behaviour, yet little work has been conducted on the effects of female aggression on hormone levels. In this study, we compared the effects of a simulated territory intrusion (STI, a method for testing "the challenge hypothesis") on males and females of the fish, *Neolamprologus pulcher*. This cichlid fish from Lake Tanganyika is a particularly useful species to examine sex differences in the behavioural mediation of hormones as breeding pairs remain in a territory year round and both sexes defend this territory against conspecific and heterospecific intruders. In our study, both sexes aggressively defended their territory against a simulated territory intruder. Both males and females displayed elevated levels of 11-ketotestosterone but only females exhibited increases in testosterone. Neither aggressive male nor female fish showed changes in estradiol levels compared to control (non-aggressing) fish. Residents were more aggressive than the intruders and won most of the interactions. However, residents (or winners) did not show higher hormone levels than intruders (or losers). We suggest that aggression commonly modulates androgen levels in both male and female teleost fish.

Is the ability of Canadian national parks to conserve species richness at risk?

R. Desrochers and J. Kerr

University of Ottawa

Session 2

National parks have been criticized for failing to conserve viable wildlife populations or including Canada's endangered species even as well as randomly chosen areas. The question remains, however, are national parks able to conserve species that are found within and around them by providing effective habitat protection? The number of forest species that can be supported within a park is related not only to the forested area within a park but also within its surrounding area. The presence of "buffers" of forested area increase parks' effective size and thereby their ability to conserve more species. A reduction in forested area around a park would isolate the park's forests and reduce its ability to conserve species even if forest habitat is maintained within the park boundaries. A measure of this, the Species Richness Capacity (SRC), has been derived from the species-area relationship. We used four land cover maps at 1-km resolution, spanning from 1985 to 2000, to measure change in forested area within buffer areas around 23 of the 42 national parks and used these values to calculate the SRC for the parks. Statistical analysis of the results revealed no significant change, increasing or decreasing, in the area occupied by forests within these buffer areas over this fifteen-year period. We also found no significant change in each park's SRC, indicating that these parks have not seen a reduction in their ability to conserve species and forests within the parks are not becoming isolated due to human activities. The establishment of national parks seems to lead to effective habitat protection within greater parks' ecosystems.

Habitat selection during brood-rearing: the adventure of Common Eider

H. Diéval, J.-F. Giroux, and J.-P. L. Savard

Université du Québec à Montréal

Session 16

Common Eiders (*Somateria mollissima dresseri*) nest in colonies on islands of the St. Lawrence estuary in Quebec. After hatching, females must reach adequate habitats for rearing their ducklings. Adult birds also undertake a moult in late summer but their distribution is not well known. The aim of our study was to determine the biotic and abiotic factors that influence the distribution of these birds during the brood-rearing and moulting periods. The number of

Common Eiders was recorded by age, sex and status bi-weekly in 2003 and 2004 at 68 sites located along a 200-km stretch of the south shore of the St. Lawrence River. In 2004, we recorded the behaviour of individuals and noted their locations on the water. We developed a human disturbance index and estimated food abundance. Common Eiders did not distribute randomly and used the same sites in both years. Females without ducklings and males were found further east along the estuary while broods preferred the westerly areas near the nesting islands. The densities of females without ducklings increased significantly during the summer as they move eastward. Broods spent more than half of the day time feeding while this proportion decreased through time from nearly 40% to 10% for adults without ducklings. Broods used mainly the intertidal zone whereas adults without ducklings were distributed further off-shore. Food abundance was the best variable to describe the distribution of Common Eiders along the shore while human disturbance had little effect, which was contrary to our expectations. In conclusion, very few of the sites identified are included within conservation areas along the St.Lawrence river and measures should be taken to insure their protection.

How habitat selection influences growth of Giant Canada Goose goslings in a suburban environment

M. Doiron and J.-F. Giroux

Université du Québec à Montréal

Session 16

Giant Canada Geese (*Branta canadensis maxima*) began to breed in southern Quebec in 1992. This population is increasing rapidly and could eventually become overabundant, bringing about problems for humans. The main objectives of this study were to determine the effect of habitat, hatch date and year on gosling growth and to evaluate the potential of brood-rearing habitat as a limiting factor for the growth of this population. During the summer 2004, we monitored adult females equipped with radio-transmitters or conventional alpha-numeric collars to determine habitat used by broods. In 2003 and 2004, we marked goslings at hatch and recaptured them a few weeks before fledging so they could be measured and weighted. Our observations showed that broods used both anthropogenic habitats (i.e. lawns, agricultural fields) and natural habitats (i.e. islands, marshes). Once a brood-rearing site was chosen, there was little movement among sites or habitat types. Goslings reared mainly on lawns had higher structural size and body mass than goslings reared predominantly in natural habitats. There were no annual (2003 vs. 2004) or seasonal (early- vs. late-hatched) variations in body mass or structural size of goslings, and male goslings were larger and heavier than female goslings in both years. These results suggest that geese benefit from the presence of anthropogenic habitats such as fertilized lawns which are abundant in suburban areas, though we lack data on food quality and availability to confirm this hypothesis. Shortages of suitable brood-rearing habitat will probably not limit the growth of this newly-established population in the near future.

The phylogeny and sister group relationships of the click beetle subfamily Cardiophorinae (Coleoptera: Elateridae)

H. Douglas and S. Peck

Carleton University

Session 19

The click beetles are an ecologically and economically important group of beetles and the 9th largest beetle family worldwide. Containing over 11000 described species, Elateridae is the largest beetle family for which no robustly supported phylogenetic hypotheses have been proposed. Preliminary results indicate extensive paraphyly and polyphyly within the current subfamily level classification of the family. The same problems are found within the genus level classification of subfamily Cardiophorinae. Several changes are suggested to the current classification. Phylogenetic reconstruction of ancestral character states indicates that the common ancestor of Cardiophorinae inhabited inorganic riparian deposits.

Using *Chrysemys picta* as test of the Cost Benefit Model of Thermoregulation

A. Edwards and G. Blouin-Demers

University of Ottawa

Session 17

Body temperature affects nearly all processes of ectotherms. Reptiles cannot generate sufficient heat to internally regulate their own body temperature, so it is regulated Behaviourally. The extent to which reptiles regulate body temperature, however, varies greatly, and to this point it has been predicted using the Huey and Slatkin Cost-Benefit Model. The model advances the hypothesis that individuals will thermoregulate more precisely in environments of high thermal quality. In order to test this model over 36000 temperature measurements were taken of 18 midland painted turtles (*Chrysemys picta*) throughout their active season in the northern portion of their range. Operative temperatures (T_e) were derived from physical models and preferred temperature (T_{set}) was determined in a thermal gradient. These temperature measurements were used to calculate thermal indices (Ex and $de-db$) to quantify the extent of thermoregulation. The results show that effort to regulate body temperature increases when the difference between the environmental temperatures and the preferred temperature of the turtle increases. Thermoregulatory effort is higher in times when T_{set} cannot be achieved than when T_{set} is available ($t=8.53$, $p=0.00$). Lastly, in the spring *C. picta* spends a higher percentage of time thermoregulating when T_{set} is available than in the summer when the thermal quality is higher. These results are contrary to the cost-benefit model currently used.

Effect of the configuration of habitat relative to roads on anuran species richness

F. Eigenbrod, S. Hecnar, and L. Fahrig

Carleton University

Session 21

All anurans require secondary upland habitat (to varying degrees), and the amount of forest and wetland (natural habitat) in the landscape is a major predictor of amphibian species richness. However, secondary habitat may be of little use to anurans if they are unable to access it due to a barrier such as a road. We predicted that the amount of natural habitat that is accessible from a breeding pond without crossing a paved road (accessible habitat amount) will be a better predictor of anuran species richness than the total amount of natural habitat in the landscape. We tested this hypothesis by looking at a subset a 180 pond dataset of species richness data collected 1992-94 by Steve Hecnar. We found significant effects of accessible habitat amount after controlling for total habitat amount at 5 spatial scales: 600m, 1250m, 1500m, 1750m and 2000m, despite over 90% correlation between total and accessible habitat amount. These findings have important conservation implications as they mean that it is important to consider how much habitat in the landscape can be accessed without crossing roads in addition to considering the total amount of habitat in the landscape.

Comparative Study of sound generation in the Genus *Cyphoderris*

N. Elfeki

N. Elfeki, G. K. Morris, and F. Montealegre-Z

University of Toronto

Session 6

Males in the suborder Ensifera (Orthoptera) stridulate with their forewings, using membranous wing-cell regions excited by a scraper and file. *Cyphoderris* is a genus of relict orthopterans (Haglidae). As with crickets, the calling song generated by haglid males is a high-Q, musical sound; but the songs of *Cyphoderris* occur at much higher frequencies (12-15 kHz) than crickets. Like crickets, haglids have bilaterally symmetrical forewings; but *Cyphoderris* can stridulate using either wing overlap, left over right or right over left. Two species of *Cyphoderris* were studied, *C. monstrosa* and *C. buckelli*; the former produces sounds at a lower frequency than the latter. The cause of this frequency difference was investigated using morphometric measurements and digital sound analysis. We determined the variation in frequency during a pulse. Inter-tooth distances, tooth density and mass were measured for both wings. There are differences in the stridulum of these species, but these differences do not conform to the expected model for frequency

- potentially use cycle by cycle analysis to look at fm in pennsylvanicus

differences. Mechanical differences between grylloid and haglid stridulation may give clues to an understanding of the independent evolution of the stridulatory apparatus in these two taxa.

Reproductive suppression in the cooperatively breeding fish *Neolamprologus pulcher*

J. L. Fitzpatrick, J. K. Desjardins, K. A. Stiver, R. Montgomerie, and S. Balshine

McMaster University

Session 1

In most cooperative breeders, dominants suppress the reproduction of subordinates. However, two previous studies of *Neolamprologus pulcher*, a cooperatively breeding cichlid fish, have suggested that socially subordinate helper males sneak fertilizations from dominant breeding males. If such sneaking does occur, both theoretical work and empirical studies of other fish species suggest that sperm competition will select for increased reproductive investment by sneaker males. To address these issues we quantified gonadal investment and sperm characteristics of 41 *N. pulcher* male breeders and 62 male helpers from 55 groups. Gonadal investment followed patterns consistent with reproductive suppression, with breeders having considerably larger testes masses than helpers. Breeders also had faster and longer swimming sperm, and a higher percent of motile sperm compared to helpers. However, sperm characteristics of large helpers were similar to those of breeders, but these same helpers had lower testes masses. Thus, large helpers had sperm that was physiologically equivalent to that of breeders, but their relatively small gonads imply that they were reproductively suppressed.

Frequency-dependent selection and the evolution of foraging strategies.

M. J. Fitzpatrick, E. Feder, L. Rowe, and M. B. Sokolowski

University of Toronto

Session 4

Larvae of the fruit fly *Drosophila melanogaster* utilize one of two foraging strategies: roving or sitting. Rovers have longer foraging trails and are more likely to leave a food patch than sitters. Natural allelic variation in the foraging gene underlies much of the variation in foraging behaviour. The rover allele (*forR*) is phenotypically dominant to the sitter allele (*forS*) and they occur at 50:50 genotypic frequencies in nature. Previous research has shown that the *for* locus responds to density-dependent selection whereby high densities select for rovers and low densities select for sitters. Here we address the role of frequency-dependent selection on the maintenance of these two alleles in nature. Since rovers are morphologically indistinguishable from sitters, we have generated rovers and sitters that carry a green fluorescent protein (GFP). Under a constant density and in conditions known to impose a stress on survival, we raised rovers and sitters at three frequency ratios: 1) even ratio of rovers to sitters, 2) 3:1 ratio of rovers to sitters, and 3) 1:3 ratio of rovers to sitters. We will discuss the results of our experiments with respect to the evolution and maintenance of this behavioural polymorphism.

Is wind pollination an inefficient process?

J. Friedman and S. C. H. Barrett

University of Toronto

Session 3

Wind pollination is typically viewed as a random and inefficient process, depending upon the uncertainty of atmospheric conditions, and thus requiring large numbers of pollen grains to ensure reproductive success. However, wind pollination is a derived condition in the angiosperms and has arisen independently in several families from animal pollination. The repeated evolution of wind pollination from animal pollination suggests that wind pollination is a more effective means of outcrossing in some situations. We quantified the efficiency of pollination in 20 anemophilous species from 8 families. We measured the amount of pollen produced by anthers and the amount captured by stigmas. To determine if the amount of pollen captured was sufficient for full seed set, we compared seed set under

natural and supplemental pollination. Our results indicate that between 0.01% and 10% of pollen is successfully transported to stigmas. Also, plants in these populations are not consistently pollen limited. We compare our findings to the literature on animal pollinated species and also discuss their implications for the strong association between wind pollination and uniovulate flowers in angiosperms.

The relative effects of forested, agricultural and urban landscapes on amphibian communities in eastern Ontario

S. A. Gagné and L. Fahrig

Carleton University

Session 21

Since the early 1990s, evidence has been accumulating of the impact of landscape composition on amphibian species richness and abundance. The present study seeks to determine the relative effects of forested, agricultural and urban landscapes on anuran species richness and abundance in eastern Ontario. Six evening call surveys were conducted between April and June 2004 to assess anuran species richness and abundance at ponds surrounded by > 50% forest cover (9 ponds), > 70% open cover (10 ponds), and > 50% urban cover (11 ponds) within 1.5 km radius landscapes. Vegetation and water quality surveys were also conducted at each pond in June 2004 to measure local variables likely to affect anuran diversity. Preliminary results indicate that anuran species richness is significantly higher in forested and agricultural ponds than in urban ponds. Pond perimeter has also been identified as a significant positive predictor of anuran species richness. The effects of forested, agricultural and urban landscapes on the abundance of individual amphibian species will also be discussed.

Examining the role of diet and its relationship to mercury contamination in *Lutra canadensis*, River Otter Central Ontario

N. Grochowina, R. D. Evans, and B. Hickie

Trent University

Session 15

Any mammalian consumer of fish can be considered a model for how mercury (Hg) may behave in the human physiological system. Since river otter and wild mink occupy top trophic positions, similar to humans, they are suitable organisms to act as a model for Hg accumulation. Seventy- six river otters were collected by registered trappers from known locations in the Kawartha Lakes and regions north of Parry Sound, Ontario. Using atomic absorption spectrometry, the total Hg (THg) was measured in the fur. Hg in the content and tissue of the stomach and rectum was also measured. Relationships between Hg in fur and gastrointestinal tract tissue and content will be examined taking into consideration trapped location and age of the animal. Fish were also collected from the same locations the otters were trapped and will be tested for total Hg to correlate prey to predator concentrations of total Hg.

Epidemiological issues in a conservation hatchery: British Columbia's living gene bank

C. Halpenny and M. Gross

University of Toronto

Session 20

Survival from the smolt to adult life stage for the Keogh River steelhead trout (*Oncorhynchus mykiss*) of north eastern Vancouver Island has dropped from a historic average of 15% (1976-1989) to below 1%. In an attempt to recover steelhead, the "Steelhead Recovery Plan" was initiated by the BC government in 1998, which combines watershed restoration, reduced fishing pressure and a Living Gene Bank (LGB) program. The LGB program was designed to use hatcheries as a conservation tool to raise smolts to adulthood, spawn them under a genetic protocol, and raise the fry and juveniles for release to migrate with the wild population. Disease has been recognized as an important

factor in the reduction of both culture and wild populations, with the expression and severity of disease relying on the complex interactions of variables associated with host, environment and pathogen. This project aims to begin quantifying these variables and their interactions through: 1) quantitative survey; 2) historical data base review; and 3) empirical literature review. This information will be synthesized and applied to an evaluation framework in order to assess the epidemiological issues associated with this conservation program and to contribute to an understanding of the implications for both LGB and wild populations.

Conservation implications of geographic disjunction in a widespread prairie species isolated on Great Lakes alvars

J. Hamilton and C. Eckert

Queen's University

Session 14

Critically imperiled alvar communities are made up of a unique complex of peripheral or disjunct populations of species at the limits of their geographic ranges. The geographic isolation of these disjunct populations is expected to result in particularly low diversity and high differentiation, although the evolutionary consequences of geographic disjunction of alvar species has not previously been considered. In this study, I used microsatellites to examine the population genetic structure of a species characteristic of alvar habitat, *Geum triflorum* Pursh. (Rosaceae, prairie smoke) which is widespread throughout the mid-western prairies and disjunct within the Great Lakes region, isolated on alvars. As predicted, disjunct 'alvar' populations exhibited lower genetic diversity (H') than populations from the more continuous 'prairie' region. Alvar populations were also more genetically differentiated (F_{ST}) from each other than were prairie populations. Alvar populations contained a subset of alleles found in prairie populations suggesting prairie species may have colonized alvar habitat post-glacially during warmer-dry periods and stochastic loss of allelic variation occurred during founding. Low within-population diversity and high differentiation combined with a pattern of isolation by distance is consistent with expected effects of geographic isolation since founding. Recurrent drift and infrequent gene flow may continue to occur, causing alvar populations to become less diverse and more differentiated in the future, suggesting these disjunct populations may be at risk and thus worthy of particular conservation.

The evolution of mating type frequencies in a tristylous plant

K. Hodgins and S. Barrett

University of Toronto

Session 3

In some sexually polymorphic plant species reproductive morphology plays a critical role in determining mating patterns. If populations vary in floral morphological negative frequency dependant selection should create corresponding changes in mating type frequencies. *Narcissus triandrus*, unlike other tristylous species, possesses both imperfect reciprocity among morphs in sex-organ position and a self-incompatibility system that permits mating within and between morphs. Moreover, population morph ratios exhibit three atypical features. First, the long morph predominates in most populations. Second, the mid is absent from 20% of the populations. Third, the mid frequency declines as the long morph frequency increases. Here we present data examining, floral morphology and female reproductive success to provide insight into the selective mechanisms maintaining these sexual polymorphisms.

Butting heads: sexual dimorphism in head size in field crickets and its influence on male-male competition

K. A. Judge and V. Bonanno
University of Toronto at Mississauga
Session 13

Selection on males in the context of aggressive contests over access to females is thought to have resulted in the evolution of sexual dimorphism in morphology (e.g. orthopteran insects such as New Zealand weta have evolved weapons such as horn and elongate mandibles). Field crickets (Family: Gryllinae) are well-known for aggressive contests between males. Many factors have been shown to influence success in these contests and include body weight, burrow residency, history of prior wins and losses, and mating status. Despite previous interest in male fights, and the knowledge that males grapple with their mandibles and butt heads, no study has examined potential sexual dimorphism in weaponry. Here we report sexual dimorphism in head width independent of body size in two species of field crickets. In male *Gryllus pennsylvanicus* and *G. integer* we used head size as a proxy for mandible length. We predicted that, when matched for body size, fight history, mating status, age and burrow residency, males with proportionately wider heads should win fights more often. We report on tests of this prediction, and the assumption that head size is an accurate predictor of jaw length. We also examine condition-dependence of head size in relation to the evolution of male morphology.

Fighting for resources: the assessment of asymmetries during male-male contests in the sexually dimorphic Wellington tree weta

C. D. Kelly
University of Toronto at Mississauga
Session 13

Females often require resources essential to their survival and/or reproduction and males that control these sites increase their reproductive success. Rival males compete for control of resources in many different ways, for example, via ritualized displays or direct combat using weaponry. Contests for resources can be settled based on asymmetries in fighting ability or resource ownership. Males that accurately assess a rival's fighting ability prior to engaging in potentially costly combat should be favoured by selection. Game theory provides three models to explain how individuals gather information regarding their opponent's fighting ability and how they decide to persist in or flee from a fight. These models are the energetic war of attrition, the sequential assessment model and the cumulative assessment model. Using staged contests in the laboratory, I tested predictions of these models using the Wellington tree weta (*Hemideina crassidens*), a sexually dimorphic insect native to New Zealand. Male *H. crassidens* use their enlarged mandibles as weapons in fights for cavities in trees that are occupied by adult females. My data did not support the energetic war of attrition model and partially supported the sequential assessment model. The strongest support, however, was for the cumulative assessment model of contest settlement: a) contest duration was negatively correlated with weapon-size asymmetry; b) fights are settled based on the sum of the opponent's actions; c) fights occur in a single phase and escalate and d) contests involved physical combat and injury.

Rapid and convergent responses of butterfly species richness to broad-scale global changes over 120 years

J. T. Kerr and M. Ellis
University of Ottawa
Session 2

Global change represents a leading threat to biodiversity. Although several studies demonstrate climate-driven species range shifts across broad regions in Europe, these shifts could also result from land use. In this study, we ask three questions. First, has butterfly species richness in Canada changed significantly in the past 120 years? Second,

do these changes relate to concurrent climatic change, to land use change, or both? We used high resolution data for butterfly species distributions in the 19th and 20th centuries to address these questions relative to two study epochs: 1880-1949 and 1950-2000. We discover a positive, linear relationship between minimum annual temperature differences and species richness differences between study epochs. This link is consistent across Canada, within areas with widespread, intensive human land use, and in areas with no detectable permanent human land use. Butterfly species richness increased significantly slower than expected given climatic warming, or actually declined, in areas with human land use but also increased more rapidly in high elevation areas or areas with increasing land cover heterogeneity. Climate change has already exerted large, coherent effects on nearly 200 butterfly species across Canada. Butterfly species lag behind the climatic signal in areas with extensive human land uses, potentially heralding widespread species declines due to rapid global changes. Retaining areas with high habitat heterogeneity may reduce the likelihood of global change-driven extinctions.

Bright coloration in mites - a warning to newts?

J. Kimball and B. P. Smith

Ithaca College

Session 5

Many species of water mites are bright red or orange; previous research has implied that these are aposematic (warning) colorations, alerting fish that mites are unpalatable. However, brightly colored water mites are most prevalent in ponds and temporary waters that lack fish predation. The red-spotted newt, *Notophthalmus viridescens*, is a keystone predator of microcrustacea in ponds and temporary waters that lack fish predation. Mites are similar to microcrustacea in size and habitat, so in the experiments, red-spotted newts were tested as potential predators of water mites. Water mites and *Daphnia magna* were offered sequentially to newts and the behaviours "mouth and reject", "eaten", and "did not attack" were recorded. In this study, we demonstrated that all water mites tested, regardless of color, were unpalatable to newts. Conspicuous water mites (*Hydrodroma despiciens*, a population of red *Arrenurus manubriator*, *Limnochares americana*, and *Lebertia* sp.) were mouthed and rejected more often than cryptic water mites (black and white *Piona* sp., and a population of blue *Arrenurus manubriator*). Only two mites out of 600 offerings were eaten, while 600 *Daphnia magna* of 600 offerings were ingested. We conclude that bright coloration does not serve as a warning to newts, and probably is either or both a 1. plesiotypic trait, retained in many early-derivative species of water mite, 2. pigment used to block harmful components of sunlight.

Selective incentives for cooperation: second-order punishment vs. second-order reward

T. Kiyonari and P. Barclay

McMaster University

Session 22

Some models describing the evolution of altruism suggest that punishment maintains group cooperation (e.g. provision of public goods), and punishment is itself maintained by second-order punishment (punishing those who do not punish free-riders). While second-order punishment requires some group-level advantages or conformist transmission to maintain its existence, second-order rewarding (rewarding those who reward cooperators) does not. Higher-order rewards are essentially a system of indirect reciprocity, and Panchanathan & Boyd (2004) have shown that rewards can stabilize cooperation in collective action projects. Furthermore, the reciprocation induced by rewards is more favourable to the rewarder than the retaliation provoked by punishment, so we propose that people will be more willing to pay a personal cost to impose second-order rewards than second-order punishment. This prediction was supported by an experiment in which 97 Canadian subjects did a cooperative group task and were given two opportunities to punish or reward other participants. Additional data from Japanese subjects indicate that second-order punishment is rare among either Canadian or Japanese participants.

Survival and Home Range Characteristics of Fishers in Eastern Ontario

E. Koen

University of Ottawa

Session 16

By the 1940s, likely as a result of over-harvesting and habitat destruction, fishers (Mustelidae, *Martes pennanti*) were extirpated in Ontario south of the French and Mattawa Rivers. Recently, however, they have recolonized much of their former range. I examined survival and home range characteristics of a fisher population in this recolonized area. Sixty-one fishers were fitted with radio collars and tracked using ground and aerial telemetry in Grenville County, Ontario from February 2003 until January 2005. I found that survival rates were significantly lower during the fur trapping season. Females were almost twice as likely as males to survive the 2 year study period. Additionally, home ranges were consistently smaller than those reported in the literature. My study provides furbearer managers with region-specific baseline data on fisher demographics on which future management decisions can be based.

An American in Paris: Ragweed (*Ambrosia artemisiifolia*) escapes its enemies in France

P. M. Kotanen

University of Toronto at Mississauga

Session 19

Ragweed (*Ambrosia artemisiifolia*) is a notorious North American weed which is now well-established in Europe, and has occurred in France for at least 140 years. A series of experiments was conducted to investigate whether its success in its new range is associated with a loss of natural enemies (as predicted by the Enemy Release hypothesis), and whether invading populations have reduced levels of defence (as predicted by the Evolution of Increased Competitive Ability hypothesis). Surveys of 29 natural populations in both the native (Ontario, Canada) and invaded (France) range of this species indicated that levels of herbivore damage are much lower in France. Reciprocal transplant experiments conducted on both continents with North American and French genotypes also demonstrated far lower levels of damage in France. This reduced damage occurs despite the fact that *Ambrosia* in its native range is host to a wide range of polyphagous herbivores, not just specialists. Native genotypes were as damaged as invading ones at all experimental sites, and laboratory feeding trials with an oligophagous beetle (*Systema blanda*) indicated no preference for French genotypes. These results indicate that Ragweed has escaped its enemies in Europe, as predicted by the Enemy Release hypothesis, but that there is no evidence of loss of defence against either specialist or generalist herbivores.

A cue of kinship affects human cooperation

D. B. Krupp, L. M. DeBruine and P. Barclay

McMaster University

Session 22

A great deal of human cooperative behaviour takes place within groups of unrelated individuals, a phenomenon that is noticeably rare among other animal species. The form and function of non-nepotistic group cooperation has been the subject of a great deal of recent debate among evolution-minded behavioural scientists. Based on the results of laboratory experiments using economic paradigms, some have argued that human decision-making evinces a history of group-level selection for "strongly" reciprocal behaviour – that is, psychological adaptations designed to promote group success at the expense of the altruist's own fitness. However, previous experiments may not have taken into account the full range of cues that inform cooperative decision-making, such as the presence of others and the characteristics of group members. One possible method to affect decision-making in cooperative tasks is to bias group members towards nepotistic discrimination, even when those group members could not be genetically related. Participants performed a series of anonymous, one-shot economic tasks modelling a "tragedy of the commons". The faces of the ostensible group members (in reality, pre-programmed computer strategies) were either self-resembling digital composites of the participant's own face and a stranger's face, or nonself-resembling composites of two

strangers' faces. Our results support the notion that implicit cues may bias strongly reciprocal behaviour and that, as yet, there is no compelling evidence that the human mind is designed by group-level selection to promote true altruism.

Constraints on correlated evolution of specialization and body size in avian brood parasites

M. J. Lajeunesse

Cornell University

Session 11

Body size of parasites may be an adaptive component of specificity that can constrain ecological opportunity and use of available host species. To test this hypothesis, I correlate body size with the host range of 76 species of avian brood parasite. I find that across the major clades of brood parasitism (cowbirds, honeyguides and African finches, old and new world cuckoos, and parasitic fowl), species with marginal body sizes (i.e. those at extremes of the range in sizes found across species) have narrower host ranges than brood parasites with more intermediate body sizes. This pattern was robust when using only wing length as a surrogate of body size across several species, when using multiple measurements of body size but on fewer species, and after accounting for a hypothesized evolutionary relationship between these brood parasites. I also found that phylogenetic transitions in body size were matched with changes in specialization of brood parasites. These results indicate that body size is a strong evolutionary correlate of specificity in brood parasites, and that selection towards marginal body sizes (either larger or smaller sizes) can be matched with a joint reduction in resource breadth.

The cost of sexual dimorphism: are colourful male damselflies more likely to be a dragonfly's lunch?

D. Lowe

Carleton University

Session 13

In pond damselflies (Zygoptera: Coenagrionidae), males often exhibit more colourful markings than females. These markings can be very subtle, such as the small blue spot on the last abdominal segment of male *Nehalennia irene*, or very noticeable, such as the bright blue and black colouration of males in many species of *Enallagma*. Female damselflies are usually drabber in colouration (called "gynomorphs") or they can display male-like colour patterns (called "andromorphs"). In this experiment, males and gynomorphic females of both *N. irene* and *Enallagma* spp. were presented to predatory dragonflies to determine if males are more conspicuous and thus more likely to be attacked. Additional observations were made to ascertain whether damselfly activity, weather conditions, and presentation methods influence attack rates. Data was also collected to determine if certain damselfly morphs are rejected more than others by attacking dragonflies. No difference was found in attack times on *N. irene*, but male *Enallagma* spp. were attacked faster than conspecific gynomorphs, indicating a higher fitness cost for bright male colouration. Prey activity and weather conditions did not affect attack times, but damselflies tied around the neck were attacked faster than those tied around the abdomen. After being attacked, *Enallagma* spp. males were rejected at a higher rate than expected, thus reducing the fitness cost associated with greater conspicuity.

Intrasexual competition for mates: is there active interference among male *Arrenurus manubriator* mites?

L. Massengale and B. P. Smith

Ithaca College

Session 4

Male reproductive success in many species relies on the number of sexual partners he has; due to the scarcity of the female gametes compared to male gametes, females often become the subject of competition. We investigated male-male competition for mates in *Arrenurus manubriator* water mites. A previous study by Heather Proctor suggested that the unmated *A. manubriator* male in a triad often "harassed" the mating pair, and that in one case, the unmated male was able to take over mating. In this study, we performed triad tests using two virgin *A. manubriator* males and one *A. manubriator* virgin female. Behaviors (swimming, walking, arrestant behavior, leg fanning, leg crooking) and inter-male distance were recorded every minute for five minutes prior to introducing the female into the container, every minute for five minutes after the female was added, and then continuing every five minutes for an hour after female introduction. Males were closer to each other when there was a female present compared to when there was no female, however we did not observe physical interference as had been noted in Proctor's study. We also tested pairs of males in one of 3 treatments: 1) control water, 2) water containing female sex-attractant pheromone, 3) water with a female present. Behaviors were recorded when males were introduced into the container and every subsequent minute for five minutes. There was no statistical significance in the distance relationships among males in pheromone treated water compared to fresh water and in the presence of a female. While casual observations have indicated that male *A. manubriator* water mites physically interact while competing for matings, our evidence suggests that this is coincidental because both males are attracted towards the female, rather than the males being attracted to each other and actively interfering with each other.

Rapid evolutionary change in flowering phenology, reproductive output and size in invasive *Lythrum salicaria*

J. L. Montague and C. G. Eckert

Queen's University

Session 11

Purple loosestrife (*Lythrum salicaria*) is an aggressive invader of North American wetlands. The ecological impacts of biological invasion have been well-studied but an understanding of the evolutionary changes that are associated with the invasion process remains limited. Because invasive, non-indigenous species may encounter new environmental conditions during the invasion process, changes in morphology, reproductive output and life-history strategies are expected in response to new selective pressures. We investigated whether *L. salicaria* exhibits evidence of such evolutionary change in response to climatic variation by examining differences in phenology, reproductive output and size at first flowering from populations located throughout most of its latitudinal range. Evidence from both a common greenhouse experiment and from extensive field surveys reveal that populations vary clinally in these important life history traits in a way that is consistent with life history theory. These findings provide strong evidence that populations have rapidly adapted across the introduced range in response to climatic variation.

Wing deformation powers ultrasonics in a rainforest katydid: a comparative analysis

F. Montealegre-Z, G. K. Morris, and A. C. Mason

University of Toronto at Mississauga

Session 6

*- reason tooth distance increases on file
is because the scraper is speeding up → it's
easier to put a constant force w/do*

Many animals new to science await discovery in the world's diminishing tropical rainforests and this is one such animal, a new katydid genus (*Arachnoscelis*). It compels interest with its 128-kHz pure-tone call: no other calling animal soliciting a mate in the tropical night has a higher calling frequency. Crickets and katydids call by forewing

stridulation, hitting a row of right-wing teeth (file) with a lobe (scraper) of the left wing. Scraper-tooth contacts create oscillation in adjacent forewing structures (wing veins and cells) that radiate sound. High-speed video recordings show that this insect makes its song by rubbing its wings together, moving them with muscles as do crickets, but at lower velocities. A comparative analysis among several katydid species using pure tones at various frequencies shows that extreme and low frequency singers differ in the mechanism of stridulation. We concluded that *Arachnoscelis* males, and other katydids singing above ~40 kHz, achieve their pure-tone ultrasonic by putting elastic energy through wing bending into the process.

Sexual selection on thievery in satin bowerbirds

R. Montgomerie and S. Doucet

Queen's University

Session 4

Satin Bowerbird (*Ptilonorhynchus violaceus*) males build stick bowers as part of their courtship display. They decorate the platforms in front of those bowers with a wide variety of coloured objects, including feathers, shells, flagging tape, drinking straws and trinkets, if they can get them. Previous studies have shown that the quantity and quality of bower decorations influences female choice in this species, and thus that a male's choice of decorations is influenced by sexual selection. We studied 12 of these bowers, and their owners, in the rainforest at Mount Baldy, Queensland, Australia during two breeding seasons and have shown, in work that is already published, that males vary in their plumage colour, and that this colour variation is associated with various aspects of male (size, parasite load, condition) and bower quality (number of decorations and symmetry of construction). We also studied bower decorations in some detail and we show here that males obtain many of their decorations by stealing them from the bowers of other males, that males are choosy about what decorations they steal, and that the quality of purloined decorations is an indicator of male quality. Since females base their mate choice decisions in part on the quality of a male's decorations, thievery may be considered to be a sexually selected trait in this species.

The Costs of Commitment: Functional Convergence in CAM plants

E. A. Nelson and R. F. Sage

University of Toronto

Session 10

Crassulacean acid metabolism (CAM) is a photosynthetic pathway that has evolved independently on dozens of occasions and is now found in over 7% of flowering plant species. CAM species vary greatly in the amount of carbon taken up via the CAM pathway, and have diverse ecological roles and habitats. In this study, the anatomical and functional convergence of CAM was examined in eighteen evolutionary lineages. CAM species were found to have significantly thicker leaves with larger mesophyll cells when compared with typical C3 leaves. CO₂ was taken up by these cells over significantly reduced cell surface areas from spatially restricted intercellular air spaces. These anatomical traits have been shown to reduce internal CO₂ conductance in C3 leaves, thus limiting overall carbon uptake. However, CAM anatomy may enhance CAM photosynthesis by limiting carbon loss during the transient phases of this pathway. This trade-off between carbon uptake and carbon economy may influence the degree of CAM expression during the evolution of CAM. Preliminary results suggest that the degree of CAM expression is correlated with the extent of CAM leaf anatomy, further supporting this evolutionary constraint.

Consequences of self-fertilization for molecular evolution in *Eichhornia paniculata*

R. W. Ness and S. C. H. Barrett

University of Toronto

Session 3

The transmission and distribution of heritable variation within and among populations is largely governed by the mating system. As genetic variation is necessary for evolution by natural selection the study of mating systems and their adaptive significance has been of major interest to evolutionary biologists. Within the angiosperms the commonest mating system transition has been from cross-fertilization to self-fertilization. Population genetic theory predicts a number of consequences of self-fertilization including, reduced heterozygosity, effective population size, recombination, and the efficacy of selection, all of which can influence genetic variation and molecular evolution. The neotropical annual aquatic plant *Eichhornia paniculata* (Pontederiaceae) offers a rare opportunity to evaluate some of these predictions within a single species. In this species there is evidence for the multiple origin of selfing from outcrossing. Therefore, comparisons among independent selfing lineages with varying levels of outcrossing should provide insight into the relative importance of the factors controlling the maintenance of variability. Here I present data on polymorphism in single copy-nuclear genes from populations of *E. paniculata* from Brazil, Jamaica, Nicaragua and Mexico.

Mercury mass balances and accumulation in fish for remote lakes of the Muskoka River Watershed

E. O'Connor and P. Dillon

Trent University

Session 15

Although atmospheric mercury (Hg) deposition is uniform over large geographic areas, Hg levels in fish can vary between lakes of a region remote from point sources. We hypothesized that variation of fish Hg concentrations between remote lakes is significantly related to differences in Hg loading (from watersheds and upstream lakes) to lakes of a large region, the Muskoka River Watershed (MRW, 5000 km², 859 lakes) in Southern Ontario. The objectives were to 1) estimate DOC concentrations for all lakes of the study area, 2) create landscape-level Hg mass balances for these lakes, 3) compare field measurements with modeled values, and 4) semi-empirically compare Hg loading with fish Hg. Hg transport from watershed to lake and subsequent bioaccumulation in fish are affected by DOC-Hg complexation and ratios of watershed, lake and wetland areas. Watershed spatial attributes were derived through GIS techniques and linked with published DOC mass balance models to create a regional-scale model that estimated lake DOC concentrations for the MRW. Using modeled DOC values and a published relationship between DOC and Hg fluxes, a semi-empirical Hg mass balance model was developed. Lakewater Hg samples from 19 lakes were collected in summer (2004) and total Hg concentrations were compared with model estimations. Average fish concentrations for juvenile fish sampled from the MRW and selected adult species from the Ontario Sport Fish Contaminant database were compared empirically with watershed Hg loadings from the model to test the hypothesis.

Population Structure of *Salmonella Typhimurium* DT104

G. G. Perron, G. Bell, and S. Quesney

McGill University

Session 7

Developing effective strategies for the control of bacterial pathogens requires a good understanding of the invader's population dynamics. Since the evolution of transmissible bacteria is influenced by the genetic diversity present in a population, it is vital to properly recognize the structures of the different players within that population along with the fate of genetic variation. We used multilocus sequence typing (MLST) and pulse field gel electrophoresis (PFGE) to examine the genotypic diversity of *Salmonella Typhimurium* DT104 isolates from swine carcasses presenting no clinical sign of infections. We implemented our analysis of background populations to highly adaptive clonal

complexes previously observed among DT104 clinical isolates to actualize the clonal model associated with this important pathogen. The model provides valuable insights into the role genetic variance plays in the evolution and dispersion of most virulent genotypes into animal populations.

Competition escalates cannibalism among siblings

J. C. Perry and B. D. Roitberg

University of Toronto

Session 12

- once sib has been killed then it pays to join in

Current models of sibling cannibalism are based on a frequency-independent application of Hamilton's rule. However, when opportunities to cannibalize are limited, competition among siblings may influence optimal cannibalism phenotypes. Using a game-theoretic simulation model, we show that game interactions drive the evolution of increased willingness to consume siblings. Parental interests in sibling cannibalism are also addressed. Depending on the benefit of cannibalism, parents may, optimally, use tactics to limit or facilitate cannibalism among offspring.

Changes in cyprinid habitat use and school size in response to the introduction of brook trout (*Salvelinus fontinalis*) in two oligotrophic lakes in northern Ontario

M. Pink, T. C. Pratt, and M. G. Fox

Trent University

Session 9

Habitat partitioning and the high densities of fish most often found in vegetated areas have been attributed to two main factors: (1) the availability of food and (2) refuge from predation. However, the ability of predators to structure habitat use in natural ecosystems has not been documented. The objectives of my research are to characterize patterns of cyprinid habitat use and cyprinid school size in the absence of predators and to observe if there are changes in these habitat use patterns and/or school sizes when predatory brook trout (*Salvelinus fontinalis*) are introduced. To document fish habitat use and school size before (2003) and after (2004) predator introductions in two lakes in northern Ontario, fish were observed via snorkelling line transects, and habitat specific population estimates were obtained using a distance sampling method in both the early and late summer of both years. The same documentation of fish habitat use was also completed in three control lakes, also in northern Ontario during the same sampling periods. While changes in habitat use after the introduction of predators were not statistically significant, there were trends towards the use of more complex area such as beaver lodges and woody debris after the introduction. In fact, after the introduction of brook trout into one of the manipulated lakes, adult cyprinids were observed in beaver lodge habitats only. There was also an unexpected increase in the proportion of one cyprinid species observed in open habitats in the second lake where brook trout were introduced. Mean school size of all cyprinids increased significantly after the introduction of brook trout suggesting that refuge may be found in numbers, as well as in complex habitats.

The Effect of Social Environment on Male-Male Competition in Guppies (*Poecilia reticulata*)

A. Price and H. Rodd

University of Toronto

Session 1

We examined male-male competition in guppies (*Poecilia reticulata*) to test for evidence of hierarchy formation and any subsequent effects on male mating success by comparing the interactions of pairs of males that were siblings and life-long tank mates with those of unrelated pairs that had never met. These pairs of males were first observed in the absence of a female; then a female was added to gauge the effects of the initial male-male interactions on male sexual behaviour. The unfamiliar/unrelated pairs engaged in significantly more aggressive interactions such as physical contacts, nipping, and chasing than the familiar/related pairs. Based on several previous studies, we suggest

that familiarity played a greater role than relatedness in the differences in behaviour that we observed. Our results suggest that, in some circumstances, more aggressive males may have more mating opportunities. Our results also indicate that males adjust their aggressive and courtship behaviours to the perceived intensity of competition for mates, based on the number of mature males in their rearing tanks.

Evolution of mimicry in hoverflies (Diptera: Syrphidae)

A. Rashed and T. N. Sherratt

Carleton University

Session 5

Several species of hoverflies are believed to mimic noxious hymenopteran models (wasps and bees) in order to deter would-be predators. Previous studies addressing the evolution of mimicry and warning signals have considered avian predators as the main selection pressure driving the evolution of mimicry in this group of flies. However, it is quite possible that invertebrate predation and/or interspecific competition over flower resources also play a role in the evolution of mimicry. In an experimental study using dragonflies as invertebrate predators, we found no evidence to support the contention that wasp-like warning signals protect small insect prey from attack by dragonflies, although size seems to play an important role in dragonfly prey choice. Furthermore, to investigate the role of competition, in an ongoing experiment, we have used a pair-wise method to present pollinators and other flower visitors with a choice of two goldenrod flowers pinned with mimetic hoverfly, non-mimetic fly or wasp specimens. Our preliminary results indicate that while flower visitors show a greater tendency to feed on empty flowers, the feeding time and number of visits do not differ significantly between flowers pinned with different specimen types. In this presentation we will discuss our ideas further and compare them with previous studies in the field of the evolution of mimicry.

Population Genetic Structure of Southern Ontario Brook Trout (*Salvelinus fontinalis*)

C. Reaume and C. Wilson

Trent University

Session 8

When approaching species conservation, it is essential to understand the distribution of genetic variation within and among geographically isolated populations. By defining these parameters, responsible decisions can be made regarding potential management units and the implementation of management programs. Lacking such information could lead to poor management strategies, such as inappropriately initiating gene flow between historically isolated and genetically differentiated populations. Additionally, it is inappropriate to manage populations separately if there is extensive gene flow between them. Movements of resident stream salmonids have been extensively studied and until recently a "restricted movement paradigm" (sensu Gowan et al. 1994) has been thought to describe sedentary behaviour in adults of these fishes. Recent estimates have suggested that brook trout may move between 50 to 3400m over the course of several months with the majority of adults moving up to 2000m. Brook trout have been shown to move substantial distances (>67m) upstream in steeply sloped reaches (up to 22%) and even ascend falls of over 1m high (Adams et al. 2000). Additionally, it has been suggested that brook trout move in response to habitat enhancement. Despite having a tendency to spawn in natal headwaters, brook trout may disperse due to disturbance (Gowan et al. 1994) or to straying incidents following movement events (Reiman and Dunham 2000). This suggests the potential for fine-scale genetic structuring in this species. This study will examine the genetic structure of resident brook trout populations in headwater tributaries of streams in southern Ontario by looking at the extent to which putative subpopulations exchange migrants.

Ecology of *Saccharomyces cerevisiae*

T. Replansky and G. Bell

McGill University

Session 8

Saccharomyces cerevisiae has been used for decades in genetic and molecular research, creating an extensive knowledge of its cell biology including a fully sequenced genome. It is an equally attractive model system for studies in ecology and evolution due to its ease of culturing and assaying in the laboratory, as well as its fast generation time, easily-manipulated sexual system, and close relationship to higher eukaryotes. However, the close association of *S. cerevisiae* with humans may alter this species' geographic distribution, as well as select for novel genetic and phenotypic properties. We thus propose to use its sister species, *S. paradoxus*, for ecological and evolutionary studies, as it is nearly indistinguishable from *S. cerevisiae*, naturally coexists with it, and is not associated with humans. The close relationship of these two yeasts also allows us to relate the wealth of genetic and molecular data available for *S. cerevisiae* to research involving *S. paradoxus*. The ecology of *S. paradoxus* must be well-characterized in order to construct a baseline model of yeast ecology for future ecological and evolutionary research. I have found yeast inhabiting tree xylem, bark and soil, where *Saccharomyces* have been repeatedly found. As other yeasts have been found to be the dominant microflora present in the latter environments, we consider tree xylem as an important habitat for this genus. I will thus sample tree xylem and sap for *Saccharomyces* to determine if they naturally exist inside tree vascular systems. Laboratory assays will be performed in order to test tree sap as a growth medium. These series of experiments will begin to characterize the natural habitat of *S. cerevisiae*.

Thermal quality influences investment in thermoregulation, habitat use, and behaviour in milksnakes

J. Row and G. Blouin-Demers

University of Ottawa

Session 17

Thermoregulation has costs and benefits and, therefore, the extent of thermoregulation should be adjusted to maximize the benefit to cost ratio. The central prediction of the cost-benefit model of thermoregulation is that ectotherms should invest less in thermoregulation when thermal quality is low. Recent comparative data suggest the opposite: lizards invest more in thermoregulation when thermal quality is low. Because the cost-benefit model was designed for intraspecific comparisons, however, we provided a more stringent test of the central prediction of the model with eastern milksnakes (*Lampropeltis triangulum*). Because behavioural thermoregulation is accomplished through habitat selection, we also investigated the link between thermoregulation, habitat use, and behaviour. During 2003-2004, we located 25 individuals 890 times and recorded their body temperature. Thermal quality was lower in the spring and fall than in the summer, and was also lower in forests than in open habitats. Milksnakes invested more in thermoregulation in the spring than in the summer and fall, and more in the forest than in open habitats, which was contrary to the central prediction of the cost-benefit model of thermoregulation. Milksnakes had a strong preference for open habitats in all seasons, which was likely to facilitate behavioural thermoregulation. The preference for open habitats was equally strong in all seasons and, therefore, the higher investment in thermoregulation was not a result of altered habitat use. Instead, milksnakes modified their behaviour and were seen basking more and moved less in the spring than in the summer.

Climatic determinants of sexual size dimorphism in the chipmunks (*Tamias* spp.)

A. I. Schulte-Hostedde

Laurentian University

Session 18

The evolution and maintenance of sexual size dimorphism is the result of independent, sex-specific selection acting on body size that leads to different optima for males and females. Climate has been shown to affect the evolution of

body size in mammals, and may be an important determinant of geographic patterns of sexual size dimorphism. Here I examine climate data and geographic variation in male and female body size from 40 populations of chipmunks (*Tamias* spp), to determine how climate affects variation in sexual size dimorphism. Chipmunks are small ground squirrels that exhibit a consistent degree of female-biased sexual size dimorphism. Multiple regression analysis revealed that (1) female-biased sexual size dimorphism was most pronounced in southern populations and in populations that experienced cool and dry climates, and (2) variation in sexual size dimorphism was most influenced by variation in male size, rather than female size as has been previously hypothesized. Geographic variation in male size relative to climate may be the result of sex differences in habitat use with respect to hibernation sites, or geographic variation in the strength of sexual selection on male size. A review of published studies indicates the general trend that male size increases relative to females in warm, wet climates. Males may be emancipated from the costs of large size in benign climates, and thus climate does not constrain the evolution of male size via sexual selection.

The Impacts of silvicultural practices on the Rose-breasted Grosbeak (*Pheucticus ludovicianus*) in the woodlots of southern Ontario, Canada

L. A. Smith, D. M. Burke, and E. Nol

Trent University

Session 14

Concern over the recent decline of many Neotropical migrant songbird species has led to an inquiry into forestry practices and the potential role that they play in this decline. In southern Ontario, uneven-aged management is prevalent and is a preferable silvicultural practice due to the retention of higher canopy cover and emulation of natural disturbances by removing individual trees throughout the stand. The Rose-breasted Grosbeak (*Pheucticus ludovicianus*) is a Neotropical migrant songbird that breeds in Eastern and Central North America and its population has been undergoing a significant decline. Rose-breasted Grosbeaks were studied in woodlots in southern Ontario from 2000-2004. Study sites included reference sites (uncut for at least 25 years) and recently cut sites from two silvicultural treatments. Uneven-aged silvicultural practices increased Rose-breasted Grosbeak density, nest site availability, and the abundance of wild fruits. Silvicultural practices elicited minor decreases in insect biomass and abundance and increases in rates of parasitism by Brown-headed Cowbirds in sites harvested below provincial standards (less than 20 m²/ha). There were no significant effects on daily nest survival rates, predation rates, clutch sizes, the number of fledglings, seasonal productivity and the age structure of Rose-breasted Grosbeaks. Rose-breasted Grosbeak populations appear resilient to the effects of uneven-aged forestry management practices in these deciduous woodlands.

Factors Affecting Nest Site Selection and Reproductive Success of Tundra Nesting Shorebirds

P. A. Smith, H. G. Gilchrist, and J. N. M. Smith

Canadian Wildlife Service

Session 17

In environments such as Arctic tundra, where bird densities are low and habitats are comparatively homogeneous, suitable nest sites are not likely to be limited. Under these conditions, reproductive success of birds may be determined by factors other than the habitat characteristics of nests. I studied the influence of nest habitat, food, nest distribution and parental behaviour on the reproductive success of tundra breeding shorebirds at East Bay, Southampton Island, Nunavut. From 2000-2002, I monitored the nests of five species: Black-bellied Plover (*Pluvialis squatarola*), Red Phalarope (*Phalaropus fulicaria*), Ruddy Turnstone (*Arenaria interpres*), White-rumped Sandpiper (*Calidris fuscicollis*) and Semipalmated Plover (*Charadrius semipalmatus*). For each species, habitat differed between nest sites and random sites. In contrast, habitat differed between successful and failed nest sites only for White-rumped Sandpipers. Although nest success varied between species in all years, artificial nest experiments suggested that interspecific variation in predation rate was not related to habitat type. Shorebirds did not prefer to nest in habitats where food was most abundant. Instead, interspecific patterns of success are consistent with the hypothesis that reproductive success is related to the amount of parental activity near the nest; species taking fewer incubation

recesses had higher nest success. However, the factor with the greatest influence on nest success was the fluctuating predation pressure, apparently related to the abundance of predators and lemmings.

Do agricultural drains provide fish habitat?

K. Stammler, R. McLaughlin, and N. Mandrak

University of Guelph

Session 15

The purpose of this research is to determine whether drains act as natural systems in terms of the fish assemblages they support and what impact drain maintenance has on fish habitat. Fish species richness and abundance were examined in 30 agricultural drain sites paired with 30 similar sites on natural watercourses in southwestern Ontario. Pairs were defined by similarity in size, order and location within the same watershed. We predict that if drains do act as natural systems, then richness and abundance of fishes should be similar within pairs. Sampling effort was standardized for each pair using electrofishing and/or seining to collect fishes. All fishes were identified to species and total length was measured for the first 30 individuals of each species to estimate biomass in each type of watercourse. At each site, the physical attributes of the stream and flow, hydraulic head, substrate and riparian cover were measured to determine if there is a difference in instream or riparian habitat. The goal of this research is to develop and conduct the science necessary to determine whether drains provide fish habitat, to test the applicability of current legislation to drains, and to develop alternative management suggestions. The findings of this study will be used by fishery and drain managers to develop better drain management guidelines that consider the needs of agriculture, while preserving fish biodiversity.

Phylogenetic position and plastid genome evolution of the plant parasitic genus *Cuscuta* (Convolvulaceae)

S. Stefanovic and R. G. Olmstead

University of Toronto at Mississauga

Session 11

The Convolvulaceae are one of the very few angiosperm families showing substantial structural differences in the chloroplast genome. The only parasitic genus of this family, *Cuscuta*, has been the subject of extensive molecular analysis. The findings on chloroplast genome structural rearrangements in this genus were attributed to its parasitic life style, but without proper comparison to related non-parasitic members of the family. We used long PCR approach to obtain large portions of plastid genome sequence from poorly investigated holoparasitic subgenus *Grammica* in order to determine the size, structure, gene content, and synteny in the plastid genome. These new sequences are compared with the tobacco chloroplast genome, and, where data are available, with corresponding regions from taxa in the other *Cuscuta* subgenera. When all known plastid genome structural rearrangements in parasitic and nonparasitic Convolvulaceae are considered in a molecular phylogenetic framework three categories of rearrangements in *Cuscuta* are revealed: plesiomorphic, autapomorphic, and synapomorphic. Many of the changes in *Cuscuta*, previously attributed to its parasitic mode of life are better explained either as plesiomorphic conditions within the family, i.e., conditions shared with the rest of the Convolvulaceae, or in most cases, autapomorphies of particular *Cuscuta* taxa, not shared with the rest of the species in the genus. The synapomorphic rearrangements are most likely to correlate with the parasitic lifestyle, because they represent changes found in *Cuscuta* exclusively. However, it appears that most of the affected regions, belonging to all of these three categories, probably have no function (e.g., introns) or are of unknown function (a number of open reading frames, the function of which, if any, has yet to be discovered).

Sperm competition and mechanisms of fertilization success in a fish with external fertilization

J. Stoltz and B. Neff

University of Western Ontario

Session 1

Sperm competition has been argued to have the widest diversity in fishes as compared to other taxa. It now is well understood that males typically differ in their competitiveness during fertilization, but the mechanisms that males use during sperm competition to increase their fertilization success are just beginning to be understood. Here, we investigated the factors influencing fertilization success during sperm competition between males with alternative mating tactics in the bluegill sunfish (*Lepomis macrochirus*). Previously, it has been shown that parasitic males (called "sneakers" and "satellites") are superior sperm competitors to larger, nest-tending males called "parentals." We now show that differences in timing of sperm release, number of sperm released and proximity of males to eggs during ejaculation can explain these competitive differences. Specifically, we show that satellites release only 0.44 times the number of sperm that parentals release, but are 3.7 times closer to the female when spawning. Although, sneakers ejaculate about half a second after parentals and are 1.4 times farther from the female, they release 4 times the number of sperm. These data contribute to our understanding of sperm competition and the evolution of mating systems.

Baseline flying insect survey for Ruthven National Historic Park

N. Taraban-Lagois, M. Gunderman, and P. Chow-Fraser

McMaster University

Session 14

Ruthven National Historic Park is comprised of 1500 acres of oak savanna and Carolinian forest habitat. It is part of the Cayuga eco-region in the Grand River Watershed and is one of the last remaining conservation areas in the region. As part of conservation and restoration efforts in the park, a flying insect survey was conducted on the property and compared to the North Lambton Insect Survey which was conducted at Pinery Provincial Park. Pinery Provincial Park is the only other oak savanna habitat left in Southern Ontario, so it is important to compare and contrast insects in order to find similarities or differences at either site and assess the quality of habitat. Insects are an important part of forest ecosystems and the food web, they are food for birds and fish, and they are decomposers of organic material, and pollinators of plants. Insects were collected in malaise traps for eleven weeks from June 15, 2004 until August 28, 2004 and with the use of taxonomic keys were sorted to the level of order and family. Thirteen orders and 67 families of insects were found at Ruthven, whereas 15 orders and 240 families of flying insects were found in the North Lambton insect survey. Nine families were found at Ruthven which were absent from the Lambton survey. These include families in the orders of Trichoptera and Plecoptera which are general indicators of good water quality. Emergence times of each insect family were recorded to understand successional patterns of flying insects. Herbivores were found to emerge before carnivores and a mix of insect types; carnivore, herbivore, detritivore and blood-sucking were found throughout the sampling period. The recorded emergence times of insect families in this study may be useful for future comparisons dealing with the impact of climate change on native fauna of southern Ontario.

Alternative foraging modes: an exploration of individual flexibility and tactic use in the nutmeg mannikin (*Lonchura punctulata*)

A. Thibaudeau, M. Wu, and L.-A. Giraldeau

Université du Québec à Montréal

Session 4

Individual variation in behaviour is widespread but its significance often overlooked. Flocks of nutmeg mannikins foraging according to the producer-scrounger game respond to different types of changes by adjusting their allocation to the producer and scrounger tactics. Although results from previous studies of the producer-scrounger game in nutmeg mannikins implicate some level of individual adjustment, they do not specify the extent to which all group members contribute to the adjustment effort to reach a new equilibrium frequency. Moreover, no study has consistently explored the extent to which individuals vary in their use of alternative tactics and whether this variance is associated with phenotypic characteristics of the birds. We observed three flocks of eight nutmeg mannikins in captivity while they were feeding in two seed conditions. Individual joining effort and flexibility were measured as well as morphological and behavioural characteristics. Every individual adjusted its joining effort to changing foraging conditions. Individuals differed in their joining effort: males joined more than females. However, most of the observed variation remained unaccounted for. In a second experiment, three flocks of four birds were tested at a six months interval in the same seed condition. Birds were then shuffled to create three new flocks that were tested in the same seed condition. Individual tactic use remained consistent after six months but changed with the shuffled flocks. These results suggest that nutmeg mannikins adjust their tactic use through learning and that, in a frequency-dependent context, learning can lead to strong, consistent yet arbitrary individual differences.

Vibration as a means of creating “personal space” in the hook-tip moth caterpillar (Lepidoptera: Drepanidae)

T. A. Timbers and J. E. Yack

Carleton University

Session 6

Caterpillars are key constituents of most terrestrial ecosystems and include some of the most serious pests of crops and forests. The larvae of many species live gregariously at some stage of their development, and interactions between individuals for purposes of aggregation, competition, and foraging are believed to be crucial for survival. Little is known about the mechanisms underlying communication. Comparative evidence indicates that one mechanism of interaction, larval acoustic signalling, may be widespread throughout the Lepidoptera, meriting consideration as a principle mode of communication for this important group of insects. In this study we characterized the vibrational signals produced by early instar (1-2) *D. arcuata* and tested for their function. It was found that they produce a complex repertoire of vibrational signals with 4 components. Sounds are produced by drumming and scraping the mandibles and specialized anal “oars” against the leaf surface. We now report that the primary function of the acoustic signals produced by gregarious *D. arcuata* larvae is to promote spaced-out gregariousness. This is the first evidence of insect larvae using vibration as a means of creating “personal space” within a group.

Large-scale links between songbird populations: A study of dispersal and source-sink dynamics

R. Tittler, L. Fahrig, and M.-A. Villard

Carleton University

Session 14

Although source-sink dynamics are thought to occur among songbird populations, current research does not provide insight into the distances over which they occur. Since the management of source habitat is likely to affect any dependent sink populations, such information is crucial to predict the large-scale effects of even small-scale

management. Since populations must be linked through dispersal, source-sink dynamics should occur over the distances over which dispersal occurs, but it is often difficult to properly assess dispersal distances. We therefore present a novel approach to the study of source-sink dynamics and dispersal using long-term abundance data. We show that dispersal and source-sink dynamics likely occur among songbird populations separated by distances from 20 to 80 km, depending on the species. These distances are generally an order of magnitude larger than dispersal distances reported in the literature. Preliminary analyses also indicate a possible link between these distances and species-specific body sizes. We recommend that conservation and management strategies for these species be designed at correspondingly large scales.

Lithium Chloride subacute toxicity to Rainbow trout gills

V. Tkatcheva, N. M. Franklin, G. McClelland, R. Smith, I. J. Holopainen, and C. M. Wood

University of Joensuu, Finland

Session 15

The physiological response of young rainbow trout (*Oncorhynchus mykiss*) gills on Lithium Chloride subacute concentration have been studied. Blood ions, metabolic enzymes activity, apolipoprotein AI, cholesterol E and fatty acid concentrations in blood plasma and fish gills (the organ continuously exposed to ambient water) were analyzed in order to reveal effects on e.g. acid-base regulation or ion transfer. Gills which were exposed to 528 µg Li l⁻¹ demonstrated that Li has toxic effect on them. The affect is the inhibition of Na⁺K⁺ATPase activity which sufficiently agree to lower concentrations of free fatty acids and cholesterol E. The results observed in this experiment are opposite to those which we had before from the same species of fish in the experiment with potassium and Li mix. This lab studies comparison probably confirm that potassium play a protective role against Li as well as sodium.

Do the drivers of disproportionate space use result in core areas occurring at a unique spatial scale for moose?

E. Vander Wal and A. R. Rodgers

Lakehead University (current address: University of Saskatchewan)

Session 20

Three hypotheses were examined to identify differences in habitat selected by moose (*Alces alces*; n=60) in core areas and home range peripheries; (1) core areas of home ranges represent superior spatial configurations of habitats; (2) core areas are selected to contain a subset of 'preferred' forage species with higher individual densities; and (3) a higher total density of all forage species than home range peripheries. The models were interpreted to understand where core areas fit in the hierarchy of habitat selection by moose. Binary logistic regression habitat models were constructed using spatial landscape metrics and explained 44-60% of the variation between core areas and home range peripheries (receiver operating characteristic curve area under the curve (AUC) range: 80-86%). Separate binary logistic regression models were calculated using browse density data from core areas and home range peripheries. Browse density model coefficients of determination ranged from 10-15% for models constructed using individual 'preferred' species (AUC < 70%); models constructed using total browse density had coefficients of determination from 17-22% (AUC range: 73-74%). Core areas and home range peripheries comprise similar habitat – primarily young seral patches. Core areas, however, have a refined size, shape, and interspersion of habitat, compared to home range peripheries, such that ecological factors affecting core use change monotonically with scale. Thus, core areas for moose occur at an ambiguous scale, which incorporates patch and home range level habitat selection characteristics.

Influence of Age on Child Facial Cues

A. A. Volk and V. L. Quinsey

Queen's University

Session 12

- is infant attractiveness correlated with adult attractiveness

- younger → don't have to work as hard because parents want to invest more

Ethologists have suggested that infant facial cues may serve as releasers for either parental care itself, or emotions associated with the provision of parental care. Previous research has shown that adults are sensitive to cues of resemblance, health, and cuteness/attractiveness in infant and child faces. However, previous research has yielded conflicting results regarding at what age child facial cues are maximally effective at eliciting adult responses associated with the provision of parental care. There are three hypotheses, each supported by limited evidence: that younger facial cues are most effective, that older facial cues are most effective, and that age does not influence the effectiveness of facial cues. Using the Hypothetical Adoption Paradigm (H.A.P.), we examined the relationship between child facial age and adults' ratings of adoption preference, cuteness, health, and resemblance. The results of our initial study, as well as a second confirmatory study, strongly support the hypothesis that younger child facial cues are most effective at eliciting adult emotions associated with the provision of parental care.

Characterization of guppy LWS opsins: multiple opsins found in a single individual

C. J. Weadick, D. Kolovos, S. Lazic, H. Rodd, and B. S. W. Chang

University of Toronto

Session 8

The Trinidadian guppy (*Poecilia reticulata*) has long been considered a model system for studying the evolutionary consequences of mate choice behaviour. Females choose among potential mates based on a number of traits, the best studied of which is male colour pattern; the most attractive males tend to be those with the largest and most chromatic orange spots, though the strength of this preference varies between and within populations. Previous studies have shown that the guppy's long-wavelength sensitive (LWS) photoreceptors (red cone cells) can vary among individuals within populations, and that sensitivity to long wavelength light is an evolutionarily labile trait. Beyond this, however, little has been done towards investigating the underlying neurophysiological mechanisms that influence mate choice in an evolutionary context. We have recently begun efforts to characterize the guppy's LWS opsin proteins, a key component of the visual pigment compounds responsible for detecting light. Our preliminary results show that multiple LWS opsins are found in a single individual, suggesting that the raw material necessary for subtle variation in vision among guppies exists at the molecular level. Furthermore, the guppy appears to possess a level of LWS opsin diversity rarely found among vertebrates.

Temperature and human population density as predictors of butterfly species richness in Canada analyzed across spatial and temporal scales

P. White and J. Kerr

University of Ottawa

Session 2

Regional patterns of species richness are often explained in models using temperature or measures habitat suitability. Generally, species richness is positively associated with temperature, and negatively associated with habitat degradation. While these models have been well tested across spatial scales, they have been seldom-tested on a temporal scale - in part due to the difficulty in ascertaining accurate historical data at an appropriate resolution. In this study, we compared the results of temporal and spatial models, each incorporating two predictors of species richness: temperature, and human population density (as a surrogate of human-related habitat impacts). We found that the change in species richness from the early to late part of the 20th century was positively correlated with temperature change, and negatively correlated with human population density change. When we compared these results to a spatial model using contemporary data alone, we found that temperature remained a positive and

significant predictor, while human population density became a positive predictor offset by a negative (temperature x human population density) interaction term. Our results demonstrate a case where a spatial, "snapshot-in-time", model fails to accurately predict temporal changes of species richness. We also show that richness is uniformly predicted by temperature and linked to human population density related factors (such as habitat modification) across both scales.

Perceptual worlds of individual young of the year brook charr: a behavioural and neurological perspective

A. D. M. Wilson and R. L. McLaughlin

University of Guelph

Session 9

Recently-emerged brook charr (*Salvelinus fontinalis*) foraging in still-water pools along the sides of streams tend to be either sedentary, feeding from the lower portion of the water column (a sit-and-wait tactic), or very active, feeding from the upper portion of the water column (an active search tactic). We tested whether charr using different search tactics in the field differ in their willingness to explore and take risks in novel environmental situations. After quantifying the behaviour of fish in the field, focal individuals were captured and their behaviour quantified in novel laboratory situations. In an aquarium, individuals that used an active search tactic in the field spent a higher proportion of time moving and less time near the aquarium bottom, and took less time to find their way out of an erect glass jar, than did individuals that used a sit-and-wait tactic in the field. Differences in activity were maintained up to eight days. Individuals did not respond differently to a pebble dropped in the aquarium (simulated risk from above). Research linking exploratory behaviour to brain morphology is underway. How individual charr behave in novel environments can be predicted by past behaviour in the field suggesting individuals differ in how they perceive new environments.

Life on the edge - relating demography, population structure, and genetic structure in a broad geographic context

S. Yakimowski and C. Eckert

University of Toronto

Session 18

Geographically peripheral populations are thought to be valuable for conservation and for answering questions regarding the evolution of range limits. Predictions based on the abundant center hypothesis suggest that peripheral populations may be less frequent, small, unproductive, and low in genetic variability. Thus, for conservation these predictions suggest that peripheral populations may be difficult to manage. As well, lowered demography and genetic variability could prevent peripheral populations from adapting to local conditions, thus causing range limits. However, our broad-scale geographic surveys of *Vaccinium stamineum* (Ericaceae) show that, although population frequency is lower near northern range margins, within population abundance and density is not. Also, despite extensive among-population variation in sexual reproductive output and its components, this variation was not structured geographically. Peripheral populations did not exhibit low reproductive output. In fact, we detected a striking increase in seed size towards range margins, which is associated with faster and higher rates of germination, and increased seedling growth rate. This could be interpreted as an adaptation to more northern conditions where winter conditions come quickly and there is a premium on quick establishment of seedlings. In accordance with the overall reproductive pattern, population genetic diversity was not lower in peripheral populations.

POSTER ABSTRACTS

(Listed alphabetically by first author)

← Oviposition and feeding preference of the leek moth on native eastern Ontario plants →

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Poster #77

The leek moth, *Acrolepiopsis assectella* Zeller (Lepidoptera: Acrolepiidae), is an exotic species from Europe identified in the Ottawa region as recently as 1993. This specialist on *Allium* spp. (Asparagales: Alliaceae) can cause up to 40% crop damage. Although the preferred host is cultivated leek, *Allium ampeloprasum*, there is little information about the survival of the species on plants native to this region. The threat posed to related crop species and other native plants that may serve as a refuge must be understood to assess the potential impact of the leek moth. The purpose of this study is to examine oviposition and feeding preference of the leek moth as the phylogenetic distance from the preferred host increases. The leek moth appears to show oviposition preference and improved larval survival on plants closely related to the preferred host, cultivated leek. Both closely related crop species and wild species, may be at risk. The leek moth may be able to switch to native *Allium* spp. as novel hosts or temporary refuge during pest management efforts.

← Live long or prosper? The evolutionary tradeoff between longevity and reproduction in three plant species →

J. Andrews and A. Simons

Carleton University

Poster #78

The cost of reproduction has direct implications for the evolution of senescence, and is a major component of life-history theory. Annual plants maintain a strategy of high reproductive allocation and low longevity, while perennial plants adopt the reverse strategy. Under low population growth rate and high juvenile mortality the perennial habit is favoured. Although it is convenient to designate species as either annual or perennial, populations may exist at some evolutionary point between the two. Within one genus a variety of life history strategies exist, and evidence for genetic variation exists also within species for these characters. Therefore, systems of closely related species offer the ideal forum for studying the evolution of annual and perennial strategies. This study aims to ask: Is there an evolutionary trade-off between present and future fecundity? Can this be measured within species? Is this trade-off genetically based? Here we report preliminary analyses of this cost in *Arabidopsis thaliana*, *Arabidopsis lyrata* and *Lobelia inflata*. Cost is measured as a genetic correlation between initial and secondary growth in several populations collected over a wide geographic range. This novel approach using within species variation in habit aims to provide insight into evolutionary trade-offs and the evolution of longevity.

← Floristic quality in riparian habitats within an agricultural landscape →

K. Bowers and C. Boutin

Carleton University

Poster # 85

This study involved a survey of plant biodiversity along riparian habitats within an agricultural landscape in southeastern Ontario, Canada. Comparisons of plant species assemblages were made between riparian habitats of different disturbance levels. The accuracy of several floristic-based habitat assessment measurements was examined to determine their relative ability to recognize the gradient of disturbance present. Floristic measures examined included species richness (the total number of species present), the proportion of non-native species present, and the

values generated using a regional floristic quality index. This floristic quality index is an assessment tool developed over the last twenty years that seeks to quantify plant communities by the disturbance sensitivity and habitat fidelity of the constituent plant species. Each native plant in the region has been given coefficient of conservatism based on the above characteristics, and it is these conservatism numbers (ranging from 0 to 10) that are used to calculate the index values that are assigned to each habitat surveyed. Preliminary results have shown that mean index values per site increase with decreasing disturbance – an expected pattern given that higher mean index values should be associated with more pristine habitats – while plant species richness does not change significantly between sites of differing disturbance. Results have also shown that the simple measure of the proportion of non-native plant species present increased with increasing levels of disturbance. These results call into question the usefulness of basic plant species richness measurements in assessing changes in natural habitats.

Effects of status change on behaviour and physiology in cichlid fish

E. M. Brown, J. Fitzpatrick, R. Smith, C. Wood, and S. Balshine
McMaster University
Poster #86

Animals commonly need to adapt their behaviour and physiology to changes in their social environment. The underlying proximate mechanisms that control short-term dynamic changes are not well understood. In this study we used an African cichlid fish, *Neolamprologus pulcher* to explore how changes in social conditions influence growth, reproductive investment, the endocrine and molecular pathways. *N. pulcher* provides a useful model to explore the impact of social change because when a dominant breeder is removed from the social group, subordinate individuals within the group often quickly move up in status and take over the breeding vacancy. We compared subordinate males in groups where the dominant male breeder was removed for 15 days (ascending males, n=7) to males in control groups where the dominant male breeder was not removed (control males, n=6). Males ascending in status were less submissive, performed more social behaviours with the female breeder and spent more time inside the brood chambers. Ascending males also gained more body mass, had larger gonads (controlling for body size), and larger livers. These ascending males also had a higher RNA concentration in their muscle tissue suggesting higher rates of protein synthesis. Our results show that ascending in social status is accompanied by changes at behavioural, physiological and cellular levels. The results also support the notion that in *N. pulcher* subordinate males are reproductively suppressed by dominant male breeders. Once males are relieved of the presence of a dominant they allocate more resources towards both growth and reproduction.

Genital allometry in two species of bruchid beetle (Coleoptera: Bruchidae)

M. den Hollander
University of Toronto
Poster #81

Animal genitalia often show unusual elaboration and extreme variation, even between closely related species. Sexual selection is usually cited as playing a key role in this diversification. The male genitalia of the bruchid beetle *Callosobruchus maculatus* is of particular interest as it has been shown that the spiny elaborations of the aedeagus cause damage within the female genital tract. The function of these structures are currently unknown, however it has been hypothesized that sexual conflict may present a selective pressure. Males may benefit from causing harm if females respond to the inflicted damage in ways that increase male reproductive success. This study examines the allometric relationships of male genitalia in *C. maculatus* and in the closely related species *C. chinensis*. These species differ in the amount of genital elaboration and likely in the degree of sexual selection (promiscuous versus female monogamy mating systems, respectively). Measurements of elytra length (body size correlate) were related to length of the aedeagus and to the length and width of the femur. Allometric relationships may indicate the type of selection functioning in the evolution of genitalia. Conventionally it is thought that sexually selected traits would typically show positive allometry, although the generality of this pattern has recently come under question, especially concerning genitalia. Results from this study show that both species demonstrate negative genital allometry. This result is in concordance with several other studies examining genital allometry, but contradicts the expected pattern for sexually selected traits. Possible reasons for this discrepancy are discussed.

Investigating the maintenance of the rover-sitter polymorphism in *Drosophila melanogaster*

E. Feder, M. J. Fitzpatrick, M. B. Sokolowski, and L. Rowe

University of Toronto

Poster #87

Although various theoretical mechanisms have been put forward to account for non-neutral genetic variation, adequate explanations for discrete variation in natural populations are rare. Using *Drosophila melanogaster*'s naturally occurring rover-sitter polymorphism as a model system, our research will empirically address the question of how such variation is maintained. Initially, we will explore the role of two potential mechanisms: frequency dependent selection and temporal environmental variation. While the assumptions required for temporal environmental variation alone to maintain discrete genetic variation are restrictive, this mechanism may exhibit important interactions with frequency dependence, which theoretical models have shown to be capable of maintaining variation under a broader set of conditions. Environmental conditions within bottles of laboratory-reared populations degrade over time, and these environmental changes have been found to have significant fitness consequences. In our first experiment, sets of focal first-instar larvae of either rover or sitter genotype will be introduced into background populations of either rovers or sitters at one of three stages of bottle development, and we will subsequently assess the relative fitness of rovers and sitters in each of these six conditions using measurements of survival and development rate. The results of this experiment may reveal whether frequency-dependent selection occurs at the larval phase, and if so, at what stage(s) of bottle development. Furthermore, it may suggest potential mechanisms for the operation of frequency dependence, which can be explored in future experiments.

Will rare species stop cropping up? Patterns and mechanisms of species decline in agricultural landscapes

A. Feswick and J. Kerr

University of Ottawa

Poster #88

Habitat loss is the primary cause of biodiversity loss worldwide. In particular, expansion and intensification of agriculture is the leading cause of extinction in many regions of the world, including Canada. Although curtailing further agricultural expansion will improve the conservation outlook, preventing extinctions within these landscapes is a higher priority as much of the world's remaining biodiversity is concentrated in such areas. This necessitates identification of the specific mechanisms of species decline within agricultural landscapes. We test three hypotheses to help identify specific mechanisms of species decline. First, we test whether increasing agricultural intensity relates to lower species diversity, second that species are lost from increasingly agricultural areas because of habitat loss *per se*, and lastly that species are lost because increasing agricultural intensity leads to reduced habitat heterogeneity. We located a series of old field habitats surrounded by natural areas, light or moderate intensity agriculture (e.g. hay), and high intensity agriculture (e.g. corn) within 75km of Ottawa, Ontario. We measured butterfly and plant species richness in these areas from May to August, 2004. Preliminary results suggest that agriculture may reduce biodiversity through landscape rather than site-specific processes, as butterfly richness is unrelated to overall plant richness, host plant richness, or to habitat area of study sites. Increasing agricultural intensity leads to large declines in butterfly richness but not in plant richness. Overall, intense agriculture seems to reduce butterfly species richness by eliminating habitat remnants to a greater degree than in less intense agricultural areas.

Response of understory plant communities to gap disturbance in trembling aspen forests

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Poster #79

When trembling aspen (*Populus tremuloides* Michx.) dominated forests reach between 60 and 120 years of age, small-scale disturbances play a major role in creating canopy gaps. Although the economic importance of this stage of forest development has long been recognized, there has been little focus on its ecological importance. Based on previous studies that examine gap dynamics in tropical and temperate forests, we predicted that the most important ecological impacts would be i) a differential response of understory juvenile tree species to increasing gap size and age, and ii) a restructuring of the overall vascular plant community with respect to increasing gap size and age. To test these predictions, understory plant communities in five trembling aspen stands were examined. Four gap types, based on size and age, and a closed canopy understory control were used to completely census understory vascular plant communities. We measured growth and abundance of juvenile trees, and percent cover of shrubs and herbs. In contrast to our predictions, our results show that gaps had a minimal impact on understory plant communities: abundance and growth of juvenile trees was not significantly different among gap types; similarly, gaps had little impact on overall vascular plant species richness and composition. These results are contrary to expectation and indicate that gap-based theories of forest development in boreal forests should be treated with scepticism.

A field study of seed dispersal and seedling performance in the invasive exotic vine *Vincetoxicum rossicum*

D. Ladd and N. Cappuccino

Carleton University

Poster #75

The exotic vine *Vincetoxicum rossicum* (Kleopow) Barbar. (Asclepiadaceae) is a major natural-area pest throughout the Great Lakes Basin. Colonisation of new areas by this herbaceous perennial occurs by comose wind-dispersed seeds. Previous experiments suggested a trade-off between seeds dispersability and seed quality: smaller seeds dispersed further but were less likely to emerge and were smaller when grown in competition with turf grasses in the greenhouse. In the present study, we examined dispersability by trapping seeds at distances of 0-60 m from a seed source, and we assessed seedling performance by sowing seeds of known weight individually along transects in an old field. Smaller seeds traveled significantly farther than larger seeds; however, the relationship was weak. Large seeds were significantly more likely to emerge, survive and grow taller, however the relationships between seed size and these performance variables were likewise weak. The dispersability-quality trade-off is unlikely to play an important role in *V. rossicum* spread at the local scale, as even large seeds are competent dispersers and even small seeds are capable of becoming established. Polyembryonic seeds were more likely to successfully establish than seeds from which a single seedling emerged. The high seedling emergence (50% for seeds planted above ground; 72% for those buried to a depth of 1 cm) and survivorship (71-100%, depending on embryony) are likely to contribute to the success of this species.

Competition and the evolution of heterospecific aggressive behaviour in brook stickleback

K. Peiman and B. Robinson

University of Guelph

Poster #80

When two species compete for a common resource, evolution should favour traits that assist in the monopolization of that resource. Recent reviews support the role of resource competition in morphological character shifts, termed ecological character displacement (ECD), but little attention has focused on the evolution of behaviour. Alpha-selection is the evolution of heterospecific interference traits, such as aggressive behaviour, when resources are defendable. Interference traits allow species to directly interact in a way that is not mediated by their effects on a shared resource.

Prior studies suggest that ECD has occurred in brook stickleback (*Culaea inconstans*) sympatric with ninespine stickleback (*Pungitius pungitius*) among a series of lakes in N. Ontario. Here we investigate whether aggressive behaviour has also evolved in this system. If heterospecific aggressive behaviour increases fitness by allowing individuals to monopolise defendable benthic resources, then *C. inconstans* sympatric with *P. pungitius* should have a higher level of aggression than solitary (allopatric) populations of *C. inconstans*. We reared family groups from replicate populations of allopatric and sympatric *C. inconstans* in a common laboratory environment to test for consistent variation in aggressive behaviour toward a heterospecific intruder. Aggression in juvenile *C. inconstans* increased with age in sympatric but not in allopatric populations. That aggressive behaviour is heightened over ontogeny and not just at sexual maturity suggests that it functions outside of a mating context. This is one of the first studies to provide evidence that aggressive behaviour has likely evolved under selection imposed by heterospecific competitors.

Unusual phenology in a solitary bee species

S. Prager, A. Rutgers-Kelley, and M. Richards

Brock University

Poster #74

Phenological trends are well studied in many bee species. These studies demonstrate distinct pattern differences between social and solitary species. Solitary species generally have two peaks in their population numbers, the first representing emerging bees from that year, and a second from overwintering bees that will have their own nest in the following year. Eusocial species with two broods have three peaks. A first peak is produced by foundresses, a second peak that is workers, and a third peak from gynes. We have studied an alleged solitary species, *Lasiglossum (Dialictus) paradmirandum*, in southern Ontario that appeared to have three phenological peaks in 2003. Pan traps and sweep collections revealed a peak in bees caught in early spring, a second peak in late spring and a third peak in mid summer. This pattern is not consistent with the expected solitary phenology in southern Ontario where we expect social species to have 2 peaks. We are currently using Cytochrome Oxidase I to determine if this pattern is due to a cryptic species. We are also using morphometric analysis to determine if this pattern is due to social organization.

Wintering strategies of the large carpenter bee, *Xylocopa virginica*

D. Skandalis, S. Prager, and G. Tattersall

Brock University

Poster #82

The large carpenter bee, *Xylocopa virginica*, is the only member of a neotropical genus to have extended its range into Canada. Its range appears to be limited by its ability to overwinter, especially as it hibernates above ground in wood, which offers little protection against sub-zero temperatures. The genus *Xylocopa*, perhaps due to its neotropical origin, does not appear to be able to survive the formation of ice crystals in its tissues (freeze tolerance), and so must employ some strategy that avoids this situation. This may involve concentrating solutes in the haemolymph and allowing tissues to supercool, i.e. to decrease in temperature far below the usual freezing point, without freezing (freeze avoidance). Three methods are currently being explored to quantify the extent of *X. virginica*'s supercooling abilities in response to ambient temperatures from 0 to -30°C. The first two methods involve the use of thermocouples, wherein a thin-wire probe is either invasively inserted into the inner tissues of the thorax of the test subject, or is taped to its exterior. We also make use of a thermal-imaging camera, to visualize the rate of tissue cooling and non-synchronous thermal events. Our results suggest that *X. virginica* supercools to temperatures (minimum limit of -24°C) never experienced by other neotropical bees. It also is able to supercool to a temperature many degrees lower than non-hibernating workers of *Bombus impatiens*. The supercooling temperatures we have observed are on par with the minimum extreme temperatures (approx. -25°C since 1971) that would be required to survive winter in the Niagara region.

Designating seasonality: a rate of movement model

E. Vander Wal and A. R. Rodgers

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Poster #76

Traditionally seasons for animals have been designated based on single external variables, e.g., climate or phenology; rather than an animal's response to the dynamic environments within which it lives. Interpreting an animal's rate of movement using a function of cumulative movement through time we establish a method that distinguishes thresholds between behaviours limited by 'winter' habitat conditions from those present during the 'summer'. We propose that an animal's rate of movement can act as a comprehensive proxy for environmental conditions, and ultimately stress. As moose (*Alces alces*) move faster, and consequently more, during the 'summer' than the 'winter' while exploiting differentially available and digestible forage, we defined moose 'summer' as the period during the calendar year when an animal maintains a rate of movement greater than its annual mean (n=32 female moose fixed with GPS collars in 2000). We then compare the rate of movement model results with an existing phenological model of leaf inception and abscission for moose seasonality. The rate of movement model determined 1 May as the median date for the 'winter-summer' transition (range: 2 April-24 May), prior to leaf inception; and the median transition from 'summer-winter' occurred before leaf abscission on 25 August (range: 1 Aug-23 October).

A comparison of life-history characters of arctic and alpine populations of the annual *Koenigia islandica*

I. Wagner and A. Simons

Carleton University

Poster #89

Major differences in environmental characteristics between arctic and alpine ecosystems exist, to which plants having populations in both arctic and alpine environments must adapt differently. Population differentiation in life-history characters was tested for several populations of *Koenigia islandica*, an arctic-alpine annual with a wide, circumpolar distribution, by germinating and growing each population under simulated arctic and alpine conditions. Several life-history characters are predicted to differ between arctic and alpine populations, including seed germination and reproductive strategies, as well as vegetative growth. For example, plants from northern populations grew better under simulated arctic conditions, reaching larger sizes and producing more flowers and seeds. Plants originating from low latitude environments seemed unable to benefit from the long photoperiods of arctic conditions, developing poorly and reaching smaller sizes. Also, seed stratification had different effects on the germinability of different populations.

Photosynthesis and plant performance are affected by sub-lethal herbicide exposure

A. L. White and C. Boutin

National Wildlife Research Centre

Poster #84

Agricultural intensification is contributing to the loss of natural habitats in south-eastern Canada, thus increasing the importance of conserving field margins, hedgerows, and woodlots. These habitats are important refuges for many annual and perennial plant species and provide food, shelter, and movement corridors for wildlife in agricultural landscapes. Due to their close proximity to agricultural crops, these habitats are often exposed to herbicides via direct overspray or spray drift from aerial or ground applications. The objective of this study was to determine whether plant species could recover after exposure to a sub-lethal herbicide dose and what ecological implications this might have. Four different plant species (two crop species and their closest native, non-weedy relative) were chosen for testing. Plants were exposed to a one-time application of a commonly used commercial herbicide containing atrazine (Aatrex). The reaction of the photosynthetic system was monitored several times over a 28-30 day period after herbicide exposure using a non-destructive method of measuring chlorophyll fluorescence induction. Most plants responded

within one day of herbicide exposure, with all plants showing a marked reduction in photosynthesis seven days after herbicide application. However, no visual effects could be observed until at least day 15 of the test period. Although treated plants regained the ability to photosynthesize nearly at normal capacity in most cases, total biomass did not recover to that of control plants. These results indicate that some plant species may be able to tolerate exposure to herbicides at low doses, but depending on the plant lifecycle there may be different long-term effects.

← Using landscape indices to model environmental gradients within the Mixedwood Boreal Forests of northwestern Ontario, Canada

A. J. Zeller
Lakehead University
Poster #83

Wildfire is the dominant large-scale disturbance responsible for much of the structure, pattern, and forces associated with succession within the boreal forest. Past studies suggest that community composition of vascular plants tend to respond to many different environmental gradients. These gradients are commonly related to soil moisture, nutrients, light transmittance, and general productivity. The aim of this project was to examine variations in post-fire regeneration species composition with respect to remote sensing and GIS modeled environmental gradients. Using spatial analysis procedures it has become possible to model many environmental gradients and therefore examine how species composition varies along specific environmental gradients. Field data consisted of four hundred and eighty 1m² vegetation plots that were sampled in the Nipigon-10 burn, northwest of Thunder Bay, Ontario. The species composition of these plots were examined against twenty-four common indices that correspond to environmental gradients, created within a Geographic Information System (GIS) and from Landsat TM imagery. Canonical Correspondence Analysis (CCA) was used to establish which environmental gradients were best represented by the remotely derived indices. A structural equation model was developed to confirm the relationship between the indices and environmental gradients. The three most significant gradients confirmed by the structural equation model were soil type, moisture, and light levels. These results indicate that modeled gradients derived from remote sensing and GIS can be used to predict understory species.

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