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Appendices

Odonata Larvae in Urban Retention Ponds in Winnipeg, Manitoba, Canada

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ABSTRACT

We assessed the diversity of Odonata larvae in retention ponds, a prevalent but unexplored aquatic habitat in many cities. Ten storm water retention ponds in Winnipeg were sampled for larval Odonata during the 2001 summer season. Twenty-two species were collected. Six species were common in four or more ponds: *Anax junius*, *Sympetrum costiferum*, *Lestes unguiculatus, Enallagma hageni, E. ebrium* and *E. civile*. Of the other species found, only one specimen each of 10 species was collected. There appeared to be fewer species and fewer individuals of each species in ponds where vegetation control practices had been applied. No juvenile Odonata were found in ponds where carp were present. *Anax junius* was most abundant in ponds with emergent vegetation. However, in one pond where there had been no vegetation control and where there was no emergent vegetation, the greatest number of species was collected.

INTRODUCTION

Man-made water bodies such as ponds, farm dugouts and gravel pits (Benke and Benke 1975; Wissinger1988a; Gribbin and Thompson 1991; Moore 2001; Catling and Brownell 2002) can be important habitats for Odonata, and may include rare and endangered species. Urban storm water retention ponds are thought to be poor habitat for Odonata because they receive polluted avenue waters containing heavy metals, organic debris and chemical residues (Glassey 1991; Pitt *et al*. 1995). They are a conspicuous component of urban landscapes, and in Winnipeg, Manitoba, Canada, 70 retention ponds are managed to optimize storm-water flow rather than for ecological benefit. Submergent vegetation is removed and emergent vegetation is limited by establishing gravel shorelines. For Odonata, these conditions mean poor water quality, removal of oviposition substrate (Lawton 1970; Corbet 1999) and lack of shoreline emergence support structures and visual cues thought to favour oviposition. We did not find any published studies of Odonata under these conditions.

There are published accounts of Odonata for Manitoba (Walker 1912, 1933, 1941; Conroy and Kuhn 1977) and a recent assessment of the provincial fauna (Hughes and Duncan 2003), based entirely on records for adults. No records for larval Odonata within Winnipeg have been compiled. The study of larvae is important because presence of adult Odonata implies, but does not necessarily prove, reproduction at a given site, because some species travel considerable distances from their natal waters (Corbet 1999). We studied storm water retention ponds in Winnipeg over one season, to measure diversity of juvenile Odonata and to record environmental correlates.

MATERIALS AND METHODS

The first storm water retention ponds were constructed in the 1960's, when Winnipeg started to separate avenue water from residential waste flows. All avenue runoff in new suburban areas was directed into these basins which are linked underground and flow into the closest stream or river. Nine of 70 ponds were selected from different areas of the city based on ease of access, vegetation control treatments and inclusion in the Winnipeg Department of Water and Waste water quality monitoring programme. A pond not receiving avenue flow and located in a semi-rural setting was included to compare odonate diversity with city ponds. This pond differed also in that its shoreline was largely overgrown with trees and bushes, and there was little emergent vegetation. Ponds were numbered and a summary of their locations and environmental conditions is provided in Table 1.

Retention ponds were originally engineered so that water levels remain fairly constant throughout the year, with temporary gain following high rainfall or gradual lowering during drought. Ponds were surrounded by a public park, residential housing, or a combination of the two. In winter, retention ponds were covered with ice, possibly creating anaerobic conditions. Summer conditions included high nutrients, high temperatures, heavy runoff and associated pollution. The Winnipeg Water and Waste Department collected data for 13 ponds in 2001, including Ponds 1, 7, 8, 9 and 10, examined by us for odonates. The ponds were shallow (max. depth 1.6 ± 0.25 m), alkaline (pH 9 ±

0.75) and nutrient-rich environments (total nitrogen 3 ± 1.3 ppm; phosphorous 0.26 ± 0.17 ppm). The substrate consisted of clay overlain with organic matter. Shorelines were covered with coarse, two-inch gravel from two metres above the waterline and extended into the water from zero to three metres. Filamentous algae were present in all ponds throughout the summer, along with extensive growth of pondweed (*Potamogeton* spp.) and coontail (*Ceratophyllum demersum* Linnaeus). Low rainfall and relatively high water temperatures (>20°C) resulted in the margins of smaller ponds being thick with submergent vegetation. The City controlled vegetation with herbicide (diquat, dichlorophenol) or mechanical removal. This sometimes included removal of emergent vegetation along the shoreline. Thus, some ponds received vegetation treatment and still supported emergent growth in places. Two retention ponds (Ponds 1 and 6) and the rural pond (Pond 2) had no vegetation treatments: the latter two had no gravel shoreline and supported natural growth of emergent vegetation and shrubs. All other ponds received either herbicide treatment or mechanical harvesting. Gravel shorelines were treated yearly with Roundup® (glyphosate) to kill vegetation. Most ponds contained fish, usually mud minnows (*Umbra limi* Kirtland) and sticklebacks (*Culaea inconstans* Kirtland), but bullhead (*Ictaluras melas* Rafinesque) were seen in two (Ponds 7 and 10) and carp (*Cyprinus carpio* Linnaeus) were present in Ponds 8 and 9.

Samples were collected with an aquatic D-net (maximum width, 30 cm; mesh size 1.2 mm). One sweep consisted of three, one-metre passes of substrate or vegetation (Lawton 1970, Johnson 1986) and three sweeps were made on each sampling date. As many microhabitats as possible were sampled, including bare gravel substrate, algae, floating and bottom-rooted aquatic plants, among emergent vegetation, but sampling depth was limited to one metre. Access to shorelines at some ponds was limited to public property, so only that portion of the total margin could be sampled. This was acceptable as each pond appeared to have overall homogenous habitat conditions. All ten ponds were sampled twice a month from June to August, 2001. Specimens were sorted by hand in the field and preserved in 70% ethanol. At each sampling event, emergent vegetation and shorelines were examined for exuviae. Odonate larvae were identified using keys in Walker (1958), Walker & Corbet (1975) and Westfall & May (1996). Voucher specimens were deposited in the J.B. Wallis Museum of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

RESULTS

Twenty-two species of Odonata were collected from ten ponds during the three months of this study. Great variation was seen among ponds; 10 species (in addition to inseparable specimens of *Enallagma hageni* (Walsh) and *Enallagma ebrium* (Hagen) and early stadia of *Ischnura* spp.) were found in Pond 1 and no specimens were collected in Ponds 8 and 9. Table 2 is a summary of all odonate larvae found during this study. Sufficient numbers of larvae of several species were collected to be able to determine patterns of seasonal abundance in the ponds (Figure 1). For instance, the two species of *Lestes* were found only in late June-early July; they hatch in May, develop rapidly as juveniles, and emerge by mid summer (Corbet 1999). Four *Enallagma* species occurred abundantly as late stadia in early June and emerged by mid to late June.

Juvenile *Enallagma* were not found after early July, but adults were abundant, laying eggs in the floating aquatic plants. Beginning 12 July, 2001 and continuing for the rest of the summer, large numbers of early stadia of larval Coenagrionidae were collected, evidence of their synchronous hatch. These large numbers were not seen in ponds where vegetation control had been undertaken (Ponds 3, 4, and 10) and only moderate populations were seen in the rural Pond 2. *Coenagrion angulatum* (Walker) was the only Coenagrionidae larva identifiable to species in early stadia.

Anax junius (Drury) larvae were not collected until late June and then were collected regularly throughout July until their emergence in August. Adults were seen patrolling shorelines only in early June and not after adult emergence. The entire pattern of juvenile development could not be determined in one season, but *A. junius* appeared to be univoltine, with one cohort present in the ponds. *Sympetrum corruptum* (Hagen) was the only libellulid caught in sufficient numbers to determine its life cycle (Fig. 1). It emerged in August, after which adults were seen laying eggs. There was one cohort that either over-wintered as early instars, or delayed hatching until spring.

Within the confines of these small man-made ponds, biotic and abiotic factors differed considerably. Substrate varied from coarse gravel and clay to dead vegetation and a black, anoxic organic medium. Vegetation was also varied, with thick stands of *Typha*, floating algae, algae anchored to gravel and pond weeds growing up from clay substrates. Larvae had different affinities for these habitats over the course of sampling. Overwintering larvae were found at depths greater than one metre in preliminary samples taken in May. As the water warmed, larvae were found throughout the pond. *Anax junius* and the early stadia of Coenagrionidae spp. were usually collected among surface portions of submerged vegetation; Libellulidae larvae were mainly sprawled on bottom substrates among dead vegetation; *Lestes* spp. occurred among emergent vegetation. Immediately before their emergence, *A. junius* and *Enallagma* spp. occurred in very shallow water (<10 cm) at the shoreline.

Differences among ponds may have contributed to the observed differences in species assemblages. For instance, *Lestes* spp. were never found in ponds without emergent vegetation (yet were missing at some ponds that supported it). *Anax junius* was generally found in ponds with mud minnows and were more abundant in ponds with abundant emergent vegetation. Six species of Libellulidae were collected in Pond 1, even though it had no emergent vegetation, a factor thought to encourage oviposition in Anisoptera (Corbet 1999). No Odonata were collected in the two ponds where carp were observed. There appeared to be smaller numbers and fewer species of odonate larvae in ponds with vegetation control than in those without.

Arigomphus cornutus (Tough) was only found in Ponds 2 and 6. These ponds were similar in that they had naturally vegetated shorelines and received water from neither non-residential (Pond 2), nor residential avenues (Pond 6).

Almost half of all species were represented by only one individual, but six species occurred in half or more of ponds containing Odonata. No odonates were collected in two of the 10 ponds. The most commonly collected species were *A. junius* and *Enallagma hageni*, which were collected in 60% of the ponds, followed by *Enallagma ebrium*, *Lestes unguiculatus* (Hagen), *Enallagma civile* (Hagen) and *Sympetrum costiferum* (Hagen) in 40% of ponds. The greatest number of species was collected not in the rural

pond, but in the smallest retention pond. No vegetation control had been conducted in this latter pond for approximately ten years.

The collection of *Sympetrum rubicundulum* larvae is surprising. Hughes and Duncan (2003) concluded that earlier reports of its presence in Manitoba were erroneous. However, the identification of the specimens has been verified by both authors as well as Lisette Ross (Ducks Unlimited).

Only 100 exuviae were collected over the sampling period (Figure 2). Sampling every two weeks may be too long an interval to assess emergence quantitatively, with most exuviae being lost to the elements. However, the collected exuviae can be used to document the approximate period of emergence for Coenagrionidae from mid June to early July, *A. cornutus* in late June to mid-July, *S. corruptum* and *A. junius* throughout August. Exuviae were found almost exclusively (96%) on emergent vegetation, never on gravel shorelines or in the short grass above the gravel. At ponds without emergent vegetation (Ponds 1 and 5), *Enallagma* spp. were seen climbing onto floating algal mats and emerging. Exuviae of *S. corruptum* were also found on these mats at Pond 1. On hot afternoons in late June, Common Grackles (*Quiscalus quiscula*) were seen at these same ponds feeding on Odonata larvae from the gravel. On one occasion, an *Enallagma* larva was observed crawling among gravel for several minutes until it found the observer's boot, whereupon it climbed five cm up the side and proceeded to emerge.

DISCUSSION

Of the 95 species of Odonata recorded in Manitoba (Hughes and Duncan 2003), almost one quarter were found in the retention ponds during this study. The observed temporal patterns for larvae of species collected were consistent with reported species-specific oviposition, hatching and emergence patterns. Factors which affected species abundance and diversity among ponds may be related to the limited environmental data gathered, but should be interpreted with caution.

Enallagma spp. and *A. junius* were commonly collected species. Their development and aggregation near the shore before emergence were similar to that reported by others (Trottier 1966; Lawton 1970; Benke and Benke 1975). These species were found together in floating vegetation; *A. junius* may prey upon early instar *Enallagma* (McPeek 1990). Growth and emergence of *A. junius* corresponded to the migratory cohort described by Trottier (1966), where adults migrating from the south in spring lay eggs that hatch and quickly develop to emerge by late summer, the adults then migrate south (Wissinger 1988b). Resident *A. junius* hatched in July, overwintered as late stadia, and emerged in June having spent 11 months as larvae (Trottier 1966). More frequent sampling and arrangement of specimens into discreet instars are required to verify to which population these Winnipeg specimens belong. Ponds 4 and 6, with extensive emergent vegetation, had considerable numbers of *A. junius*. The extent and nature of vegetation is an important factor during oviposition for this species, as its eggs are inserted into stems of emergent plants. It may be for this reason that there were few *A.*

junius found in ponds with little or no emergent vegetation. On the other hand, many species of Libellulidae lay their eggs directly into the water. Libellulids were abundant in Pond 1, where there was little emergent vegetation and few *A. junius*.

Carp are omnivorous, their diets including plants, macroinvertebrates and even mollusks (Marsden 1997). They are also credited with destruction of aquatic macrophytes during their aggressive, bottom-feeding habit (Dr. Gordon Goldsborough, Dept. of Botany, University of Manitoba, pers. comm.). We do not know whether carp may have impacted the Odonata as a result of habitat modification and disruption, or if they consume the larval stages as well. The presence of carp, coupled with shoreline treatments with glyphosate resulted in an absence of vascular plants at these ponds, eliminating oviposition sites in and around the pond for species requiring plants for egg-laying. No species of odonates that are directly or indirectly dependent upon these plants were collected. It may be that ponds experiencing vegetation disruption have less diverse overall invertebrate populations and this may affect colonization success and survival in Odonata with specific prey requirements. Libellulidae may be examples of this phenomenon, as they were found almost exclusively in ponds without vegetation control. Determination of prey populations and Odonata in a controlled vegetation experiment would be needed to test this hypothesis.

In ponds where there was no emergent vegetation, few Lestidae were collected, although there was still a wide diversity of other Odonata. A lack of emergent vegetation may affect overall success when emerging larvae become more openly exposed to bird predation. No exuviae were found at ponds without emergent shoreline vegetation and the presence of avian predators at these ponds may constitute a significant mortality factor during this susceptible stage in the life cycle. Wissinger (1988a) observed that up to 50% of emerging damselflies were consumed by birds. Avian predation appears to be greatly facilitated where there are gravel shorelines.

Reduced diversity has been related to shaded, man-made ponds in England (Moore 2001). Because the rural pond (Pond 2) was surrounded with shrubs, the margins were shaded much of the day. This, in combination with its lack of emergent vegetation may have affected the diversity of odonates found in the pond.

Links among odonate species diversity and environmental factors have not been conclusively demonstrated (Carchini *et al*. 2002). In just one season, it was not possible to determine the most important factors that affect distribution and abundance of each species in Winnipeg retention ponds. Almost half of all species collected during this study were represented by only one specimen. Pond habitats may be marginal for these species, or perhaps these species were not particularly abundant in 2001. Retention ponds have become an important component of the urban landscape, and additional study in future years is needed to gain a better understanding of the ecology of the odonates in them.

In conclusion, storm water retention ponds supported a diverse community of Odonata. It appears that pond habitat could be improved and odonate diversity increased by encouraging vegetation and eliminating carp. If these changes could be accomplished while meeting the intended functions of the retention ponds, improved Odonata habitat would add to the aesthetic appeal and ecological diversity of suburban neighbourhoods.

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Table 1. Environmental variables for storm retention ponds in Winnipeg in which dragonfly larva were sampled in 2001. Some variables are indicated as presence (1) and absence (0).

				Vegetation Controls				
Pond	Location	Dept.* code	Area** (m^2)	Harvest	Herbicide	Gravel shore	Carp	% shore with emerg veg.
1	Isbister & Hamilton	2-2	3,000	0	0	1	0	0
2	Little Mountain Park	-	6,000	0	0	0	0	10
3	Burrows & Benbow	3-3	15,000	1	0	1	0	<10
4	Burrows & Albina	3-2	15,000	1	0	1	0	50
5	Springfield Rd. east of Gateway	4-2	37,500	1	1	1	0	<10
6+	Paquin & Debaets	5-2	15,000	0	0	0	0	100
7	Markham & Lakeland	6-8	7,500	1	0	1	0	<10
8	Dalhousie & Baylor	6-10	15,000	0	0	1	1	0
9	Baldy Creek Park	6-11	11,250	0	0	1	1	0
10	Grandmont Park	6-12	7,500	0	1	1	0	<10

* Winnipeg Department of Water and Waste identification code.

** Estimated values

+Pond 6 is in a sparsely developed industrial park; however, no water quality data were available for this pond in 2001.

Table 2. Total numbers of Odonata larvae and exuviae collected at ten Winnipeg ponds during June to August, 2001. Taxa are listed from most prevalent to least.

Species	Pond 1 (6)[4]	Pond 2 (5)	Pond 3 (5)	Pond 4 (4)	Pond 5 (4)	Pond 6 (5)	Pond 7 (5)	Pond 8 (4)	Pond 9 (4)	Pond 10 (5)	Total Individuals	# of Ponds Where Found
Coenagrionidae spp. imm.[1]	515	88	27	3	830	1429	313	0	0	0	3205	7
Anax junius	2	1	8	31	0	27	5	0	0	0	74	6
Enallagma hageni	0	6	3	2	14	2	0	0	0	4	31	6
Enallagma spp. mature[2]	3	17	0	1	7	5	0	0	0	0	33	5
E. ebrium/hageni[3]	3	5	0	2	16	0	0	0	0	3	29	5
Lestes unguiculatus	0	0	1	7	0	11	2	0	0	0	21	4
Enallagma ebrium	0	2	0	3	4	0	0	0	0	1	10	4
Enallagma civile	1	2	0	2	4	0	0	0	0	0	9	4
Sympetrum costiferum	1	1	1	1	0	0	0	0	0	0	4	4
Enallagma cyathigerum	4	10	0	0	4	0	0	0	0	0	18	3
Coenagrion angulatum	7	0	1	0	1	0	0	0	0	0	9	3
Lestes spp.	0	0	0	6	0	1	1	0	0	0	8	3
Sympetrum rubicundulum[5]	0	0	1	1	0	0	0	0	0	0	2	3
Arigomphus cornutus	0	14	0	0	0	2	0	0	0	0	16	2
Sympetrum corruptum	8	0	0	0	0	8	0	0	0	0	16	2
Sympetrum spp.	11	0	0	0	0	4	0	0	0	0	15	2
Ischnura spp.	10	0	0	0	2	0	0	0	0	0	12	2
Leucorrhinia spp.	12	0	0	0	0	0	0	0	0	0	12	1
Lestes dryas	0	0	0	0	0	1	0	0	0	0	1	1
Nehalennia irene	0	1	0	0	0	0	0	0	0	0	1	1
Aeshna sp.	0	1	0	0	0	0	0	0	0	0	1	1
Epitheca canis	0	0	0	0	0	0	1	0	0	0	1	1
Leucorrhinia intacta	1	0	0	0	0	0	0	0	0	0	1	1
L. frigida	1	0	0	0	0	0	0	0	0	0	1	1
L. proxima	1	0	0	0	0	0	0	0	0	0	1	1
Sympetrum danae	0	1	0	0	0	0	0	0	0	0	1	1
Cordulia shurtleffi	0	1	0	0	0	0	0	0	0	0	1	1
Sympetrum internum	1	0	0	0	0	0	0	0	0	0	1	1
Total species	10	10	6	7	5	6	3	0	0	2		

[1] These are early stadia Coenagrionidae, individuals that were not identified to species or genus.

[2] Late stadia *Enallagma* with missing caudal gills, preventing further identification.

[3] Females of *E. ebrium* and *E. hageni* were not distinguishable and are labeled as *E. ebrium/hageni*.

[4] Sample events during season.

[5] The occurrence of this species in Manitoba needs to be confirmed (Hughes and Duncan 2003) with collections of

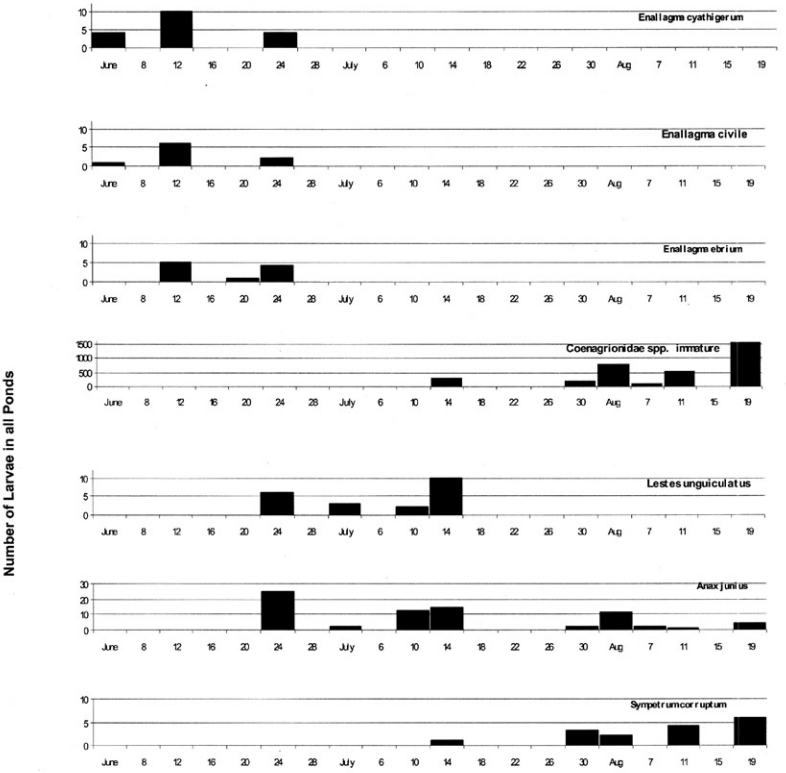

Figure 1. Temporal distribution of Odonata larvae found in retention ponds in Winnipeg in 2001. Note: Most Coenagrionidae are not distinguishable in early stadia, so all were combined into the single category, "Coenagrionidae spp. imm."

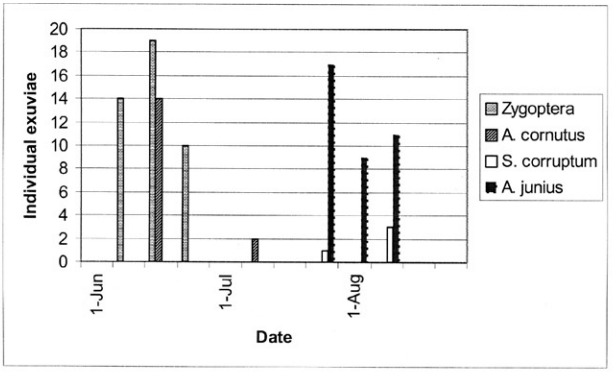

Figure 2. Exuviae of *Arigomphus cornutus*, *Sympetrum corruptum* and *Anax junius* found at retention pond sites in Winnipeg in summer, 2001. Zygoptera include two Lestidae and 41 Coenagrionidae.

Development time of *Urolepis rufipes* (Hymenoptera: Pteromalidae) and effect of female density on offspring sex ratio and reproductive output

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ABSTRACT

Two experiments studying i) offspring developmental time and ii) female density-effects on offspring sex ratio and female reproductive output were conducted on a Manitoba population of *Urolepis rufipes*, a solitary pupal parasitoid of flies, including *Musca domestica* and *Stomoxys calcitrans* (Diptera: Muscidae). Mean development time (± SEM) was 12.90 ± 0.03 d for males and 14.43 ± 0.03 d for females at 23°C. A significant correlation ($P = 0.005$) was observed between offspring sex ratio and log female density as the number of females in the arena increased from 1 to 6, although the data were highly variable ($r^2 = 0.18$). *Urolepis rufipes* offspring sex ratios were male-biased when 4 or 6 females were present within the arena. Number of emerging offspring per female was not significantly ($P > 0.05$) affected by female density. Although the

development time of *U. rufipes* offspring is short relative to other pteromalid species, offspring sex ratios become male-biased at even modest female densities, perhaps making mass rearing of *U. rufipes* inefficient for innundative biological control.

INTRODUCTION

Urolepis rufipes (Ashmead) (Hymenoptera: Pteromalidae) is distributed throughout much of the United States and Canada, including Manitoba, and parts of Denmark and Germany, mainly as a solitary pupal parasitoid of flies, including *Musca domestica* L. and *Stomoxys calcitrans* (L.) (Diptera: Muscidae) (McKay and Galloway 1999; Gibson 2000; Gibson and Floate 2004). It has been suggested that *U. rufipes* may be an effective biocontrol agent of filth flies in northern regions because of its short developmental time relative to other pteromalids (Smith and Rutz 1986, Matthews and Petersen 1989). Rearing conditions balancing efficiency costs and productivity are required to mass-rear parasitoids economically. A short development time would allow for rapid turnover of parasitoid generations, possibly reducing rearing costs associated with incubating host puparia and potentially allowing for subsequent generations of the parasitoid to reduce the pest population. In addition, a large reproductive output per ovipositing female and a female-biased offspring sex ratio are desired for parasitoid release (Heinz 1998). Female density has a significant effect on reproductive decisions made by females of other pteromalid species (Werren 1983; King 1989; King and Seidl 1993), but the importance of *U. rufipes* female density in determining offspring sex ratio and reproductive output is not known. We conducted a study to evaluate two aspects of parasitoid reproduction, offspring developmental time and female density-effects on offspring sex ratio and female reproductive output, in a Manitoba population of *U. rufipes* in the context of evaluating it as a potential innundative biocontrol agent.

MATERIALS AND METHODS

The developmental time in the Manitoba population was measured using a laboratory colony initially started from *U. rufipes* collected from 7 June, 1998 to 2 August, 1998 at the Glenlea Research Station, Faculty of Agricultural and Food Sciences (Glenlea, MB). Each of 255 females was offered 50 house fly pupae in a 10 cm x 10 cm x 3 cm, covered, transparent dish for 24 h at 23°C (L18:D6). Up to six females were allowed to oviposit at any one time within each arena. Pupae were then placed in 96-well tissue culture plates (one pupa/well), incubated at 23°C (L18:D6), and monitored daily for parasitoid emergence. Number of days from oviposition to emergence was recorded as development time. Development time data from the subsequent experiment was consistent with those from this experiment and was included in the analysis.

An experiment was conducted to observe *U. rufipes* oviposition behaviour under conditions of changing female density. The experiment was conducted over a period of four consecutive days. Females emerging on each day were randomly assigned to one of the four treatments. One 2-3 day-old male was mated to 1, 2, 4, or 6 newly emerged

(<24 h) females in a 10 cm x 10 cm x 3 cm, covered, transparent dish. Mating was assumed to occur after a male mounted a female for ≥10 s. Males were then removed and fifty 2-3 day-old house fly pupae were added per female, resulting in the host: parasitoid ratio being held constant across the different treatments, and the oviposition arena was incubated for 24 h at 23°C (L18:D6). After 24 h, pupae were treated as described above. Sex and number of emerging adults were recorded. Each treatment was replicated 10 or 11 times.

RESULTS AND DISCUSSION

Males developed significantly faster than females ($t_{2734} = 36.3$; $P < 0.001$). Mean development time (± SEM) was 12.90 ± 0.03 d for males (n = 1605 males, range: 11-21 days) and 14.43 ± 0.03 d for females (n = 1131 females, range: 12-19 days). This is shorter than the development time of males and females from Denmark (21.7 and 24.1 d, respectively, at 20°C and 14.2 and 15.5 d, respectively, at 25°C; Stenseng *et al.* 2003) and slightly longer than that for males and females from Nebraska (12.3 and 13.5 d, respectively, at 20°C; Smith and Rutz 1986), suggesting that development time varies among populations of *U. rufipes*. The development time observed here is comparable to that observed for *Nasonia vitripennis* (Walker) and shorter than that observed for other pteromalid species (Rueda and Axtell 1985; Lysyk 2001).

Urolepis rufipes offspring sex ratios were highly variable; however, a positive correlation was observed between offspring sex ratio ($\sin^{-1}\sqrt{}$(proportion male)) and log female density (Fig. 1). Offspring sex ratios were significantly male-biased when 4 or 6 females were present within the arena; backtransformed mean sex ratios (95% confidence interval) for the 1, 2, 4, and 6 female treatments were 0.39 (0.21 - 0.58), 0.60 (0.43 - 0.76), 0.68 (0.60 - 0.75), and 0.64 (0.58 - 0.70), respectively. As one male was used to mate all females in an oviposition arena, it is possible that males became sperm-depleted and some females were constrained by the amount of sperm received. However, if this were the case, offspring sex ratios should continue to increase as the number of constrained females in the oviposition arena increased. Instead, offspring sex ratio did not differ among the three highest female density treatments ($P > 0.05$, Tukey-Kramer HSD), indicating that the increase in offspring sex ratio was not due to sperm depletion. No significant difference in the mean number of offspring per female (following square root transformation) was observed among the different treatments ($F_{3,39} = 0.63$; $P = 0.6$). Mean numbers of offspring per female were 8.9 (4.9 - 14.1), 10.2 (6.6 - 14.6), 12.0 (8.6 - 16.1), and 12.7 (8.9 - 17.2) for the 1, 2, 4, and 6 female treatments, respectively. No more than one parasitoid emerged from a single host.

During oviposition at low host density, increasing host density can affect offspring sex ratio and/or number of offspring (King *et al.* 1995, Kumar *et al.* 2000, Sagarra *et al.* 2000). When host density is maintained at a constant level, the presence of additional female parasitoids in an experimental arena results in a reduction in the number of hosts present per female, which could also influence parasitoid behaviour. For this study, the host:parasitoid ratio was held constant to isolate the effect on parasitoid behaviour of increasing the number of females present in the arena. Since no effect of host density

was observed for any of the measured behaviours in the above studies at the host: parasitoid ratio (50:1), this ratio was chosen for the current study, in which none of the treatments resulted in 100 % parasitism as adult house fly emergence was observed in all replicates. This confirms that the number of hosts present in the arenas was not limiting and the results observed here were likely due to changing female density and not the confounding variable, changing host density.

Urolepis rufipes has attributes beneficial for its potential use as a biological control agent of muscid flies in Manitoba and possibly elsewhere in Canada and the northern United States, including its rapid rate of development and its tolerance to being cultured in laboratory colonies. However, *U. rufipes* offspring sex ratios become male-biased at even modest female densities, perhaps making mass rearing of *U. rufipes* inefficient.

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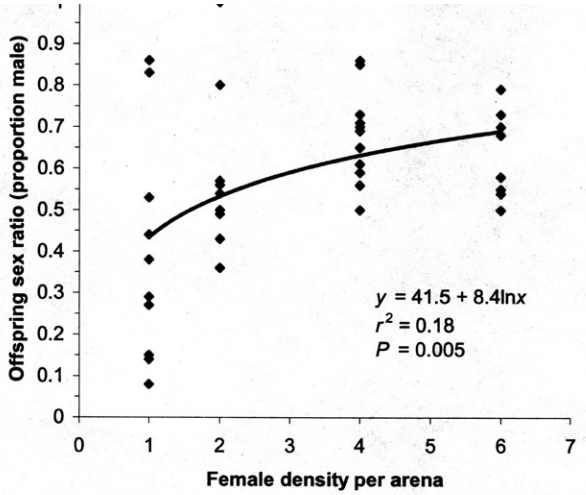

Figure 1. Logarithmic regression of *Urolepis rufipes* offspring sex ratio by the density of mated females in oviposition arenas. One, 2, 4, or 6 mated females were confined to an oviposition arena containing fifty *Musca domestica* pupae per female and allowed to oviposit for 24 h.

Scientific Programme Abstracts for the 2003 Annual Meeting of the Entomological Society of Manitoba 59th Annual Meeting 24-25 October, 2003, Winnipeg, Manitoba

Symposium: Mosquitoes and West Nile Virus: Present Situation and Perspective

Lead Speaker

INVASION OF CALIFORNIA BY WEST NILE VIRUS. W. Reisen, Centre for Vectorborne Diseases, School of Veterinary Medicine, University of California at Davis.

The invasion of the New World by West Nile virus (WNv) has lead to the largest mosquito-borne encephalitis outbreak in history and the largest recorded WN outbreak documented globally. Expanded surveillance in the US and Canada has provided useful insight into the summer amplification cycle, but far less is understood about persistence and dispersal mechanisms. The purpose of the current presentation was to review the current invasion of California by WN and available information about the epidemiology and control encephalitis viruses endemic to California to aid in planning expanded surveillance and control. Specific topics reviewed include: 1) Current distribution of WN in NA, 2) Possible introduction and amplification methods, 3) Status of mosquito vectors based on field isolation rates, vector competence and vectorial capacity, 4) Avian host competence data, 5) Risk assessment, and 6) Problems with conventional adult control.

Symposium Participants

WEST NILE VIRUS AND ANIMALS: RESERVOIRS, SENTINELS AND VICTIMS. I. Barker, Ontario/Nunavut Region, Canadian Cooperative Wildlife Health Centre, Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, ON, N1G 2W1.

During 2002 and 2003, as part of the Canadian programme of enhanced passive surveillance, West Nile virus (WNv) activity was monitored in the province of Ontario by recording sightings of dead American crows and common ravens; by determination of the WNv infection status of dead crows and ravens; and by passive surveillance for mortality attributed to WNv in other avian species in wild populations, in a major zoo,

and in wildlife rehabilitation facilities. In both 2002 and 2003, substantial mortality was detected in wild corvids throughout Ontario. In 2002, West Nile virus activity was associated with a noticeable increase in the number of submissions of some species of raptors for diagnosis of cause of death; WNv infection was detected in about 65% of them. In 2003, mortality attributable to WNv has been considerably less. WNv infection was detected in wild birds on the Toronto Zoo grounds, and in birds from the collection. An outbreak in endangered Eastern Loggerhead Shrikes killed 5/6 exposed birds, and WNv killed a Barbary ape *Macaca sylvanus*. Major mortality also occurred in a large captive collection of owls in southern Ontario. Mortality was 100% in some species of northern owls, while other species of owls had moderate mortality rates, and a few seemed refractory to disease induced by WNv infection. Among wild mammals, WNv was detected as a cause of meningoencephalitis in gray squirrels, in which local epidemics of neurologic disease were reported.West Nile virus has a unprecedented host range among birds, many of which serve as reservoirs of infection for mosquitoes. Some species of birds suffer high mortality from WNv infection; other species, though susceptible to infection, and capable of acting as reservoirs, seem refractory to mortality. Systematic study of naturally-occurring WNv in free-ranging and captive populations of wild birds can provide data on species susceptibility basic to models predicting the impact of this agent on populations of wild birds, including endangered species, in the western hemisphere.

WEST NILE VIRUS: MOSQUITO SURVEILLANCE AND CONTROL IN WINNIPEG. R. Gadawski, Insect Control Branch, City of Winnipeg, Winnipeg, MB.

West Nile virus (WNv) was first introduced into Canada in 2001. Since then the disease has continued to expand, both in its geography and in its intensity. No longer do Canadians view mosquitoes as a simple nuisance. In 2002, 20 people died as a result of WNv infection and several hundred others were made seriously ill. A large proportion of those made ill will suffer long-term physical or mental disabilities. In 2003, the Prairie Provinces have become the region of greatest concern. The various levels of government have responded to the threat of WNv by developing response plans that are based on the perceived level of risk. One of the more direct action plans is the control of the mosquito population. These controls are sometimes controversial and have associated risks and benefits. The role of insecticides in the integrated response to WNv will be discussed.

WEST NILE VIRUS DIAGNOSTICS. M. Drebot, R. Lindsay, and H. Artsob, Zoonotic Diseases and Special Pathogens, National Microbiology Laboratory, Health Canada, Winnipeg, MB, R3E 3R2.

The emergence of West Nile virus (WNv) in North America has necessitated the application and development of a number of diagnostic procedures for use in various surveillance programmes. WNv diagnostic methodologies can be divided into three different categories: 1. virus isolation, 2. antigen and nucleic acid detection, and 3.

serology. Different testing formats vary in their appropriateness depending upon the type of sample and its origin. Viral isolation has been used to document infection in mosquitoes and birds; however, successful isolation of WNv from human specimens is rare due to low virus concentration and transient viremia. Antigen detection procedures and/or nucleic acid amplification tests (NATs) have been extensively used in surveillance programmes requiring high throughput screening of bird specimens and mosquito pools. The availability of commercial antigen capture kits (Eg. VecTest) has greatly facilitated the testing of corvids collected as part of the 2003 avian surveillance programme. The demonstration of blood transfusion associated WNv illness in 2002 has led to the use of NATs in the screening of blood products for viral nucleic acid. For human case investigations serological procedures continue to be the most appropriate diagnostics for documenting human infection. Front line testing involves the use of IgM and IgG enzyme linked immunosorbant serological assays (ELISAs) and hemagglutination inhibition (HI) tests to detect the presence of WNv antibodies in human serum samples. Flavivirus antibodies can exhibit significant cross reactivity in HI tests and ELISAs, therefore, neutralization assays are used to confirm the presence of WNv specific antibodies in sera collected from patients.

WEST NILE VIRUS: PUBLIC HEALTH CHALLENGES OF AN EMERGING DISEASE. J. Kettner, Manitoba Health, Winnipeg, MB.

Today, the public health system is at a crossroads as to define and sustain its role. The challenging face of health care poses new challenges for the detection, treatment and prevention of infectious diseases. There are several anxieties and concerns which must be addressed.

Submitted Papers

EVALUATION OF RAPID DIAGNOSTIC TESTS TO DETECT WEST NILE VIRUS IN CORVIDS AND MOSQUITOES. R. Lindsay[1], R. Anderson[2], M. Drebot[1], I. Barker[3], G. Nayar[4], A. Dibernardo[1], and H. Artsob[1.1]Zoonotic Diseases and Special Pathogens, National Microbiology Laboratory, Health Canada, Winnipeg, MB; [2]Department of Biology, University of Winnipeg, Winnipeg, MB; [3]Ontario/Nunavut Region, Canadian Cooperative Wildlife Health Centre, Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, ON; [4]Veterinary Services Branch, Manitoba Agriculture and Food, Winnipeg, MB.

The utility of a commercially available antigen capture assay (VecTest™) to detect West Nile virus (WNV) in field-collected dead corvids was evaluated in Manitoba and Ontario, Canada in 2001 and 2002. Swabs were taken from the oropharynx and/or cloaca of 109 American crows, 31 blue jays, six common ravens and four black-billed magpies from Manitoba, and 255 American crows and 28 blue jays from Ontario. The sensitivity and specificity of the antigen capture assay (compared to RT-PCR) were

greatest for samples from American crows; oropharyngeal swabs were more sensitive than cloacal swabs, and there was minimal inter-laboratory variation in the results. The sensitivity and specificity of the VecTest assay using oropharyngeal swabs from crows were 83.9 and 93.6% for Manitoba samples and 83.3 and 95.8% for Ontario birds. In addition, 63 pools of mainly *Culex tarsalis* mosquitoes that were positive for WNV infection using RT-PCR were re-tested using the VecTest assay and an experimental antigen capture assay called the RAMP assay. The VecTest and RAMP assays correctly detected 57.1 and 69.8% of the known positive mosquito pools, respectively. The utility of incorporating antigen capture assays into WNV surveillance programmes will be discussed.

DETECTING WEST NILE VIRUS ANITBODIES IN CENTRAL NORTH DAKOTA YELLOW-HEADED BLACKBIRDS. J. Newbrey and W. Reed, Department of Biological Sciences, North Dakota State University, Fargo, North Dakota, 58105, USA.

The recent spread of the mosquito-borne West Nile virus (WNV) across North America has produced the need for research to better understand the influence of the virus on free-living wildlife populations. Research of avian WNV infection has focused primarily on the lethal effects of the virus, but has largely ignored the non-lethal effects of the virus on breeding bird biology. We do know that female birds tradeoff between allocating limited resources to their own physiological needs and egg production, which can greatly influence offspring performance. West Nile virus could potentially influence these resource allocation tradeoffs by compromising female immunity. The objective of our research is to determine the effects of WNV infection and female immune function on yellow-headed blackbirds (*Xanthocephalus xanthocephalus*) breeding in central North Dakota. Blood samples will be collected from captured female yellow-headed blackbirds to assess WNV antibody production and non-lethal immune challenges will be conducted to assess variation in immune function. Females will be banded for individual recognition and their nests will be monitored throughout the breeding season to quantify nest success and nestling performance. One egg will be collected from each study nest to quantify the diversity and concentration of carotenoids in the egg yolk in order to assess variation in maternal investment in eggs. This research will provide insight into the evolutionary aspects of life-history tradeoffs among carotenoids, immunity, and reproduction and how non-lethal exposure to WNV can affect these tradeoffs.

OUTBREAK OF WEST NILE VIRUS IN AN OWL REHABILITATION CENTRE AND THE IMPLICATIONS OF ICOSTA AMERICANA (DIPTERA: HIPPOBOSCIDAE) AS A POTENTIAL VECTOR. H. White[1], A. Gancz[2], A. Dibernardo[1], R. Lindsay[1], I. Barker[2], K. McKeever[3], and B. Hunter[2], [1]Zoonotic Diseases and Special Pathogens, National Microbiology Laboratory, Health Canada, Winnipeg, MB; [2]Ontario/Nunavut Region, Canadian Cooperative Wildlife Health Centre, Department

of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, ON; [3]The Owl Foundation, Vineland, ON, Canada.

An outbreak of West Nile Virus (WNV) occurred in an owl rehabilitation facility in Vineland, Ontario, from July to September, 2002. This was the first and largest outbreak of WNV in a captive bird facility in Canada. At the time of the outbreak, the facility housed 260 birds representing 17 species of owls and 2 species of falcons. By mid-September, 43% (108) of the owls kept outdoors had died. WNV was identified as the causative agent of the outbreak by post-mortem examination, PCR and immuno-histochemical staining. At the time of the outbreak, many birds were heavily infested with the hippoboscid fly, *Icosta americana*, in some cases more than 360 flies were found per bird. Aside from being a major stress factor for the birds, it was hypothesized that these flies may act as a vector of WNV. To investigate this hypothesis, adult flies and pupae were collected from cages during the outbreak and pooled for testing. Flies were also removed from owls that were confirmed positive for WNV. The midgut, salivary glands, developing larvae and remaining body parts were removed from selected adult flies and these body parts as well as pools of adult flies and pupae were tested for the presence of WNV using RT-PCR. WNV was detected in 1of 792 pools of adult flies, and in 1of 179 pools of pupae collected from owl cages. Of the 42 dissected adult flies 17 were positive for WNV. WNV was detected in the body, abdomen, midgut, and salivary glands. The possible role of mosquitoes and hippoboscid flies in the transmission of WNV to captive birds will be discussed.

AN EVALUATION OF REITER'S MEDIUM AND THREE DIFFERENT POOL SIZES FOR OVIPOOL SURVEILLANCE OF *CULEX TARSALIS, CULEX RESTUANS* AND *CULISETA INORNATA* IN MANITOBA. L. Baspaly[1], T. Galloway[1], and R. Lindsay[2], [1]Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2; [2]Zoonotic Diseases and Special Pathogens, National Microbiology Laboratory, Health Canada, Winnipeg, MB, R3E 3R2.

This study was conducted to determine whether hay infusion and smaller ovipools could replace current oviposition surveillance methods. Female *Culex tarsalis* given a choice of oviposition sites in the lab showed a preference for standing tap water over hay infusion ($X^2 = 82.9$; $p<.05$). Hay infusion (as described by Reiter in 1983) was not a suitable replacement for the conventional sod infusion in Manitoba. Field experiments were conducted to determine the minimum size of ovipool that could be used for surveillance of *Culex tarsalis*, *Cx. restuans* and *Culiseta inornata*. One point five per cent of egg rafts laid were collected from the smallest pools (10 cm X 10 cm X 15 cm), 47.8% were collected from the medium pools (30 cm X 15 cm X 15 cm) and 50.7 % were collected from the largest pools (40 cm X 30 cm X 15 cm). When frequency of oviposition events were calculated, there was no significant difference in the efficacy of the small, medium, large and traditional meter-square pools used.

"NYAH! WHAT'S UP DOC?" WHY IS THE SUCKING LOUSE, *HAEMODIPSUS SETONI* (ANOPLURA: POLYPLACIDAE), AN ECTOPARASITE OF EASTERN COTTONTAIL, *SYLVILAGUS FLORIDANUS* (LAGOMORPHA: LEPORIDAE), IN MANITOBA? T. D. Galloway, Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2.

A survey of ectoparasites on rabbits and hares was conducted in Manitoba, based primarily on specimens salvaged in collaboration with the Manitoba Wildlife Rehabilitation Organization at Glenlea. Animals were washed in warm, soapy water and the ectoparasites collected over a fine mesh screen. *Haemodipsus setoni* Ewing, 1924 is recorded here for the first time in Canada. It was found on one of seven specimens (14.3%) of Snowshoe Hare, *Lepus americanus*, a well known host for this louse in North America. More surprising was its presence on Eastern Cottontail, *Sylvilagus floridanus*, of which 22 of 79 specimens (27.9%) were infested. Prevalence in juvenile and adult cottontails was about equal (27.5% versus 28.2%, respectively). Mean intensity of infestation on 21 of these infested hosts, exclusive of one doe which was infested with 10,798 lice (469♂; 1453♀; 8876 juveniles), was 10.3 (95% confidence limits: 4.38 to 22.43). This is the first record of *H. setoni* on this host. No lice were found on two specimens of Whitetail Jackrabbit, *Lepus townsendi.*

THE USE OF *TRICHOGRAMMA* IN WAREHOUSES TO CONTROL *PLODIA INTERPUNCTELLA* (INDIANMEAL MOTH). P. Fields, Cereal Research Centre, Agriculture and Agri-Food Canada, Winnipeg, MB, R3T 2M9.

Stored-product moths are among the major stored-product pests, infesting a wide variety of cereals and cereal based products. Traditional chemical control measures require the shut down of the facility, and there are restrictions to their use because of concerns of worker safety or residues on the finished product. In Germany and Austria, the control of the Indian meal moth *Plodia interpunctella* (Hübner) and the Mediterranean flour moth *Ephestia kuehniella* Zeller in food processing facilities is achieved by releasing large quantities of *Trichogramma evanescens* Westwood using the inundative strategy. In North America, despite the wide-spread use of parasitoids in field and glass house settings, this biological control method has not been used commercially to control warehouse and food processing moth pests. We evaluated three species of *Trichogramma* native to North America: *T. deion, T. pretiosum* and *T. platneri* in a commercial warehouse and simulated warehouse.

ORIGIN OF RESISTANCE GENE IN WHEAT EFFECTIVE AGAINST WHEAT MIDGE. R. Lamb, R. McKenzie, I. Wise, and M. Smith, Cereal Research Centre, Agriculture and Agri-Food Canada, Winnipeg, MB, R3T 2M9.

The gene Sm1 has been identified as an effective source of resistance against the wheat midge, *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae), when the gene is expressed in spring wheat. The gene was discovered in winter wheats grown in the eastern

USA, but resistance was first posited for a land race of wheat grown in Nova Scotia in the late 1800's. Tests of winter wheat land races, early cultivars from the USA, and modern resistant wheats from China show that resistance often is weakly expressed in these wheats in the laboratory, but some express high levels of resistance in the field. The oldest known resistant wheat is a land race called Mediterranean that came to the eastern USA from Genoa, Italy, in the early 1800's. This land race is an ancestor to all known resistant wheats in North America and probably is the source of Sm1. Chinese winter wheats do not appear to express Sm1, and show low levels of resistance, which nevertheless might be useful if resistance to Sm1 breaks down.

WATER BEETLES OF CHURCHILL, MANITOBA. R.E. Roughley, Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2.

Eight families and about 100 species of water beetles are known for the arctic-boreal transition area around Churchill, Manitoba. The families (number of species in parentheses) are: Gyrinidae (4), Haliplidae (3), Dytiscidae (81), Hydrophilidae (9), Hydraenidae (2), Helodidae (unknown), Elmidae (1) and Chrysomelidae – Donaciinae (2). The fauna of most groups of water beetles is about what is expected and known for the region with some surprises; the juxtaposition of ecozones and transportation from south to north by the Churchill River are probably responsible for the higher than expected diversity in the region. The collections for the family Dytiscidae, however, yielded more species than expected (81/148 =55% of species in Manitoba and many new records for Churchill. Reasons for this abundance of species of Dytiscidae are explored, such as (1) habitat diversity, (2) habitat abundance, (3) more sampling, (4) more efficient sampling techniques and (5) greater knowledge of habitats within the region.

REVISION OF THE NEARCTIC SPECIES OF *BRYCHIUS* THOMSON (COLEOPTERA: HALIPLIDAE). T. Mousseau and R.E. Roughley, Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2.

The crawling water beetle (Coleoptera: Haliplidae: *Brychius*) occurs in small, disjunct populations in North America. A revision of this genus is needed to determine species status for all populations and to clarify the existing classification. A traditional study of structure has revealed three distinct species, where the form of the male genitalia provides a reliable character. Life history information for the entire family is sparse, particularly for species of *Brychius*, therefore *Brychius hornii* from Manitoba have been observed in the natural habitat and laboratory.

CAUSES OF VARIATION IN BODY SIZE AND CONSEQUENCES FOR THE LIFE HISTORY OF *SITODIPLOSIS MOSELLANA* (DIPTERA: CECIDOMYIIDAE). M. Smith and R. Lamb, Cereal Research Centre, Agriculture and Agri-Food Canada, Winnipeg, MB, R3T 2M9.

The body sizes of mature larvae and adults from field and laboratory populations of *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae) were measured to determine the causes of variation in size and consequences of such variation for the life history of the wheat midge. Mature larvae varied eight-fold in weight. Female larvae were 80% heavier than males, on average. Variation in weight was associated with both the position of larvae on a wheat spike and the number feeding together on a developing seed. Larvae were smaller when they developed on smaller, later developing seeds and when they competed with other larvae. Fewer small larvae survived winter and few parasitoids emerged from small larvae. These effects were probably due to size, but sex may have also been a factor. The size of adults, measured by wing and abdomen length was also variable, although less so than larvae. Adult size was not associated with time of emergence, and both large and small females dispersed, but female fecundity increased with body size. The effects of food quality on larval body size, mediated by feeding site and larval competition, were dependent on the density of eggs deposited by females. This density dependence increased variation in body size in the next generation, and the smaller offspring in the size distribution exhibited higher winter mortality and lower fecundity than larger wheat midges.

AN ENTOMOLOGICAL OASIS IN BALDUR, MB: EFFECTS OF SALINITY ON COMMUNITIES OF AQUATIC COLEOPTERA (HALIPLIDAE, HYDROPHILIDAE AND DYTISCIDAE). M. Alperyn, Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2.

A group of lakes with various salinities were examined in Baldur, Manitoba for their diversity of aquatic Coleoptera. Water beetles were sampled with bottle traps and volumetric techniques. Lakes were also analysed for their water chemical profile, algal density, macrophyte diversity, and emergent vegetation. Sampling was conducted each month, May to September for years 2001 and 2002. Species richness was negatively correlated, but abundance of some species was positively correlated with salinity. Of the three families, Dytiscidae had the highest species richness in saline waters with overrepresentation of species of the genus *Hygrotus* Stephens.

THE INFLUENCE OF TIGER SALAMANDERS (*AMBYSTOMA TIGRINUM*) ON INVERTEBRATE COMMUNITIES IN PRAIRIE PONDS. M. Alperyn and N. Lauro, Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2.

Tiger salamanders adults and larvae were collected with seine net and bottle traps among various wetlands across southern Manitoba. The gut contents of salamander were ana-

lyzed to determine prey selection and subsequently the potential for these predators to alter invertebrate communities. We examined the gut contents of 44 salamanders. Insect foodstuffs were identified to the family level, while all other invertebrates were identified to lowest taxonomic level possible. Amphipoda and the insect families Corixidae and Chironomidae were found in more than 65% of the salamanders examined. Large and/or mobile prey items were features that united the majority of food items found in salamander guts. Of the water beetles, larvae rather than adults were more commonly represented in the samples. In addition, a variety of different prey items were found in salamander guts, reflecting the hunting habits of generalist and opportunistic predator. Therefore tiger salamanders can alter invertebrate communities in prairie ponds.

POTENTIAL IMPACTS OF WILD RICE (*ZIZANIA PALUSTRIS*) ON THE MACROINVERTEBRATE COMMUNITIES WITHIN LAKES IN NORTHWESTERN MANITOBA. M. Lowdon and K. Kidd, Department of Zoology, University of Manitoba, Winnipeg, MB, R3T 2N2.

Over the last 20 years, wild rice (*Zizania palustris*) has been seeded in a number of lakes in the west-central region of Manitoba. It is not known whether these introductions have impacted the species abundance and community composition of littoral communities in these lakes. In this study we compared bays with and without wild rice in three lakes near Flin Flon, MB and identified differences in the diversity, abundance, and functional feeding groups of the macroinvertebrate communities. Bottle traps, emergence traps, and a bucket volume sampler were used to capture the macroinvertebrates. One lake was examined in August of 2002 and three lakes were sampled in June and August of 2003. PCA analyses of data from 2002 indicate that macroinvertebrate communities were significantly different between wild rice and native macrophyte bays. Collectors and gatherers, such as amphipods, were more predominantly found within the wild rice bay while the predators dominated the native macrophyte community. Family and functional feeding group diversity was examined using a modified Simpson's index and no significant differences were observed between sites ($p \geq 0.15$). In addition, invertebrate family abundance did not significantly vary between native macrophyte and wild rice sites ($p \geq 0.55$). These findings suggest that wild rice is a more suitable habitat for certain invertebrate families. Since invertebrates are a substantial food source for fish, any changes to the invertebrate community may disrupt the entire food web. Once completed, results from 2003 will help to further characterize the impacts of wild rice on littoral communities.

THE FIRST RECORD OF THE LEAFY SPURGE HAWK MOTH (*HYLES EUPHORBIAE L.*) AS A POLLINATOR OF THE WESTERN PRAIRIE FRINGED ORCHID (*PLATANTHERA PRAECLARA* SHEVIAK AND BOWLES). C. Jordan, Department of Entomology, North Dakota State University, Fargo, North Dakota, 58105.

A leafy spurge hawk moth (*Hyles euphorbiae* L.) was collected carrying pollinia of the western prairie fringed orchid (*Platanthera praeclara* Sheviak and Bowles) on July 28, 2003 in the Sheyenne National Grassland in southeastern North Dakota. This is the first record of the leafy spurge hawk moth as a pollinator for the western prairie fringed orchid, which is a federally listed threatened species. The moth was collected in a trap which consisted of a screen cone within a screen cylinder suspended above a flowering orchid on a metal hook. Twelve of these traps were placed over flowering orchids during the summer of 2003 to gain information about orchid-pollinator relationships. The moth was carrying four pollinia on its right eye. The leafy spurge hawk moth is a native of Eurasia which was introduced to North America in the 1960s as a potential biological control agent for leafy spurge (*Euphorbia esula* L.), an exotic weed species which also originated in Eurasia. The larvae feed on the foliage of leafy spurge. The fact that this introduced species is able to act as a pollinator shows that we still have much to learn about the relationship between this orchid species and its insect pollinators.

CAN MUSTARD SEED MEAL INCREASE THE ABUNDANCE OF CABBAGE ROOT MAGGOT NATURAL ENEMIES IN CANOLA? K. Riley[1],[2], U. Kuhlmann[1], J. Whistlecraft[3], and N.J. Holliday[2], [1]CABI Bioscience Centre, 1 Rue des Grillons, 2800 Delémont, Switzerland; [2]Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2; [3]Agriculture and Agri-Food Canada, London, ON, N5V 4T3.

The literature reports that a white mustard seed meal mulch applied to brassica vegetables in Sweden attracts *Aleochara* spp. (Coleoptera: Staphylinidae) that suppress *Delia radicum* (Diptera: Anthomyiidae). In summer canola in Switzerland, we compared *D. radicum* and *Aleochara* numbers in plots with and without mustard meal mulch to verify the attractiveness. In addition, olfactometer experiments were conducted to determine the attractiveness of mustard meal to staphylinids.

POTENTIAL BIOLOGICAL CONTROL OF *DELIA RADICUM* (DIPTERA: ANTHOMYIIDAE) WITH ALEOCHARA SPP. (COLEOPTERA: STAPHYLINIDAE). K. Hemachandra[1],[2], K. Riley[1],[2], U. Kuhlmann1, J. Klimaszewski[3] and N.J. Holliday[2] , [1]CABI Bioscience Centre, 1 Rue des Grillons, 2800 Delémont, Switzerland; [2]Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2; [3]Resources Canada, Canadian Forest Service, Laurentian Forestry Centre,1055, rue du P.E.P.S., Case postale 3800, Sainte Foy (Québec), G1V 4C7.

Important natural enemies of *Delia radicum* are *Aleochara bilineata* and *A. verna* in Canada, and *A. bilineata* and *A. bipustulata* in Europe. We have examined specimens labelled *A. bipustulata* that were collected in 24 North American locations and are now held in five museum collections. This material represents all alleged North American *A. bipustulata* that we can trace, and corresponds with several publications reporting *A. bipustulata* in North America. Dissections of genitalia show all these specimens are in fact *A. verna*. We conclude that reports of *A. bipustulata* in the Nearctic are erroneous, and that *A. bipustulata* is a promising candidate for classical biological control of *D. radicum* in Canada.

KINSHIP VERSUS FELLOWSHIP: COOPERATION IN THE HONEY BEE COLONY. R. Underwood[1], J. Hare[2], and M. Lewis[2], [1]Department of Entomology and [2]Department of Zoology, University of Manitoba, Winnipeg, MB, R3T 2N2.

Both kin selection and fellowship have been proposed to explain the cooperative nature of honey bee, *Apis mellifera* L., workers. The kin selection hypothesis suggests that individuals act nepostistically and benefit via like copies of their genes being propogated by relatives. Fellowship involves individuals acting altruistically to benefit other individuals with whom they are familiar, but not necessarily genetically related. This study tests whether kinship or fellowship prevails in a honey bee colony by measuring brood and honey production within colonies with low genetic relatedness or high genetic relatedness. In this way, we attempted to discern between the competing hypotheses of kinship and fellowship in explaining the advanced sociality in honey bees. None of the parameters measured; brood production, brood sex ratio, or honey production was affected by intracolony relatedness. This provides support for the fellowship hypothesis. Honey bees rely on familiarity with nest mates and not necessarily the degree of genetic relatedness.

THE IMPACT OF PLANT BUGS INJURY ON YIELD OF BUCKWHEAT AND SEED ALFALFA IN MANITOBA. A. Mostafa and N. Holliday, Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2.

Plant bugs are serious pests in the Canadian Prairies, where they attack many economic crops. Large numbers of Lygus bugs attack seed alfalfa and buckwheat early and near the end of the growing season. There is no information about the effects of these insects on yield quantity and quality of these crops. In summer 2002, the first year of a three year project, we investigated the impact of plant bugs on yield parameters of buckwheat and seed alfalfa. A field plot of buckwheat was established at the University of Manitoba Field Station, Carman. The insect population was manipulated in one section of this plot by applying insecticide in late July. From late August until harvest, 60 pairs of plants were caged with three levels of Lygus bugs: 0, 5 and 20 bugs/cage. The population of Lygus bugs in August, when not controlled by the insecticide, decreased yield significantly. There were significant effects of number of Lygus per cage on seed weight and number, and percentage of malformed seeds. This is the first proof of damage by Lygus bugs on buckwheat. In alfalfa, plant bug populations were manipulated by using insecticide applications to produce "zero population", low population" and "high population" treatments of bugs from late August until harvest. There was a significant reduction in number of pods/m^2, number of seeds/100 pods and weight of seeds/m^2 in the "high population" treatment. In 2003, we repeated the cage trial in buckwheat in Carman with lower numbers of insects, and conducted another cage trial to study the effects of nymphs and adults on different growth stages of buckwheat. We also conducted trials in which early season and late season populations of these Lygus bugs were manipulated with insecticide applications in commercial fields of buckwheat and seed alfalfa.

EFFECT OF DISTURBANCE TYPE (FIRE AND HARVESTING) ON THE ECOLOGICAL DIVERSITY OF CARABID BEETLES (COLEPTERA: CARABIDAE) IN BLACK SPRUCE (*PICEA MARIANA* (Mill.) BSP.) FORESTS OF EASTERN MANITOBA. L. Capar[1] and R. Westwood[2], [1]Department of Entomology, University of Manitoba, Winnipeg MB, R3T 2N2; [2]Department of Biology, University of Winnipeg, Winnipeg, MB.

Carabid beetle (Coleoptera: Carabidae) diversity was used to compare black spruce-dominated forest stands disturbed by either fire or harvesting. Three forest age classes of each disturbance type were sampled: recently burned and harvested stands, mid-successional burned and harvested stands, and old-growth burned and harvested stands. Effects of disturbance type and age class on carabid beetle populations were examined. Age class seemed to influence carabid diversity more than disturbance type. However, recently disturbed stands carabid diversity differed between disturbance types mainly due to pyrophilous species only occurring in burned sites. Environmental variables such as percent cover of woody debris also influenced carabid assemblages.

PCR DETECTION OF PHYTOPLASMA IN LEAFHOPPERS CAUSING ASTER YELLOW DISEASES IN CARROT PLANTS. F. Daayf[1], M. Iranpour[2], O. Wally[1], A. Khadhair[3], L. Adam[1], B. Elliott[4], T. Shinners-Carnelley[4], and P. Northover[4], [1]Department of Plant Science, University of Manitoba, 222 Agriculture Building, Winnipeg, MB, R3T 2N2; [2]Department of Entomology, University of Manitoba, Winnipeg, MB, R3T 2N2; [3]Manitoba Agriculture and Food, Carman, MB; [4]Alberta Research Council, Vegreville, AB.

Aster yellow diseases (AY) are caused by microorganisms called phytoplasmas, carried by leafhoppers and transmitted to plants as these insects feed. In the last few years, this disease was identified as an important factor in growing carrots in Manitoba. Due to the interactions among insects, phytoplasma, plants, and the environment, AY disease management and control in carrots require a multidisciplinary approach, including a fast and accurate detection system. In this project, we successfully adapted PCR (Polymerase Chain Reaction) techniques for the detection of phytoplasmas in both plants and insects, and we were able to determine the accuracy of visual symptom assessments done by field scouts for both healthy- and diseased-looking plant samples. Using these molecular techniques, phytoplasmas were also found in other plant species around the carrot fields, which means that these plant species can act as additional sources of inoculum.

The Entomological Society of Manitoba gratefully acknowledges the following organizations, which provided financial support for the 59th Annual Meeting

Canadian Grain Commission

Canola Council of Canada

City of Winnipeg – Insect Control Branch

Dow Agro Sciences Canada Inc. – Ag Research

Dow Agro Sciences Canada Inc. – Turf, Ornamentals & Horticulture

Louisiana-Pacific Canada Ltd.

Manitoba Agriculture and Food

Metro Pest Control

National Microbiology Laboratory, Health Canada

North/South Consultants

Orkin/PCO/Swat Team

Poulin's Pest Control Services

Province of Manitoba-Conservation

Minutes of the Entomological Society of Manitoba 59th Annual Business Meeting

Canad Inn, Pembina Highway, Winnipeg, MB

2:00 p.m., Thursday, 13 November 2003

Attendance of Members

President	Neil Holliday
President-Elect	John Gavloski
Member-at-Large	Tonya Mousseau
Past-President	Paul Fields
Secretary	Noel White
Treasurer	Ian Wise

Members

Michael Alperyn	Scott McMahon
Christie Borkowsky	Kris Riley
Rob Currie	Rob Roughley
Brent Elliott	Kathleen Ryan
Terry Galloway	Robyn Underwood
Mahmood Iranpour	David Wade
Bob Lamb	

1. Acceptance of Agenda (Appendix A)

Motion: Roughly/Lamb Carried

2. Acceptance of the Minutes of the Last Annual General Meeting of November 29, 2002

Motion: T. Galloway/R. Currie Carried

3. Business Arising From the Previous Minutes

Feedback on presentations made by students at the annual scientific meeting.

Motion: T. Galloway/R. Underwood - That the Committee Guidelines for the Scientific Programme Committee be changed to include feedback to students presenting papers at the scientific meeting in a manner to be decided by the Committee. Carried

4. Reports

Motion: J. Gavloski/P. Mackay - That the annual reports of the Society be received.

Carried

5. Executive

Appendix B — President's Report

Discussion arose over the joint ESA North Central Branch/ESM Meeting to be held in March 2007.

M. Smith suggested we hold a business meeting in October 2006 and have our 2006 scientific meeting in March 2007 and then a regular annual meeting in November 2007.

I. Wise indicated fundraising should be for the ESM not the NCB.

B. Lamb suggested a 1-day session of submitted papers and a business meeting followed by a social mixer for October 2006. This was widely approved.

The issue of scientific meetings on Thursday and Friday, or Friday and Saturday arose. During the week we can have free access to the Freshwater Institute, not on Saturday. It was generally accepted that the Friday and Saturday format be retained.

New joint Editors for the Newsletter are P. MacKay and M. Iranpour.

Appendix C — Treasurer's Report/Financial Statement

Appendix D — Regional Director to the Entomological Society of Canada's Report

Appendix E — Report of the Editor of the Proceedings of the Entomological Society of Manitoba

Appendix F — Report of the Endowment Fund Board

Appendix G — Scholarship and Awards Report

Appendix H — Report of the Finance Committee

Appendix I — Report of the Social Committee and Newsletter

Appendix J — Report of the Youth Encouragement Committee

Archives — No report

A filing cabinet was requested.

Motion: R. Roughley/P. MacKay. That a filing cabinet be purchased at the direction of the Executive. Carried

Appendix K — Scientific Programme Committee Report

Appendix L — Fund Raising Committee Report

Appendix M — Membership Committee Report

Appendix N — Web Page Report

Appendix O — Election Results
President-Elect — Brent Elliott
Member-at-Large — Mahmood Iranpour
Motion: T. Galloway/B. Lamb. That the ballots of the 2003 election be destroyed.

Carried

6. New Business

Motion: R. Underwood/R. Currie. For presentation of ESM awards to students, the cost for a ticket for the awardee to attend the ESM function at which the award is to be given should be covered by the Society and this will be retroactive for the 2003 Meeting.

Carried

7. Transfer of Office

John Gavloski accepted the gavel and thanked N. Holliday for his activities as President.

8. Appointment of Auditors

Motion: I. Wise/N. Holliday. That Doug Nicholson and Co. be reappointed as ESM auditors for 2003-2004. Carried

9. Adjournment

Motion: P. Fields/R. Roughley

Appendices

Appendix A: Agenda of the Entomological Society of Manitoba, 59th Annual Business Meeting, 13 November, 2003

1. Acceptance of Agenda.

2. Acceptance of the Minutes of the last Annual Meeting (29 November 2002).

3. Business arising from the Minutes.

4. Reports - Executive

President	N. Holliday
Treasurer	I. Wise
Regional Director to the ESC	P. MacKay
Editor of the Proceedings	T. Galloway
Endowment Fund Board	M. Smith

5. Reports - Committees

Scholarship & Awards	R. Westwood
Finance	M. Smith
Publicity / Newsletter	N. Lauro
Social	M. Alperyn
Youth Encouragement / Public Ed.	C. Borkowsky
Archives	R. Roughley
Scientific Programme	M. Iranpour
Fund Raising	J. Gosselin
Membership	B. Elliott
Web Page	P. Fields

6. Elections Results - scrutineer, C. Demianyk

   Destruction of ballots

7. New Business
   - Free admission for award winners at ESM annual banquet.
   - Directive to Scientific Programme Committee to present feedback to all student presenters at the annual scientific meeting. Modify Committee Guidelines.

8. Transfer of Office

9. Other Business — Appointment of Auditor

10. Adjournment

Appendix B: Report of the President - 2002 / 2003

During the last year, the Executive Committee has met three times to consider the Society's business, much of which had to do with scientific meetings, past and present. I began my term of office just after the Joint Annual Meetings with the Entomological Society of Canada, which the Entomological Society of Manitoba hosted in October 2002. The final accounting indicated that there were 181 fee-paying full (121) or student (60) registrants, 11 invited speakers, 7 accompanying persons, and 6 people who registered for one or two days. Although these attendance numbers were somewhat lower than hoped for, the organizing committee had constructed a realistic budget, with the result that the overall profit from the meetings (after loan repayments) was $7404. Half of this was remitted to the Entomological Society of Canada and the other half was paid to the ESM; the ESM will also benefit from a GST refund. The meetings were therefore a financial success, which is a relief, but their main objective was to be a scientific success, which all who attended can attest was undoubtedly so. Such success comes only as a result of prolonged efforts by members who develop the scientific programme and make the local arrangements, and to the shorter-term but very valuable contributions of those who staff registration desks and operate projection equipment. To all of you, a big thank you on behalf of the Society. I particularly want to recognize the contribution of Don Dixon who, for the second successive Joint Annual Meeting, was overall chair of the meeting.

At last year's Annual Business Meeting, the Society was informed of a request from the North Central Branch of the Entomological Society of America for Winnipeg to be the site of the 2007 NCB meetings. We now have plans for a joint ESM/NCB meeting on 25-29 March 2007. Paul Fields and Brent Elliott have taken joint responsibility for leading local meeting committees. Paul and Brent attended the NCB Executive Meeting in Madison in March 2003, and one or the other will be attending similar meetings in future years. As a result of discussions in Madison, the ESM President wrote a letter of understanding to the NCB President, outlining the arrangements between the Societies. The financial aspects of the understanding are that NCB will take all net profits and will be responsible for losses, if any. Either Paul or Brent will be attending future NCB branch meetings to ensure communication with the NCB executive, and it is the intent that the costs of attending these meetings, when not covered by our representative's employers will be considered a cost to the 2007 meeting budget. Our representatives have already developed a timetable of preparations, some programme ideas, and a tentative budget.

Mahmood Iranpour was Scientific Programme Chair for the 2003 ESM Annual Meeting, held on 24 and 25 October. This was a very successful meeting with good attendance at both Friday and Saturday scientific sessions, and at the two social events. Our thanks

to Mahmood and his committee. By having the Saturday session at the Canadian Science Centre for Human and Animal Health, Mahmood cleverly solved a problem. The Society has been able to use the Freshwater Institute facilities without cost for many years, but heightened security now prevents that happening on a Saturday. The new Executive and Programme Committee will have to address this issue for the long term, potential solutions for which include reverting to a Thursday-Friday meeting as was the norm many years ago, finding a different venue for both days, or finding a different venue, such as the Department of Entomology, for the Saturday.

During the year, the Society made representations to the Province in support of the proposed change of status of the Criddle Property at Aweme to that of Provincial Heritage Park. Also, there have been discussions regarding the Swat Award, the future of which was in doubt with the change of ownership of Swat. I am happy to report that negotiations were successful in producing the Orkin/Swat Award, which was awarded at the recent ESM Banquet. The new Executive will need to make whatever adjustments are appropriate to the new circumstances surrounding the award.

In terms of day-to-day operations, the Society has been in very good hands during the last year. Noel White, as Secretary, has kept the President in line in a low key but effective manner. Ian Wise, as Treasurer, and Marjorie Smith as Chair of Finance Committee and the Endowment Fund Board, have excellent control of the finances of the Society; no mere society president can evade Ian's scrutiny when the talk turns to spending money. Terry Galloway, as Proceedings Editor, has the publication schedule back on track and those members who did not pick up their Proceedings at the Scientific Meetings, should have received them in the mail. Our Newsletter Editors have been Nicole Lauro and Michael Alperyn, and since Nicole now lives in southern Ontario and Michael is trying to finish his M.Sc., I have been hunting for replacement editors. I am happy to report that my hunt was successful and that Pat MacKay and Mahmood Iranpour will be the new Newsletter Editors. My thanks to Nicole and Michael for their service to the Society. We should also thank Michael for his service as Social Committee Chair, a position which he has held for several years.

I would like to recognize all the volunteers that make the Society work, whether they are committee chairs or not, and whether I have mentioned them by name or not. I would like to highlight the efforts of one particular committee, and make a plea on its behalf. The Youth Encouragement and Public Education Committee is one of the most active Committees in the Society, and a catalogue of its recent activities will presumably be presented by its current chair, Kathleen Ryan, who took over from Christie Borkowsky during the year. Both of these people, like their recent predecessors, are graduate students, and with the exception of a couple of individuals, almost all those who contribute to the Committee's many activities are graduate students. Frequently, I hear pleas at Entomology seminars for volunteers to make presentations or assist at insect education activities directed at school children, day cares, or the general public. Those pleas are directed primarily at fellow graduate students, many of whom respond when they can. However, in the absence of volunteers, the Chair is left with the job. There is no doubt that the academic programmes of some graduate student Chairs of this Committee have suffered considerably, and this is an unfair imposition on them. There are several factors contributing to this imposition: often the Chair of this Committee takes on the job when they are new students and do not know many

non-student Society members upon whom to call. Also, I think many members think that only youth can encourage youth; this is not so. I think that if half of our membership — that is about 50 people — were to participate in a Youth Encouragement activity once per year, the distribution of labour would be much more equitable, and many of the participants would find they actually enjoy the interactions. The work is not difficult, and there are well developed programmes and activities that can be used for many sessions. Kathleen Ryan, the current Chair of the Committee, is looking for recruits, who could be called upon perhaps once, or — if willing — perhaps several times, over the course of a year, and has prepared a sign-up sheet. I urge you to sign up during this meeting for what can be a very rewarding activity, one which clearly can contribute to the future of entomology in this Province.

Thank you for providing me with the opportunity to be your President, and again thanks to all those who volunteer their time on behalf of the Society.

N. J. Holliday
ESM President

Appendix C: Report of the Treasurer

Entomological Society of Manitoba, Inc. Financial Statements

August 31, 2003

DOUG NICHOLSON* & CO.,

Certified General Accountant

AUDITOR'S REPORT

To the Members of the Entomological Society of Manitoba Inc.

I have examined the balance sheet of the Entomological Society of Manitoba Inc. as at August 31, 2003 and the statement of revenues, expenditures and surplus for the year then ended. My examination was made in accordance with Canadian generally accepted auditing standards, and accordingly included such tests and other procedures, as I consider necessary in the circumstances.

In common with many non-profit organizations, the organization derives some cash revenue, the completeness of which is not susceptible to conclusive audit verification. Accordingly, my verification of these revenues was limited to the amounts recorded in the records of the organization and I was not able to determine whether any adjustments for unrecorded receipts from these sources might be necessary to income or surplus balances.

In my opinion, except for the effect of any adjustments, if any, which I might have determined to be necessary had I been able to satisfy myself concerning the completeness of the cash revenues referred to the above, these financial statements present fairly the financial position of the society as at August 31, 2003 and the results of its operations and the changes in it's financial position for the year then ended in accordance with Canadian generally accepted accounting principles.

original signed by Doug Nicholson & Co.

Winnipeg, Canada — Doug Nicholson & Co.,

October 7, 2003 — Certified General Accountant

*PROFESSIONAL CORPORATION

ENTOMOLOGICAL SOCIETY OF MANITOBA, INC.
BALANCE SHEET
AUGUST 31, 2003

ASSETS

CURRENT	**2003**	**2002**
Cash in bank	$ 3,092	$ 2,916
Canadian T-Bill fund (note 3)	4,737	3,660
Investment Certificates (note 2, 4)	36,892	36,137
	$44,721	$42,713

LIABILITIES

LIABILITIES	nil	nil

SURPLUS

SURPLUS	$44,721	$42,713
	$44,721	$42,713

APPROVED BY THE BOARD:

_____ President _____ Treasurer

The accompanying notes form an integral part of these financial statements

ENTOMOLOGICAL SOCIETY OF MANITOBA, INC.
STATEMENT OF REVENUES, EXPENDITURES AND SURPLUS
FOR THE YEAR ENDED AUGUST 31, 2003

REVENUE	**2003**	**2002**
Annual meeting (see Schedule A attached)	$3,701	$1,669
Donations	$1,015	$1,660
Fundraising committee	$650	$223
Interest income	$1,890	$1,963
Members fees	$1,592	$1,778
Miscellaneous	$121	$10
Proceedings	$367	$273
Social committee	$73	$0
Youth encouragement & public education	$200	$620
	$9,609	$8,196
EXPENDITURES		
Awards and Scholarships	$1,520	$1,450
Donations	$650	$500
Fundraising	$499	$0
General	$1,305	$2,121
Meetings	$1,353	$3,765
Newsletter	$203	$0
Proceedings	$1,678	$0
Social Committee	$82	$0
Youth encouragement & public education	$311	$57
	$7,601	$7,893
EXCESS OF REVENUES OVER EXPENDITURES	**2008**	**303**
Add: Surplus, beginning of the year	$42,713	$42,410
SURPLUS, END OF YEAR	**$44,721**	**$42,713**

The accompanying notes form an integral part of these financial statements

ENTOMOLOGICAL SOCIETY OF MANITOBA, INC.
ESC-ESM 2002 - SCHEDULE A
STATEMENT OF REVENUES & EXPENDITURES
FOR THE YEAR ENDED AUGUST 31, 2003

	2003
REVENUE	
Registration fees	$28,615
Souvenir sales	$1,757
Sponsorships & funding	$25,940
	$56,312
GENERAL EXPENDITURES	
Administrative	$6,499
Art show	$2,400
Banquet	$1,800
Facility rental	$24,309
Honorarium	$100
Refunds	$477
Souvenir purchases	$1,430
Speaker & special guests	$8,121
Translation	$2,937
Travel	$836
	$48,909
EXCESS OF REVENUES OVER EXPENDITURES	**$7,402**
Allocated as follows:	
Payment to Entomological Society of Canada	$3,701
Payment to Entomological Society of Manitoba	$3,701
	$7,402

The accompanying notes form an integral part of these financial statements

ENTOMOLOGICAL SOCIETY OF MANITOBA, INC.
NOTES TO THE FINANCIAL STATEMENTS
AUGUST 31, 2003

NOTE 1 PURPOSE OF THE ORGANIZATION

The Entomological Society of Manitoba Inc. was formed to foster the advancement exchange and dissemination of Entomological knowledge. The Entomological Society of Manitoba was incorporated on July 21st, 1976 under the laws of the Province of Manitoba as a non-profit organization and a registered charity under the Income Tax Act.

NOTE 2 SIGNIFICANT ACCOUNTING POLICIES

Income and expenses are recorded on the cash basis of accounting. There are no accruals of receivables or payables at the year-end. Inventory is expensed when it is purchased. Interest from investment certificates is paid out annually and no interest is accrued. Capital assets are expensed when acquired and, therefore, there are no annual amortization allowances.

NOTE 3 CANADIAN T-BILL FUND

The Canadian T-Bill fund was opened February 28, 1997 with a principal balance of $3,000. The T-Bill is shown at market value at year-end.

NOTE 4 INVESTMENT CERTIFICATES

Certificate Number	Interest Rate	Maturity Date	Par Value
900055611-0001	2	26 Feb 2004	$3,000
900055611-0002	4.8	5 Apr 2004	$2,000
900055611-0004	6	12 Nov 2004	$10,957
960006276-0003	5.15	16 Sep 2003	$4,000
960006276-0004	4.8	11 Dec 2003	$3,000
960006276-0005	4.55	31 Oct 2007	$3,135
960006276-0006	2	10 Feb 2004	$10,800
			$36,892

NOTE 5 STATEMENT OF CHANGES IN FINANCIAL POSITION

A Statement of Changes in Financial Position is not included with these financial statements as the Society uses the cash basis of accounting and would not provide any useful information that cannot be attained by the Balance Sheet and the Statement of Revenues, Expenditures, and Surplus.

Appendix D: Report of the ESC Regional Director

Over the past year, as Regional Director for the Entomological Society of Manitoba on the Governing Board of the Entomological Society of Canada, I have carried out several duties. As Regional Director I have served on the ESC Membership Committee and the ESC Science Policy and Education Committee. In addition to reporting at the Annual Meeting, I submitted a report on ESM activities to the Interim Meeting of the ESC Executive Council in Ottawa on April 12, 2003. From November 1-5, 2003, I attended the Joint Annual Meeting of the Entomological Societies of Canada and British Columbia in Kelowna, BC, including the two scheduled Board Meetings and the Annual Business Meeting of the ESC. At the latter, Charles Vincent, AAFC, St. Jean, took over from Sandy Smith, Forestry, U of T, as President. At the same time, ESM member Bob Lamb moved from 2nd Vice-President to 1st Vice-President.

The next ESC Annual Meeting is a joint meeting with the Acadian Entomological Society on Prince Edward Island, Saturday October 16th to Monday October 18th, 2004. The change in days of the week for this meeting is, in part, intended to make it easier for University people to travel to the meeting without missing as much class time. The Board of ESC is finalizing arrangements for a number of awards to assist students to travel to the ESC Annual Meeting. It is expected that the first awards will be made for the 2004 PEI meeting. At this time it is expected that there will be four awards of $500 each for those meetings. Students and supervisors should watch for the announcement in the Bulletin and on the website, giving details of application procedures.

There have been changes at the Society's journal, The Canadian Entomologist (TCE), which may be of interest to ESM members. Jean Turgeon, CFS, Sault Ste. Marie, is stepping down as Editor-in-Chief at the end of 2003, and will be replaced by Richard Ring, recently retired from the University of Victoria. The new structure of editors continues to work well, with three Divisional Editors, each with a set of Associate Editors, under the Editor-in-Chief. Currently the Divisional Editors are: Don Lafontaine (Biodiversity/Systematics/Morphology/Evolution), Michel Cusson (Physiology/Biochemistry/Development & Genetics), and ESM member Bob Lamb (Behaviour/Ecology).

As ESC members are no doubt aware, the ESC has been migrating rapidly to electronic format. Both TCE and the Society's Bulletin, the latter edited by ESM member Paul Fields, are now available electronically. During the first year of electronic publication, members could choose to receive both the paper copy and the electronic copy at no extra charge. In future years there will be an additional charge for receiving material in both formats.

ESC continues in its efforts to serve the Canadian entomological community, and will in the near future be distributing a survey to obtain data on why members have joined and why some entomologists have not joined. It will be sending the survey not only to members of ESC, but also to members of the regional societies. ESC would appreciate feedback on what members want from their society, and what might induce non-members to join. When you receive the questionnaire, please take the few minutes necessary to fill it out and help ESC serve you and others better.

Patricia A. MacKay
Regional Director for ESM on the ESC Board

Appendix E: Report of the *Proceedings* Editor

Volume 58 (2002) of the *Proceedings* of the Entomological Society of Manitoba was 76 pages, and included three submitted papers, the Scientific Programme and abstracts for the Joint Annual Meeting of the ESM/ESC held in Winnipeg, 5-9 October, 2002, Minutes of the Annual Business Meeting of the ESM held on 29 November, 2002, and Committee Reports. *The Proceedings* was printed and paid for in August, 2003. Therefore, payment appears under expenses for the 2002-2003 fiscal year, in the same fiscal year as the Joint Annual Meeting, as directed by the ESM Executive. Volume 58 was again printed by Warren Schuetz at the University of Winnipeg Print Shop, at a total cost of $839.45 for 225 copies. Additional costs include envelopes and postage. *The Proceedings* was distributed to members at the Annual Meeting on 24-25 October, 2003, and the remainder was mailed on 2 November, 2003.

I would like to thank Noel White, Secretary of the ESM, for his expeditious handling of the committee reports, and to Bob Lamb, Chair of the Scientific Programme Committee for his contribution in submitting the programme and abstracts from the Joint Annual Meeting. I would also like to thank Paul Fields, the ESM webmaster, for getting the *Proceedings* online. As result of his efforts, submitted papers in the *Proceedings* are for the first time, available to entomologists around the world. I hope this will be an incentive for potential contributors.

Proceedings Editor, T.D. Galloway

APPENDIX F
Entomological Society Of Manitoba, Inc.
Report Of The Endowment Fund Board For 2002-2003

The Endowment Fund provides a basis for funding the Student Scholarship and the publication of the *Proceedings*. In the past the Fund provided full support for these commitments, but income generated has declined each year as maturing GICs are reinvested at lower interest rates. The principle amount in the Fund is currently $35,135, but the cap is $40,000, which was approved in 1998. It may be time to consider increasing the Fund to the current cap.

The Endowment Fund Board met on 9 September, 2003, to review the investments. In 2004 four GICs will mature, accounting for $25,000 of the Fund's principle. The Board recommends that the total principle be redistributed so that approximately $7,000 of certificates matures each year, and that the certificates maturing in a given year be combined into one GIC to reduce paperwork and simplify the audit.

Tables 2 and 3 are projections to show the proposed redistribution of GIC principle amounts as discussed at the Board meeting. Interest generated during the fiscal year is based on current interest rates.

Marjorie Smith, Chair
Ian Wise
Pat MacKay

Endowment Fund Guaranteed Investment Certificates

Table 1: Account information as of August 31, 2003. Interest generated during the 2003-2004 fiscal year.

Certificate No.	Principle	Interest Rate (%)	Maturity Date	Annual Interest
900055611-0001	$3000.00	2.00	Feb 26, 2004	$60.00
900055611-0002	$2000.00	4.80	Apr 5, 2004	$96.00
900055611-0004	$10,957.35	6.00	Nov 12, 2004	$657.44
960006276-0003	$4000.00	5.15	Sept 16, 2003	$206.00
960006276-0004	$3000.00	4.80	Dec 11, 2003	$144.00
960006276-0005	$3135.00	4.55	Oct 31, 2007	$142.64
960006276-0006	$10800.00	2.00	Feb 10, 2004	$216.00
Total	**$36,892.35**			**$1,522.08**

Table 2: Projected account information as of 31 August, 2004 (based on Nov., 2003 interest rates). Interest generated during the 2004-2005 fiscal year.

Table 3: Projected account information as of 31 August, 2005 (based on Nov., 2003 interest rates). Interest generated during the 2005-2006 fiscal year.

Certificate No.	Principle	Interest Rate (%)	Maturity Date	Annual Interest
900055611-0001	$3000.00	3.00	Feb 26, 2010	$90.00
900055611-0002	$2000.00	3.00	Apr 5, 2010	$60.00
900055611-0004	$7,000.00	2.00	Nov 12, 2006	$140.00
900055611-0004	$2,200.00	1.75	Nov 12, 2005	38.50
960006276-0003	$4000.00	3.30	Sept 16, 2008	$132.00
960006276-0004	$3000.00	3.00	Dec 11, 2008	$90.00
960006276-0005	$3135.00	4.55	Oct 31, 2007	$142.64
960006276-0006	7,000.00	3.00	Feb 10, 2009	$210.00
960006276-0006	$3800.00	2.35	Feb 10, 2007	$89.30
Total	**$35,135.00**			**$992.44**

NOTE: The plan will be to split large certificates, and then to combine the smaller amounts that mature in the same year, so that, by 2006, one certificate matures each year. Summary of principle amounts and year of maturity:

$7,000.00 – 2006
$6,935.00 – 2007
$7,000.00 – 2008
$7,000.00 – 2009
$7,200.00 – 2010

Appendix G: Report of the ESM Student Awards and Scholarship Committee

Student Achievement Award

Awarded to a student who is in a Bachelor's degree programme. This award recognizes students who have shown exceptional interest in entomology as evidenced by their

insect collections, insect photography, published articles of entomological interest, insect experiments and/or outstanding contributions during summer employment.

This year's winner is: Mr. Ian Trembath. Ian has completed an undergraduate degree at the University of Toronto and is now enrolled in Zoology at the University of Manitoba.

Orkin/Swat Student Award

This award is designed to foster and encourage student interest in general entomology including natural methods of insect pest control and the proper use of insecticides. Candidates must have a demonstrated interest in entomology, superior scholastic ability, high research potential, originality and industriousness in their university courses and/or summer work.

This year's winner is: Ms. Kathleen Ryan. Kathleen completed her B.Sc. at the University of Winnipeg in spring 2003 and immediately began a Master's Degree in the Department of Entomology at the University of Manitoba under the supervision of Drs. Westwood and Holliday.

The ESM Graduate Scholarship

This scholarship is awarded to a student in a M.Sc. or Ph.D. programme in entomology at the University of Manitoba. Students must be enrolled in their graduate programme for at least 12 months prior to Oct. 1 of the award year. This award recognizes superior scholastic ability, high research potential as evidenced by industriousness, good judgement, originality, a conscientious attitude and organizational ability, and excellent communication skills.

This year's winner is: Mr. Michael Alperyn. Michael is currently in the final year of his M.Sc. project working under the supervision of Dr. R. Roughley.

Desirée Vanderwel
Rob Anderson
Richard Westwood (Chair)
October 2003

Appendix H: Report of the Finance Committee

The Finance Committee met on 10 November, 2003, to review the 2002-2003 financial statement and the budgets received for the current fiscal year. The Society is in good financial shape, thanks largely to the substantial surplus from last year's ESC-ESM Joint Annual Meeting. The $7,402.68 surplus was divided equally between the ESC and ESM. The financial situation is expected to change next year, when a substantial portion of the GICs in the Endowment Fund mature and are reinvested at much lower interest rates. By 2005 investment income is expected to drop by about $500. The Society will need to consider other sources of increased revenue, such as increased registration fees for the Annual Meeting.

This fiscal year, the largest expenses are the Annual General Meeting and the cost of the audit, which included the Joint Annual Meeting accounts in addition to the ESM accounts. These costs were partially offset by higher than usual donations, and a large GST rebate from costs associated with the Joint Annual Meeting.

A new expense category, beginning in 2002-2003, is the proposed Joint Annual Meeting of the North Central Branch of the Entomological Society of America, the ESA, and the ESM, to be hosted by the ESM in the spring of 2007. No expenses are expected for the current or the next fiscal year, but further expenses are expected beginning in 2005-2006.

Marjorie Smith, Chair
Ian Wise
Pat MacKay

ENTOMOLOGICAL SOCIETY OF MANITOBA

BUDGET ITEMS **REVISED 10 November, 2003**	**2002-03** **Actual**	**2003-04** **Actual and Projected**	**2004-05** **Projected**
Endowment Fund	$36,892.35	$37,589.24	$35,135.00
REVENUE			
Membership Dues	1,592.46	1,500.00	1,500.00
Proceedings	366.57	220.00	220.00
Social Committee	0.00	0.00	0.00
Youth/Education Committee	200.00	200.00	200.00
Donations: from YEC activities	345.00	300.00	300.00
fundraising for AGM	0.00	1,700.00	1,200.00
Fundraising Committee	470.00	1,000.00	0.00
Student Awards and Scholarship	200.00	200.00	200.00
Meetings: ESM/AGM	0.00	1,808.00	1,750.00
ESC – ESM JAM	4,701.34	---	---
Interest: GIC income [1]	1812.23	1,522.00	1,448.00
T-Bill Account	77.00	100.00	100.00
Miscellaneous – GST rebate	120.98	1,250.00	120.00
TOTALS	9,885.58	9,800.00	7,038.00
EXPENSES			
General Society Expenses	1,304.06	1,650.00 [5]	900.00
Proceedings	1,679.05 [4]	900.00	900.00
Newsletter	202.90	200.00	200.00
Social Committee	8.51	100.00	100.00
Youth/Education Committee	311.15	300.00	300.00
Fundraising Committee	498.57 [2]	0.00	0.00
Student Awards and Scholarships	1,520.00	1,500.00	1,500.00
Meetings: ESM/AGM	0.00	4,300.00	3,000.00
ESC – ESM JAM	299.20	---	---
NCB – ESA – ESM JAM	2,054.19 [3]	0.00	0.00
Donations	0.00	0.00	0.00
Representation at ESC	0.00	400.00	400.00
TOTALS	7,876.73	9,350.00	7,300.00
Net Gain (Loss), year ending Aug. 31	2,008.85	450.00	(262.00)

[1] Some of this investment income is being held in the Endowment Fund. See Note on Report of the Endowment Fund.
[2] Purchase of baseball caps with logo; income to be received next fiscal year.
[3] This is the amount spent to send Paul Fields and Brent Elliott as representatives at the NCB-ESA meeting. Some or all of this may be recovered in the future.
[4] Cost of publishing two issues of the Proceedings, 2001 and 2002.
[5] $1,605.00 of this amount was the cost of the annual audit, which this year includes the joint meeting accounts.

Appendix I: Report of the Social Committee

The new members' social welcomed Lisa Capar into the Society and was attended by over 25 ESM members. Mark Lowdon graciously hosted the social at his home. The evening included a potluck and a film-trivia challenging video after which prizes were awarded. Admission price was $3 for students and $5 for non-students. The cost of the evening to the Society was $8.51 after ticket sales.

The Social Committee was also responsible for the banquet at the 2003 ESM Scientific Meeting. A description of the event and associated expenses is provided by Mahmood Iranpour.

Michael Alperyn is resigning his position as Social Committee Chair.

Michael Alperyn, Chair

Appendix J: Report of the Publicity/Newsletter Committee

Two newsletter issues (Winter and Summer 2003) were put out by the Newsletter Committee. The Committee would like to thank the following individuals for their submissions over the last two issues: Neil Holliday, Terry Galloway, John Gavloski, Robbin Lindsay, Brent Elliot, Rob Roughley, Christie Borkowsky, Pat MacKay, Mahmood Iranpour, Kathleen Ryan and Scott McMahon.

Nicole Lauro and Michael Alperyn are resigning their positions from the Newsletter Committee. The positions of Editor and Co-Editor will be filled by Pat MacKay and Mahmood Iranpour, respectively.

Nicole Lauro, Editor and Michael Alperyn, Co-Editor

Appendix K: Report of the Youth Encouragement Committee

The foundation of the Youth Encouragement Programme continues to be the delivery of age-appropriate insect presentations to school groups and day cares. The Youth Encouragement (YE) Programme has seen an increasing number of requests for classroom presentations and tours of the Department of Entomology. These programmes continue to be delivered entirely by graduate students in the Department.

Since the beginning of the year, the YE Committee has been able to provide 24 presentations and 6 tours to schools and day cares. Almost 600 children have had the opportunity to learn about entomology through these programmes. However since May, 23 requests for programming could not be accommodated due to a lack of available volunteers.

The Amazing Grains Programme, sponsored by Agriculture in the Classroom Manitoba Inc., has recently expanded its programming with the addition of a third day in the Brandon event. The AG Programme continues to promote agricultural awareness to urban students in Grades 4-6 and accesses approximately 2400 students per year. In

addition to graduate students, we have relied on some ESM members and University of Manitoba personnel to be able to staff the Amazing Insects station at these events.

Over the past year, the Youth Encouragement Committee has also organized and staffed two insect displays visited by the general public.

In total, more that 3000 children have been exposed to entomology through YE programmes. The feedback from these programmes continues to be overwhelmingly positive both from teachers and students. Because of the increasing popularity of YE programming and due to graduate student volunteer shortages, especially during critical times of the year, the YE Committee cannot meet the demand for programming. I would strongly encourage ESM members to consider participating in the delivery of YE programmes.

I would like to thank everyone who has assisted with YE events over the past year. I would especially like to thank Christie Borkowsky for her extensive help both with presenting programmes and with ensuring that the YE programme ran smoothly during the transition in chairpersons.

Kathleen Ryan
Chair, Youth Encouragement Committee

School/ Day care programs

2003	Number of programs requested	Number of tours	Number of presentations	Number of students
January	Not available	1	0	7
February	Not available	0	2	38
March	Not available	1	8	126
April	Not available	1	6	150
May	6	0	3	76
June	9	2	1	89
July/August	17	1	2	68
September	1	0	1	24
October	1	0	1	20
Total	**NA**	**6**	**24**	**598**

Amazing Grains

Amazing Grains Brandon, June - 1200 students (400 per day)
Amazing Grains Winnipeg, September - 1200 students (400 per day)

Public programmes

March - Ag Everyday (1 day - booth)
April – Manitoba Museum, Spring Break Programme (1 day - booth)

Volunteers

School, day care and public programmes: David Wade, Christie Borkowsky, Tonya Mousseau, Ayman Mostafa, Lisa Capar, Robyn Underwood, Michael Alperyn, Jashim Uddin, Heather White, K.S. Hemachandra and Kathleen Ryan.

Amazing Grains: Kim Riley, Scott McMahon, Lisa Babey, Christie Borkowsky, Robyn Underwood, Jashim Uddin, Tonya Mousseau, Ayman Mostafa, Micheal Alperyn, K.S. Hemachandra , Mark Lowdon, Paul Fields, Tanis Mayert, Colin Demianyk, Noel White, Jeff Shaddock, Margaret Smith, Alicia Leroux, Terri McCullough and Kathleen Ryan.

Apologies to those volunteers who may have been inadvertently missed from this list.

Appendix L: Report of the Scientific Programme Committee

The 59th Annual Meeting of the Entomological Society of Manitoba was held on October 24th and 25th, 2003 at the Freshwater Institute and National Microbiology Laboratory. The theme of the meeting was "Mosquitoes and West Nile Virus: Present Situation and Perspective".

The submitted paper session began Friday morning and continued through the afternoon and was chaired by R. Lamb and J. Gavloski. A total of 3 posters and 17 oral presentations were submitted. Eight oral presentations were entered in the student paper competition. The judges of the student paper competition were T. Galloway, P. Fields, and J. Uddin. The winner of the paper competition was Mark Lowdon. The submitted paper sessions were attended by over 50 people.

A symposium on West Nile Virus was held on Saturday, 25 October at the Microbiology Laboratory followed by a tour of the Canadian Science Centre for Human and Animal Health in the afternoon. The symposium was chaired by R. Lindsay and the five speakers for the symposium were: W. Reisen, University of California; I. Barker, University of Guelph; R. Gadawski, City of Winnipeg; M. Drebot, Health Canada; J. Kettner, Manitoba Health. The Symposium was attended by more than 50 people.

The annual banquet was organized by Michael Alperyn (Chair of the Social Committee) and took place at the Southwood Golf and Country Club. Lara Ciekiewicz's singing and piano playing provided the entertainment for the evening. A total of 43 attended the banquet (26 non-student members, 14 students and 3 symposium speakers). An informal mixer was held the evening of 25 October at the home of R. Lamb and P. MacKay.

In total, the 63 people registered for the meeting this year consisted of 33 regular members, 25 students, and 5 non-members. Registration ($990) and Donations ($1725) netted the meeting $2715 and all expenses to date are $2601.39. The net meeting profit was $113.61. The banquet expenses were $1782.73 against revenues of $818 for a net loss of $964.73. Overall the meeting will incur a loss of about $850.

The Committee wishes to thank all the speakers for their excellent contributions to the

Meeting. Special thanks to go Dave Rosenberg and Robbin Lindsay for arrangements at the Freshwater Institute and Microbiology Laboratory, respectively; to Treasurer Ian Wise and the others who staffed the registration desk; to David Wade who operated the projection equipment and all institutions, companies, and societies who made donations for this meeting.

The Organizing Committee consisted of R. Lamb and J. Gavloski, who brought experience to the table as the Chairs of previous years' committees; R. Lindsay and R. Gadawski who helped the Committee liaise with health institutions and West Nile Virus researchers; D. Rosenberg who coordinated building arrangements for the meeting; M. Alperyn who acted as Secretary for the Committee and organized an outstanding social programme; J. Gosselin, who was our extraordinary fund-raiser; and P. MacKay and R. Lamb for hosting us at their home for the Meet-the-Visitors-Mixer.

Mahmood Iranpour
Chair, Scientific Programme Committee

Appendix M: Report of the 2002 Fund-raising Committee

For the Joint Meeting of the ESC/ESM, the total revenues came in at $25,940. The net amount of donations given directly to the ESM was $1015. The breakdown for the expenses can be found in the Treasurer's Report, which has been reviewed by an auditor. The Committee wishes to recognize Jo Anne Buth who did most of the work to contact the donors who provided generously to ensure the Meeting would be another successful event. The assistance of the volunteers who sold souvenirs is also noted and is very much appreciated.

Chair
Joel N. Gosselin

Appendix N: Report of the ESM Membership Committee

Membership at 29 November, 2002 was 137 individuals. Nine new members joined the Society over the past year. Regrettably, 39 members were dropped from the list. Though this number is considerable, many of the names should likely have been dropped at some point in the past due to long terms of non-payment. Several members requested to be dropped from the membership list. The current membership (prior to the 2003 Annual Meeting) stands at 107 individuals.

Brent Elliott

Appendix O: Report of the ESM Internet Site Committee

There have not been major changes to the web site. Issues of the Newsletter and the

Proceedings have been added as they have come available. In 2002 there were 10,500 requests for files on our website, in 2003 to date there have been 9,000 requests. The abstracts of the Joint ESM-ESC Meeting are the most requested file with 930 downloads in 2002 and 750 downloads in 2003. The various issues of the Newsletters are downloaded 50 to 120 times a year. In 2003, the first year that we had the *Proceedings* available, there were 180 downloads of the 2001 *Proceedings*, and the other issues, 2000, 1999, 1998 and 1997 were downloaded about 100 times each. I have put up individual papers from the *Proceedings*, and "Wise, I.L., Turnock, W.J., and Roughley, R.E. 2001. New records of coccinellid species for the province of Manitoba. Proc. Entomol. Soc. Man. 57: 5-10" was the most popular download of the papers, with 128 downloads.

In summary, the web site is a simple way for people to access our two publications, the *Proceedings* and the Newsletter and to tell members about other Society activities. As always, I am open to ways we can improve the web site.

The address of the web page is: http://home.cc.umanitoba.ca/esm/index.html.

Paul Fields
Chair of the Internet Site Committee
12 November 2003

Appendix P: Election Report

October 3, 2003

Elections closed October 1, 2003 for the Entomological Society of Manitoba offices of President-Elect and Member-at-Large. Candidates for President-Elect were Brent Elliot and Robbin Lindsay, Member-at-Large were Christie Borkowsky and Mahmood Iranpour. The successful candidate for President-Elect is Brent Elliot and for Member-at-Large is Mahmood Iranpour. We thank all candidates for their willingness to participate in the election. Formal announcement and commencement of terms will be at the Annual Business Meeting in November.

Colin Demianyk
Chairperson, Scrutineer Committee

Noel White
Secretary