Smedden

OEEC '90

Brock University

ST. CATHARINES, ONTARIO

L2S 3A1

20-22 APRIL 1990

Celebrating 25 years

APRIL 21, 1990 ROOM 243

09:10 Introduction and welcoming remarks

09:30 Charles J. Krebs The experimental paradigm and long term studies in ecology: what should we do for the next 30 years?

ROOM 244

MODERATOR - Patrick Colgan

10:45 (1) Stewart, S.C. Advantages of sexual reproduction can be episodic in natural populations of Impatiens pallida.

11:00 (3) Thompson, C.F. Intra-seasonal reproductive costs in multi-brooded House Wrens.

11:15 (5) Lavery, B.J. & P.W. Colgan Brood stage and defense in the Convict Cichlid: support for the age-investment hypothesis.

11:30 (7) Noakes, D.L.G., M.M. Ferguson, & D.B. Noltic Size, shape, and behaviour of Pink Salmon.

11:45 (9) Bobyn, M.L. & R.J. Brookes Effects of clutch and incubation environment on embryonic and hatchling snapping turtles (Chelydra serpentina).

12:00 (11) Houpt, A.M. Size selective mortality in young-of-the-year Smallmouth Bass.

12:15 (13) Mulder, C. Seed weights and tolerance of burial in Oenothera parviflora.

MODERATOR - Jack S. Millar

14:00 (14) Byrne, R. & R. Harmsen A theoretical examination of sex ratios under local mate competition with relatedness.

ROOM 246

MODERATOR - Paul B. Cavers

Suffling, R. (2) Climate warming, forest fires and ecosystem migration in Northern Ontario

Morgan, A.V. (4) Coleoptera: Library of the past, key to the future?

Bethke, R.W. (6) Variation in the diversity of duck guilds along a gradient of environmental variability.

Reader, R.J. & J. Buck (8) Herbivory and plant community structure on a topographic gradient.

Meave, J. & M. Kellman (10) Species segregation as a diversity enhancing mechanism in a tropical riparian forest system.

Henein, K.M. (12) Chipmunk movement in an agricultural landscape

LUNCH

MODERATOR - John Middleton

Miyanishi, K. & R.W. Wein (15) Potential impact of proposed bison kill in Wood Buffalo National Park.

ROOM 244

14:15 (16)	Stockdale M.C. & R. Harmsen	Life history strategies of two sympatric sibling species of plant bugs.
14:30 (18)	Roeder, C. & R. Harmsen	The effects of relatedness on sex ratio in the Two-spotted Spider Mite (Tetranychus urticae).
14:45 (20)	Kuang, R.P., Harmsen, R. & D. Clements	A comparative study on population growth parameters of insects with reference to mites.
15:00 (22)	Clements, D.R.	Population implications of egg cannibalism.
15:15 (24)	Burness, G.P. & W.A. Montevecchi	Geographic variation in Great Auk body size.
15:30 (26)	Neilson, A.L.	Population ecology and conservation of Little Brown Bat.

ROOM 246

Apel, K.A., Bendell, J.F., James, R.D. & L.B. Cadogan (17)	Effects of the insecticide B.t. on wildlife and arthropods.
Dickman, M.D., Filipowski, A. & B. Stewart (19)	Toxins and genotoxins in the Niagra River watershed as reflected by Chironomid (Diptera: Chironomidae) labial plate deformities.
Moore, M. & M.D. Dickman (21)	Chironomid labial plate deformities and their significance.
Souroukis, K. & W.H. Cade (23)	Sources of variation in the calling song of Gryllus integer.
Ballard, K.A. & K.M. Kovacs (25)	A comparison of the in-air acoustic repertoires(24) of the Harp, Harbour and Hood Seal.
Mable, B.K. (27)	Induction of calling in triploid hybrid treefrogs.

COFFEE

MODERATOR - David L.G. Noakes

MODERATOR - Michael D. Dickman

16:15 (28)	Becket, S.A. & J.J.H. Ciborowski	Factors affecting microdistribution of S. vittatum larvae.
16:30 (30)	Krannitz, P.G. Aarssen, L.W. & J. Dow	Genotypic differentiation in seedling survival under severe nutrient deprivation.

Briskie, J.V. (29)	Seasonal and diurnal copulation patterns in Smith's Longspurs.
Bertram, S. (31)	Why are juvenile Threespot Damselfish territorial?

ROOM 244

16:45 (32)	Hanes, E.C. & J.J.H. Ciborowski	Factors contributing to size variation of Hexagenia larvae.
17:00 (34)	McRae, S.B. & K.M. Kovacs	Paternity exclusion of Hooded Seal males determined by DNA fingerprinting.
17:15 (36)	Hurd, P.L. & P.J. Weatherhead	Why do most birds eat their nestling's feces?
17:30 (38)	Fausto, J.A.	Seasonal movements of the burrowing mayfly Hexagenia limbata (Ephemeroptera: Ephemeridae) in stratified lakes.

17:45-1900 **POSTER VIEWING** (see Abstract #'s 54-61).

19:00- **BANQUET**

ROOM 246

Montgomerie, R. (33)		Barn Swallow tails and the costs of sexual selection.
Jamieson, I.G. & P.W. Colgan (35)		Cuckoldry and egg stealing by male Three-spined Sticklebacks.
Straszynski, E. (37)		The role of aggression in Notostracan mating systems.
Brown, W.D. (39)		The cause of assortative mating in a Blister Beetle.

APRIL 22, 1990

ROOM 243

09:30 M. Brock Fenton — Biopolitics

ROOM 244

MODERATOR - Ralph D. Morris

10:45 (40)	Acharya, L.	Monitoring attack success of foraging bats.
11:00 (42)	Tuchscherer, A.M. & R.J. Brooks	Sex-related variations in behaviour and home range food abundance of collared lemmings, Dicrostonyx groenlandicus.

ROOM 246

MODERATOR - William H. Cade

Snedden, W.A. & S.K. Sakaluk (41)		Male mating costs: limited remating opportunity.
Burpee, D.M. & S.K. Sakaluk (43)		Courtship feeding and costs of reproduction in crickets.

ROOM 244

11:15 (44)	Robertson, I.C. & P.J. Weatherhead	Thermal constraints on swimming performance and escape responses of northern water snakes.
11:30 (46)	Robertson, G.R.	Agricultural habitats, edges and raccoon foraging.
11:45 (48)	Colgan, P., Gotceitas, V. & J. Frame.	Individual variation, acquisition, and re-acquisition in a foraging task by juvenile Bluegill Sunfish (Lepomis macrochirus).
12:00 (50)	Hickey, M.B.C.	Use of torpor by free-living hoary bats.
12:15 (52)	Fryxell, J.M. & C.M. Doucet	"Provisioning in beavers"

ROOM 246

Gwynne, D.T. & L.W. Simmmons (45)		A test of sexual differences theory: experimental manipulation of sex roles in an insect.
Seburn, C.N.L. (47)		Sexual dimorphism in the Five-lined Skink (Eumeces fasciatus).
Proctor, H.C. (49)		Courtship in Neumania water mites: males capitalize on female adaptations for predation.
Sakaluk, S.K. (51)		Postcopulatory mate guarding in Decorated Crickets.
Rowell, G.A. & W.H. Cade (53)		Computer simulation of alternative male strategies in the Field Cricket (Gryllus) mating system.

POSTERS

(54) Belme, D.M. & W.H. Cade. Repeated mating and fertility in field crickets.

(55) Li, S.Y. & R. Harmsen. Spatial distribution of Pollonorycter blancardella (F.) following insecticide applications.

(56) Ciceran, M.A. & W.H. Cade. The natural variation in the temporal patterning of song structure in the northern field cricket Gryllus pennsylvanicus.

(57) Mallick, S. Olfaction in the Tasmanian Swamp Rat.

(58) Millikin, R.L. & K.N. Barber. Indirect effects of B.T. on ground-nesting songbirds in a Jack Pine plantation of northern Ontario.

(59) Schappert, P.J. The size and shape of butterfly wings: on the relationship between morphology and behaviour.

(60) Suffling, R. & A. Younger. Anthropogenic forest fires in northwestern Ontario in the 18th. and 19th. centuries.

(61) Villard, M.A. Forest bird metapopulations in agricultural landscapes of eatsern Ontario.

THE EXPERIMENTAL PARADIGM AND LONG-TERM STUDIES IN ECOLOGY: WHAT SHOULD WE DO FOR THE NEXT 30 YEARS? Charles J. Krebs, Department of Zoology, University of British Columbia, Vancouver, BC.

Most ecologists recognize the value of long-term studies to population and community ecology, and many also subscribe to the experimental approach as the most effective way of obtaining ecological knowledge. But if we are experimentalists, do we need long-term studies? I argue the answer to this question is yes, that we must combine these two approaches to solve the major ecological questions of the next century. Most of the challenging questions facing ecologists involve systems subject to long-term time trends or high environmental variability.

Because of the statistical power of many ecological methods, long-term studies are essential to measure time trends in ecosystems. Ignoring statistical power has been a major problem with short-term studies which have predominated in the ecological literature.

BIOPOLITICS. M. Brock Fenton, Department of Biology, York University, Downsview, Ontario.

For over 10 years the combined ravages of inflation and underfunding have eroded the basic scientific research operation in Canada. Basic research in Ontario's universities mirror the situation, reflecting the synergistic effects of Federal and Provincial policies about basic research and postsecondary education. To change this situation will require action by scientists on at least four fronts: 1) lobbying through scientific societies; 2) informing elected representatives about the situation in universities; 3) educating the public about science and research; and 4) ensuring that university graduates appreciate the intertwining of research and teaching in university. Scientists must invest time and money in these activities remembering that long term benefit could be a change in the situation.

(1) **ADVANTAGES OF SEXUAL REPRODUCTION CAN BE EPISODIC IN NATURAL POPULATIONS OF *Impatiens pallida*.**

S. C. Stewart. Department of Botany, University of Guelph, Guelph, Ontario, N1G 2W1.

*Impatiens pallida*has become a model system for studies of the evolution of sexual reproduction because each individual has both a selfing mode of reproduction (cleistogamous flowers) and a mode of sexual reproduction (chasmogamous flowers): in direct contrast to theoretical expectations that such a mixed strategy is evolutionarily unstable. Relative fitness of seed produced by cleistogamous and chasmogamous flowers was estimated from changes in the level of inbreeding (estimated from electrophoretic data) at three life stages for each of five generations. During two of five winters, seed produced by self-fertilization suffered catastrophic mortality while seeds produced by sexual reproduction survived well. Otherwise, the relative fitness of seed produced by the two flower types was equal. These results can provide a sufficient explanation for the maintenance of both the sexual and inbreeding modes of reproduction.

(2) CLIMATE WARMING. FOREST FIRES AND ECOSYSTEM MIGRATION IN NORTHERN ONTARIO. Suffling, R. Faculty of Environmental Studies, University of Waterloo, Waterloo, Ont. N2L 3G1.

A S.W. to N.E. climate gradient across Northern Ontario provides continuously varying forest fire occurrence with a maximum in the S.W. Maximal landscape diversity is induced in the centre of the area where there is intermediate forest fire occurrence. It is hypothesised that, with global climate warming, this diversity centre will shift to the N.E. The implications for tree species distributions will be discussed.

(3) INTRA-SEASONAL REPRODUCTIVE COSTS IN MULTI-BROODED HOUSE WRENS. Thompson, Charles F., R.G. Harper, & N.E. Drilling. Ecology Group, Dept. of Biological Sciences, Illinois State Univ., Normal, Illinois 61761 U.S.A.

We manipulated brood size of house wrens (Troglodytes aedon) in order to investigate effects of raising additional nestlings on subsequent reproductive attempts in the same season. We measured the effect of brood manipulations on length of nestling period, frequency of second clutches, likelihood of mate switching, interbrood interval, and size and success of second broods. We also determined the rate at which parents fed their nestlings. Males and females responded differently to the manipulations; we found no compelling evidence of costs expressed as detrimental effects on subsequent reproduction.

(4) COLEOPTERA: LIBRARY OF THE PAST, KEY TO THE FUTURE? Morgan, A.V. Department of Earth Sciences, University of Waterloo, Waterloo, Ontario N2L 3G1.

Coleoptera are believed to be rapid and sensitive indicators of climatic change. Fossil assemblages recorded from different parts of North America indicate large latitudinal changes in conjunction with ice advances and retreats during the last interglacial/glacial cycle. Such changes reflect the movement of Coleoptera species and "complexes", and paleoecological and climatic regimes can be postulated for different regions through time. With current concern about the doubling of CO_2, longterm baseline ecological studies should be undertaken for Coleoptera in Ontario and elsewhere in Canada.

(5) BROOD STAGE AND DEFENSE IN THE CONVICT CICHLID: SUPPORT FOR THE AGE-INVESTMENT HYPOTHESIS. Lavery, B.J. and P.W. Colgan. Department of Biology, Queen's University, Kingston, Ont. K7L 3N6
We varied the number of times a model predator was presented to parental convict cichlids, Cichlasoma nigrofasciatum, at three offspring developmental stages: egg, wriggler, and fry. Stage was a better predictor of brood defense than the number of previous model presentations, thereby lending support to the age-investment hypothesis. Defensive behaviour of both sexes increased with stage. Time away and latency to attack decreased as the young matured. Sex differences in defense behaviour will also be discussed.

(6) VARIATION IN THE DIVERSITY OF DUCK GUILDS ALONG A GRADIENT OF ENVIRONMENTAL VARIABILITY. Bethke, R.W., Dept. of Zoology, Univ. of Guelph, Guelph, Ont. N1G 2W1.
It has been proposed that communities regulated by competition in benign, predictable environments were characterized by (i) dampened variation in evenness relative to variation in richness over time, and (ii) high evenness. Communities regulated by variation in the abundance and diversity of resources in rigorous, unpredictable environments, on the other hand, would exhibit the opposite characteristics. To test whether patterns of variation in components of diversity reflected the mechanisms regulating community structure, temporal and spatial changes in the diversity, richness and evenness of breeding duck guilds were examined along a gradient of variability in wetland conditions using thirty-three years of census data from the Canadian prairie and boreal forest regions. Over time, variation in evenness was independent of environmental variability and changes in richness were related more to the appearance of drought displaced ducks in relatively benign habitats, than to competition. Evenness was not significantly higher for duck guilds in more constant environments, as predicted. Changes in duck diversity over space appeared to be related to underlying gradients in habitat and resource heterogeneity and productivity, all of which, it is suggested, are ultimately determined by geographical gradients in environmental variability and wetland basin morphology. Variation in components of diversity, as predicted, do not provide a basis for distinguishing between mechanisms the regulate duck guild structure.

(7) SIZE, SHAPE, AND BEHAVIOUR OF PINK SALMON. Noakes, D.L.G., M.M. Ferguson & D.B. Noltie. Department of Zoology, University of Guelph, Guelph, Ontario N1G 2W1
Pink salmon (Oncorhynchus gorbuscha) have the greatest degree of sexual dimorphism of all salmonid species. Their life cycle is virtually an invariant 2 years, so differences are not a consequence of age. Among pink salmon males there is considerable variation in development of secondary sexual charcaters, with some males closely similar to females in appearance. We studied a recently-founded population of this species in Lake Erie, Ontario. We assessed the morphology of males and females, and through crosses from known individuals estimated genetic and environmental effects on growth and size. We discuss our results in relation to the possible evolution of these species.

(8) HERBIVORY & PLANT COMMUNITY STRUCTURE ON A TOPOGRAPHIC GRADIENT.
Reader, R.J. & J. Buck. Botany Dept., University of Guelph.
To test the hypothesis that selective and differential herbivory is responsible for change in community structure along an environmental gradient, we compared the survival of caged and non-caged seedlings of 14 plant species dominant either on ridges or in hollows in an abandoned pasture. Caged seedlings survived better than non-caged seedlings but species dominant in hollows did not survive in hollows any better than did species dominant on ridges. Variation in herbivory along the topographic gradient could account for some but not all variation in plant community structure.

(9) EFFECTS OF CLUTCH AND INCUBATION ENVIRONMENT ON EMBRYONIC AND HATCHLING SNAPPING TURTLES (Chelydra serpentina). Bobyn, M.L. & R.J. Brooks. Department of Zoology, University of Guelph, Guelph, Ont. N1G 2W1.

We tested the hypothesis that incubation conditions have significant effects on embryo survival and sex, as well as hatchling size and viability. Eggs from 21 snapping turtle clutches from four Ontario sites were incubated at 21, 25 or 29°C in either a wet or dry substrate. Incubators set at 21 and 29°C produced mostly females whereas those at 25°C produced males. Site, clutch and incubation temperature affected egg mortality, but incubation moisture did not. Embryo mortality was highest at 21°C and lowest at 25°C. Eggs at 25°C in wet substrate produced the heaviest hatchlings. Hatchling mass was also influenced by clutch and initial egg mass, but did not affect hatchling survival to 2 months. Posthatching mortality was highest for turtles from eggs at 29°C in wet substrate. Our results may be useful in determining factors limiting the northern range of this species.

(10) SPECIES SEGREGATION AS A DIVERSITY ENHANCING MECHANISM IN A TROPICAL RIPARIAN FOREST SYSTEM. MEAVE, Jorge and Martin KELLMAN. Geography Dept. York University, North York, Ontario, M3J 1L3.

Species segregation was investigated as a mechanism promoting diversity in small riparian forest patches in the Mountain Pine Ridge savanna, Belize. The spatial distributions of 51 species were analyzed along transects perpendicular to the stream. Variation in the densities of the studied species were correlated with distance from the creek and the savanna ends of the transects. Densities of ca. 80 % of the species were significantly correlated with the distance to either one or both transect ends, indicating that preferential distribution may be an effective mechanism for species packing in the small areas of these forest patches. Disturbance regimes particular to these forests, rather than characteristics of the physical environment, appear to be the primary cause of these patterns.

(11) SIZE SELECTIVE MORTALITY IN YOUNG-OF-THE-YEAR SMALLMOUTH BASS. Houpt, A.M. Department of Biology, York University, Toronto, Ont. M3J 1P3.

The purpose of this study was: 1) to determine if there is size selective mortality occurring in young-of-the-year (YOY) smallmouth bass between the time of dispersal and their first winter and 2) to determine if risk of mortality varies between habitats. Preliminary data suggest that animals remain in the habitat affording more protection until they reach a size at which predation pressures decline.

(12) CHIPMUNK MOVEMENT IN AN AGRICULTURAL LANDSCAPE. Henein, K.M. Department of Biology, Carleton University, Ottawa, Ont. K1S 5B6.

Small mammal habitat in woodland has become increasingly fragmented by human activity. For example, clearing land for farming leaves remnant woodlots and neglected strips of vegetation along fences and drainage ditches. Animals persisting in such human-altered landscapes must operate at different spatial and temporal scales because they can no longer count on local availability of resources. Behavioural change that increases rate and scale of exploration and therefore the probability of locating resource patches will be favoured. Radio-tracking and live-trapping of chipmunks in farmland near Ottawa has shown that some animals may move hundreds of meters in a single exploratory foray, and that this movement is not restricted to any single age-class or sex.

(13) SEED WEIGHT AND TOLERANCE OF BURIAL IN OENOTHERA PARVIFLORA.
Mulder, C. Biology Department, Bates College, ME (currently at Biology Department, Queen's University, Kingston, Ont. K7L 3N6).
Oenothera parviflora L. grows in the dunes at Seawall Beach, Maine. Its seeds are small and numerous, and are very likely to get buried in their natural environment. Depth of burial significantly affects emergence from < 3 cm in depth. Seed weight does affect emergence from depths < 3 cm, but not from depths > 3 cm. Very small seeds have a lower percent emergence than heavier seeds at all depths. Surface-sown seeds have lower mortality than buried seeds. Time until emergence is affected by depth of burial, but not by seed weight. Although seed weight is low compared to other species in this habitat, a small increase in seed weight would probably not increase emergence rates.

(14) A THEORETICAL EXAMINATION OF SEX RATIOS UNDER LOCAL MATE COMPETITON WITH RELATEDNESS.
Byrne, R. and R. Harmsen. Biology Department, Queen's University, Kingston, K7L 3N6.
Hamilton's model of local mate competition presented an environment consisting of isolated patches each colonized by a number of mated females. A degree of relatedness is added to Hamilton's model and, using an inclusive fitness approach, an equilibrium sex ratio is predicted. Further work is being done that uses this augmented model to investigate sex ratio in cases where females can assess relatedness.

(15) POTENTIAL IMPACT OF PROPOSED BISON KILL IN WOOD BUFFALO NATIONAL PARK.
Miyanishi, K. & R.W. Wein, Department of Geography, University of Guelph, Guelph, Ont. N1G 2W1 & Boreal Institute of Northern Studies, University of Alberta, Edmonton, Alta. T6G 2E9.
Following hydrologic changes in the Peace-Athabasca Delta since 1967 many meadows have experienced invasion by willow shrubs. In some meadows heavy bison grazing has controlled shrub growth and maintained meadow habitats. Plots within one of these meadows were subjected to grazing protection and burning. Exposure to grazing did not result in significant shrub mortality but did stunt growth. Thus removal of bison may result in clonal spread of willows and conversion of meadows to shrublands as has occurred in meadows not frequented by bison. Burning controlled growth and also caused significant mortality. Therefore prescribed burning would be recommended for maintenance of Delta meadows during temporary absence of bison grazing.

(16) LIFE HISTORY STRATEGIES OF TWO SYPATRIC SIBLING SPECIES OF PLANT BUGS.
Stockdale, M.C. and R. Harmsen. Biology Department, Queen's University, Kingston, K7L 3N6. Two species of the genus Lygus (Hemiptera, Miridae), L. lineolaris and L.vanduzeei, were studied in old-field communities in relation to variability in the resource density and patchiness. Various parameters related to host-plant specificity, competitive interactions, niche breadth and dispersal were established. These parameters indicate adaptive life strategies such that the two species have various levels of co-existence in a spatially and temporally heterogenous environment.

(17) EFFECTS OF THE INSECTICIDE B.t ON WILDLIFE AND ARTHROPODS.

Apel, K.A., J.F. Bendell, R.D. James and L.B. Cadogan.
Faculty of Forestry, University of Toronto, Toronto, Ontario, M5S 1A1
FORCAN (F.P.M.I.) Sault Ste. Marie, Ontario, P6A 5M7.

Boreal jack pine plantations, near Gogama, Ont., were sprayed with B.t (Bacillus thuringiensis var. kurstaki). We examined the effects on wildlife and arthropods of the shrub and herb layers and forest floor. Results are tentative. B.t. reduced : the numbers of song birds (canopy feeders) by 30%, spruce grouse brood size by 40%, and caterpillars of the shrub and herb layers by 60%. American toads, masked shrews, and 4 orders of arthropods were unaffected. Ants and grasshoppers increased. Spruce grouse and some song birds need caterpillars as food.

(18) THE EFFECTS OF RELATEDNESS ON SEX RATIO IN THE TWO-SPOTTED SPIDER MITE (*TETRANYCHUS URTICAE*). Roeder, C. and R. Harmsen. Biology Department, Queen's University, Kingston, Ont. K7L 3N6.

Sex ratio theory predicts that when there is potential for intense competition among related males for mates, a more female biased progeny sex ratio should be produced in patches with closely related mothers than with more distantly related ones. We tested this prediction in the laboratory using two-spotted spider mites (*Tetranychus urticae*). We compared progeny sex ratio in patches (5 females) consisting of sisters from a highly inbred laboratory colony, sisters from a single apple orchard, non-sisters from the same apple orchard, and non-sisters each from a different apple orchard. There was a female biased sex ratio in all treatments but the bias was less marked in patches of distantly related mothers than among closely related mothers.

(19) **Toxins and Genotoxins in the Niagara River Watershed as Reflected by Chironomid (Diptera: Chironomidae) Labial Plate Deformities**

Mike Dickman, Ann Filipowski and Bruce Stewart
Biological Sciences Depart., Brock Univ., St. Catharines, Ont.

Nickel and chromium, both genotoxic heavy metals, were found at high concentrations (about 2 orders of magnitude above background levels) downstream of a large steel company which discharges into the Welland River. The frequency of labial plate deformities at this site was 18 % which was three times higher than background. (6%).

(20) A COMPARATIVE STUDY ON POPULATION GROWTH PARAMETERS OF INSECTS WITH REFERENCE TO MITES. R.P.Kuang, R.Harmsen & D.Clements. Department of Biology, Queen's University Kingston, Ontario, K7L 3N6

In this presentation, we dealt with population growth parameters of 148 species extracted from the literatures from the period of 1940s to 1990. The results showed that distribution of species number against the intrinsic growth rates was well characterized by the model: $S=25.894 \cdot \exp(-8.692 r_m^2)$. Phytophagous species exhibited greater variation in growth rates than do entomophagous species; Furthermore, we compared the population growth parameters of 2 prey-predator systems and 6 host-parasitoid systems. Finally, we discussed biological implications of these results.

(21) CHIRONOMID LABIAL PLATE DEFORMITIES AND THEIR SIGNIFICANCE.

Moore, M.J., and M.D. Dickman. Department of Biology, Brock University, St. Catharines, Ont. L2S 3A1.

The larvae of chironomids (Chironomidae:Diptera) have been shown to be of considerable value in the monitoring of pollution levels in aquatic environments. Pollution levels have been correlated with the frequency of labial plate deformities observed in sampled organisms. Deformities in the labial plate range from chipped teeth (mild asymmetry) to missing, fused or misshapen teeth (gross deformities). Little work has been done on the induction of labial plate deformities by toxic chemicals in a controlled laboratory setting. Research is underway to observe the effects of N-nitrosodimethylamine, a proven cancer causing agent, on chironomid labial plates. This chemical received public attention when it was detected in the Grand River near the Uniroyal Company in Elmira, Ontario.

(22) POPULATION IMPLICATIONS OF EGG CANNIBALISM.

Clements, D.R. Biology Department, Queen's University, Kingston, Ont. K7L 3N6.

Experimental preference studies revealed that egg cannibalism by the predatory mite, *Zetzellia mali* (Acarina:Stigmaeidae) is an important phenomenon. *Z. mali* eggs are more strongly preferred by juvenile *Z. mali* than by adult females. I explored the effects of egg cannibalism on the population dynamics of *Z. mali* and other members of the acarine community through system simulation. Egg cannibalism increases the effectiveness of *Z. mali* as a predator, by providing an alternative food source when prey are scarce and by providing high quality food for very young *Z. mali*.

(23) SOURCES OF VARIATION IN THE CALLING SONG OF *GRYLLUS INTEGER*.

Souroukis, K., Cade, W. H. Department of Biological Sciences, Brock University, St. Catharines, Ontario, L2S 3A1.

The calling song of the Texas field cricket, *Gryllus integer*, is a species specific pattern of trills alternated with silence. The song functions to attract sexually receptive females and spaces competing males in the field. It also attracts predators and parasites. Four song parameters were studied: pulse rate, pulses per burst, interburst interval and percent dropped pulses. Substantial variation of song pattern exists within the species. In this study possible sources of song variation include: temperature, time of calling, adult age, weight at eclosion and wing length dimorphism.

(24) GEOGRAPHIC VARIATION IN GREAT AUK BODY SIZE.

Burness, G.P. & W.A. Montevecchi. Dept. of Biological Sciences, Brock University, St. Catharines, Ont. L2S 3A1; and Dept. of Biology, Memorial University of Newfoundland, St. John's, NF. A1B 3X9.

Hufthammer (1982) morphometrically analysed Great Auk bones recovered from Scandinavian archaeological sites of different latitudes and ages, and hypothesized the existance of geographic and temporal variation in Scandinavian Great Auk (Pinguinus impennis) body size. To indirectly test her hypothesis, we measured Great Auk bones from Funk Island, Newfoundland. We predicted that if the variation in the sizes of these bones (from a single colony and point in geologic time) was greater than or equal to Hufthamer's samples then her hypothesis would not be supported. No differences in variance were found between the Newfoundland and Scandinavian samples making her hypothesis statistically unlikely. The bones from Funk Island were, however, larger in many dimensions. We attributed this apparent difference in body size to differing sea surface temperatures and/or prey selection by immature Great Auks.

(25) A COMPARISON OF THE IN-AIR ACOUSTIC REPERTOIRES OF THE HARP, HARBOUR AND HOOD SEAL. Ballard, K.A. & K.M. Kovacs. Department of Biology, University of Waterloo, Waterloo, Ont. N2L 3G1.

The airborne vocalizations of the harp (Phoca groenlandica), harbour (Phoca vitulina) and hood (Cystophora cristata) seals, were recorded during their respective breeding seasons and then compared to determine whether those species having more complex social systems also have more complex vocalizations. Calls were categorized according to the vocalizing animal's behaviour and secondarily according to the call structure.

The complexity of the acoustic repertoire of adults was positively correlated with the density of aggregation exhibited by a species and the frequency of encounters with conspecifics. The most highly aggregated species, the harbour seal, emits the most intricate vocalizations followed by harp seals which are intermediate in density and finally by hooded seals which are the most sparsely distributed.

(26) POPULATION ECOLOGY AND CONSERVATION OF LITTLE BROWN BAT. Alison L. Neilson. Department of Biology, York University, North York, Ont. M3J 1P3

I studied the movements of the 15,000 Myotis lucifugus forming colonies in many buildings at the Chautauqua Institution, New York. More than 95% of the banded bats were recaptured at their original roosting site, indicating a high degree of roost fidelity. Although alternative attic spaces may be available, the unwillingness of the animals to use them after being evicted from a house, mean that the roost sites may be limited and limiting the size of populations. Bat houses may provide alternatives suitable to the bats. Three experimental seedings of bat houses with animals were successful.

(27) INDUCTION OF CALLING IN TRIPLOID HYBRID TREEFROGS. Mable, B.K. Department of Zoology, University of Guelph, Ont. N1G 2W1. Calls produced by hybrids resulting from laboratory crosses of tetraploid Hyla versicolor females and either diploid Hyla chrysoscelis (Type I), or Hyla arborea (Type II) males were induced through manipulation of environmental conditions. Type I hybrids produced trilled calls which were lower in dominant frequency and not significantly different in pulse rate than H. versicolor, but lower in pulse rate and not significantly different in frequency than H. chrysoscelis. Mean duration was shorter than in both parent calls. Type II hybrids produced calls which were intermediate in the call parameters examined between the parent types. Hybrid calls may provide a means of identifying triploids in the field.

(28) FACTORS AFFECTING MICRODISTRIBUTION OF S. vittatum LARVAE. Beckett, S.A. & J.J.H. Ciborowski. Dept. Biology, Univ. Windsor, Windsor, ON. N9B 3P4. We conducted a field study to determine the microdistribution of larval black flies and co-occurring macroinvertebrates in Wigle Creek, Ontario. We assessed the importance of water depth, current velocity, and turbulence, as well as 5 attributes of substrate (texture, periphyton cover, inclination, face, and substrate size) to larval density. Stepwise multiple linear regression revealed that greatest densities occurred on cobbles with uneven surfaces and little periphyton, in fast, shallow water. The importance of evenness to microhabitat selection was assessed in laboratory aquaria using paired tiles (even, uneven). Preliminary results suggest larvae select uneven surfaces. Since types of near-boundary flow vary with surface features, larvae may select uneven surfaces because of increased turbulence, which may have a positive effect on feeding ability.

(29) SEASONAL AND DIURNAL COPULATION PATTERNS IN SMITH'S LONGSPURS.
Briskie, J.V. Dept. Biology, Queen's Univ., Kingston, ON K7L 3N6.
Smith's Longspurs (*Calcarius pictus*) form mating associations that are best described as simultaneous polyandry-polygyny. Females copulate with 2 males (alpha and beta) and each male with 1 to 3 females for a total of at least 300 copulations per clutch. This is one of the highest copulation rates observed in birds. Copulations began 4 d before clutch initiation and ceased by the laying of the penultimate egg. Female copulation rate with alpha males peaked 2 d before laying at 6.8 cop/h and with beta males 2 d after clutch initiation at 2.6 cop/h. Copulations were most frequent during the morning and late evening. These seasonal and diurnal patterns correspond to a time when inseminations were most likely to fertilize eggs. Multiple mating by females and lack of territoriality in males suggest high copulation rates in this species evolved as an adaptation to sperm competition.

(30) GENOTYPIC DIFFERENTIATION IN SEEDLING SURVIVAL UNDER SEVERE NUTRIENT DEPRIVATION. Krannitz, P.G.; L.W. Aarssen & J. Dow. Dept. of Biology, Queen's University, Kingston, Ont. K7L 3N6
50 seedlings from each of 10 genotypes of Arabidopsis thaliana, were tested for longevity under extreme nutrient deprivation (supplied with distilled H_2O only). The genotypes differed in the median number of days to death and in the shapes of their survival curves. These differences were not associated with seed size differences. Seedlings survived from a mimimum of ½ mo. to a max. of 4½ months. Some of the seedlings from genotypes that survived the longest produced flowers. Seedlings were able to resume growth and flower when placed on nutrient-rich agar, after 2 or 4 mo. of nutrient deprivation. This "wait and tolerate" strategy may represent an adaptation for withstanding nutrient deprivation and thereby maximizing the chances of surviving to exploit future amelioration of environmental conditions.

(31) WHY ARE JUVENILE THREESPOT DAMSELFISH TERRITORIAL? Bertram, S. Department of Biology, Trent University, Peterborough, Ontario K9J 7B8.
Juvenile threespot damselfish, Pomacentrus planifrons, exhibited interspecific territorial behaviour. Natural encounters were observed and model-bottle manipulations were performed on five size-classes of threespots. Results indicate aggression is dependent upon the number of intruders, their total length and distance from the territorial shelter. Territoriality develops with juvenile total length and functions in food defense with secondary functions in shelter defense. Juvenile aggression towards egg eating bluehead wrasse, Thalassoma bifasciatum, and congeneric beaugregory damselfish, Pomacentrus leucostictus, appears to be maladaptive. Adaptionist reasoning is discussed.

(32) FACTORS CONTRIBUTING TO SIZE VARIATION OF HEXAGENIA LARVAE. Hanes, E.C. & J.J.H. Ciborowski. Dept Biology, Univ. of Windsor, Windsor, ON. N9B 3P4
We studied the influence of time required for eggs to hatch and maternal size on subsequent mayfly larval size/survivorship. After 40 d growth, maternal size influenced the size of offspring ($p<0.01$). Larger females produced smaller larvae. Offspring of intermediate-size females had higher survival rates ($p<0.05$) than offspring of larger or smaller females. After 40 d growth, day of hatch did not influence larval size ($p>0.05$), but it significantly influenced survival of larvae ($p<0.05$). Later hatching larvae had lower survival. After 80 d, larval size was positively correlated with length of time required for eggs to hatch ($p<0.05$). Endogenous variables (maternal size, day of hatch) can influence larval size/survivorship early in larval development before exogenous sources of variation (food, density) are likely to become significant.

(33) **BARN SWALLOW TAILS AND THE COSTS OF SEXUAL SELECTION.** **Montgomerie, Robert. Department of Biology, Queen's University, Kingston, Ontario K7L 3N6, Canada**

In this study conducted near Chaffey's Lock, Ontario, we manipulated the length of outer tail feathers (streamers) of male barn swallows shortly after they returned to 4 small breeding colonies in the spring. The streamers of 10 randomly chosen males were lengthened by 20 mm while those of 10 other males were shortened by the same amount. Our results support the findings of previous work in Denmark suggesting that females in this species prefer males with longer streamers and thus that streamer length in this species may be the influence of sexual selection. Using DNA fingerprinting, however, we also found that males with elongated tails fathered a lower proportion of the nestlings in their nest than did males with shortened tails and that there was a significant correlation between paternity and original (unmanipulated) tail length. These results suggest both a cost and a benefit to exaggerated ornaments under the influence of sexual selection.

(34) PATERNITY EXCLUSION OF HOODED SEAL MALES DETERMINED BY DNA FINGERPRINTING. McRae, S. B. & K. M. Kovacs. Department of Biology, University of Waterloo, Waterloo, Ont. N2L 3G1.

Mature male hooded seals, *Cystophora cristata*, compete for access to parturient females. Trios consisting of females nursing pups and their attending males, are sparsely distributed over the pack-ice whelping site. When the pup is weaned, the female leaves the whelping site with the male that last attended her. Yet, copulation occurs in the water making observation difficult.

Blood samples were collected from individuals of 12 trios from the Gulf of St. Lawrence breeding population. Using DNA extracted from leucocytes, we investigated whether each male had sired the pup of the female he had been attending. Multilocus DNA fingerprints revealed that the attending male was not the father of the pup. Pairings are therefore unlikely to persist between breeding seasons.

(35) CUCKOLDRY AND EGG STEALING BY MALE THREE-SPINED STICKLEBACKS. Jamieson, I.G. & P.W. Colgan. Biology Department, Queen's University, Kingston, Ont.

A laboratory study was conducted to examine the contexts in which cuckoldry and egg stealing occurred among nesting male sticklebacks and what effect, if any, egg stealing had on the mating success of the egg stealer. Three males were allowed to compete for nest sites and mates. Those males that were last to complete construction of their nests and last to spawn in their own nests, raided most frequently. Raids were initiated primarily during spawning by neighbouring males and the majority of incidents of egg stealing were preceded by acts of cuckoldry. Stealing eggs did not increase the chances of a male attracting a female to his nest to spawn. Stealing eggs may affect mating success in larger populations, but under the conditions of the present experiment we conclude that the adaptive function of egg stealing remains unclear.

(36) Peter L. Hurd and Patrick J. Weatherhead. Carleton University

Why do most birds eat their nestling's feces?

Most passerine nestlings void urine and feces in mucosal fecal sacs which parents dispose of either by carrying away from the nest or by eating them. As the nestlings get older, their parents eat a smaller proportion of the fecal sacs. Fecal sacs and ingestion patterns of Red-winged Blackbirds (Agelaius phoeniceus), Tree Swallows (Tachycineta bicolor) and American Robins (Turdus migratorius) were examined. Counter to expectation, no differences were found in the energy density of fecal sacs as nestlings matured. As the nestlings got older the proportion of sacs ingested decreased, while the weight and energy content per sac increased. The results suggest that ingestion of fecal sacs is a time-saving short cut. Sacs are most likely to be ingested when they are small, and time at the nest is most valuable.

(37) THE ROLE OF AGGRESSION IN NOTOSTRACAN MATING SYSTEMS. Straszynski, E. Watershed Ecosystems Graduate Program, Trent University, Peterborough, Ont., K9J 7B8.

Lepidurus couesii (Crustacea: Notostraca) occurs in ephemeral freshwater habitats in the prairie provinces. The species is sexually dimorphic with respect to behaviour as well as morphology. The nature, costs, and benefits of behavioural differences were examined. Males are more aggressive than females, and can mate repeatedly over short time periods. However, males may incur higher predation costs. Sexual selection appears negligible. Alternative causes and roles of the dimorphism are suggested in light of a brief comparison with L. arcticus, an arctic hermaphroditic species.

(38) SEASONAL MOVEMENTS OF THE BURROWING MAYFLY HEXAGENIA LIMBATA (EPHEMEROPTERA:EPHEMERIDAE) IN STRATIFIED LAKES. Fausto, J. A. Watershed Ecosystems Programme, Trent University, Peterborough, Ontario K9J 7B8

Spring and fall Ekman dredge samples from an oliogtrophic and a mesotrophic lake in the edge of the Canadian shield reveal littoral and offshore movement of Hexagenia prior to and after emergence respectively. The similarity of movement patterns in the oligotrophic lake suggest that this activity was not initiated by reduced hypolimnetic oxygen concentrations of summer. Wing-pad and total length analysis showed a relationship between ontogeny and depth distribution, which correlated with laboratory growth and temperature studies. It is hypothesized that seasonal movements allow development to synchronize with spatial changes in temperature heterogeneity and food availability.

(39) THE CAUSE OF ASSORTATIVE MATING IN A BLISTER BEETLE. Brown, W. D. Dept. of Zoology, Erindale College, University of Toronto, Mississauga, Ontario L5L 1C6.

Although positive assortative mating has been the subject of much theoretical analysis, determining its causes has proven difficult and studies that clearly distinguish between alternative models of mate assortment are lacking. I tested three hypotheses of assortative mating using the blister beetle Lytta magister. Results show that assortative mating by size occurs in L. magister because both males and females prefer large mates. Because large size is the universally preferred phenotype, big individuals are more able to express their preference and tend to pair off. This leaves small beetles no choice but to mate among themselves. These preferences have presumably evolved because large females produce more eggs per clutch and large males are more capable of producing the large spermatophore passed during mating.

(40) MONITORING ATTACK SUCCESS OF FORAGING BATS. Acharya, Lalita. Department of Biology, York University, North York, Ontario. M3J 1P3.

Feeding buzzes, the high echolocation pulse repetition rates produced by bats attacking airborne prey, are said to provide information about attack success and prey size. Using data from foraging hoary (n = 187 attacks) and red bats (n = 63 attacks), I found that the silent period at the end of a feeding buzz was significantly longer after successful than after unsuccessful attacks for both species. My data did not, however, show that length of feeding buzz was an accurate predictor of prey size.

(41) MALE MATING COSTS: LIMITED REMATING OPPORTUNITY. Snedden, W. A. & S. K. Sakaluk. Dept. of Zoology, Erindale College, Univ. Toronto, Mississauga, Ont. L5L 1C6 & Dept. of Bio. Sci., Illinois State Univ., Normal, Ill., USA. 61761.
Males of many cricket and katydid species provide females with a nuptial meal during mating. This food gift often represents a significant resource; males are limited in their ability to produce subsequent gifts. Male Sagebrush Crickets provide females with two nuptial gifts. The female feeds on the male's fleshy hind wings during coupling, and on the spermatophore sometime afterwards. Previous research has shown a virgin male mating advantage. We hypothesized that non-virgins, having invested in mating, were energetically handicapped and thus their ability to sing and attract females was compromised. We found that virgins called significantly longer than non-virgins and that calling duration was directly related to mating success.

(42) SEX-RELATED VARIATIONS IN BEHAVIOUR AND HOME RANGE FOOD ABUNDANCE OF COLLARED LEMMINGS, Dicrostonyx groenlandicus. Anna Maria Tuchscherer and Ronald J. Brooks, Dept. of Zoology, University of Guelph, Guelph,ON N1G 2W1

Fieldwork near Churchill, Manitoba in 1988 and 1989 was performed to determine if female collared lemmings occupy areas of relatively high food density compared to males. Males have larger home ranges, but females have much higher energy demands, since they are pregnant and/or lactating for most of the summer. If females occupied relatively food-rich areas, they could minimize foraging time and thus time away from the pups. After estimating home range sizes using radiotelemetry, we analyzed 12 male and 13 female home ranges. There was no difference between the sexes in the proportion of food in the home ranges (Mann-Whitney U-test, P=0.9356). Alternative hypotheses are discussed.

(43) COURTSHIP FEEDING AND COSTS OF REPRODUCTION IN CRICKETS. Burpee, D.M. & S.K. Sakaluk. Dept. Biology, Illinois State University, Normal IL, U.S.A.
Life history evolution theory assumes a fitness related cost of reproduction that is expressed in terms of reduced lifespan and future RS. However, costs of reproduction to females may be offset by the acquisition of courtship food gifts. This hypothesis was tested in two cricket species, one in which the male provides the female with a nuptial food gift at mating (Gryllodes supplicans), and a non-gift giving species (Gryllus veletis). We predicted that: 1) survival of mated females in the gift-giving species, measured with respect to virgin survival, should be greater than the survival of mated females in the non-gift giving species and 2) survival of mated males relative to virgins in the gift-giving species should be less than that of mated males in the non-gift giving species. These predictions are based on the premise that: 1) food gifts constitute an important source of nutrition to females, and 2) investment in food gifts increases the costs of reproduction to males.

(44) THERMAL CONSTRAINTS ON SWIMMING PERFORMANCE AND ESCAPE RESPONSES OF NORTHERN WATER SNAKES. Robertson, I.C. & P.J. Weatherhead. Dept. of Biology, Carleton University, Ottawa, Ont. K1S 5B6.
Temperature has been shown to influence the predator avoidance strategies of ectotherms. We examined the effect of water temperature on swimming speed and escape behaviour of the northern water snake, Nerodia sipedon. In the field, basking water snakes typically retreated to water when approached. Although swimming speed decreased at lower temperatures, approach distances of basking snakes were not affected by water temperature. Basking snakes retreated to water sooner when perched at lower heights, possibly to compensate for greater vulnerability to predators. Perch heights decreased as the season progressed. We suggest that seasonal changes in the thermal environment may indirectly influence escape behaviour by influencing basking height.

(45) A TEST OF SEXUAL DIFFERENCES THEORY: EXPERIMENTAL MANUPULATION OF SEX ROLES IN AN INSECT Gwynne, D. T. and Simmons, L. W. Erindale Campus, University of Toronto, Mississauga, Ontario, Canada L5L 1C6 and Zoology Department, University of Liverpool, Liverpool, L69 3BX, UK.

Although sexual selection theory predicts that the relative parental investment in offspring controls which sex competes for mates, experimental tests of this are lacking. In katydids, a group in which males feed females while mating, there is intraspecific variation in the courtship roles. This study shows that an experimental increase of food changes a mating system with inter-female competition and male choice to one exhibiting the more typical courtship roles. This result supports the above prediction since the value of the courtship meal (relative male investment) decreased with increased food; a decrease in female mating frequency indicated that they no longer required the courtship meals obtainable through multiple mating.

(46) AGRICULTURAL HABITATS, EDGES AND RACCOON FORAGING. Robertson, G.R. Biology Department, Carleton University, Ottawa, Ont. K1S 5B6.

Forests in various parts of the world are being clear-cut for agriculture resulting in a relative increase in forest edge as woodlot size decreases. Some evidence suggests that predation is higher along edges than in the interior of woodlots. This hypothesis was tested with raccoons using tracking trays in woodlots as well as fencerows and fields. No significant difference was found between the frequency of use of the woodlot edge and the woodlot interior by raccoons. Other factors, such as the availability of food and den sites, seem to determine their frequency of foraging in the six habitats. As well, no significant difference was found between their relative use of the habitats in the summer as compared to the fall.

(47) SEXUAL DIMORPHISM IN THE FIVE LINED SKINK, (EUMECES FASCIATUS). Seburn, C. N. L., Department of Biological Sciences, University of Windsor, Windsor, Ont. N9B 3P4.

Sexual dimorphism is of interest because it suggests either sexual selection or differential selective pressures. Five-lined skinks are dimorphic for head colour during the breeding season. Dimorphisms are demonstrated in several metric traits. Differences in reproductive roles including parental investment are described. Examination of the functional importance of a trait may aid in determining why that trait is dimorphic. For example, differences in weight are likely a direct result of differential reproductive roles whereas head width differences may be a result of sexual selection.

(48) INDIVIDUAL VARIATION, ACQUISITION, AND RE-ACQUISITION IN A FORAGING TASK BY JUVENILE BLUEGILL SUNFISH (LEPOMIS MACROCHIRUS).

P. Colgan, V. Gotceitas, and J. Frame. Biology Department, Queen's University. Kingston, Ontario, K7L 3N6.

In each of four episodes 10 juvenile bluegills were given the opportunity to forage once daily for 10 days on 10 items of a particular food type. The first two episodes presented white worms, the third waterfleas, and the fourth damselfly nymphs. The time to capture each item on each day was recorded and these data provided measures of latency, foraging success, and capture rate for each fish in each episode. Factorial ANOVA was used to examine within episode variation. Rank correlations were used to compare performance between episodes. This individual variation was persistent across episodes for some behavioural measures and was strongly influenced by food type and previous feeding history.

(49)

COURTSHIP IN NEUMANIA WATER MITES: MALES CAPITALIZE ON FEMALE ADAPTATIONS FOR PREDATION. Proctor, H.C. Department of Zoology, Erindale College, University of Toronto, Mississauga, ON. L5L 1C6

Neumania water mites are ambush predators that orient to and grasp at point-sources of vibration. Courting males vibrate their forelegs near females and elicit the same orientation and grasping response as do prey animals. Males do not discriminate between ovigerous and non-ovigerous, or hungry and well-fed females by this behaviour. Rather, the male mite appears to use female hunting responses to manipulate his mate's orientation until it is favourable for spermatophore deposition and uptake.

(50)

USE OF TORPOR BY FREE-LIVING HOARY BATS. Hickey, M.B.C. Department of Biology, York University, North York, Ontario M3J 1P3.

I used temperature-sensitive radio transmitters to study the use of torpor by female hoary bats. When daily minimum temperatures were 14.5 C or lower some bats entered torpor while above 15 C all bats remained active. On a given night not all bats adopted the same thermoregulatory strategy, and some bats seemed to have a lower threshold for entering torpor. As predicted based on their morphology, hoary bats enter torpor at lower temperatures than other temperate species studied so far.

(51) POSTCOPULATORY MATE GUARDING IN DECORATED CRICKETS. Sakaluk, S.K. Dept. Biological Sciences, Illinois State University, Normal, IL 61761, USA.

It is widely believed that mate guarding in crickets functions to prevent the female from prematurely removing the externally attached spermatophore. I tested this hypothesis by comparing spermatophore retention times of female Gryllodes supplicans that were guarded by their mates with those females whose mates had been removed. Their was no difference in spermatophore attachment durations for the two groups. Two additional hypotheses related to the function of mate guarding were also tested: 1) mate guarding allows a male to maintain close physical proximity to his mate during the time it takes to produce a new spermatophore and 2) mate guarding functions to exclude rivals from the immediate vicinity of the mated female. There was no correspondence between guarding time and the time required to produce a new spermatophore. However, the predictions of the rival-exclusion hypothesis were upheld.

(52)

Fryxell, J.M. & C.M. Doucet. Department of Zoology, University of Guelph, Guelph, Ont. N1G 2W1.

Descriptive studies of foraging patterns suggest that beavers are increasingly selective the farther they forage from the lodge. This behaviour could result either from spatial variation in food availability or the effect of provisioning time. We tested the effect of provisioning time by providing beavers in experimental enclosures with equal frequencies of saplings and compared patterns of resource use with predictions from an explicit model of central place foraging. The model accurately predicted changes in mean size and variance of aspen and maple saplings utilized at distances ranging from 10 to 40m. These results suggest that beavers use foraging strategies that maximize rates of energy intake.

(53) COMPUTER SIMULATION OF ALTERNATIVE MALE STRATEGIES IN THE FIELD CRICKET (GRYLLUS) MATING SYSTEM, Rowell, G. A. & W. H. Cade. Department of Biological Sciences, Brock University, St. Catharines, Ont. L2S 3A1.

Male field crickets utilize both calling and noncalling ("satellite") strategies to secure mates. The occurance of satellite males has been associated with high population densities, yet it is unclear how mating success might depend on the satellite strategy. In this study, a computer simulation is used to compare the relative mating success of calling and satellite males with respect to population density, caller/satellite frequency and sex ratio. The simulation uses simple movement rules on a two-dimensional plane to model the mating success of individual crickets in a population.

(54) REPEATED MATING AND FERTILITY IN FEMALE FIELD CRICKETS.

Belme, D.M. & W.H. Cade. Department of Biological Sciences, Brock University, St. Catharines, Ontario. L2S 3A1

Female multiple mating behaviour was studied in the field cricket, Gryllus integer. Observations in a field habitat and in the laboratory were carried out to determine the frequency of female matings, and the fecundity and fertility of females that mate a variable number of times and under different nutritional states. Data are presented to test the hypothesis that repeated mating by females benefits female reproductive success. Alternatively, female multiple mating may result from a correlation with male traits.

(55) SPATIAL DISTRIBUTION OF PYLLONORYCTER BLANCARDELLA (F.) FOLLOWING INSECTICIDE APPLICATIONS.

Li, S. Y. and R. Harmsen. Department of Biology, Queen's University, Kingston, Ont. K7L 3N6.

The effects of insecticide applications on the abundance and spatial distribution of the spotted tentiform leafminer, *Pyllonorycter blancardella* (F.) in an apple orchard were studied over two seasons. Insecticide applications significantly decreased the larval population density, but had little impact on the percentage of trees infested with the pest and mean larvae per infested leaf. The percentage of leaves with larvae per infested tree was higher in control plots than that in chemical applied plots. The spatial distribution of *P. blancardella* is aggregated at all densities according to Taylor's power law analysis. The practical applications of spatial distribution parameters were explored in this study.

(56) THE NATURAL VARIATION IN THE TEMPORAL PATTERNING OF SONG STRUCTURE IN THE NORTHERN FIELD CRICKET *Gryllus pennsylvanicus*.

Ciceran, M.A., and W.H. Cade. Department of Biological Sciences, Brock University, St. Catharines, Ontario, L2S 3A1.

The calling song of the field cricket *Gryllus pennsylvanicus* is species specific composed of 3-5 pulses arranged into distinct chirps which are separated by silent periods. The song functions to attract sexually receptive females and spaces competing males in the field. Four song parameters studied were studied: pulse rate, number of pulses per burst, interburst interval, and burst duration. Tremendous variation in the temporal patterning exists within the population. In this study sources of variation included: age, weight, time of day calling and neighbouring distance

(57) Olfaction in the Tasmanian Swamp Rat. Mallick, S. Department of Zoology, Scarborough Campus, University of Toronto, Scarborough, M1C 1A4

Urine marking is well developed in both male and female swamp rats, R. lutreolus, and appears to involve deposition of preputial gland scents. Such scents may play a role in sex attraction and possibly the maintenance of female swamp rat territoriality. The length of the male urinary papilla and the unusual development of the corresponding structure in female rats is postulated to be an adaptive modification of the external genitalia to act as a device for depositing numerous traces of urine and accessory gland secretion during urine marking behaviour.

(58)

INDIRECT EFFECTS OF B.T. ON GROUND-NESTING SONGBIRDS IN A JACK PINE PLANTATION OF NORTHERN ONTARIO. Millikin, R.L. & K.N. Barber. Forest Pest Management Institute, Forestry Canada, Sault Ste. Marie, Ontario, P6A 5M7. B.t.k was applied on June 11, 1989. Bioassays showed residues were active against Lepidoptera for at least 2 days after treatment. Ground-nesting songbirds were studied for differences food, growth and survival of nestlings, in treated verses control areas.

(59) THE SIZE AND SHAPE OF BUTTERFLY WINGS: ON THE RELATIONSHIP BETWEEN MORPHOLOGY AND BEHAVIOUR. Schappert, P.J. Department of Biology, Trent University, Peterborough, Ont., K9J 7B8.

Mate-location behaviours of butterflies are often characterized by two extremes: perching and patrolling (passive and active search). Scott (1983, J. Res. Lep. 21:177-87) suggested that differences in mate-locating behaviour is correlated with overall size and fore-wing shape. I have measured size and forewing shapes and angles in 43 species (31 genera in 6 families) of butterflies from Peterborough County, Ont. I find that size is the most important influence on forewing shape and that there is no evidence to support Scott.

(60) ANTHROPOGENIC FOREST FIRES IN N.W. ONTARIO IN THE 18TH AND 19TH CENTURIES. Suffling, R. A. Younger, Faculty of Environmental Studies, University of Waterloo, Waterloo, Ont N2L 3G1.

Late 18th century stand-replacing fires in boreal N.W. Ontario were so extensive that the area was dubbed the "Fire Country" by fur traders. In Hudsons Bay Company journals for Osnaburgh House (51o20'N 90o10'W) from 1786-1911, over a third of recorded fires were started by people. The causes of the remainder are undetermined, but probably mostly lightning. Anthropogenic fires were started by cooking fires, as signals, and in politically-motivated arson, but there was no evidence for game management by fire. Thus one should not assume that the boreal forest was "pristine", even in the 18th century!

(61) FOREST BIRD METAPOPULATIONS IN AGRICULTURAL LANDSCAPES OF EASTERN ONTARIO. Villard, M.-A. Department of Biology, Carleton University, Ottawa, Ont. K1S 5B6. Results from two different approaches indicate that bird species dependent on forest habitat persist in agricultural landscapes as sets of interacting patch populations which frequently go extinct and are recolonized. At the level of species assemblages, point count censuses showed an increase in the number of forest species with proximity to large ($\geq$100 ha) forests. At the species level, substantial rates of local extinction and recolonization were observed in three neotropical migrant target species. However, the proportion of patches occupied by these species at the landscape scale showed no significant differences between years. These dynamics are in agreement with metapopulation models.