

# Ontario Ecology & Ethology Colloquium 1998

4-6 May 1998 Queen's University

| [Home](#) | [Registration](#) | [Accommodation](#) | [Abstracts](#) | [List of Registrants](#) | [Biology Homepage](#) |

## PROGRAM

| [General Schedule](#) | [Presentation Format](#) | [Program](#) |

### (1) General Schedule

	Monday 4 May	Tuesday 5 May	Wednesday 6 May
0900-1030		Sessions 1 2 3	Sessions 9 10 11
1100-1200		PLENARY: Hutchings	PLENARY: Giraldeau
1200-1330		Lunch	Lunch
1330-1500	Registration	Sessions 4 5 6	Depart
1530-1700	Registration	Sessions 7 8	
1700 ++	Registration Mixer (1900 onwards)	Posters & Cocktails BBQ & Music	

### PLENARY LECTURES

- **Jeff Hutchings, Dalhousie University** -- Strengthening the Role and Communication of Science in Canadian Fisheries Resource Management
- **Luc-Alain Giraldeau, Concordia University** -- The Emergence of Social Foraging

The Mixer will be held at the Queen's University Grad Club, on the NW corner of Barrie & Union Street -- a 30 second walk from the BioScience Complex. For entertainment at the mixer, there will be a celtic music jam session; all puveyors of strathspeys, jigs, reels & hornpipes are welcome to join in.

The registration desk will be located in the Atrium of the BioScience Complex, except during the Mixer, when it will be at the Grad Club.

### (2) Format of Contributed Papers

Talks will be 12 minutes long plus 3 minutes for questions. Slide projectors, carousels and overhead projectors will be provided. Unfotunately, computer-video will not be available.

Posters should fit in a 1.5x1.5 m space and should be easy to read (use 18-point font or

larger). Authors should be prepared to stand beside their posters throughout the poster session (Tuesday 500-700pm).

### (3) Program

Here is the program. Titles are listed by session and position within that session. There is usually three concurrent sessions.

Day	Time	No.	Authors	Title
Tues	900	1.1	Hutchings JA, Bishop TD & McGregor-Shaw CR	Mate Competition and Mate Choice in a Broadcast Spawner: Do Atlantic Cod Lek?
Tues	915	1.2	Ortigosa A	Cryptic Female Choice in <i>Gerris buenoi</i> ??
Tues	930	1.3	Westlake K & Rowe L	The costs of sexual elaborations in the water strider genus <i>Rheumatobates</i> .
Tues	945	1.4	Tseng M	Sexual size dimorphism and allometry in the water strider <i>Gigantometra gigas</i>
Tues	1000	1.5	Gentile G	Daily Patterns of Oviposition Mediate Sexual Conflict in a Polygynandrous Mating System
Tues	1015	1.6	Barber CA & Robertson RJ	Extra-pair young are randomly distributed within the laying sequence of tree swallows
Tues	900	2.1	Lyons A, Weis IM, and Susko D	Size-dependant variation of reproductive effort in ten species of mustards (Brassicaceae).
Tues	915	2.2	Bonser SP, Duffy NM & Aarssen LW	Components of size-dependent meristem allocation in <i>Arabidopsis thaliana</i>
Tues	930	2.3	Henry HAL & Aarssen LW	Patterns of shade tolerance and shade avoidance strategies in 12 species of temperate deciduous trees.
Tues	945	2.4	Thomas JJ, Massonnet B & Eckert CG	Sexual reproduction in introduced populations of flowering rush, <i>Butomus umbellatus</i> (Butomaceae)
Tues	1000	2.5	Burnham J & Posluszny U	The reproduction of <i>Hydrocharis morsus-ranae</i> L. (Hydrocharitaceae); evidence of density effects on reproduction
Tues	1015	2.6	Potter K & Lovett Doust L	Biomonitoring site quality in stressed aquatic ecosystems using the aquatic macrophyte <i>Vallisneria americana</i>
Tues	900	3.1	de Laplante K	Complex Systems Ecology: Science or Philosophy?
Tues	915	3.2	Kalhok, S	Influence of biological factors on cadmium and metallothionein concentrations in natural populations of a freshwater mussel

Tues	930	3.3	Robinson CJ & Casselman JM	Determination of the sex of fish using growth parameters: Muskellunge ( <i>Esox masquinongy</i> ) and northern pike ( <i>E. lucius</i> ) examples
Tues	945	3.4	McCurdy DG	Nematodes stage the encounter: Migrating sandpipers and crawling amphipods
Tues	1000	3.5	Hecker K, Leonard N & Forbes MRL	Damselflies and gregarines: patterns and effects of parasitism.
Tues	1015	3.6	Leonard, NJ	Limnochares americana Lundblad parasitism of the damselfly Enallagma ebrium: effects on host behaviour and survival.
Tues	1330	4.1	Hume DK & Montgomerie R	Looking for Fluctuating Asymmetry in a Nonstudent Human Sample
Tues	1345	4.2	Bullock HL & Montgomerie R	Fluctuating Asymmetry and Human Sexual Response
Tues	1400	4.3	Judge KA & Brooks RJ	Determinants of chorus tenure and the effects of feeding on chorus behaviour and participation in male bullfrogs, <i>Rana catesbeiana</i>
Tues	1415	4.4	Brown TJ & Handford P	Open Communication: Consistently Degrading
Tues	1430	4.5	Lochead JK & Brooks RJ	Experimental size manipulation of snapping turtle hatchlings ( <i>Chelydra serpentina</i> )
Tues	1445	4.6	Rogers L	The Timing of Sex- and Phase-Change in Stochastic Environments
Tues	1330	5.1	Eckert CG & Mavraganis K	Morphological vs. function dichogamy in columbine, <i>Aquilegia canadensis</i> (Ranunculaceae).
Tues	1345	5.2	Routley MB & Eckert CG	The effect of population size on selffertilization, inbreeding depression and genetic structure in columbine, <i>Aquilegia canadensis</i> (Ranunculaceae)
Tues	1400	5.3	Larson BMH & Barrett SCH	The ecology of pollen limitation in buzz-pollinated <i>Rhexia virginica</i> (Melastomataceae)
Tues	1415	5.4	Grabas G and Laverty TM	The effect of Purple Loosestrife ( <i>Lythrum salicaria</i> ) on the reproductive success of co-flowering wetland plants
Tues	1430	5.5	Dorken ME & Eckert CG	The loss of sex in highly clonal populations of swamp loosestrife, <i>Decodon verticillatus</i> (Lythraceae)
Tues	1445	5.6	Houle D & Rowe L	Capturing constraint in a bottle
Tues	1330	6.1	GregoryEaves I & Smol JP	Diatoms as indicators of past climatic and environmental changes in Alaska
Tues	1345	6.2	Ciesielka IK, Sylvestre SA, Bailey RC	Pooled or averaged description of benthic communities: is there a difference?
Tues	1400	6.3	Linke S & Bailey R C	Impact of seasonal changes on bioassessment using predicted and actual benthic macroinvertebrate communities
Tues	1415	6.4	Hecnar SJ, McCloskey RT & Brooks RJ	Species richness and spatial dynamics of amphibian communities in southwestern Ontario.

Tues	1430	6.5	Bishop DJ	SAPROXYLIC BEETLE ASSEMBLAGES IN RELATION TO HABITAT STRUCTURE OF NATURAL AND MANAGED SPRUCE FORESTS IN NOVA SCOTIA
Tues	1530	7.1	Chek AA, Louheed SC, Bogart JP, Boag PT	Phylogenetic relationships among Neotropical tree frogs of the 30 chromosome clade
Tues	1545	7.2	Holder K, Montgomerie R & Friesen V	Phylogeography of North American rock ptarmigan: a test of the Glacial Refugium Hypothesis
Tues	1600	7.3	Patirana A, Piatt J and Friesen V	A conservation genetic study of common murres ( <i>Uria aalge</i> ) in the Exxon Valdez spill area through a comparison of mitochondrial control region and cytochrome b sequences
Tues	1615	7.4	Wood J & Friesen V	Genetic Variation Between Regional and Colonial Samples of Ancient Murrelets
Tues	1630	7.5	Vallianatos M, Louheed SC, Cadman M & Boag PT	Mitochondrial DNA Diversity in a Declining Eastern Canadian Population of Loggerhead Shrikes ( <i>Lanius ludovicianus</i> ).
Tues	1530	8.1	Downs MP & Cavers PB	The effects of wetting and drying on germination and emergence of bull thistle, <i>Cirsium vulgare</i> (Savi.) Ten.
Tues	1545	8.2	Qaderi MM & Cavers PB	Germination responses of four local populations of Scotch thistle, <i>Onopordum acanthium</i> L., under contrasting light and temperature regimes.
Tues	1600	8.3	Nurse R & Cavers PB	The germination characteristics of <i>Scrophularia marilandica</i> L.
Tues	1615	8.4	Blaney CS, Sotomayor J & Kotanen PM	Comparative seed ecology of native and exotic old field plants.
Tues	1630	8.5	Susko DJ & Lovett-Doust L	Seed mass variation in <i>Alliaria petiolata</i> (Brassicaceae): consequences for seedling fitness
Tues	1645	8.6	Chang ER & Jefferies RL	Seed bank dynamics in degraded and undamaged coastal habitats of the Hudson Bay lowlands.
Wed	900	9.1	Lorch PD	Sex role reversal, sexual selection and Bateman's principle
Wed	915	9.2	Yezerinac S & Gibbs HL	Offspring sex ratio, parental sex allocation and paternity in the yellow warbler
Wed	930	9.3	Houle D & Poon A	Estimates of mutational variance from populations of <i>Drosophila melanogaster</i> in mutation-drift equilibrium.

Wed	945	9.4	Rowe L	Experimental test of life history and behavioral responses to time constraints
Wed	1000	9.5	Tait P & Houle D	Is Shape More Heritable Than Size in <i>Drosophila melanogaster</i>
Wed	1015	9.6	Kassen R & G Bell	The phylogenetic and ecological structure of diversity in <i>Chlamydomonas</i>
Wed	900	10.1	Thurston E & Reader RJ	Impacts of hiking and mountain biking in deciduous forest
Wed	915	10.2	Brgan M & Hunter FF	Adult oviposition choice and larval rearing success of <i>Heliconius</i> butterflies on <i>Passiflora</i> host plants
Wed	930	10.3	de Man F, Houston K & Harmsen R	Effect of winter forage quality on movements of moose ( <i>Alces alces</i> ) in northeastern Ontario.
Wed	945	10.4	McIntire E	Plant Responses To Collared Pika Grazing In Southwest Yukon Territory: The Benefit Of Feeding
Wed	1000	10.5	Bast ML & Reader RJ	Simulated herbivory, resource availability, and compensatory growth by black spruce ( <i>Picea mariana</i> )
Wed	900	11.1	Kramer DL & Chapman MR	Fish home range behaviour and marine reserve design
Wed	915	11.2	Elkin C	Effect of predation risk on micro-habitat selection by larval damselflies.
Wed	930	11.3	de Solla, SR & Brooks, RJ	Incorporating search area into home range estimators
Wed	945	11.4	Imre I, Noakes DLG & McLaughlin RL	Tough choice: Swimming station preference and swimming behaviour of young-of-the-year brook charr ( <i>Salvelinus fontinalis</i> ) in their natural habitat
Wed	1000	11.5	Guiasu RC & Dunham DW	AGGRESSION AND COMPETITION IN THE SURFACE WATER CAMBARUS CRAYFISH SPECIES OF ONTARIO

[top]

# oeeec98 Program

Dept. of Biology Queen's U.  
4-6 May 1998

## TUESDAY MORNING

### ROOM 1102 Animal Mating Systems

CHAIR: COLLEEN BARBER					
Tues	900	1.1	Hutchings JA, Bishop TD & McGregor-Shaw CR	Mate Competition and Mate Choice in a Broadcast Spawner: Do Atlantic Cod Lek?	
Tues	915	1.2	Ortigosa A	Cryptic Female Choice in <i>Gerris buenoi</i> ?	
Tues	930	1.3	Westlake K & Rowe L	The costs of sexual elaborations in the water strider genus <i>Rheumatobates</i> .	
Tues	945	1.4	Tseng M	Sexual size dimorphism and allometry in the water strider <i>Gigantometra gigas</i>	
Tues	1000	1.5	Gentile G	Daily Patterns of Oviposition Mediate Sexual Conflict in a Polygynandrous Mating System	
Tues	1015	1.6	Barber CA & Robertson RJ	Extra-pair young are randomly distributed within the laying sequence of tree swallows	

### ROOM 1103 Plant Ecology

CHAIR: HUGH HENRY					
Tues	900	2.1	Lyons A, Weis LM, and Susko D	Size-dependant variation of reproductive effort in ten species of mustards (Brassicaceae).	
Tues	915	2.2	Bonser SP, Duffy NM & Aarsen LW	Components of size-dependent meristem allocation in <i>Arabidopsis thaliana</i>	
Tues	930	2.3	Henry HAL & Aarsen LW	Patterns of shade tolerance and shade avoidance strategies in 12 species of temperate deciduous trees.	
Tues	945	2.4	Thomas JJ, Massommet B & Eckert CG	Sexual reproduction in introduced populations of flowering rush, <i>Butomus umbellatus</i> (Butomaceae)	
Tues	1000	2.5	Burnham J & Poslusny U	The reproduction of <i>Hydrocharis morsus-ranae</i> L. (Hydrocharitaceae); evidence of density effects on reproduction	
Tues	1015	2.6	Potter K & Lovett Doust L	Biomonitoring site quality in stressed aquatic ecosystems using the aquatic macrophyte <i>Vallisneria americana</i>	

### ROOM 1120 Animal Ecology

CHAIR: SARAH KALHOK					
Tues	900	3.1	de Laplante K	Complex Systems Ecology: Science or Philosophy?	
Tues	915	3.2	Kalhok, S	Influence of biological factors on cadmium and metallothionein concentrations in natural populations of a freshwater mussel	
Tues	930	3.3	Robinson CJ & Casselman JM	Determination of the sex of fish using growth parameters: Muskellunge ( <i>Esox masquinongy</i> ) and northern pike ( <i>E. lucius</i> ) examples	
Tues	945	3.4	McCurdy DG	Nematodes stage the encounter: Migrating sandpipers and crawling amphipods	
Tues	1000	3.5	Hecker K, Leonard N & Forbes MRL	Damselflies and gregarines: patterns and effects of parasitism.	
Tues	1015	3.6	Leonard, NJ	Limnochares americana Lundblad parasitism of the damselfly <i>Enallagma ebrium</i> : effects on host behaviour and survival.	

### 10:30 - 11:00 COFFEE BREAK IN THE ATRIUM

11:00-12:00 JEFF HUTCHINGS, Dalhousie University: Strengthening the Role and Communication of Science in
ROOM 1102 Canadian Fisheries Resource Management

12:00 - 13:30 LUNCH IN THE ATRIUM (included in your registration fee)

# oeec98 Program

## TUESDAY AFTERNOON

### ROOM 1102 Sex & Communication

				Chair:
Tues	1330	4.1	Hume DK & Montgomerie R	Looking for Fluctuating Asymmetry in a Nonstudent Human Sample
Tues	1345	4.2	Bullock HL & Montgomerie R	Fluctuating Asymmetry and Human Sexual Response
Tues	1400	4.3	Judge KA & Brooks RJ	Determinants of chorus tenure and the effects of feeding on chorus behaviour and participation in male bullfrogs, <i>Rana catesbeiana</i>
Tues	1415	4.4	Brown TJ & Handford P	Open Communication: Consistently Degrading
Tues	1430	4.5	Lochead JK & Brooks RJ	Experimental size manipulation of snapping turtle hatchlings ( <i>Chelydra serpentina</i> )
Tues	1445	4.6	Rogers L	The Timing of Sex- and Phase-Change in Stochastic Environments

### ROOM 1102 Sex & Communication

				Chair:
Tues	1330	4.1	Hume DK & Montgomerie R	Looking for Fluctuating Asymmetry in a Nonstudent Human Sample
Tues	1345	4.2	Bullock HL & Montgomerie R	Fluctuating Asymmetry and Human Sexual Response
Tues	1400	4.3	Judge KA & Brooks RJ	Determinants of chorus tenure and the effects of feeding on chorus behaviour and participation in male bullfrogs, <i>Rana catesbeiana</i>
Tues	1415	4.4	Brown TJ & Handford P	Open Communication: Consistently Degrading
Tues	1430	4.5	Lochead JK & Brooks RJ	Experimental size manipulation of snapping turtle hatchlings ( <i>Chelydra serpentina</i> )
Tues	1445	4.6	Rogers L	The Timing of Sex- and Phase-Change in Stochastic Environments

### ROOM 1103 Plant Sex

				Chair:
Tues	1330	5.1	Eckert CG & Mavraganis K	Morphological vs. function dichotomy in columbine, <i>Aquilegia canadensis</i> (Ranunculaceae).
Tues	1345	5.2	Routley MB & Eckert CG	The effect of population size on self fertilization, inbreeding depression and genetic structure in columbine, <i>Aquilegia canadensis</i> (Ranunculaceae)
Tues	1400	5.3	Larson BMH & Barrett SCH	The ecology of pollen limitation in buzz-pollinated <i>Rhexia virginica</i> (Melastomataceae)
Tues	1415	5.4	Grabas G and Laverty TM	The effect of Purple Loosestrife ( <i>Lythrum salicaria</i> ) on the reproductive success of co-flowering wetland plants
Tues	1430	5.5	Dorken ME & Eckert CG	The loss of sex in highly clonal populations of swamp loosestrife, <i>Decodon verticillatus</i> (Lythraceae)
Tues	1445	5.6	Houle D & Rowe L	Capturing constraint in a bottle

### ROOM 1103 Plant Sex

				Chair:
Tues	1330	5.1	Eckert CG & Mavraganis K	Morphological vs. function dichotomy in columbine, <i>Aquilegia canadensis</i> (Ranunculaceae).
Tues	1345	5.2	Routley MB & Eckert CG	The effect of population size on self fertilization, inbreeding depression and genetic structure in columbine, <i>Aquilegia canadensis</i> (Ranunculaceae)
Tues	1400	5.3	Larson BMH & Barrett SCH	The ecology of pollen limitation in buzz-pollinated <i>Rhexia virginica</i> (Melastomataceae)
Tues	1415	5.4	Grabas G and Laverty TM	The effect of Purple Loosestrife ( <i>Lythrum salicaria</i> ) on the reproductive success of co-flowering wetland plants
Tues	1430	5.5	Dorken ME & Eckert CG	The loss of sex in highly clonal populations of swamp loosestrife, <i>Decodon verticillatus</i> (Lythraceae)
Tues	1445	5.6	Houle D & Rowe L	Capturing constraint in a bottle

### ROOM 1120 Community Ecology

				Chair:
Tues	1330	6.1	Gregory-Eaves I & Smol JP	Diatoms as Indicators of past climatic and environmental changes in Alaska
Tues	1345	6.2	Ciesielka IK, Sylvestre SA, Bailey RC	Pooled or averaged description of benthic communities: Is there a difference?
Tues	1400	6.3	Linke S & Bailey RC	Impact of seasonal changes on bioassessment using predicted and actual benthic macroinvertebrate communities
Tues	1415	6.4	Hecnar SJ, McCloskey RT & Brooks RJ	Species richness and spatial dynamics of amphibian communities in southwestern Ontario.
				SAPROXYLIC BEETLE ASSEMBLAGES IN RELATION TO HABITAT STRUCTURE OF NATURAL AND

**TUESDAY AFTERNOON****ROOM 1102 Molecular Ecology**

<b>CHAIR: KAREN HOLDER</b>			
Tues	1530	7.1	Chek AA, Lougheed SC, Bogart JP, Boag PT
Tues	1545	7.2	Holder K, Montgomerie R & Friesen V
Tues	1600	7.3	Pattarana A, Piatt J and Friesen V
Tues	1615	7.4	Wood J & Friesen V
Tues	1630	7.5	Vallianatos M, Lougheed SC, Cadman M, Boag PT <i>ludovicianus</i> .

**ROOM 1103 Seed Ecology**

<b>CHAIR: E. CHANG</b>			
Tues	1530	8.1	Downs MP & Cavers PB
Tues	1545	8.2	Qaderi MM & Cavers PB
Tues	1600	8.3	Nurse R & Cavers PB
Tues	1615	8.4	Blaney CS, Sotomayor J & Kotanen PM
Tues	1630	8.5	Susko DJ & Lovett-Doust L
Tues	1645	8.6	Chang ER & Jefferies RL

**17:00–19:00 POSTERS and cocktails IN THE ATRIUM****19:00–MIDNIGHT BBQ & Music IN THE ATRIUM (included in your registration fee)**

### **WEDNESDAY MORNING**

#### **ROOM 1102 Animal Sex**

**CHAIR: STEPHEN YEZERINAC**

Wed 900 9.1	Lorch PD	Sex role reversal, sexual selection and Bateman's principle
Wed 915 9.2	Yezernac S & Gibbs HL	Offspring sex ratio, parental sex allocation and paternity in the yellow warbler
Wed 930 9.3	Houle D & Poon A	Estimates of mutational variance from populations of <i>Drosophila melanogaster</i> in mutation-drift equilibrium.
Wed 945 9.4	Rowe L	Experimental test of life history and behavioral responses to time constraints
Wed 1000 9.5	Tait P & Houle D	Is Shape More Heritable Than Size in <i>Drosophila melanogaster</i>
Wed 1015 9.6	Kassen R & G Bell	The phylogenetic and ecological structure of diversity in <i>Chlamydomonas</i>

#### **ROOM 1103 Mostly Herbivory**

**CHAIR: FEMKE DEMAN**

Wed 900 10.1	Thurston E & Reader RJ	Impacts of hiking and mountain biking in deciduous forest
Wed 915 10.2	Brgan M & Hunter FF	Adult oviposition choice and larval rearing success of <i>Heliconius</i> butterflies on Passiflora host plants
Wed 930 10.3	de Man F, Houston K & Harmsen R	Effect of winter forage quality on movements of moose ( <i>Alces alces</i> ) in northeastern Ontario.
Wed 945 10.4	McIntire E	Plant Responses To Collared Pika Grazing In Southwest Yukon Territory: The Benefit Of Feeding
Wed 1000 10.5	Bast ML & Reader RJ	Simulated herbivory, resource availability, and compensatory growth by black spruce ( <i>Picea mariana</i> )

#### **ROOM 1120 Habitat Selection**

**CHAIR: ISTVAN IMRE**

Wed 900 11.1	Kramer DL & Chapman MR	Fish home range behaviour and marine reserve design
Wed 915 11.2	Elkin C	Effect of predation risk on micro-habitat selection by larval damselflies.
Wed 930 11.3	de Solla, SR & Brooks, RJ	Incorporating search area into home range estimators
Wed 945 11.4	Imre I, Noakes DLG & McLaughlin RL	Tough choice: Swimming station preference and swimming behaviour of young-of-the-year brook charr ( <i>Salvelinus fontinalis</i> ) in their natural habitat
Wed 1000 11.5	Gulasu RC & Dunham DW	AGGRESSION AND COMPETITION IN THE SURFACE WATER CAMBARUS CRAYFISH SPECIES OF ONTARIO

### **10:30 - 11:00 COFFEE BREAK IN THE ATRIUM**

**11:00–12:00 LUC-ALAIN GIRALDEAU, Concordia University: The Emergence of Social Foraging  
ROOM 1102**

**12:00 LUNCH (not included in registration fee) and DEPARTURE**

**12:00–13:00 STEERING COMMITTEE MEETING (gather outside Room 1102)**

**Poster No. 12.01**

Avila G & Stephenson AG

Spatial pattern of damage and overcompensation in *Cucurbita texana*: male and female functions

**Poster No. 12.02**

Betts AA, Smol JP & Zeeb BA

A paleolimnological investigation of environmental change in the high arctic

**Poster No. 12.03**

Havelock JM & Smol JP

The use of diatom-inferred paleolimnological techniques to assess the effects of anthropogenic watershed development in the Muskoka-Haliburton region, Ontario

**Poster No. 12.04**

Keogh T & Keddy PA

Patterns of tree species richness in forested wetlands

**Poster No. 12.05**

Neidrauer L, Lougheed SC, Chek AA, Boag PT

Phylogeography of a North American tree frog, *Pseudacris crucifer*

**Poster No. 12.06**

Porto, L., Noakes, D.L.G. & McLaughlin, R.L.

Impact of Low-head Barrier Dams on Fish Movements

**Poster No. 12.07**

Ramsay SM & Ratcliffe LM

Mating tactics of female black-capped chickadees

**Poster No. 12.08**

Rendell WB &amp; Robertson RJ

Clutch-size variation in a cavity-nesting passerine: is it best explained by individual optimization theory?

**Poster No. 12.09**

Robb L &amp; Maxwell C

Dinitrogen fixation by cyanobacterial crusts in two temperate limestone quarry

**Poster No. 12.10**

Sokolovska N

A metaanalysis on the relationship between body size and fitness in damselflies and dragonflies

**Poster No. 12.11**

Stuart CTL &amp; Cumming BF

Climate change on the Canadian prairies: a ten thousand year perspective

**Poster No. 12.12**

Tarof S &amp; Ratcliffe L

Sexual and Natural Selection in Least Flycatchers (*Empidonax minimus*): Why do Breeding Birds Cluster?**Poster No. 12.13**

Van Coeverden de Groot P and Boag P

A preliminary study of muskox microsatellites - invariance galore.

*Poster No. 12.14**+ Montgomery R**Sperm mobility in arctic char*

---

Avila G & Stephenson AG

POSTER

Department of Biology, Penn State University

**Spatial pattern of damage and overcompensation in *Cucurbita texana*: male and female functions**

Herbivores forage according to different temporal and spatial patterns. Since carbon translocation is restricted in plants, the effects of herbivore damage on plant fitness could be influenced by the spatial pattern of the damage. It has been proposed that when damage is dispersed over the whole canopy of a plant, it is less detrimental than when the same amount of damage is concentrated in one or a few branches. This hypothesis was tested on the wild gourd *Cucurbita texana* grown in agricultural fields. On 25 plants, we selected three branches and randomly assigned them to one of three foliar damage treatments: control (undamaged), dispersed - 5% leaf area damaged on each leaf, or concentrated - 15% leaf area removed from every third leaf. Both damage treatments had a 5% damage intensity at the branch level. Herbivory was simulated using a paper puncher. We assessed the male reproductive function in terms of pollen germination and pollen tube growth rate in vitro. We performed a pollen competition experiment to evaluate the ability of pollen from each treatment to sire seeds. To assess the female function, all the seeds from two mature fruits on each branch, were counted and a sample of them was weighed.

Male function - We found no differences among treatments for pollen germination and pollen tube growth. However, pollen from both damage treatments sired more seeds than pollen from flowers on the control branches. Female function - The number of seeds per fruit was larger in the concentrated damage treatment than in the other two. These unexpected results suggest that, at this level of damage, the nodes bearing the structures in which pollen and seeds are developed are favoured by physiological changes induced by the damage. Seed mass was influenced by the combination of plant and treatment. Additional experiments suggested that undamaged parts of the plants are providing the resources needed for reproduction at the damaged branches.

---

Barber CA & Robertson RJ

Raleigh

PAPER

Department of Biology, Queen's University

**Extra-pair young are randomly distributed within the laying sequence of tree swallows**

We examined nestling paternity with respect to laying order in nineteen tree swallow (*Tachycineta bicolor*) broods having mixed paternity to test the prediction that extra-pair young are more likely to hatch out of later-laid eggs than earlier-laid eggs. We found no evidence for an increased frequency of extra-pair young with laying, but instead determined that extra-pair young are randomly distributed within the laying sequence. Therefore, females who decide to obtain fertilizations outside of the pair bond pursue extra-pair copulations even before they begin laying.

Bast ML & Reader RJ *Ruthard*  
University of Guelph

PAI

**Simulated herbivory, resource availability, and compensatory growth by black spruce (*Picea mariana*)**

This study tested the hypotheses that a woody plant with a slow growth rate: 1) does not grow faster in a high resource environment than in a low resource environment, and 2) does not compensate for tissue lost to herbivores regardless of resource availability. To test these hypotheses, the annual growth of 5 year old black spruce trees (*Picea mariana* (Miller) BSP was measured in field plots where both herbivory and resource availability were manipulated experimentally. Herbivory treatments consisted of 4 levels of bud removal (none, 25%, 50%, 75%) from the top 1/3 of the tree which simulated late winter bud removal by hares. In low resource availability plots, vegetation surrounding spruce trees was left intact and no fertilizer was added. In high resource availability plots, vegetation surrounding spruce trees was removed and fertilizer was added. The total mass of new shoots produced per tree was recorded to evaluate the effects of experimental treatments. Shoot mass was significantly greater in the high resource availability treatment than in the low resource availability treatment. Bud removal did not affect shoot mass, regardless of resource level, indicating that trees compensated for simulated herbivory. These results do not support the two hypotheses. Rapid, indeterminate growth apparently allows juvenile black spruce to replace tissue lost to herbivores and to take advantage of a high resource environment.

*Jinn*

Betts AA, Smol JP & Zeeb BA

*J*

POST

Department of Biology, Queen's University

**A paleolimnological investigation of environmental change in the high arctic**

High Arctic ponds and small lakes respond rapidly to slight changes in environmental conditions due to their small size and simple food webs. Consequently, these aquatic systems make ideal study sites for paleoecological studies. Furthermore, chrysophyte algae, which typically dominate the phytoplankton and periphyton of northern regions, may be particularly useful indicators for studies of environmental change in arctic environments. However, to date, very few data are available on this new group of paleoindicators.

Bishop DJ

*V*

PAI

Department of Biology, Carleton University

**Saproxylic beetle assemblages in relation to habitat structure of natural and managed spruce forests in Nova Scotia**

Conservation initiatives that seek to minimize the alteration of biodiversity by forestry must incorporate an understanding of the relationship between disturbance and forest biodiversity. One requirement is to understand how forestry alters forest habitat structures that are important for forest species. This paper examines the relationship between deadwood habitat structures and saproxylic beetles in red spruce forests with natural (wind and fire) and forestry (clearcut and clearcut with thinning) disturbance histories. These relationships are considered within forests (alpha diversity) and between forests (beta diversity), and the contribution of the variation at the alpha and beta scales to the overall (gamma) diversity were analyzed. Although little evidence supports the prediction of low species richness in managed forests, strong evidence supported predictions that the beetle assemblage was composed differently depending on forest disturbance class, that turnover of beetle assemblages was high.

by CS, Sotomayor J & Kotanen PM

Department of Botany, University of Toronto

**Comparative seed ecology of native and exotic old field plants.**

ecology may differ significantly between native and exotic plants. For example, in arison with natives, seeds of exotics may be more dispersive (reflecting a history of ization and dispersal), and less subject to predation and disease (reflecting escape from al enemies). However, experimental tests of these ideas are rare, and often are unded by phylogenetic relationships among species. We have performed field iments to examine adhesive dispersal, above-ground predation, and below-ground s of seeds of more than 60 native and exotic plants occurring in old fields in southern o. We have controlled for relationship by using phylogenetically independent arisons. Results indicate that native and exotic species did not differ with respect to rsal ability or losses to above-ground seed predators. In contrast, natives suffered icant losses to below-ground predators and fungal pathogens, while exotics did not. results indicate that escape from predators and pathogens in the seed bank may ate plant invasions.

PAPER

er SP, Duffy NM & Aarssen LW

Department of Biology, Queen's University

PAPER

**Components of size-dependent meristem allocation in *Arabidopsis thaliana***

xamined how the allocation of meristems to reproductive versus vegetative fates varies plant size in *Arabidopsis thaliana*. A clear allometric relationship was evident but the n of allometry depended on what was causing variation in plant size. The components e variation between plants are genotypic variation, environmental variation, and ion in age or developmental stage. Allocation of meristems to reproduction (%R) used with plant size when size variation was due to variation in age only (constant onment and genotype). However, for plants that were allowed to reach final opmental stage (senescence), %R decreased with plant size when size variation was due ototypic variation only (constant environment and stage), and %R decreased or was endent of plant size when size variation was due to environmental variation only ant stage and genotype). Size-dependent meristem allocation can be interpreted in of size threshold effects, canalized patterns of development, structural constraints and trategy associated with adaptation to changing mortality risks with change in size and changing environmental conditions that limit size. However, these results indicate that terpretation of size-dependence is generally not possible if the three components of ariation are not controlled to avoid confounding effects of their interaction.

---

Brgan M & Hunter FF

PAPER

Biological Sciences Dept., Brock University

**Adult oviposition choice and larval rearing success of *Heliconius* butterflies on *Passiflora* host plants**

The larvae of *Heliconius charithonia*, a common butterfly of South America, feed on plants in the family Passifloraceae. Tests were done to determine whether prior feeding on selected host plants had an effect on oviposition choice in the next generation of females. Females were reared in an insectarium and tested for their ovipositional preferences with 6 different host plants (*Passiflora biflora*, *P. coracea*, *P. caerulea*, *P. edulis*, *P. vitifolia*, *P. quadrangularis*). Larvae were fed with the same plants to ascertain their viability (percentage reaching adulthood), time spent in the larval stage (days), and growth rate. The results obtained indicate that host plant consumed by *H. charithonia* had a significant effect on the viability, time spent in the larval stage, and larval growth rates. Ovipositional choice of adult females did show a casual shift towards the host plant fed while in the larval stage.

---

Brown TJ & Handford P <sup>Law</sup>

PAPER

Department of Zoology, University of Western Ontario

**Open Communication: Consistently Degrading**

The acoustic adaptation hypothesis (AAH) predicts that vocalizations intended for long range unambiguous communication should possess amplitude modulation (AM) characteristics such that the temporal patterning of amplitude degrades (due to reverberation and atmospheric turbulence) less than alternative patterns during transmission through native type habitat. Specifically, the AAH predicts that OPEN HABITAT signals should be structured as rapid rate AM TRILLS. Such a signal structure is expected to best combat irregular amplitude fluctuations (IAFs), the main form of degradation typical of open habitats. IAFs are expected to mask low rate AM signal patterns (i.e. whistles). Three experimental approaches were taken to investigate the AAH predictions for open habitat signal structure. Results from a computer simulation, the transmission of synthetic signals through natural habitats, and the transmission of natural bird song through natural habitats, all offer clear support the general AAH predictions that open habitat signal should be structured as trills. However, the results reveal that the standard rationale which underlies these predictions (i.e. minimization of degradation) is incomplete because assessments of signal performance must not only consider which structure minimizes average degradation levels incurred (i.e. transmits best on average), but also which structure minimizes the variability about that average transmission quality. Results from the 3 experimental approaches revealed that in open habitats, although trills incur more degradation, on average, than whistles, they clearly transmit with a greater consistency in quality compared to highly variable whistles. Therefore, in open habitats, the only type of signal that degrades both INCREASINGLY AND PREDICTABLY with distance are trilled signals.

ck HL & Montgomerie R  
rtment of Biology, Queen's University

### Fluctuating asymmetry and human sexual response

an female orgasm is not necessary for conception. It therefore seems reasonable to hypothesize that orgasm is an adaptation that has other utilities. One possibility is that the orgasm exists as an adaptation for influencing sperm competition (Thornhill et al. 1995; Animal Behaviour, 50, 16011615) which examined the relationship between human female orgasm and mate fluctuating asymmetry (FA). Through a series of multiple regressions, Thornhill et al. (1995) found that FA was the only significant predictor of the frequency of female orgasm. Other factors (such as socioeconomic status, male relationship duration, age, and love) did not significantly predict orgasm rate. By using a sample size of 111 couples, we chose an alternative measurement technique photographing characters and counting the images from down loaded photos to determine the overall fluctuating asymmetry index (FAI) and the frequency of female orgasms. Using multiple regression analyses, our results demonstrate that no relationship exists between male FAI and female orgasm rate. These results contradict those found in Thornhill et al. (1995) and we conclude that further investigation is necessary to determine the relationship between male FA and frequency of female orgasm.

PAPER

(N18 1,6,1)

lam J & Posluszny U  
tment of Botany, University of Guelph

PAPER

### Reproduction of *Hydrocharis morsus-ranae* L. (Hydrocharitaceae); evidence of density effects on reproduction

*Hydrocharis morsus-ranae* L., European Frog's bit, is a floating aquatic plant that reproduces sexually by seeds or asexually by turions. Its dense and rapid growth can have an effect on aquatic ecosystems. The literature states that the plant predominately reproduces by turions and that sexual reproduction is of limited importance; however, there is little evidence to support this hypothesis. Production of seeds and turions, per square meter, was measured by placing sections of the floating mat into partially submersed buckets. Wet weight, number and sex of flowers, number and mass of turions, fruits and seeds per fruit were recorded for thirty-six replicates. A significant linear correlation exist between density, biomass per area, and the number of turions produced; with a tradeoff between the number and mass of turions produced. At high density, the mat produced 8001,000 seeds/m<sup>2</sup> with 80% being smaller than 0.09 grams. At low density, the mat produced 25300 seeds/m<sup>2</sup> with 50% being larger than 0.09 grams. Seed production contained numerous variables: number of female flowers, male:female sex ratio, and the number of seeds per fruit. At low density, the mat produced a skewed female sex ratio; however, the number of seeds per fruit was low; 1520 seeds/fruit. In areas with high density the mat produced a balanced male sex ratio and only a few female flowers exist, but they contained 5560 seeds/fruit. At intermediate densities, the population contained a male favored sex ratio, but had a relative high number of seeds per fruit, resulting in 3,0004,000 seeds/m<sup>2</sup>. These results suggest that density effects sexual and asexual reproduction.

---

Chang ER & Jefferies RL

PAPER

Department of Botany, University of Toronto

**Seed bank dynamics in degraded and undamaged coastal habitats of the Hudson Bay lowlands.**

Spring grubbing and heavy grazing by high numbers of lesser snow geese (*Anser caerulescens caerulescens*) have triggered the conversion of large tracts of coastal salt marsh into mudflats largely devoid of vegetation. A recent study has shown that in the absence of grazing, vegetative re-establishment of early successional graminoids is possible in these desertified areas. However, the regenerative potential of higher successional dicotyledonous species from soil seed reserves remains to be determined. Due to the position of their apical meristems, dicotyledonous species are particularly vulnerable to goose foraging. The objectives of this study were 1) to determine the size and composition of the seed bank in undamaged and degraded soils, 2) to deduce the relationship between the existing species present in the vegetation and the seed bank and 3) to assess the potential for revegetation in the case that grazing pressure and soil degradation processes can be stabilized. Soil cores were collected from both intact and degraded sites and their seed content was determined through a modified seedling emergence technique. Preliminary results have indicated large differences in the seed bank composition of intact and degraded sites. The seed banks of degraded areas were dominated by mudflat annuals, in particular the halophyte, *Salicornia borealis*. In contrast, there was greater number and diversity of seeds as well as closer representation of species typical of salt-marsh vegetation in undamaged sites. The absence of some formerly abundant species (*Potentilla egedii*, *Plantago maritima*, *Stellaria humifusa*) from the seed bank could be due to seed predation and the negative effects of sustained goose grazing on seed input into the soil.

---

*Author* *Author* *Author*

Chek AA, Lougheed SC, Bogart JP, Boag PT

PAPER

Dept. of Zoology, University of Guelph, Dept of Biology, Queen's Univ

**Phylogenetic relationships among Neotropical tree frogs of the 30 chromosome clade**

The phylogenetic relationships among tropical taxa are poorly known when compared to temperate counterparts. In frogs, this situation is compounded by a notoriously conserved morphology which yields few readily-apparent characters. Thus hypotheses of speciation and character evolution have often been based on limited data or simply relied upon gross similarity and contemporary biogeography. We have used DNA sequence data to investigate the phylogenetic affinities among the 30 chromosome group of tree frogs of the genus *Hyla*. This group has representatives from Central America through the Andes, across the Amazon basin and into the Atlantic forests of Brasil. We compare the existing view of this group with the picture revealed by DNA sequence data.

Ciesielka IK(1), Sylvestre SA(2), Bailey RC(1)

✓ PAPER

1 Dept Zoology, Univ Western Ontario; 2 Environment Canada, Atmospheric & Aquatic Sciences, Vancouver

**Pooled or averaged description of benthic communities: is there a difference?**

Within the last several years, benthic macroinvertebrates have proven to be good indicators of water quality, and the use of biological assessment in running water systems has increased dramatically. One overlooked aspect of these studies has been the variation of benthic communities at multiple spatial scales. We characterize variation among sites carefully, yet we still know little about the spatial variability within a site, and virtually never include such variation in our description of the community at the site. Many current biological assessment methods [e.g. RBP] consist of visiting the stream, selecting a riffle, and taking one or more samples within the riffle. Regardless of the particular metric(s) employed to describe the community, the observations taken at a given site are averaged or pooled prior to calculation of indices or application of a multivariate approach. I will demonstrate how replicated observations from a given site can be used to create a much more comprehensive description of the community present, and lead to more sensitive and accurate bioassessments.

de Laplante K

✓ PAPER

Department of Philosophy, University of Western Ontario

**Complex Systems Ecology: Science or Philosophy?**

Complex Systems Ecology (CSE) is a blend of traditional ecosystem ecology, network theory, thermodynamics and hierarchy theory. I review the historical development of CSE, and analyze the relationship between the different theoretical components of CSE and the way they interact to generate explanations of ecological phenomena. Finally, I consider the scientific and philosophical consequences of accepting CSE as a legitimate branch of ecological science.

de Man F, Houston K & Harmsen R

Rolf

✓ PAPER

Department of Biology, Queen's University

**Effect of winter forage quality on movements of moose (*Alces alces*) in northeastern Ontario.**

During mid-winter, moose in the claybelt region of northeastern Ontario relocate from sparse mixedwood stands with open canopies to more sheltered, heavily forested areas. Various factors have been proposed to account for the move, namely increasing snow depth, thermoregulatory constraints and predator avoidance. One factor which has not been considered is the relationship between forage quality and the selection of particular plant species for feeding. We tested the hypothesis that moose habitat selection in winter is based on differences in forage quality between habitat types. Beginning in January 1997, four different plant species were sampled over a four month period from both early and late winter habitat sites in northeastern Ontario. Samples were analyzed for levels of total carbohydrates, lignin, cellulose and nitrogen. While some forage species more common to early sites have a higher nutritional quality than those common to late sites, there is no significant difference in quality within species over the first three months. This may imply that the nutritional quality of a forage species is not influencing moose winter movement, however, species assemblages differ among habitats and affect the overall nutritional quality available to moose.

de Solla, SR & Brooks, RJ

Department of Zoology, U. of Guelph

### Incorporating search area into home range estimators

Home range analyses are commonly used by ecologists to test aspects of behaviour, demographics, reproductive strategies, and other aspects of ecology. Utilization distributions, which are often used to estimate home ranges, do not follow from the definition of home range. The utilization distribution area estimated from the location observations taken from the animal's path may approach a zero area as the sample size increased. I suggest a method that uses the animal's search area to determine the bound of the home range. I simulated 100 animal paths within a bounded region and then subsampled the paths at different time intervals. Home ranges were then estimated for interval using kernel density analysis. The bandwidth of the kernels were selected using least-squares cross-validation (LSCV) to estimate the utilization distribution. The bandw was also selected using invariant kernels, corresponding to search radii, to estimate the search area. The use of LSCV led to inconsistent and highly variable estimates, while th invariant kernels tended towards non-zero asymptotes, and had much lower variances. use of search area calls into question the concept of a single boundary home range; inst home ranges may be multi-dimensional areas that depend upon interactions between s patterns and resource types, and vary with spatial scale.

PA

Dorken ME & Eckert CG

PA

Department of Biology, Queen's University

### The loss of sex in highly clonal populations of swamp loosestrife, *Decodon verticillatus* (Lythraceae)

Most flowering plants are capable of both sexual and asexual reproduction, and the bal between the two reproductive modes has a major impact on the demography, genetic diversity and, ultimately, the evolutionary potential of populations. In this study, we investigated ecological and genetic factors potentially underlying wide variation in sexuality among populations of the clonal, tristylous, wetland plant, *Decodon verticillatus*. I surveyed components of sexual reproduction in 28 populations distributed along a 400 km northsouth transect in New England, and then compared the sexual capacity of these populations in a greenhouse. All components of sexual reproduction were much lower in northern compared to southern populations, and were strongly correlated with temperatures during flowering and fruiting. Northern populations were also uniformly monomorphic for style length, and an investigation of genotypic diversity at allozyme loci revealed that 83% of these populations consist of single clones. When grown in the greenhouse, plants from northern populations exhibited reduced pollen tube growth and an extremely limited seed set compared to plants from southern populations. Together with detailed genetic analyses, the results of this study suggest that sexual infertility in northern populations of *D. verticillatus* is the result of relaxed selection for sex accompanied by the accumulation of mutations impairing sexual functions.

is MP & Cavers PB

rtment of Plant Sciences, University of Western Ontario

**Effects of wetting and drying on germination and emergence of bull thistle, *Cirsium  
re* (Savi.) Ten.**

Bull thistle is a noxious weed, the seeds of which have little or no dormancy. Following dispersal from the parent plant, these seeds will germinate readily, both in the fall and spring. It commonly grows in disturbed areas, fields, pastures, fencelines and woodlot edges. The distribution of bull thistle along fencelines and woodlot edges is less concentrated than in some other habitats. In the fall, leaf litter accumulates in areas where density of bull thistles is low. Seedling emergence is greatly reduced by the presence of litter. This reduction may be a result of physical or chemical factors, or interactions between the two. One such factor is water availability. Seeds under layers of leaf litter receive less moisture than those in open areas. As such, they are exposed to periods of water availability immediately following rainfall, and periods of restricted water availability afterwards. The objective of this study was to determine the effects of cycles of wetting and drying on germination and emergence of bull thistle seeds and seedlings. Seeds were exposed to 0, 1, 2, 4, or 8 cycles of wetting and drying both in petri dishes and pots of soil. In all cases, exposure to these cycles resulted in decreased and/or delayed germination and emergence, with some of the seeds becoming dormant. These results suggest that changes in water relations associated with the presence of leaf litter are involved in observed reductions or delays in seedling emergence.

✓ PAPER

---

Eckert CG & Mavraganis K

PAPER

Department of Biology, Queen's University

**Morphological vs functional dichogamy in columbine, *Aquilegia canadensis* (Ranunculaceae)**

The maturation of anthers and pistils at different times within flowers (dichogamy) is very common in angiosperms. In selfcompatible species, dichogamy is thought to be a key trait controlling the levels of self and crossfertilization. However, the effectiveness of dichogamy depends strongly on patterns of pollinator visitation and foraging behaviour. We investigated the functioning of dichogamy in *Aquilegia canadensis*, a shortlived, selfcompatible, springflowering perennial common to rocky outcrops throughout eastern North America. Within flowers, styles elongate to position the stigmas to where they might contact visiting pollinators about 5 days before the stamens unfurl to bring dehiscing anthers close to the stigmas, resulting in automatic selfpollination. If dichogamy is effective in reducing selfing, then stigmas must collect enough pollen to fertilize the 25 or so ovules in each ovary before anthers start shedding pollen. In contrast, an analysis of pollen deposition across the floral life span in four populations indicated that, on average, only 8 pollen grains were deposited on each stigma before anther dehiscence compared to 240 grains by the end of anther dehiscence. Limited pollen deposition before anther dehiscence is associated with extremely low levels of nectar production and sepal expansion, suggesting that flowers are relatively unattractive to pollinators during this phase. Finally, controlled crosses in a greenhouse followed by analysis of pollen tube growth showed that, even if pollen is deposited on stigmas, germination and tube growth is very limited before dehiscence. These observations suggest that dichogamy does not greatly reduce the potential for selffertilization. Indeed, estimates of the proportion of seeds produced through selffertilization for two populations were high (average = 0.45). These results indicate a disparity between the degree of morphological vs. functional dichogamy in *A. canadensis*. Though flowers present stigmas well before anther dehiscence, there is little or no temporal

---

Elkin C

PAPER

Department of Zoology, University of Toronto

**Effect of predation risk on micro-habitat selection by larval damselflies.**

Many studies indicate organisms select micro-habitats with high structural complexity as a way of reducing risk of predation. I used laboratory experiments to show that damselfly larvae, *Ischnura verticalis*, suffer higher predation rates from pumpkinseed sunfish in low density vegetation. However, larvae do not preferentially occupy micro-habitats with high vegetation density in either the presence or absence of sunfish; when given a choice, number of larvae per stem of vegetation was equal across all densities of vegetation. That larvae do not congregate in dense vegetation may reflect costs of aggressive interactions. Larval interactions result in an increase in conspicuous behaviours, most notably swimming, and a consequent increase in predation from fish. Results from a subsequent experiment suggest micro-habitat selection reflects a trade off between reduced risk of predation in areas of high vegetation caused by the decreased proximity of larvae and the subsequent increase in activity.

- any mobility of individual larvae?

Gentile G

PAPER

Department of Biology, Concordia University

**Daily Patterns of Oviposition Mediate Sexual Conflict in a Polygynandrous Mating System**

Sexual conflict is now considered a strong force in shaping mating systems. Thus an understanding of the behaviour of both sexes is essential. The waterstrider *Aquarius remigis* has been used in several studies investigating sexual conflict. However, little is known about oviposition behaviour or how it might affect male / female interactions. In this study, I observed and quantified oviposition behaviour, tested whether the absence of males affected the temporal pattern of oviposition, and looked for relationships between oviposition behaviour and male / female interactions. Females oviposited under water and in a manner not previously described for waterstriders. A daily rhythm in oviposition occurred in the absence of temperature cues. Rates of oviposition were highest in the evening just prior to 'lights out' or dusk and continued above average for the first few hours of darkness. In the absence of males, females oviposited at more moderate rates, over a longer span of light hours, and at very low rates in the dark. Delayed oviposition in the presence of males was not a consequence of prolonged copulation since females initiated oviposition around the same time regardless of their copulation history. Females were much more reluctant to mate before oviposition than after oviposition. The daily rhythm of oviposition and the effect of oviposition on female reluctance alter the intensities of sexual conflict and sexual selection over the course of the day.

Grabas G and Laverty TM

PAPER

Department of Zoology, Univ Western Ontario

**The effect of Purple Loosestrife (*Lythrum salicaria*) on the reproductive success of co-flowering wetland plants**

Purple Loosestrife (*Lythrum salicaria*) was introduced to North America from Eurasia in the early nineteenth century. Since then, it has spread and become well established in several locations across the continent. Although there have been several attempts to control and eradicate *L. salicaria*, it is still not clear what effect, if any, *L. salicaria* has on native wetland flora and fauna. In this study, we investigated the impact of *L. salicaria* on the reproductive success of two co-flowering, native wetland plant species: Spotted Touch-me-not (*Impatiens capensis*) and Joe-pye Weed (*Eupatorium maculatum*), in southwestern Ontario. At two sites, in the summer of 1997, we measured and compared factors that influence reproductive success in these plants such as pollinator visitation, heterospecific and conspecific stigmatic pollen loads, fruit set and seed set within experimentally manipulated plots of low, medium and high densities of *L. salicaria*. We found that *E. maculatum* received more frequent pollinator visits in the medium and high densities of *L. salicaria* than at the low density treatment. This trend was partially reflected by significantly more *L. salicaria* pollen grains on *E. maculatum* stigmas at the medium density of *L. salicaria*. Although an increase in the proportion of heterospecific pollen can have detrimental effects on reproductive success in some plants, subsequent seed production in *E. maculatum* was not significantly affected despite the increase in pollen contamination. At high densities of *L. salicaria* we also found that *I. capensis* set significantly fewer fruit than at the medium or low densities. Pollinator observations indicated a large overlap in pollinator fauna between *I. capensis* and *L. salicaria*. Such overlap, suggests that competition between *L. salicaria* and *I. capensis* for pollination occurred. This, presumably, resulted in reduced pollination, fruit set, and ultimately reduced seed production, in *I. capensis* plants at the high density treatment of *L. salicaria*.

*zhu*

Gregory Eaves I & Smol JP

PA

Dept. of Biology, Queen's University

**Diatoms as indicators of past climatic and environmental changes in Alaska**

Knowledge of past climatic and associated environmental dynamics are critical for assessing recent warming trends, particularly in high latitude environments where warming is more pronounced. Paleoecological studies are necessary to extend the time series of measured temperature records and expand upon the spatial network of monitoring sites. Diatom-based paleolimnology is one effective technique for deriving such data. For this study, modern diatom communities and environmental data were collected from 51 Alaskan lakes in order to develop quantitative models that could be used to infer past climatic and environmental conditions. As a result, robust transfer functions for maximum depth ( $r^2_{jack} = 0.60$ ), conductivity ( $r^2_{jack} = 0.62$ ), total phosphorus unfiltered ( $r^2_{jack} = 0.49$ ), and total Kjeldahl nitrogen/nitrite ( $r^2_{jack} = 0.58$ ) were generated. Application of the depth and conductivity models to a fossil diatom record from Birch Lake Alaska, generated model estimates suggesting that a dramatic lakelevel rise occurred 6714C y BP. A similar trend is reflected by other proxy indicators, providing further confidence in the reliability of these models.

*Radiolaria* *Corallina*  
Guiasu RC & Dunham DW *Dunham*

PA

Department of Zoology, University of Toronto

**Aggression and competition in the surface water cambarus crayfish species of Ontario**

*Cambarus bartonii* and *Cambarus robustus*, the only two surface water crayfish species of the genus found in Ontario, appear to have similar habitat requirements and life cycles, but largely non-overlapping distributions. The analysis of the interspecific contests between evenly size-matched males of these two species, in the laboratory, showed that *C. robustus* were dominant over *C. bartonii*. The consistent and overwhelming dominance of *C. robustus* over *C. bartonii* during these contests, and the apparent recent expansion of the Ontario range of *C. robustus*, sometimes at the expense of *C. bartonii*, suggest that *C. robustus* has the potential to competitively exclude *C. bartonii*, if the two species are in competition for limited resources, such as shelters and food.

Havelock JM & Smol JP *zhu*

POS

Paleoecological Environment Assessment and Research Laboratory (PEARL), Dept Biol Queen's University

**The use of diatom-inferred paleolimnological techniques to assess the effects of anthropogenic watershed development in the Muskoka-Haliburton region, Ontario**

The Muskoka-Haliburton region is underlain by granitic Precambrian bedrock, making the surrounding system increasingly susceptible to the effects of acidification. In addition, recreational use and cottage development in the study area has been extensive. The lack of natural acid buffering capacity and an increased exposure to anthropogenic enrichment creates ideal conditions for determining the response of aquatic communities over time to multiple stresses. Diatoms have shown their widespread applicability as ecological indicators of environmental change. In this study, diatom assemblages will be used to evaluate past environmental change in the Muskoka Haliburton region. Use of such long term paleolimnological techniques will provide a framework for management decision making with the premise of sustaining resource health.

er K, Leonard N & Forbes MRL

rtment of Biology, Carleton University

**damselflies and gregarines: patterns and effects of parasitism.**

and female damselflies (Odonata: Zygoptera) have different optimal foraging strategies; males eat for as short a time as possible (time minimizers) to spend more time searching, whereas females eat as much as possible (energy maximizers) so as to lay more eggs. Damselflies, like many arthropods, have intestinal parasites called gregarines (Apicomplexa: Eugregarinorida). Because females eat greater volumes, they may ingest more gregarine cysts than males. We examined prevalence and intensity of gregarines in *Enallagma boreale* damselflies to test the hypothesis that females would have more parasites than males. We also stressed damselflies to determine the effect of gregarines on survivorship. We found no sex bias in larval infections, however, adult female damselflies had more gregarines than males. While most larvae were infected (91%), few *ex*-emerged adults (11%) were parasitized. Mature adults became more parasitized as the season progressed (20%-84%). Intensities of infection were relatively low in all cases. Survivorship of female *E. boreale* was independent of intensity of infection, however, we found a positive relationship between number of gregarines and days survived for males.

PAPER

ur SJ, M'Closkey RT & Brooks RJ

Zoology, Univ Guelph; Dept Biological Sciences, Univ Windsor; Dept Zoology, Univ of Guelph

**Species richness and spatial dynamics of amphibian communities in southwestern Ontario.** Ecological investigations have traditionally focused on local scales and have been of short duration. The importance of scale to perception of patterns in nature is now recognized, and there is increased interest in determining the relative roles of local versus regional, and contemporary versus historical processes in structuring populations and communities. As part of a long term research program we surveyed 180 southwestern Ontario ponds to record species presence and measure habitat and landscape variables. Our goal was to document and explain patterns of amphibian species richness and incidence, and to investigate how these patterns change spatially and temporally. Species richness and incidence differed significantly among regions and were associated with a combination of local and regional variables. However, the amount of regional woodlands accounted for most of the variance. Water chemistry played only a minor role in affecting species richness and distribution; however, laboratory studies revealed toxic effects of nitrates at high field concentrations. Species richness was significantly lower at predatory fish ponds compared to other ponds. The system is characterized by high species turnover which resulted in trends of both increased and decreased species incidence. In this system fish predation, a contemporary local process, and historical regional deforestation appear to be dominant processes affecting amphibian communities. Large-scale perspectives are necessary to explain the patterns in amphibian communities and to assess the status of species.

PAPER

Henry HAL & Aarssen LW

Department of Biology, Queen's University

**Patterns of shade tolerance and shade avoidance strategies in 12 species of temperate deciduous trees.**

Patterns of physiological and architectural adaptations to decreasing irradiance were investigated along a light gradient for 12 species of deciduous trees in southeastern Ontario, Canada. Physiological adaptation to shade (shade tolerance) was quantified by measuring dark respiration, maximum photosynthetic rate, leaf chlorophyll and leaf soluble protein for the newest full-expanded leaf on the leader. Architectural adaptation to shade (shade avoidance) was quantified by measuring branching intensity and shoot length ratios for the last three years growth of the leader and selected side shoots. For all species, shade tolerance increased with decreasing irradiance. Shade avoidance increased with decreasing irradiance for most species, although strong increases in shade avoidance were only evident in species that exhibited one major axis of growth. Species ordering based on shade tolerance and shade avoidance was not consistent with traditional shade tolerance classifications, which suggests that shade tolerance and shade avoidance alone may not account for the distribution of species along light gradients.

Holder K, Montgomerie R & Friesen V

Department of Biology, Queen's University

**Phylogeography of North American rock ptarmigan: a test of the Glacial Refugium Hypothesis**

Early studies of the distributions of northern birds and mammals suggested that, in addition to Beringia and regions south of the ice sheets, smaller glacial refugia supported flora and fauna during the last ice age. Refugial populations differentiated, giving rise to current patterns of geographic variation. We tested this Glacial Refugia Hypothesis as a model for evolutionary divergence of rock ptarmigan in North America, using genetic analysis of the mitochondrial control region. We identified several divergent lineages which are geographically segregated and correspond to sites of putative refugia. Consequently, patterns of molecular variance indicate significant genetic structuring of populations. Moreover, the distribution of genetic variation is concordant with morphometrically defined subspecies. Our estimates of divergence times of lineages suggest that North American rock ptarmigan became isolated in several refugia during the most recent glaciation event, and that current patterns of genetic variation reflect postglacial colonization by divergent lineages rather than isolation by distance. These refugia may therefore have functioned as sources for postglacial recolonization of North America by a variety of taxa.

\* evidence for Wisconsin glacial refuge in Island for these birds

PAPER

---

Houle D & Poon A

PAPER

Department of Zoology, University of Toronto



**Estimates of mutational variance from populations of *Drosophila melanogaster* in mutation-drift equilibrium.**

How is genetic variation maintained in populations? Several alternative hypotheses exist. The mutation-selection balance hypothesis, in particular, requires that estimates of VG/VM be substantially less than 1000 if the resulting estimate of  $s$ , the selection coefficient, is to be realistic. Hence, having a reliable measure of VM is an important step in understanding evolution. This experiment is designed to estimate two conventional parameters, VM/VE (mutational heritability) and CVM (coefficient of mutational variation) from sternopleural and abdominal bristle counts in *D. melanogaster*. From an isogenic stock population of flies, two full-sibling inbred populations were created and maintained for over 50 generations as mutation accumulators. Their phenotypes are contrasted with control populations derived simultaneously from the same stock, which are retrieved from cryopreservation. Estimates of VM/VE and CVM are higher in the mutation accumulation population known to contain actively transposing elements, and in general are in agreement with parameter estimates in the literature.

---

Houle D & Rowe L

PAPER

Department of Zoology, University of Toronto



**Capturing constraint in a bottle**

The power of natural selection to produce adaptation has repeatedly been demonstrated, but the limits on that power are less well understood. Despite the list of known factors which can frustrate natural selection, we do not have many real examples where the nature of such limiting factors is known. We suggest that the study of natural selection in the laboratory may provide the best opportunity to do this. We are studying a population of *Drosophila melanogaster* which has been in the lab for over 500 generations. The lab population is maintained on a discrete generation schedule, unlike natural populations which have overlapping generations. Flies have evolved to optimize mean age at maturity, but have not yet evolved an optimal norm of reaction for age at maturity as a function of the time an egg is laid. Flies have not yet evolved the ability to predict when a transfer is coming. We have captured constraint in a bottle.

Hume DK & Montgomerie R ✓

Department of Biology, Queen's University

PAI

### Looking for Fluctuating Asymmetry in a Nonstudent Human Sample

Fluctuating asymmetry (FA) of bilaterally symmetrical traits is commonly used for assessing developmental stability. FA is characterised on a population level by having a normal distribution and a parametric mean of zero. Recently, interest has piqued in the study of FA in humans; however, many of the methodological lessons learned in the nonhuman FA literature are frequently ignored in human studies. Moreover, human studies most frequently use University students as subjects. This study investigates the presence of facial and fingerprint asymmetry in a nonstudent human population and possible correlations between FA and other factors such as attractiveness. Care is taken to quantify measurement error, to assess whether the data conform to the assumptions of FA and to correct for multiple comparisons. Comparisons are made between measures of FA to illustrate how conclusions may depend on differing manipulations of FA data.

Hutchings JA, Bishop TD & McGregor-Shaw CR ✓  
Dalhousie University

PAI

### Mate competition and mate choice in a broadcast spawner: do atlantic cod lek?

We quantified individual differences in reproductive behaviour of Atlantic cod, *Gadus morhua*, under simulated natural conditions. At field spawning densities, 16 individually marked cod (7 males, 9 females) were observed twice daily and videotaped continuously for 9 weeks at ambient photoperiod and temperature in a large (60 m<sup>3</sup>) tank. Males establish an aggression-based dominance hierarchy. Ninety-five per cent of all agonistic interactions were initiated by the 3 largest males. Microsatellite DNA analysis of 1 female's brood identified paternal gene contributions from the 3 behaviourally dominant males. Interactions between sexes were dominated by male circling of females. After descending to the bottom, a motionless female was circled an average 2.4 times (range: 1 to 11), usually 1 male per circling bout but by several males throughout the spawning period. The incidence of circling increased with male dominance and male body size, and may be linked to female ovulation cycles. Circling provides opportunities for males to gain individual access to reproductive females and for females to assess the quality of potential mates. Given the prevalence of sound communication among reproductive cod and related species, sex differences in the size of sound-producing muscles in haddock, *Melanogrammus aeglefinus*, provide indirect evidence of mate choice in gadid fish. The mating conditions of cod and haddock are consistent with the hypothesis that these fish reproduce in leks.

"BETWEEN A ROCK AND A FAST PLACE"

98 Abstracts

*Robert*

Abstracts Page 17

PAPER

Noakes DLG & McLaughlin RL  
Department of Zoology, University of Guelph

**choice: Swimming station preference and swimming behaviour of  
3-of-the-year brook charr (*Salvelinus fontinalis*) in their natural habitat**

vestigated characteristics of the swimming behaviour and swimming station choice of 3-of-the-year (YOY) brook charr (*Salvelinus fontinalis*). Our purpose was to: (1) investigate the influence of tailbeat frequency, water depth, water temperature, total length location in the water column on swimming speed exhibited by YOY brook charr; (2) test hypothesis that YOY brook charr exhibit a steady swimming pattern while holding position; (3) test the hypothesis that velocity barriers provide energetic advantage to fish and characterize the microhabitat use by YOY brook charr; (4) compare the energy costs of fish swimming at current speeds of approximately 1 cm/s vs. higher current speeds. Swimming was positively correlated with water depth, individual mean tailbeat frequency, estimated fork length and negatively correlated with location in water column. There was a relationship between swimming speed and water temperature. The swimming pattern characterized by large variation in intraindividual tailbeat frequency. The range or extent of variation of the intraindividual tailbeat frequency were not correlated with current velocity, individual mean tailbeat frequency and estimated fork length. The data stated that velocity refuges offer a positive energy balance. Fish swimming at current velocities higher than 1 cm/s had a higher mean tailbeat frequency, higher oxygen consumption rate and swam at lower locations in the water column than fish swimming at a current velocity of 1 cm/s. The mean number of feeding attempts was not significantly different between the two groups. We believe that fish swimming at higher current velocities at a lower location in the water column may have a higher net energy gain due to larger drift particles delivered lower in the water column. The results of this confirm existing predictions regarding variation in propulsive movements, factors influencing swimming speed and swimming station choice.

PAPER

KA & Brooks RJ *Benth*  
Department of Zoology, University of Guelph

**minants of chorus tenure and the effects of feeding on chorus behaviour and participation in male bullfrogs, *Rana catesbeiana***

Tenure (the length of time a male spends participating in breeding aggregations) is an important component of a male Anuran's mating success. Although a male's chances of successfully mating increase with the amount of time spent in a chorus, male Anurans usually show abbreviated chorus tenures. We will be conducting research on the factors important in determining male chorus tenure in the bullfrog, *Rana catesbeiana*, in Bruce Provincial Park, Ontario. Preliminary results indicate that male bullfrogs lose weight over the course of the breeding season and that larger (presumably older) bullfrogs have longer chorus tenures and lose more weight than smaller (younger) bullfrogs. The energy consumption of chorusing male bullfrogs will be manipulated in a controlled field experiment, and the effects on chorus participation, chorus behaviour and rate of weight change will be measured. We predict that fed male bullfrogs will participate for more nights and call for a higher proportion of nights than unfed male bullfrogs.

---

**Kalhok S****PAPER**

Department of Zoology, University of Toronto

**Influence of biological factors on cadmium and metallothionein concentrations in natural populations of a freshwater mussel**

Cadmium (Cd) is a widespread, persistent element that may be toxic to aquatic biota at low concentrations. Monitoring and assessment of environmental Cd levels through the evaluation of Cd bioaccumulation and concentrations of metal-binding proteins, such as metallothionein, is hindered by inherent variability in biomonitor organisms. I examined the influence of individual size, age and condition on Cd concentration ([Cd]) and MT concentration ([MT]) in the freshwater mussel, *Pyganodon grandis*, within and across lakes along an environmental metal gradient. Approximately 40 specimens of *P. grandis*, covering a wide size range, were collected from each of 7 lakes in Quebec and Ontario in June 1996. I measured shell size, tissue mass, a condition index, age, [MT] using a 203Hg displacement method and [Cd] by atomic absorption. Mean [Cd] and [MT] varied significantly between lakes ( $p < 0.001$ ) and generally reflected the known environmental Cd gradient. Mean [MT] increased non-linearly with increasing mean [Cd], however individual [MT] was correlated with individual [Cd] in one population only. [Cd] varied positively with length and age, and varied negatively with condition in most lakes. In contrast, [MT] varied with biological factors in only 2 populations. Variation in [Cd] explained by these biological factors increased with the degree of contamination ( $p < 0.05$ ), but this was not the case for [MT]. My results suggest that the size, age, and condition of individual mussels explain a substantial amount of [Cd] variability in the freshwater mussel, *Pyganodon grandis*, particularly at higher levels of Cd bioavailability, but they do not influence MT levels. The implication of these results for the future design of biomonitoring studies are discussed.

---

**Kassen R & G Bell**

Department of Biology, McGill University

**PAPER****The phylogenetic and ecological structure of diversity in *Chlamydomonas***

We measured the quantity of genotype-by-environment interaction (GxE) variance as a function of the genetic distance among species and the ecological difference among environments in species of unicellular chlorophyte algae related to the genus *Chlamydomonas*. The performance of 15 species of known genetic relation was assayed by growing samples of each species in 20 growth media constructed from fresh soil extracts. If divergent natural selection in heterogeneous environments is responsible for the maintenance of genetic diversity, then the quantity of GxE variance between pairs of environments should increase as the environments become more different. The same pattern should also hold between pairs of genotypes. Our results suggest that VGxE increases as in the manner expected. Moreover, the evolution of VGxE can be understood in more detail as being composed of two components. The first is the environmental covariance which measures the specificity of adaptation. The second is the environmental variance, a measure of the breadth of adaptation. Our results suggest that differences in the specificity of adaptation among species is responsible for the bulk of GxE variance in this system. Taken together, these results lend empirical support to the idea that selection in heterogeneous environments is the mechanism through which diversity is maintained.

*Paul*

Keogh T & Keddy PA

POSTER ✓

Department of Biology, University of Ottawa

### Patterns of tree species richness in forested wetlands

The number of tree species in terrestrial forests declines with increasing latitude. However, it is not known whether trees in forested wetlands follow the same diversity patterns as upland forest. Herbaceous wetland plants, for example, are apparently most diverse at temperate latitudes. Wetlands are subject to strong environmental constraints, such as flooding, peat, cold and salinity, which may be particularly limiting to tree growth. In this study, tree species richness for 257 plots of forested wetlands were categorized based on the environmental constraints present [five categories]. There was a significant difference in richness between the five categories (Kruskal-Wallis ANOVA  $p<0.0001$ ), from  $n=31$  species in tropical floodplains to  $n=0$  species in northern salt marshes. Therefore, species richness within forested wetlands is apparently controlled by the number of environmental constraints, other than latitude or area sampled.

*Paul*

Kramer DL & Chapman MR *Matthew*

PAPER ✓

Department of Biology, McGill University

### Fish home range behaviour and marine reserve design

A potential limitation to the effectiveness of marine reserves is 'spillover', movement of post-settlement fish from the reserve to the fished area. Moderate spillover can benefit the local fishery, but too much spillover will prevent accumulation of large old fish that contribute most to recruitment. Home range size can influence spillover by affecting exposure to the fishery for fish living near a reserve boundary. An empirical analysis of home range size in relation to body size for coral reef fishes permits estimation of the potential magnitude of this effect. Random home range relocation results in net movement from reserve to the fished area, and this may be increased by density-dependent home range relocation, as predicted by Ideal Free and Ideal Despotic Distribution models. Increases in habitat quality inside the reserve and factors that increase the costs of moving will reduce net movement out of the reserve. We use these expectations to predict how characteristics of coral reef reserves and the fish species that inhabit them will affect the differences in population density and mean body size between reserves and adjacent fished areas.

- ? Marlene Ross — relate to BILD analyses?
- incorporate means &  $\pm$  ranges of home range sizes of fishes in streams
  - consider body of individual species ("genotype" vs "phenotype") — in terms of home range, territoriality — with regard to impact of barrier (ideal free; despotic distribution) with the asymmetry of the barrier (e.g. "out") crossing barriers)
  - of sizes of fish, densities & fish change with distance from barrier

Larson BMH & Barrett SCH

PA

Department of Botany, University of Toronto

*The ecology of pollen limitation in buzz-pollinated *Rhexia virginica* (Melastomataceae)*  
Pollen limitation of female fertility has often been documented in animal-pollinated plants but seldom have the ecological mechanisms responsible been investigated. We examine factors influencing pollen limitation in *Rhexia virginica* (Melastomataceae), a species where pollen transfer depends on bumblebees capable of buzz pollination. We conducted experimental studies in two populations at Lake Matchedash, southern Ontario, Canada where the species occurs at the edge of its familial range. Supplemental hand pollination flowers increased their fruit set compared with open-pollinated control flowers by an average of 57.6%. Pollen limitation was prevalent throughout the 3-4 week blooming period in one population, whereas in the other it was only evident at the beginning of flowering despite their close proximity. Bumblebee visits (primarily *Bombus impatiens*) to *R. virginica* flowers were infrequent and variable in their occurrence. We recorded visitation on four days during flowering. The median number of visits was 0.65 bees per hour; on six days there was virtually no bee activity, but on two days visitation rates were high. Variation in pollinator activity was apparently unrelated to local weather conditions. Field experiments demonstrated that the poricidal anthers of *R. virginica* dispense pollen gradually, with c. 10.2% of pollen removed from flowers during a single bumblebee visit. This level of pollen removal is lower than reported in other flowering plants. On average, 47.3% of pollen remained in anthers at the end of anthesis. Investigation of the relation between pollen dispersal and pollen limitation demonstrated a significant negative correlation between proportion of pollen removed from anthers on a given day and the intensity of pollen limitation. It appears that the pollen-dispersing mechanism of *R. virginica* and infrequent visitation by bumblebees compromise pollen dispersal, causing pollen limitation in Ontario populations.

Leonard, NJ

PA

Dept. of Biology, Carleton University

*Limnochares americana* Lundblad parasitism of the damselfly *Enallagma ebrium*: effect on host behaviour and survival

Parasites, by definition, cause some harm to their host. The degree to which the host is harmed by this association is important in determining the impact on parasite and host populations over both ecological and evolutionary time scales. Previous work has shown that male and female *Enallagma ebrium* (Hagen) damselflies suffer reduced fitness when parasitized by *Arrenurus* water mites. In this study, I examined whether natural levels of parasitism by another water mite species, *Limnochares americana* Lundblad affect either the behaviour or survivorship of *E. ebrium* damselflies. I conducted surveys to determine natural levels of mite parasitism and intensity on hosts which I used in my experiments. I found that pre-reproductive females increased the amount of time they spent grooming when initially colonised by mite larvae. Adult males with engorged *L. americana* mite larvae decreased the proportion of time they spent foraging. With respect to the effect of engorging *L. americana* mite larvae on the survivorship of *E. ebrium* damselflies, I found a near significant effect of parasitism on male survival and a general trend showing a reduction in survivorship. These mites appear more harmful to damselflies than other mite species, at least at levels of intensity found in natural populations.

S &amp; Bailey R C

Department of Zoology, University of Western Ontario

*Dick*

### Effect of seasonal changes on bioassessment using predicted and actual benthic macroinvertebrate communities

using benthic macroinvertebrate communities for bioassessment, seasonal variation is a disturbing factor, as the structure of a community and therefore descriptors like taxonomic richness or diversity may be subject to seasonal change. This may influence judgement as to whether a site is polluted or not. In a survey of 32 sites in the Upper Thames catchment area around London, unidirectional changes between summer and winter sampling were found in taxonomic richness and the Family Biotic Index. When assessed in winter, these descriptors tend to indicate higher water quality. The other community descriptors also varied seasonally, but not in any particular direction. A recent approach in bioassessment is to quantify natural variation in communities by taking environmental conditions into account by comparing conditions at a test site with the expected values. Several predictive models to calculate expected communities at test sites have been constructed in this study. The models were based on simple geographic and habitat descriptors (catchment area, distance to source, stream width, substrate and habitat diversity). When taking season into account in the modeling procedure, predictive power of the models and sensitivity of the assessment to detect pollution increased steeply. The best results were achieved when using separate predictive models for both seasons. In this case the models explained on average 70-75% variation in the community descriptors for reference sites.

PAPER

Sand JK &amp; Brooks RJ

Department of Zoology, U. of Guelph

*Jamie*

### Experimental size manipulation of snapping turtle hatchlings (*Chelydra serpentina*)

relatively new techniques termed 'allometric engineering' can be used to evaluate the roles of propagule size and genotype in determining offspring phenotypes. One technique involves the manipulation of the amount of yolk provided to an individual during embryonic growth and development, resulting in altered body size. This technique was used on snapping turtle (*Chelydra serpentina*) eggs in order to investigate how yolk quantity affects hatchling size and post-hatching growth. Freshly laid eggs from 8 females collected in June and July, 1997, from the Wildlife Research Station in Algonquin Provincial Park, Ontario. Eggs were randomly assigned to either control, manipulated, or experimental groups. Experimental yolk manipulations were made on 134 eggs (25% removal on 65 eggs, 50 % removal on 69 eggs). Survival to hatching was 88.9% for the control group, 36.8 % for the sham-manipulated group, 16.9 % for the 25% yolk removal treatment and 2.9 % for the 50 % yolk removal treatment. Hatchlings from the yolk removal treatments were significantly smaller than those from the control and sham groups. Hatchling growth rates are presently being monitored. Despite the limited success of this new experimental procedure, this project indicates the potential for future investigations into the relative roles of non-genetic maternal effects (body size) and maternal genetics (clutch identity) in determining offspring phenotypes.

PAPER

---

Lorch PD

PAPER

Department of Biology, University of Toronto at Mississauga

**Sex role reversal, sexual selection and Bateman's principle**

Our current understanding of the causes of sex role reversal lacks a connection to our understanding of life history evolution. I suggest that such a connection can be obtained by using the relationship between fecundity and numbers of mates to translate changes in mating energy allocation into changes in the strength of sexual selection on females relative to males. This approach provides a direct link between the evolution of changes in life history and sexual selection. I construct a model that shows how this can be done. My results show that the amount of energy available for mating affects relative upper limit of sexual selection on males and females. Nuptial gifts of any size can lead to large increases in the upper limit of sexual selection on females, but the upper limit for males keeps pace with that for females. Role reversal can occur only when nuptial gift production reduces a male's ability to mate or compete for fertilizations within his mates. My results also support the prediction that sex role reversal will occur when the nuptial gift is a large proportion of the available mating energy. The results also highlight the importance of the distribution of mates among females. When female distributions include a large number of non-maters, the difference between the sexual selection gradient on males and females shrinks. This supports existing analytical results. Finally, I discuss the consequences of this model and the approach I develop for understanding sex role reversal and sexual selection.

---

Lyons A, Weis IM, and Susko D

PAPER

Department of Biology, University of Windsor

**Size-dependant variation of reproductive effort in ten species of mustards (Brassicaceae).**

We examined the size-dependant variation in reproductive effort and reproductive allocation in ten species of Brassicaceae. In general, the species had linear realtionships between measures of size and fecundity. Allometric data showed that among species there was significant variation in growth parameters and proportional allocations. Also, most species showed positive x-intercepts of size-fecundity regressions, which suggests a threshold size for reproduction. Density effects were generally unimportant in explaining patterns in allocation or allometry. This study indicates that size-dependant effects account for most of the variation in reproducitve output among mustard species.

---

McCurdy DG

PAPER

Department of Biology, Carleton University

**Nematodes stage the encounter: Migrating sandpipers and crawling amphipods**

Certain parasites are expected to alter behaviour of intermediate hosts making these more susceptible to predation by final hosts. Manipulation is also costly; thus, selection may favour flexible manipulation depending on whether successful ingestion is likely. I tested this hypothesis using the intertidal amphipod, *Corophium volutator* (Pallas) and its nematode parasite, *Skrjabinoclava morrisoni* (Sobolev): the final host of which is a sandpiper; *Calidris pusilla* L. Consistent with the hypothesis, only mature nematodes were associated with increased crawling (or exposure of amphipods). In addition, crawling behaviour was only affected during daylight hours when sandpipers feed visually.

---

McIntire E

✓ PAPER

Department of Botany, University of Toronto

**Plant Responses To Collared Pika Grazing In Southwest Yukon Territory: The Benefit Of Feeding**

In the presently glaciated St. Elias Mountains of southwestern Yukon, Canada, rudimentary plant communities occur in isolated and very unstable arctic alpine environmental conditions. Nunataks, or barren rock islands, pierce the ice surface creating a substrate for meadow development and allowing a mammalian herbivore, the collared pika (*Ochotona collaris*), to persist. To examine the impact of the pika on these simplified and rudimentary meadows, I selected and compared sites from these icefields with sites from two other mountain ranges with similar altitude (1700-2100m), similar latitude 61°-62° N, but with much less snow accumulation, different glacial histories and much more extensive plant communities. In 1996 and 1997, I erected *in situ* mesh exclosures to experimentally remove pikas and their feeding affects in order to examine plant community response, both in terms of above ground plant production and species composition changes. Generally, one and two years after exclosure placement, plant production was reduced and species richness increased within the exclosures. Associated with this shift in species composition, was the increased dominance of graminoids and other herbivore tolerant plants outside the exclosures. While pikas appear to occupy very small Nunatak sites where food would soon become limiting, their presence is causing a higher biomass of plants, and creating a positive feedback in food availability. In the process, however, they are causing a locally reduced plant species richness.

*Dunbar*      *Peter*

---

Neidrauer L, Lougheed SC, Chek AA, Boag PT

✓ POSTER

Dept Biology, Queen's

**Phylogeography of a North American tree frog, *Pseudacris crucifer***

Most studies of phylogeographic structure examine relatively vagile taxa such as birds. Few studies have considered organisms that have limited dispersal ability or are constrained to remain near patchily distributed resources. Many frogs are highly philopatric and because most are obligate aquatic breeders, gene flow among populations is expected to be more restricted than among many birds. We used mtDNA sequence data to examine the phylogeographic structure among populations of a widespread North American frog, the Spring Peeper (*Pseudacris crucifer*). The pattern of haplotypes support the assumption of limited genetic exchange among populations. The results are considered in the context of the recent glacial history of North America

Nurse R & Cavers PB

P A I

Department of Plant Sciences, The University of Western Ontario

**The germination characteristics of *Scrophularia marilandica* L.**

Investigations on the seeds of *Scrophularia marilandica* L. (Maryland Figwort) were undertaken to determine the germination requirements of the species. Seeds were collected from three natural populations and one experimental population on or near the campus of the University of Western Ontario in the fall of 1997. Fresh and stored seeds were set to germinate under two temperature regimes (35°C 14hr light/20°C 10hr dark and 25°C 14 light/10°C 10hr dark), and in the presence of two germination promoting chemicals (GA and KNO<sub>3</sub>). Fresh seeds germinated best at 35/20°C, while stored seeds germinated best 25/10°C. Significant differences were found both among and within populations for the chemical treatments with 0.1% GA<sub>3</sub> having the highest germination. The only chemical treatment not significantly different from the control in any population was 1.0% KNO<sub>3</sub>. The general effect of the chemical treatments was to increase total percent germination. Storage on the soil surface outdoors under low alternating temperatures produced the highest germination among populations. These results give evidence that primary embryo dormancy may be present in these seeds, and low alternating temperatures and some period of after-ripening are required to break dormancy.

Ortigosa A

P A I

Department of Zoology, University of Toronto

**Cryptic Female Choice in *Gerris buenoi*??**

Conflicts of interest over mating decisions appear to dominate the dynamics of mating systems in many species of water striders. Such conflict is expected to lead to adaptations in each sex that enhance control over mating interactions. Female choice that results from the functioning after copulation is termed cryptic female choice (Thornhill 1983, Eberhard 1985). The purpose of this study was to determine whether water striders of the species *Gerris buenoi* practice one form of cryptic female choice. I investigated female fecundity and time to oviposition based on male body size. I hypothesized that females practice both pre and post-copulatory choice (cryptic choice) for large males. Males from the tails of the natural size distribution were selected to represent large and small phenotypes. Females were randomly assigned into 1 of 2 treatment groups representing each combination of sequential matings of extreme male phenotypes: Large/Small (LS) and Small/Large (SL). The following data was recorded for the first mating encounter and repeated the following day with the second male: 1) time to copulation, 2) copulation duration, 3) time to oviposition, and 5) number of eggs laid. Results showed that females did not behave according to the cryptic choice hypothesis for either fecundity or time to oviposition. Preliminary results suggest no bias for the second mating encounter, regardless of male phenotype. Thus, there was no evidence for cryptic choice of this form in *G. buenoi*.

ana A, Piatt J and Friesen V

rtment of biology, Queen's University

nservation genetic study of common murres (*Uria aalge*) in the Exxon Valdez spill area  
igh a comparison of mitochondrial control region and cytochrome b sequences

spill monitoring of areas affected by the Exxon Valdez oil spill indicates that colonies of  
non murres (*Uria aalge*) from the gulf of Alaska are failing to recover to prespill sizes.

In of an appropriate conservation strategy for the restoration of severely affected  
ies requires information on the extent of genetic structuring of such populations. In

study, genetic differentiation and gene flow between affected populations in the Gulf of  
ca and surrounding areas were quantified using highly variable genetic markers: the

chondrial control region, and cytochrome b gene. Genetic variation was assayed by  
analysis and direct sequencing of control region and cytochrome b haplotypes.

ficant differences in the 3'end of the control region and cytochrome b genotype

encies among colonies, and nonrandom segregation of sequence variation for the  
of the control region provided evidence for genetic structuring among murre

lations in the spill area and surronding regions. Pairwise analysis revealed significant

ic diffrentiation and isolation of colonies from East Amatuli Island from those in  
k Island and Kachemak Bay, indicating low probability of natural recolonization of

colonies. No significant genetic diffrentiation was found among colonies grouped into  
ns (Cook Inlet, the Semidi and Eastern and Western Aleutian Islands) although some

ence was found for possible isolation of murres from the Western Aleutians from those  
er east. Phenetic analysis revelaed no geographic sequestering of related haplotypes.

ever, a dichotomy of the 5' end of the control region and cytochrome b haplotypes  
ested that murres may have survived the last glaciations in two separate refugia.

ates of Nem showed widespread gene flow among colonies and regions, indicating  
ailure of affected murre populations to recover from the Exxon spill may not be  
utable to genetic isolation.

PAPER

J.L., Noakes, D.L.G. & McLaughlin, R.L.

rtment of Zoology, University of Guelph

ct of Low-head Barrier Dams on Fish Movements

head barrier dams are being tested as a control mechanisms for migrating parasitic sea  
rey (*Petromyzon marinus*) in tributary streams to the Laurentian Great Lakes. We

tigated the effects of these dams on the didstribution, abundance and movement of  
s in selected streams around the Great Lakes. We compared the distribution and

dance of fish species in streams with barriers and in reference streams without  
ead barriers. We also used seasonal mark-recapture of fishes in these streams to test

ypothesis that the dams directly block the movements of individual fish. We found that  
nber of species, including sea lamprey, are affected by these dams. There does not

ar to be a simple predictive relationship between fish morphology and the effects of  
dams. Mark-recapture studies showed that fish are much less likely to move over  
, either upstream or downstream, than through corresponding sections of reference

ns. Other effects of barriers on fish species appear to be the result of more complex  
nunity interactions.

POSTER

---

Potter K & Lovett Doust L

PAPER

Department of Biological Sciences, University of Windsor

**Biomonitoring site quality in stressed aquatic ecosystems using the aquatic macrophyte  
*Vallisneria americana***

With the high costs of analytical tests for contaminants, there is a need for simple, inexpensive methods of assessing site quality and tracking site remediation in the Great Lakes. We have been investigating a biomonitoring method using the submerged aquatic macrophyte *Vallisneria americana*. In 1995, plant samples were collected from Areas of Concern throughout the Great Lakes-St. Lawrence system and leaf and root surface area measurements were made. A database, containing information on limnological parameters and contaminant concentrations for each sampling site, was compiled. Using multiple linear regression, we found that the leaf-to-root surface area ratio of the plants was significantly related to plant density, light intensity, and sediment contamination. With higher concentrations of sediment contaminants, the plants showed higher surface area ratios. Further analyses suggested that both sediment organochlorine as well as sediment metal concentrations can affect the leaf-to-root surface area ratio. No significant correlations were found between concentrations of contaminants in the water column and the leaf-to-root surface area ratio. These results support our previous conclusions for *Vallisneria* that contaminant uptake occurs primarily from the sediments, via roots, and that contaminant concentrations in the sediment are more indicative than water column measures of site quality. This method shows great potential as a biomonitoring tool for evaluating site quality, mapping point source impact zones, and tracking the progress of remediation efforts.

---

Qaderi MM & Cavers PB

PAPER

Department of Plant Sciences. The University of Western Ontario

**Germination responses of four local populations of Scotch thistle, *Onopordum acanthium* L., under contrasting light and temperature regimes.**

*Onopordum acanthium* L. is a winter annual, biennial or short-lived perennial. Cypselas (seeds) of this species either have no dormancy and germinate rapidly in soil after dispersal or can remain dormant in the soil for weeks, months or years. Germination responses can be affected by postdispersal temperature and light conditions. Ripe cypselas of this species were collected from four populations in or near London, Ontario in September 1996.

Cypselas were incubated under alternating light and temperature (35/20, 25/10, and 10/5°C; 14h light, 10h dark), alternating temperature and darkness (35/20, 25/10 and 10/5°C) and constant temperature and darkness (20°C). In general, there was greater percent germination under alternating light and dark conditions than in constant darkness. However, the germination percentage was higher in constant darkness at 35/20°C than in light at the same temperature. In constant darkness germination percentages were higher at 25/10°C (average 18.75°C) than at 20°C and were negligible at 10/5°C. There were significant differences between populations in both total percent germination and rate of germination.

---

Ramsay SM & Ratcliffe LM

POSTER

Department of Biology, Queen's University

**Mating tactics of female black-capped chickadees**

The theory of sexual selection predicts for most species that males engage in intra-sexual competition for mating access to females, and females choose males based on the outcome of male-male competition. This explanation is well suited to socially polygynous species where the outcome of sexual selection is obvious, but is incomplete when applied to socially monogamous species. Sex ratio theory bases predictions of predominance in intra-sexual competition based on the number of sexually active males per receptive female (operational sex ratio). Where operational sex ratio is biased the more abundant sex is predicted to predominate in competition; where sex ratios are even then neither sex should predominate. If there is social monogamy and individuals of one sex vary substantially in quality, effective biases of operational sex ratio can arise as individuals of the choosing sex vie for partnerships with high quality individuals of the opposite sex. In black-capped chickadees, individuals develop dominance hierarchies within winter flocks. High rank males are preferred socially and genetically by females. Females will break partnerships with low rank males to mate with high rank males, and females partnered with low rank males will solicit extra-pair matings with high rank flock mates. These social and sexual elements of chickadee flocks suggest that females compete for partnerships with high rank males. What determines which females will win in competition for males? Do females who lose in competition use nest placement to enhance access to high rank males? Females chickadees partnered with high rank males have enhanced reproductive success due to increased egg production. Is female condition related to male social rank? Can females further enhance their reproductive success through adaptive sex ratio manipulation? We are addressing these questions through ongoing studies of our colour-marked population of chickadees at Queen's University Biological Station.

---

Rendell WB & Robertson RJ

POSTER

Department of Biology, Queen's University

**Clutch-size variation in a cavity-nesting passerine: is it best explained by individual optimization theory?**

Individual optimization theory suggests that if forced to rear a brood either larger or smaller than one's original brood size an individual would be less successful (lower fitness) than it otherwise would have been. We tested this prediction on 180 pairs of tree swallows (*Tachycineta bicolor*), a cavity-nesting passerine, during a 3-yr brood-size manipulation study. Typically, clutch size is 5-6 eggs in this species, and it ranges from 3-7 eggs. At hatch, randomly-chosen pairs were assigned broods of 3 or 8-10 young (typically 9). The number of fledglings (positively affected), fledging efficiency (no. fledglings / experimental brood size; negatively), and nestling size (negatively) were all significantly affected by experimental brood size and degree of brood size change, but not by either original clutch or brood size. Adult survival and nestling recruitment were independent of any measure of reproductive effort. Our results show that clutch-size variation does not reflect an individual's ability to rear young. Because some tree swallows can lay indeterminately, and renesting can be induced repeatedly, clutch-size variation appears not to be related to the ability to lay eggs either. However, it could reflect: i) one's ability to incubate clutches, or ii) variation in cavity characteristics.

---

Robb L & Maxwell C

POS

Biology Department, Trent University

**Dinitrogen fixation by cyanobacterial crusts in two temperate limestone quarries**

The restoration of ecosystems destroyed by mining and quarrying has always been a challenge to the application of ecology. Any soils that develop in limestone quarries are deficient in phosphorous, potassium and nitrogen. Microphytic crusts, composed mainly of cyanobacteria, are frequently reported in vegetation studies of abandoned limestone quarries. The crusts are believed to improve conditions for early plant colonists by the addition of fixed atmospheric nitrogen, though there is no documentation on the rates of fixation in the quarries. In this study, crusts composed mainly of *Nostoc commune*, in two abandoned quarries at Odessa and Point Anne, Ontario, were examined. The crusts at the Odessa quarry were not continuous as at the Point Anne site. An in situ acetylene reduction technique was used to measure the dinitrogen fixation rate. Rates of fixation at various temperatures were measured ex situ. Using these rates and weather data from the area, an estimate of nitrogen fixed per year was made. Crusts at the Point Anne site fixed an estimated 36.0 kgN/ha/y. The figures indicate significant inputs of nitrogen into the quarries. This nitrogen may be used by early successional species, and further investigation into the use of cyanobacteria to rehabilitate abandoned quarries should be pursued.

---

Robinson CJ & Casselman JM

John

PA

Watershed Ecosystems Graduate Program, Trent University

**Determination of the sex of fish using growth parameters: Muskellunge (*Esox masquinongy*) and northern pike**

Knowledge of sex-based characteristics of fish populations is important, particularly with species exhibiting sexually dimorphic growth. For archival and commercial or recreational user-supplied collections, sex may not be available or accurately determined for some samples. We developed a method to separate and identify the sexes of two species with sexually dimorphic growth, muskellunge (*Esox masquinongy*) and northern pike (*E. lucius*) using growth record data from cleithral bones and populations with large sample numbers of both sexes. Mean back-calculated size-at-ages of the known sex populations were converted to a von Bertalanffy growth model for each sex in each population, and the resulting parameters k, L infinity, t-zero, and the calculated parameter omega entered in discriminant function analysis. Only k and L infinity discriminated between the sexes for muskellunge ( $p < 0.0002$ ). Classification equations for both species were applied to unknown individuals to determine sex. The method increased the number of sexed samples available for studies of St. Lawrence River and Georgian Bay muskellunge, and of Bay of Quinte northern pike. Determining sex from growth is a tool available to complete collections of data for assessing the year-class strengths and growth histories of fish populations.

s L

**PAPER**

Zoology, University of Toronto

**Timing of Sex- and Phase-Change in Stochastic Environments**

Most models of sex- and phase-change predict a single optimal size or age of change that maximizes individual fitness expectations. Specifically, Ghiselin's size-advantage model states that sex-change (or phase-change) should occur at the point at which the specific reproductive rates for males and females cross. Despite the broad success of this model in predicting the direction and timing of sex-change, this model does not predict the frequently observed phenomenon of early sex-change, in which there is a protracted reproductive period falling between successful reproduction in the initial and second sexes. One explanation is that early sex-change results from tradeoffs between life-history traits. Although tradeoffs between reproduction and growth or survival are arguably plausible, such tradeoffs are not required for early phase change to be favored by selection. I show that when the probability of successful reproduction in the second sex is an increasing function of size (or age), there will always be some sex- or phase-changed individuals that are not reproductive (i.e., early). Furthermore, when the reproductive traits of the initial and second sex differ (as logically they must in sex-changing species), there is an asymmetry in the costs of being too early and too late favoring an even timing of change.

Key MB &amp; Eckert CG

**PAPER**

Department of Biology, Queen's University

**Effect of population size on selffertilization, inbreeding depression and genetic structure in columbine, *Aquilegia canadensis* (Ranunculaceae)**

In many plant species, habitat destruction by humans has decreased population size which, in turn, is expected to increase selffertilization and inbreeding by reducing both pollinator attraction and mate availability. This study investigated the effects of population size on the mating system and population genetic structure of *Aquilegia canadensis*, a shortlived, flowering perennial common to rocky outcrops across eastern North America. Ten populations ranging in size from 32 to 750 flowering individuals were sampled. The level of selffertilization (*s*) and the inbreeding coefficient of mature plants (*F*) were estimated from the variation in progeny arrays. Inbreeding depression was estimated by comparing observed *F* with that expected at inbreeding equilibrium. Estimates of *s* ranged from 0.17 to 0.86 with significant variation both within and among population size classes. Small populations (*N* < 30) tended to self at higher levels (mean *s* = 0.83) than large populations (*N* > 30, mean *s* = 0.62, *P* < 0.001). Mature plants in small populations were also more inbred (*F* = 0.31) than those in large populations (0.23), although the difference was not significant (*P* = 0.18). Substantial inbreeding depression was detected in eight of the populations for which it could be estimated, and there was a nonsignificant trend for greater inbreeding depression in small (*d* = 1 - relative fitness of selfed vs. sib-sired progeny = 0.86) than large populations (0.37, *P* = 0.14). The combination of self-incompatibility and automatic selfpollination appears to make the mating system of *A. canadensis* prone to wide variation in response to ecological and genetic factors affecting the relative levels of self and crosspollination.

---

Rowe L

PAPER

Dept Zoology, University of Toronto

**Experimental test of life history and behavioral responses to time constraints**

Time constraints, imposed by seasonality, are common to life histories. Recent theory predicts independent behavioral and life history responses to such constraints. In this study of the damselfly, *Lestes congener*, I experimentally alter individual's perception of their proximity to a time horizon to tests predictions from theory. We altered larval perception of their position in the season with light regime. Late (time constrained) larvae would have very little time to complete development and reach a large size so that they could attain their full reproductive potential prior to winter. The behaviors we assessed were activity rate, which is an indicator of foraging effort and willingness to take risks, and cannibalism, which is a component of the mortality risk of foraging. We predicted that time constrained larvae would increase their activity rates in an attempt to increase weight gain, and thereby, suffer greater cannibalism. Among the life history variables assessed were age and size at maturity. We predicted that late larvae would accelerate development, independently of growth rate, and thereby mature at an earlier age and smaller size. Each of our predictions was supported by the data. We show that the observed behavioral and life history responses were independent.

---

Sokolovska N

POSTER

Department of Zoology, University of Toronto

**A metaanalysis on the relationship between body size and fitness in damselflies and dragonflies**

A metaanalysis using 29 studies was performed, examining the relationship between body size and fitness in damselflies and dragonflies. A highly significantly positive effect of body size was found in mating rate and lifetime mating success among males. There was also a weaker but still significantly positive relationship between survivorship and body size in males. The relationship between body size and mating rate differed significantly between territorial and nonterritorial males with a stronger relationship existing in territorial males, although the relationship was significantly positive in nonterritorial males. We conclude that there is a significant positive relationship between body size and fitness in both territorial and nonterritorial males. No significant relationship between body size and fitness components was detected among females, although a much smaller data set was available in this case.

---

Stuart CTL & Cumming BF

POSTER

PEARL, Department of Biology, Queen's University

**Climate change on the Canadian prairies: a ten thousand year perspective**

With concern that anthropogenic greenhouse gas emissions are responsible for current global warming trends, natural climate variability prior to industrialization must be understood. This knowledge is especially critical in the drought-prone, yet agriculturally important North American prairies. While instrumental climate records are rarely available beyond the last hundred years, paleoecological techniques can use information available from species assemblages preserved in lake sediments to quantitatively reconstruct important limnological variables on decadal to millennial time scales. Diatoms (Bacillariophyceae), a family of unicellular algae, are excellent paleoindicators because their short generation time makes them sensitive to rapid shifts in water chemistry and their taxonomically diagnostic siliceous cell walls are well-preserved in most sedimentary profiles. This work focuses on a closed-basin lake in southern Saskatchewan, for which the lake level is thought to be intricately linked to local and regional climate change. In periods of reduced precipitation, the lake volume decreases, concentrating dissolved ions and increasing salinity. Conversely, high precipitation levels increase the lake volume and reduce salinity. A transfer function based on the present-day ecology of diatoms in the prairies will be used to reconstruct lakewater salinity from sedimentary diatom abundances as a measure of effective moisture over the past 10,000 years. The results will illustrate the range of natural climate variability and can be linked to other paleoclimatic studies to help understand the mechanisms driving regional, long-term climate change.

---

Susko DJ & Lovett-Doust L

PAPER

Department of Biological Sciences, University of Windsor

**Seed mass variation in *Alliaria petiolata* (Brassicaceae): consequences for seedling fitness**

In garlic mustard, *Alliaria petiolata*, plant size, degree of branching, and total fruit and seed production decreased clinally from southern to northern populations in North America. Seed mass varied eightfold among populations, 2.5- to 7.5-fold within populations, two- to threefold among fruits within individuals, and 1.4- to 1.8-fold within fruits. Variation in seed mass among populations explained about half of the total variance. Variation among seeds within fruits accounted for another 25% of the variance. Individual seed mass within a plant decreased with increased distance from the main stem, suggesting that access to parental resources limits seed size in a predictable manner. MANOVAs and Roy-Bargmann stepdown analysis revealed significant effects of seed mass, but not seed position, on subsequent seedling fitness measures such as days to germination, days to first leaf emergence, seedling height, and cotyledon length. Smaller seeds germinated and produced their first true leaves faster, and grew taller, whereas larger seeds produced larger cotyledons. After accounting for seed mass as a covariate, only one fitness measure, date of first leaf emergence, was affected by ovule position per se. Differences in seed mass may therefore affect seedling recruitment in this weedy species.

---

Tait P & Houle D

PA

Department of Zoology University of Toronto

**Is Shape More Heritable Than Size in *Drosophila melanogaster*?**

Selection on arbitrary aspects of wing form in *Drosophila melanogaster* was used to examine the ability of shape to evolve predictably. The measure of form we used was a complex geometric shape based on triangular areas. These triangles were defined by landmarks on the wing. This geometric shape was selected up, for eight generations and showed a strong response to the selection. This demonstrates that shape, as a phenotypic trait, has the ability to respond to directional selection and hence could be highly heritable. This led to the primary question, is shape more heritable than size? To answer this we looked at the difference in heritabilities between size and shape. Size was estimated using the lengths between wing landmarks and shape was estimated using both measures of area and of angles between two lengths. The preliminary results indicate that shape is in fact more heritable than size. This is surprising since it is generally accepted that size is the more heritable of the two.

---

Tarof S & Ratcliffe L

POS

Department of Biology, Queen's University

**Sexual and Natural Selection in Least Flycatchers (*Empidonax minimus*): Why do Breed Birds Cluster?**

The long-standing explanation of why birds aggregate their territories is derived from natural selection theory. The material resources hypothesis states that the distribution of ecological elements provides preferential breeding sites to which birds respond. Recent new theory based on sexual selection has been proposed to explain aggregative behavior. The hidden lek hypothesis holds that socially monogamous birds defending all-purpose territories aggregate for extra-pair copulations (EPCs), just as lekking species cluster for promiscuous matings. We are currently investigating these potential explanations of clustering in Least Flycatchers (*Empidonax minimus*). In 1997, territory boundaries were mapped using the Global Positioning System and territories were highly clustered (n = 13 territories per cluster at 4 study sites), with nearly all boundaries contiguous. Individuals were caught and banded, and blood samples were taken from 10 males and 2 complete sets of nestlings, despite nest heights of 5 - 20m. I collected extensive data during morning feeding watches on mating behaviour and song output (n = 27 males, 83 observations hrs.). Consistent with the hidden lek, individuals commonly visit neighbouring territories and seek EPCs (combined rate of 2.6+0.5/hr., n = 13, range 0.5 - 6.0). Males invest substantial amounts of energy and time into singing, with some males singing in excess of 3000 songs/hr. Preliminary results indicate that vegetation characteristics do not explain aggregation. This project provides a fresh perspective on the mechanisms contributing to the proclivity to cluster in this species.

nas JJ, Massonnet B & Eckert CG

rtment of Biology, Queen's University

al reproduction in introduced populations of flowering rush, *Butomus umbellatus*

(Juncaceae)

distance migration in plants is often associated with a shift in reproductive mode from sexuality to asexuality. This may have major consequences for the ecological and evolutionary potential of colonizing plant populations, since asexual reproduction is likely to reduce dispersal capacity, genetic diversity and response to natural selection. *Butomus umbellatus* is an aquatic emergent plant from Eurasia, which was introduced in the St. Lawrence River about 100 y ago, and has since spread throughout much of North America. Previous reports suggest a major change in reproductive mode during colonization. In its native European range, it reproduces both sexually and asexually through mefragmentation and bulbil production. In contrast, anecdotal reports from throughout its adventive range and detailed work in western Canada suggest that introduced populations are sexually sterile. We examined the sexual fertility of populations from the original site of introduction in eastern Ontario. Controlled crosses involving nine populations in a common greenhouse environment indicated high levels of seed production (50 seeds/fruit) and complete selfcompatibility. A subsequent greenhouse experiment over indicated moderate levels of germination (mean = 31%), and did not reveal any differences in viability among seeds from selffertilizations, withinpopulation crosses or betweenpopulation crosses. High levels of sexual fertility were also observed in a survey of natural populations. Twenty populations set abundant seed (100-250 seeds/fruit). However, two populations appeared to be sterile despite abundant flower production. High levels of seed production are likely to enhance the dispersal potential and genetic diversity of *Butomus umbellatus* in this part of the introduced range.

PAPER

ston E & Reader RJ

rtment of Botany, University of Guelph

ffects of hiking and mountain biking in deciduous forest

recent addition of recreational mountain biking to the trails of natural areas has raised concern over the amount of environmental degradation it causes, and how biking impacts compare to those of better known trail activities like hiking. This study compared the impact of experimentally applied biking and hiking on the undisturbed terrain of a deciduous forest in southcentral Ontario. Sampled plots (lanes 0.6m wide x 4m long) were assigned to one of five levels of hiking or biking: 0, 25, 75, 200, and 500 passes.

Measurements were taken of vascular plant stem density and exposed mineral soil cover, before and two weeks after experimental treatments were applied. Loss of vegetation (percentage of stems absent, dead or damaged) increased significantly from the control lanes (0% for biking, 21% for hiking) to the treated lanes (ranging from 76% to 89% for biking, and from 59% to 86% for hiking). Mineral soil exposure also increased significantly with the number of passes made, ranging from 1% (0 passes) to 39% (500 passes) for the biking treatment, and from 1% (0 passes) to 32% (500 passes) for the hiking treatment. For both vegetation loss and mineral soil exposure there were no significant differences between the biking and hiking treatment effects at any pass level. These results suggest that recreational mountain biking and hiking could be considered as similar trail activities for management purposes.

PAPER

Tseng M

PAPER

Department of Zoology, University of Toronto

**Sexual size dimorphism and allometry in the water strider *Gigantometra gigas***

Sexual size dimorphism (SSD) is assumed to be adaptive and is attributed to selection acting through differential mating success. A common example of SSD is seen in water striders of the family Gerridae, where females are typically larger than their male counterparts.

However, recent studies of the large water strider *Aquarius elongatus* show that males are sometimes larger than females and that there is evidence for sexual selection on middle leg length. Similarly, in the recently rediscovered giant water strider *Gigantometra gigas*, males appear to have much longer middle and hind legs than females. In this study, I conduct a morphological study of SSD and allometry in *G. gigas*. The mean middle and hind femur, middle and hind tibia and body length were found to be significantly greater in males than females. Plots of log leg length on log body length show that male *G. gigas* have higher leg length to body length ratios than females. Males also show greater variation in both leg length and body length. The pattern of leg length: body length ratios in males and females closely resembles that of species exhibiting sexual selection on a trait correlated with body length. Therefore, I hypothesize that in *G. gigas*, SSD in body length may be an indirect consequence of sexual selection on male leg length. The implications of size evolving as a correlated response to selection on other traits is discussed.

Mary Jane Mike Jim  
Vallianatos M, Lougheed SC, Cadman M\* & Boag PT

PAPER

Department of Biology, Queen's University \*Canadian Wildlife Service

**Mitochondrial DNA Diversity in a Declining Eastern Canadian Population of Loggerhead Shrikes (*Lanius ludovicianus*).**

We assayed variation of the mitochondrial control region for a sample of 10 Loggerhead Shrikes from the endangered Ontario population. Gene diversity and nucleotide diversity were  $0.64 \pm 0.15$  and  $0.0078 \pm 0.0056$ , respectively. These values are high compared to estimates of these same statistics for five western populations representing four subspecies and remarkable given the precipitous decline of this species in Ontario in recent years. This haplotypic diversity could represent the historical imprint of immigration during the late 1800s and early 1900s, or be due to Ontario functioning as a population sink (or both). Based on our genetic results and recent trends in northern range contraction, we discuss conservation implications for eastern Canadian populations of Loggerhead Shrike.

Van Coeverden de Groot P and Boag P  
Department of Biology, Queen's University

POSTER

*Review*

**A preliminary study of muskox microsatellites - invarinace galore.**

The muskox *Ovibos moschatus* is naturally distributed over most of the Canadian high Arctic and the non-glaciated regions of Northern and Eastern Greenland. The two putative subspecies, the White faced muskox *Ovibos moschatus wardi* and the Barren Ground muskox, *Ovibos moschatus wardi* are distinguished by subtle differences in morphology. As part of a study of muskox evolution, ungulate conservation genetics and muskox management we examined microsatellite polymorphism in this species. We sequenced an entire library of 120 positive clones. From these we designed 34 primer pairs, half of which 8 produced reliable microsatellite primers. These loci and another 15 loci most of which were cloned from other ungulates were used in a survey of microsatellite variability in Ovibos. Individuals from 13 locations spanning the entire range of some 6 million square kilometers were included. We report the lowest estimated microsatellite heterozygosities for any free ranging mammal documented to date. Initial analyses of these 'invariant' data do however support the traditional classification of this species.

Westlake K & Rowe L  
Department of Zoology, Univ. of Toronto

PAPER

**The costs of sexual elaborations in the water strider genus *Rheumatobates*.**

In the water strider genus *Rheumatobates* there has been a remarkable diversification of male morphology. This includes elaborations of various appendages including hind legs and antennae. Earlier studies have shown that these male traits function to aid male control in disputes with females over mating. Natural selection is thought to constrain elaboration by sexual selection. If so, we expect that the elaborations found in this group have come at some cost to the bearers. One possibility is that these morphological elaborations hinder development and molting success. I tested this hypothesis by determining the association between these traits and molting duration and molting mortality. My results support the view that these sexually selected traits come at a cost to males.

*Test*  
Wood J & Friesen Vicki  
Department of Biology, Queens University

PAPER

**Genetic Variation Between Regional and Colonial Samples of Ancient Murrelets**

Ancient Murrelets are a seabird endemic to the north Pacific. Recent declines in population through the introduction of predators, pollution and habitat loss have been noted across their range. This study compares genotype frequencies of the mitochondrial control region and cytochrome B gene between samples from neighbouring colonies and regional Asian and North American samples of Ancient Murrelets. No significant differences in genotype frequency were found between samples, indicating that the Ancient Murrelet population is not genetically structured over geographic space. This result also indicates that Ancient Murrelets may be effectively managed as one unit for conservation purposes.

Yezerinac S &amp; Gibbs HL

PA

Dept Biology, Queen's University, Dept Biology, McMaster Univ

**Offspring sex ratio, parental sex allocation and paternity in the yellow warbler**

Sex allocation is the division of resources by parents into sons and daughters. In theory, allocation should be altered by any factor that predictably changes the reproductive potential or relative cost of sons and daughters. We tested whether the female yellow warblers either vary the sex ratio of their offspring or make unequal investment in individual sons and daughters depending upon the quality of their mates. We used PCR amplification of a female-specific microsatellite marker to sex 486 embryos or nestlings from 144 families collected over three breeding seasons. Measures of paternity using multi-locus DNA profiling showed that males with more elaborate plumage had higher reproductive success. We found no evidence of biases in sex allocation (measured as the sex of eggs) or sex ratio in relation to paternity of the brood or the phenotypic quality of the sire(s). Moreover, the variation in sex ratio matched that expected at random from binomial determination. We reject the hypothesis that female yellow warblers adjust their sex allocation in relation to properties of their mates. We cannot, however, distinguish between two potential explanations for this result. Females may be unable to facultatively alter sex allocation. Differences in mate quality may not differentially affect the reproductive success of sons and daughters.

1987 ~~CO~~  
McMaster + Carlton

1988 Waterloo

1989 Queen's

1990 Brink

1991 Guelph

1992 Trent

1993 Windsor

1994 McMaster

1995 U of T

1996 Ottawa

1997 Waterloo

1998 Ottawa

1999 Waterloo

2001 Trent

Chris Eckang - "Wel. Warbler"  
~~Queen's~~

Scott McKinley @ Waterloo

2002?? Guelph?, Brink?, York

? Themes: