Pilot study for sampling insect diversity

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Introduction

This pilot study evaluates the efficiency of 3 types of commercially available insect traps (Malaise, black light, and pitfall) and the capture by sweeping vegetation on the Kenai NWR. The purpose was to compare the efficiency of the insect sampling methods and to determine the appropriate sampling interval for insect diversity.

Study Sites

John Morton and Dominique Collet selected 3 study sites in early June 2004 off Finger lake road on the Kenai NWR (Lat 6039N long 15050W).   Sites were selected to represent 3 habitat types: closed hardwood forest, floating Sphagnum mat and conifer woodland.
Site 1 represented closed birch forest and was located on the Finger lake road (mi 2.3, South side of the road, 100' W side of a gated overgrown dirt road). Paper birch (*Betula papyfera)* is the dominant canopy tree up to 40 feet. The dbh of *Betula papyfera* trunks vary between 2 cm and 15 cm. The following plants were identified within a 10 m diameter area centered on the traps: *Alnus crispa, Athyrium filix-femina, Betula papyfera, Cornus Canadensis, Echinopanax horridum, Equisetum pratense, Epilobium angustifolium, Gymnocarpium dryopteryx, Linnea borealis,* Poaceae sp*., Ribes triste, Streptopus amplexifolius, Trientalis europaea,Viburnum edule.*

Figure 1: Closed birch forest (site 1) location with Malaise trap in left foreground and black light trap in right background.

Site 2 represented floating Sphagnum moss habitat and as located North of the Finger Lake Road (mi 1.8, margin of a small pond). Plants identified within a 10 m diameter area centered on the traps included: *Andromeda polyfolia, Carex livida, C. rostrata, Comarum palustre, Drosera rotundifolia, Eleocharis erythropoda or macrostachya, Epilobium angustifolium, Equisetum fluviatile, Menyanthes trifoliata, Myrica gale, Oxycoccus microcarpus, Pedicularis*

parviflora, Salix fuscescens, Sphagnum spp..

Figure 2: Floating Sphagnum mat (site 2) with graminoid and forbs at the margin a small pond. Malaise trap in foreground.

Site 3 represented an open mixed conifer-hardwood stand and was located at the top of hill North of gravel pit off Finger lake rd. Plants identified within a 10 m diameter area centered on the traps were: *Calamagrostis Canadensis, Echinopanax horridum, Epilobium angustifolium, Picea glauca, Rosa acicularis.*

Figure 3: Open mixed conifer-hardwood (site 3).

Methods
One set each of 1 Malaise trap (Bioquip model 2875AG), 1 black light trap (Bioquip model 2851), and 3 pitfall traps (Bioquip model 2838A) were deployed in the 3 different habitats in June 2004 in the Moose Range within the Kenai National Wildlife Refuge. The traps were deployed in the three sites off Finger lake road on the KNWR on 6/14/04. During five consecutive days, insects and weather information were collected daily.   In addition to insects

(??) The date used in the data corresponds to the day the insects were retrieved from the traps. Specimens were either mounted on pins or preserved in alcohol vials and all are labeled with the collection data.

Results and Conclusions

Weather conditions varied throughout the 5-day sampling session (Table 1). In total, 5,430 insect specimens were captured. 4,707 specimens were identified to the family level and represented 80 families (Appendix A), of which 406 specimens were identified to the genus level, represented 54 genera.132 specimens were identified to the species level represented 20 species. Additional identifications are in progress with specimens being sent to specialists for further identifications.

Table 1: Weather conditions by sampling date**.**

Date	Weather Conditions
6/14/04	Morning and afternoon partly sunny, overcast and showers in the evening.
6/15/04	Overcast and light shower.
6/16/04	Overcast, variable wind.
6/17/04	Overcast, light rain in morning
6/18/04	Sunny, first warm dry day after Monday.

The malaise traps were by far the most efficient and captured the largest number of families (Figure 4) and individual insects (Table 2, Figure 5). The second choice is capture by sweeping and this technique may be best adapted to sample sites that are only briefly visited. Pit traps captured ground dwelling species that were poorly represented in the other sampling techniques (Table 3). Pitfall traps sample a different subset of the local entomofauna than any of the three other methods. There is little redundancy obtained in combining the use of pitfall with that of malaise trap. Like the use of malaise trap, the use of pitfall trap requires the site to be revisited.

The daily capture rates for each trap type are generally consistent and moderate fluctuations in the local weather do not affect dramatically the daily capture rate or the representation of insect families in the sampling (Table 2, Figure 6). The captures obtained using either method during 5 days provide only a partial sampling of the local entomofauna. The optimal sampling interval is not reached.
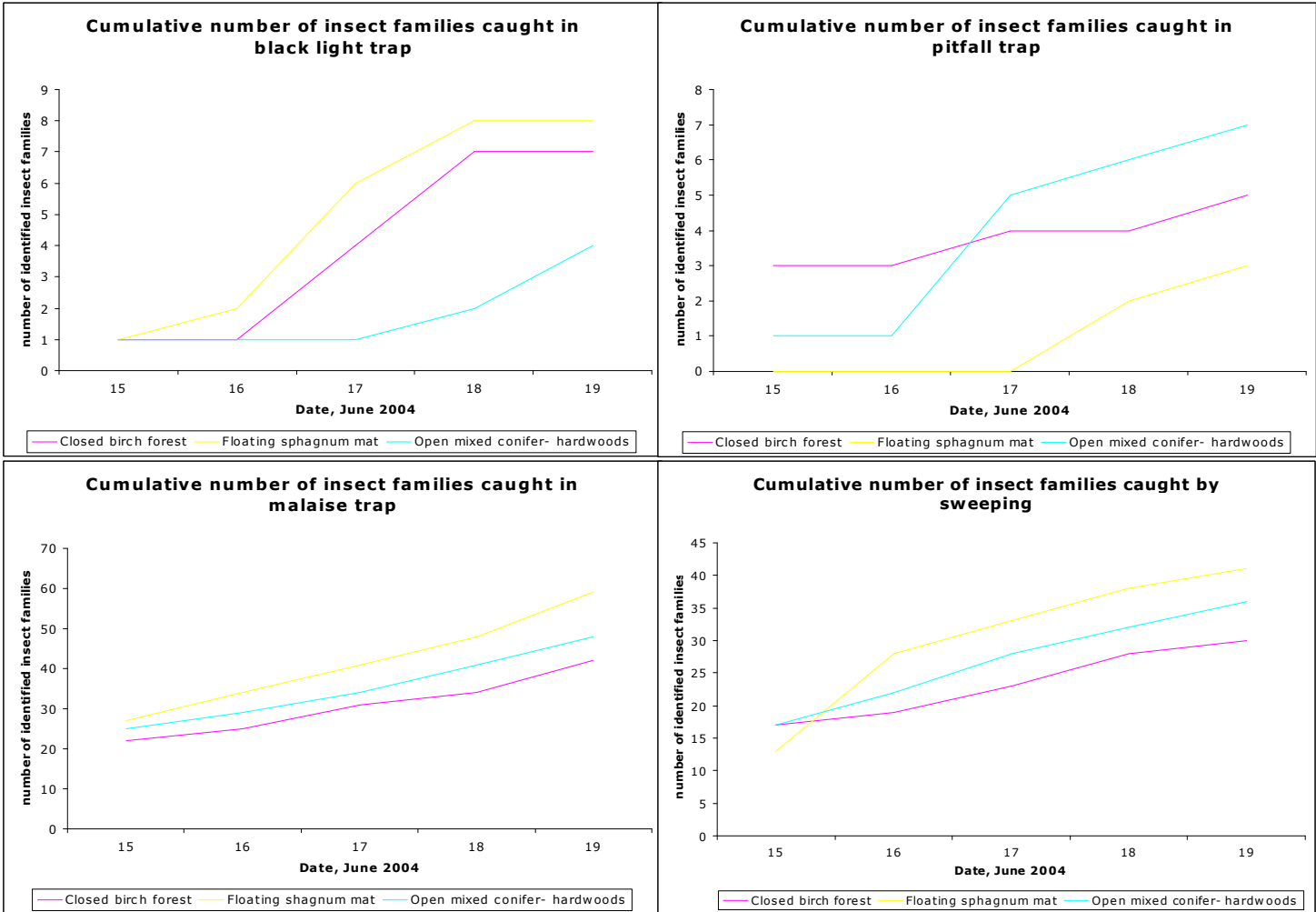
Figure 4: Cumulative number of families caught by each sampling method. The x-axes are scaled differently because the malaise and sweeping methods captured higher numbers than the blacklight and pitfall methods. Sampling sites are separated with pink indicating closed birch forest (site 1), yellow floating Sphagnum moss (site 2) and blue open mixed conifer-hardwoods (site 3).

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Table 2: Number of insects caught each day by the sampling methods.

	dates	Black light trap	Malaise trap	Pitfall trap	Sweep
Site 1	6/15	4	396	4	65
	6/16	1	96	4	80
	6/17	23	263	6	31
	6/18	13	162	10	34
	6/19	7	541	9	7
Site 2	6/15	2	307	0	40
	6/16	6	176	4	84
	6/17	11	269	7	103
	6/18	15	190	3	29
	6/19	19	369	12	11
Site3	6/15	3	360	4	73
	6/16	6	109	2	49
	6/17	0	377	4	64
	6/18	13	213	6	37
	6/19	5	658	6	43

Table 3: Comparison of the number of similar families caught by the 2 methods

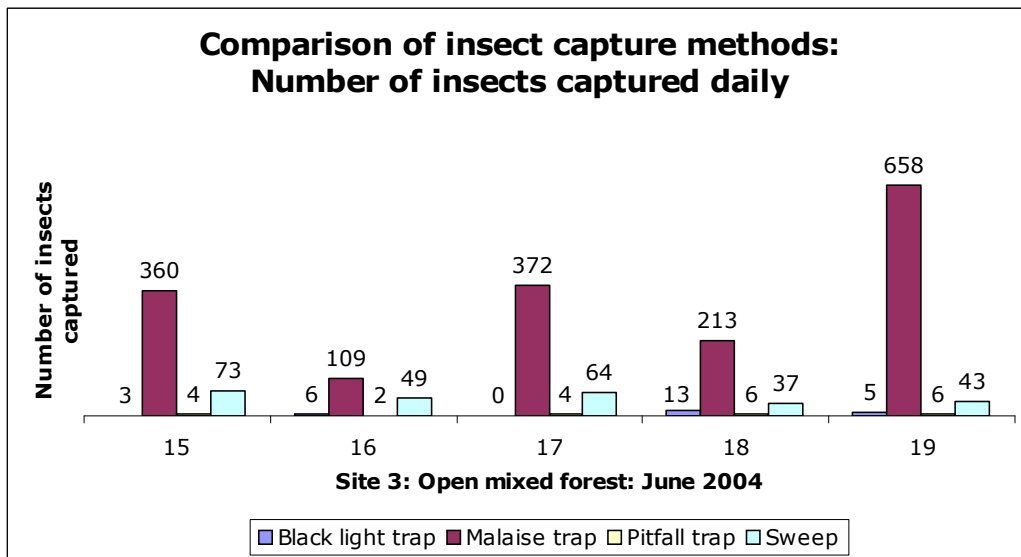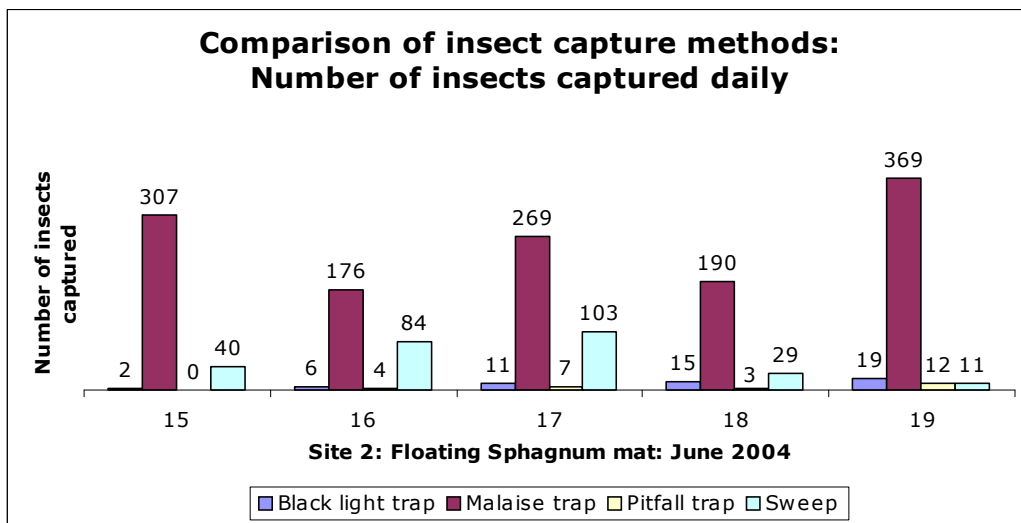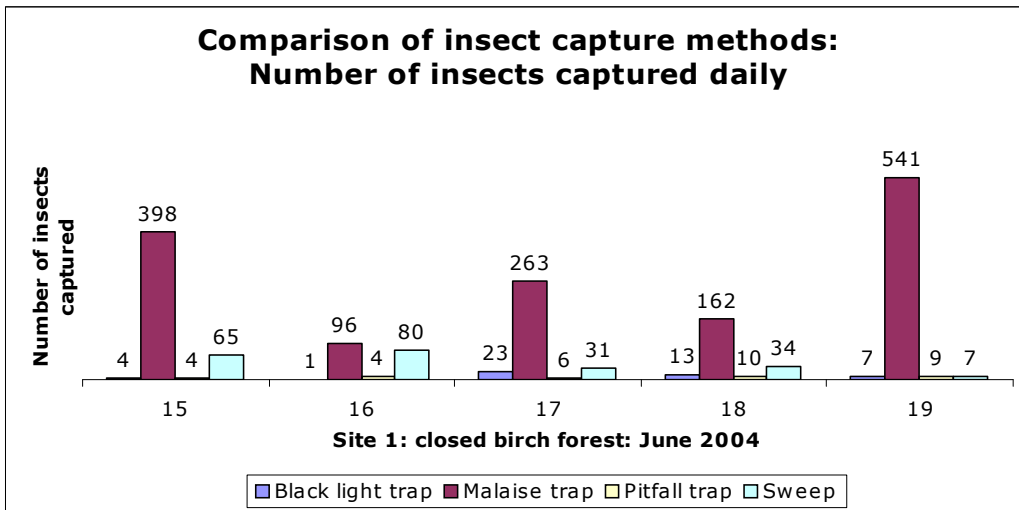|	Black light	Malaise trap	Pitfall trap	Sweep
Black light	21	18	3	15
Malaise trap	18	69	7	44
Pitfall trap	3	7	8	7
Sweep	15	44	7	53

Figure 5: Daily number of insects captured at each site by the 4 sampling methods.

**Comparison of insect capture methods:
Site 1: Closed birch forest**

Number of identified insect families

23 · 17 · 2 · 2
15 · 11 · 0 · 1
8 · 23 · 16 · 1
3 · 20 · 15 · 2
0 · 13 · 16 · 3

Daily collections: June 2004

15   16   17   18   19

□ Black light trap ■ Malaise trap □ Pitfall trap □ Sweep

**Comparison of insect capture methods: site 2:
Floating Sphagnum mat**

Number of identified insect families

2 · 18 · 0 · 13
2 · 20 · 1 · 21
4 · 30 · 1 · 19
2 · 34 · 2 · 16
1 · 35 · 2 · 4

Daily collections: June 2004

15   16   17   18   19

□ Black light trap ■ Malaise trap □ Pitfall trap □ Sweep

**Comparison of insect capture methods:
Site 3: open mixed forest**

Number of identified insect families

2 · 25 · 1 · 18
0 · 19 · 1 · 11
0 · 23 · 3 · 14
1 · 29 · 2 · 16
1 · 35 · 3 · 14

Daily collections: June 2004

15   16   17   18   19

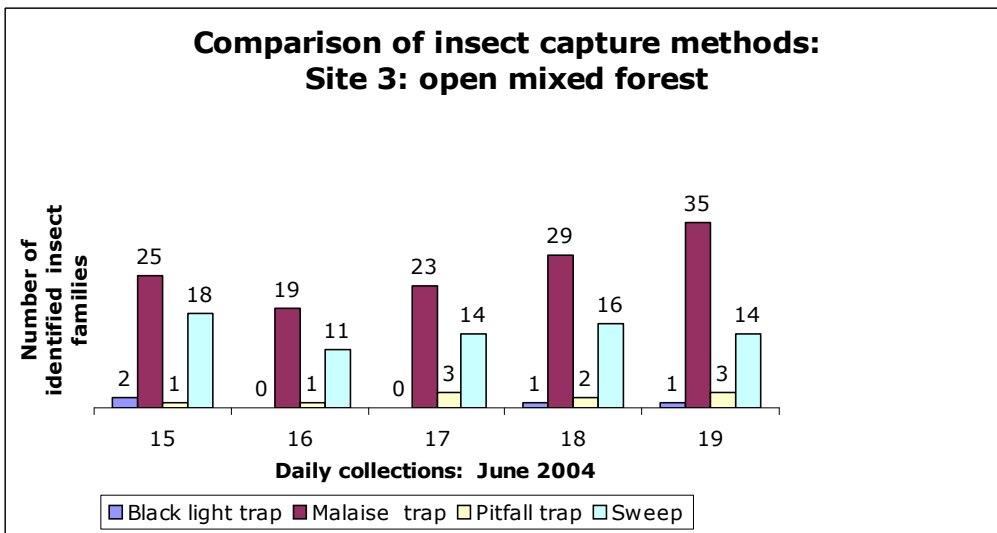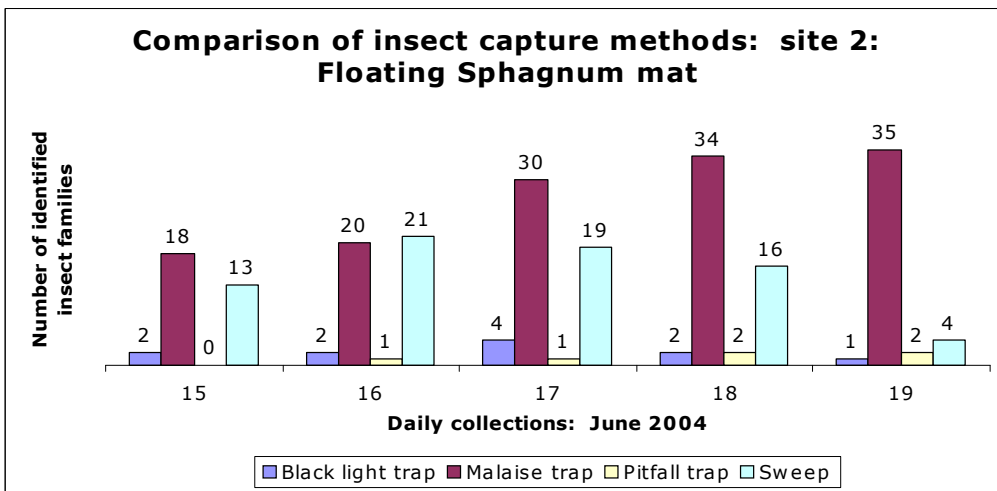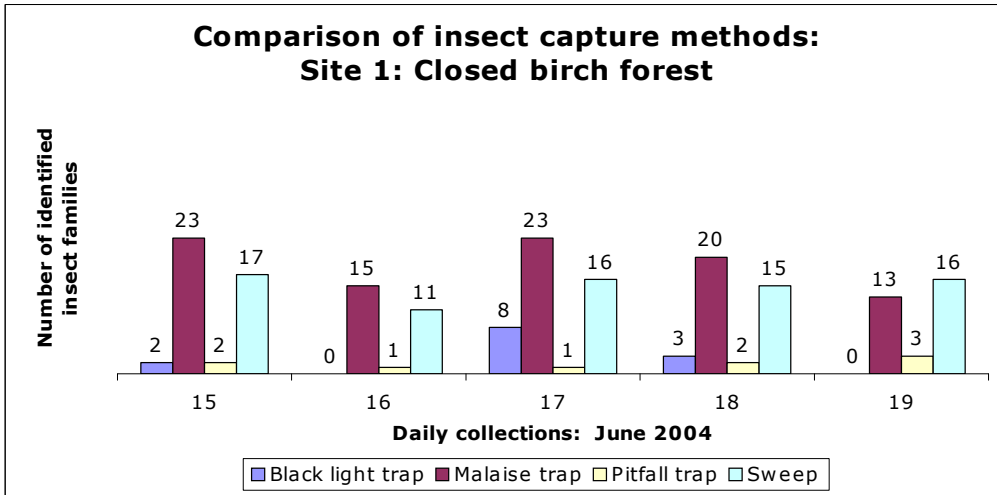□ Black light trap ■ Malaise trap □ Pitfall trap □ Sweep

Figure 6: Number of insect families captured each day by the 4 sampling methods separated by sampling site.

Appendix A: Insect families captured by collection method in KNWR 2004.

		Light trap	Malaise trap	Pitfall trap	sweep
Acanthosamatidae	Hemiptera		X	x	x
Acroceridae	Diptera		X		
Agromyzidae	Diptera		X		x
Anthomyiidae	Diptera		X		x
Aphididae	Homoptera		X		x
Apidae	Hymenoptera		x		
Bibionidae	Diptera	x	x		x
Braconidae	Hymenoptera		x		x
Calliphoridae	Diptera		x		
Cantharidae	Coleoptera	x	x	x	x
Carabidae	Coleoptera		x	x	
Cecidomyiidae	Diptera		x		x
Cephidae?	Hymenoptera		x		
Ceratopogonidae	Diptera	x	x		x
Cercopidae	Homoptera		x		x
Chamaemyiidae	Diptera		x		
Chaoboridae	Diptera	x			x
Charipidae	Hymenoptera		x		x
Chironomidae	Diptera	x	x		x
Chloropidae	Diptera		x		x
Chrysididae	Hymenoptera		x		
Chrysomelidae	Coleoptera	x	x		x
Cicadellidae	Homoptera		x		x
Clusiidae	Diptera		x		
Coccinelidae	Coleoptera		x		
Coenagrionidae	Odonata			x	x
Cordulegastridae	Odonata				x
Crabonidae	Hymenoptera		x		
Culicidae	Diptera	x	x		x
Cynipidae	Hymenoptera		x		
Diapriidae	Hymenoptera	x			
Dolichopodidae	Diptera		x		x
Dryinidae	Hymenoptera		x		
Dryomyzidae	Diptera	x	x		x
Elateridae	Coleoptera			x	x

Family	Order				
Empididae	Diptera		x		x
Eulophidae	Hymenoptera		x		x
Eurytomidae	Hymenoptera		x		x
Figitidae	Hymenoptera		x		
Formicidae	Hymenoptera	x	x	x	x
Geometridae	Lepidoptera	x	x		
Hemerobiidae	Neuroptera		x		
Hesperiidae	Lepidoptera				x
Ichneumonidae	Hymenoptera	x	x		x
Lampyridae	Coleoptera		x		x
Lathrididae	Coleoptera				x
Lauxaniidae	Diptera				x
Lonchaeidae	Diptera		x		
Megaspilidae	Hymenoptera		x		
Miridae	Hemiptera		x		x
Muscidae	Diptera	x	x		x
Mycetophilidae	Diptera		x		x
Mymaridae	Hymenoptera		x		
Pemphredonidae	Hymenoptera		x		
Phoridae	Diptera		x		x
Pipinculidae	Diptera		x		x
Platygasteridae	Hymenoptera		x		x
Proctotrupidae	Hymenoptera		x		x
Psychodidae	Diptera		x		
Psyllidae	Homoptera		x		x
Pteromalidae	Hymenoptera	x	x		x
Pyrechroidae	Coleoptera	x			
Sarcophagidae	Diptera		x		x
Scelionidae	Hymenoptera	x	x		
Sciaridae	Diptera		x		x
Scolytidae	Coleoptera	x			
Sepsidae	Diptera				x
Simuliidae	Diptera	x	x		x
Sminthuridae	Collembola		x		x
Sphaeroceridae	Diptera		x		x
Staphylinidae	Coleoptera	x	x	x	x
Stratyomyiidae	Diptera		x		x

Synneuridae	Diptera	x			
Syrphidae	Diptera	x	x		x
Tabanidae	Diptera				x
Tachinidae	Diptera		x		
Tenthredinidae	Hymenoptera		x	x	x
Thripidae	Thysanoptera		x		x
Tipulidae	Diptera	x	x		x
Vespidae	Hymenoptera		x		
Xylophagidae	Diptera		x		