

## The diversity of ground-dwelling insects in an isolated temporary wetland.

by David Search.

My Honours project for the final year of my degree course (BSc (Hons) in Environmental biology) investigated the diversity of true ground dwelling insects in Brook Meadow using the passive method of pitfall trapping. For the uninitiated this is simply a plastic cup that is inserted into the ground and into which the insects fall. A simple cover keeps the rain out. The survey identified 20 species of ground beetles (Carabidae) (see Table 1) and 15 species of rove beetles (Staphylinidae) (see Table 2). This brief analysis includes tables and records the insects caught. These were obtained from 16 sites during a 64 day period in the summer of 2005. At each site 2 pitfall traps were placed in the ground 1 metre apart.

Insects are ectothermic and have a high surface area to volume ratio and require warmth to become active. These small creatures are able to exploit the thermally heterogeneous micro-environments that exist within any vegetation (McGavin, 2001). Ground temperature readings within the various vegetation types were taken daily, and used with data provided by the Met Office to relate beetle abundance and activity to abiotic factors. Generally speaking, ground beetles are dependent on the humidity provided by vegetation.

### Ground beetles.

The survey identified 3 species that belong to the genus *Agonum*, and these formed part of the small carabids found in the meadow. Although all are similar in size, they are sufficiently distinct to be accurately identified. Both *A. fuliginosum* and *A. viduum* are blue-black so colouration is generally not a reliable guide. Species in this genus are associated with the margins of freshwaters and in marshes. However, *A. dorsale* is an exception and is yellow and green in colour. Furthermore this species is also not restricted to wet situations (Luff, 1998), and a single specimen was found in a drier and central area of the north meadow that would also receive more direct sunlight.

Five species of *Pterostichus* were identified. The generalist species *P. niger* was the most abundant and found at 12 sites. However, with the exception of a single specimen it appeared not to be present in the south meadow. Almost 50% of the total number came from the Seagull lane patch as did 44% of *P. madidus*, a thermophilic species that is associated with dry habitats. The wetland species *P. anthracinus* and *P. minor* were also found but in far fewer numbers. These species in particular have a very low resistance to desiccation. The latter of these species is a spring breeder producing summer larvae and over-winters as an adult because floods are less likely to affect it, than their larval stages. This may account for the few specimens recorded. *Pterostichus anthracinus* was only

recorded at 2 sites in the eastern margins. Two areas in the north meadow provided a shorter sward and finer grasses with Creeping Buttercup and Field Horsetail. These areas contained the highest numbers for *Harpalus rufipes* and *Poecilus cupreus* (figure 1). Previous studies by other researchers have showed that *P. cupreus* to be hygrophilic and heliophilic. That is, it requires moisture and is attracted by, and adapted for a high intensity of light. In fact 50% of the specimens trapped came from a site at the south end of the north meadow. This species was also the only carabid found in the extreme SE corner with Sea couch *Elytrigia atherica* as the dominant plant with some bare ground.

**Table 1**

The twenty carabid beetle species: ind. = total number of individuals caught, freq. = number of sites with occurrences, wetland = wetland species (Lott 2003).

Species		ind.	Freq.	Wetland
<i>Agonum dorsale</i>	(Pontoppidan)	1	1	
<i>Agonum fuliginosum</i>	(Panzer)	13	4	x
<i>Agonum viduum</i>	(Panzer)	1	1	x
<i>Amara lunicollis</i>	(Schioedte)	34	11	
<i>Badister bipustulatus</i>	(Fabricus)	3	3	
<i>Bembidion biguttatum</i>	(Fabricus)	7	4	x
<i>Bembidion guttula</i>	(Fabricus)	10	5	x
<i>Clivina fossor</i>	(Linnaeus)	2	2	
<i>Harpalus affinis</i>	(Shrank)	1	1	
<i>Harpalus rufipes</i>	(Degeer)	41	10	
<i>Leistus spinibarbis</i>	(Fabricus)	4	3	
<i>Loricera pilicornis</i>	(Fabricus)	2	2	x
<i>Notiophilus biguttatus</i>	(Fabricus)	2	2	
<i>Oxytelus obscurus</i>	(Herbst)	24	7	x
<i>Poecilus cupreus</i>	(Linnaeus)	104	12	
<i>Pterostichus anthracinus</i>	(Panzer)	4	2	x
<i>Pterostichus madidus</i>	(Fabricus)	48	9	
<i>Pterostichus minor</i>	(Gyllenhal)	12	8	x
<i>Pterostichus niger</i>	(Schaller)	207	12	
<i>Pterostichus vernalis</i>	(Panzer)	3	2	x

Ground temperatures in the Lumley wet area were significantly lower when compared with other areas. This was due to the dense growth of Field bindweed *Convolvulus arvensis*. *Amara lunicollis* was the most numerous of the carabids. This beetle has a somewhat “bullet” shape and is designed to push itself through dense grass. Of the species found, a significant proportion were wetland species such as *Oxypselaphus obscurus* and *P. anthracinus*. It was noticeable that the number of carabids trapped here and in the nearby sedge area was lower than in the middle of the central meadow. Numbers of carabids were again low in the coarse grasses on the western side.

Half of the carabid species were caught in very low numbers, i.e. 4 specimens or less. This may be because of specific reasons. For example *Clivina fossor* has adaptations for a life underground. The tarsal segments on the front pair of legs are broadened for digging. This enables exploitation of other food sources and explains why only 2 specimens were found.

#### Rove beetles.

*Tachinus signatus* was by far, the most frequently found rove beetle. This species accounted for 83% of all staphylinids recorded but was absent from the south-east corner. It was found frequently at most sites that had leaf litter and other detritus. This included an area of coarse grasses in the north meadow. However, it was especially abundant in nettle, *Urtica dioica* and leaf litter in the south meadow. In these particular areas the  $\alpha$ -diversity was low because other species recorded, existed in low numbers. However, the rove beetles make an important contribution to the total numbers of species in these areas. *Drusilla canaliculata* was frequently found in the Couch grass of the south-east corner. However, almost 40% were found in a patch of Yorkshire-fog in the central meadow but relatively few individuals were collected from most of the sites. The activity of these 2 species followed a similar profile throughout the season although *D. canaliculata* appeared much later and occurred in far fewer numbers.

The two areas in the north meadow with a shorter sward mentioned in the section on ground beetles produced an interesting result. Apart from one single specimen, all 48 specimens of the rove beetle *Platydracus erythropterus* were found in these areas. At each site, these beetles were caught surprisingly in only one of the traps! *Quedius levicollis* was evenly distributed at most sites but with few individuals at any one site. *Paederus riparius* was the most frequently trapped of the wetland species, and was found mainly in the marginal areas. Of the remaining 10 species identified relatively few specimens were found. For example, 11 specimens of *Tasgius globulifer* were trapped from 10 sites.

**Table 2**

The fifteen staphylinid beetle species: ind. = total number of individuals caught, freq. = number of sites with occurrences, wetland = wetland species (Lott 2003).

Species		ind.	Freq.	Wetland
<i>Anotylus sculpturatus</i>	(Gravenhorst)	5	3	
<i>Drusilla canaliculata</i>	(Fabricus)	120	10	
<i>Hygronoma dimidiata</i>	(Gravenhorst)	5	3	x
<i>Othius punctulatus</i>	(Goeze)	1	1	
<i>Paederus riparius</i>	(Linnaeus)	12	7	x
<i>Platydracus erythropterus</i>	(Linnaeus)	48	3	
<i>Platydracus stercorarius</i>	(Olivier)	9	5	
<i>Quedius levicollis</i>	(Brullé)	31	13	
<i>Quedius molochinus</i>	(Gravenhorst)	2	2	
<i>Rugilus rufipes</i>	(Germar)	1	1	
<i>Stenus providus</i>	(Erichson)	1	1	x
<i>Tachinus laticollis</i>	(Gravenhorst)	10	5	
<i>Tachinus signatus</i>	(Gravenhorst)	1254	15	
<i>Tachyporus tersus</i>	(Erichson)	1	1	
<i>Tasgius globulifer</i>	(Geoffroy)	11	10	

#### Other families.

*Silpha tristis* was the more abundant of 2 carrion beetles recorded (Table 3). Many larvae were found and identified as belonging to the Silphidae. These featured regularly in the traps but rarely found in the central north meadow and in nettles. Although they can be difficult to describe to species level, their distribution and abundance suggested that they are the larval stage of *S. tristis*. The larvae are strongly and widely sclerotized and conform to the Silphinae sub-family. In contrast the beetle *Nicrophorus vespillo* belongs to a different sub-family; the Nicrophorinae, in which larvae are sparsely sclerotized.

*Haltica lythri* (Crysolmelidae) is a small vivid blue flea beetle and covered with small pores. Only 4 specimens were caught in the north meadow. However, these were only revealed following cutting of the grass during the middle of August. The click beetle *Agriotes obscurus* was found in low numbers in the north and central meadows. However, almost 50% were caught in the area of low grasses in the north meadow (figure 1).

**Table 3**

Other Coleoptera: ind. = total number of individuals caught, freq. = number of sites with occurrences.

Species		ind.	Freq.
<i>Agriotes obscurus</i>	(Linnaeus)	21	8
<i>Anacaena globulus</i>	(Paykill)	11	3
<i>Choleva agilis</i>	(Illiger)	7	3
<i>Choleva oblonga</i>	(Latreille)	1	1
<i>Dryops ernesti</i>	(des Gozis)	3	1
<i>Haltica lythri</i>	(Aubé)	4	3
<i>Nicrophorus vespillo</i>	(Fabricus)	7	3
<i>Silpha tristis</i>	(Illiger)	98	12

Species belonging to the following families within the coleoptera included the following. Crysomelidae (flea beetles), Curculionidae (Weevils), Dryopidae (water beetles), Elateridae (click beetles), Hydrophilidae (water scavenger beetles), Leiodidae (round fungus), Silphidae (sexton beetles). Relatively few specimens of the first 6 families were found. Where they did occur they were specific to certain sites, e.g. the click beetle *Agriotes obscurus* in the north meadow and the water scavenger beetle *Anacaena globulus* in the Lumley wet area (see figure 1). Eight specimens of weevils (Table 4) were distributed over the site except for the extremes of the saline area and the nettle dominated patches in the south meadow.

**Table 4**

Curculionidae: ind. = total number of individuals caught, freq. = number of sites with occurrences.

Species		ind.	Freq.
<i>Liophloeus tessulatus</i>	(Müller)	2	2
<i>Liparus coronatus</i>	(Goeze)	1	1
<i>Rhinoncus gramineus</i>	(Fabricus)	5	4

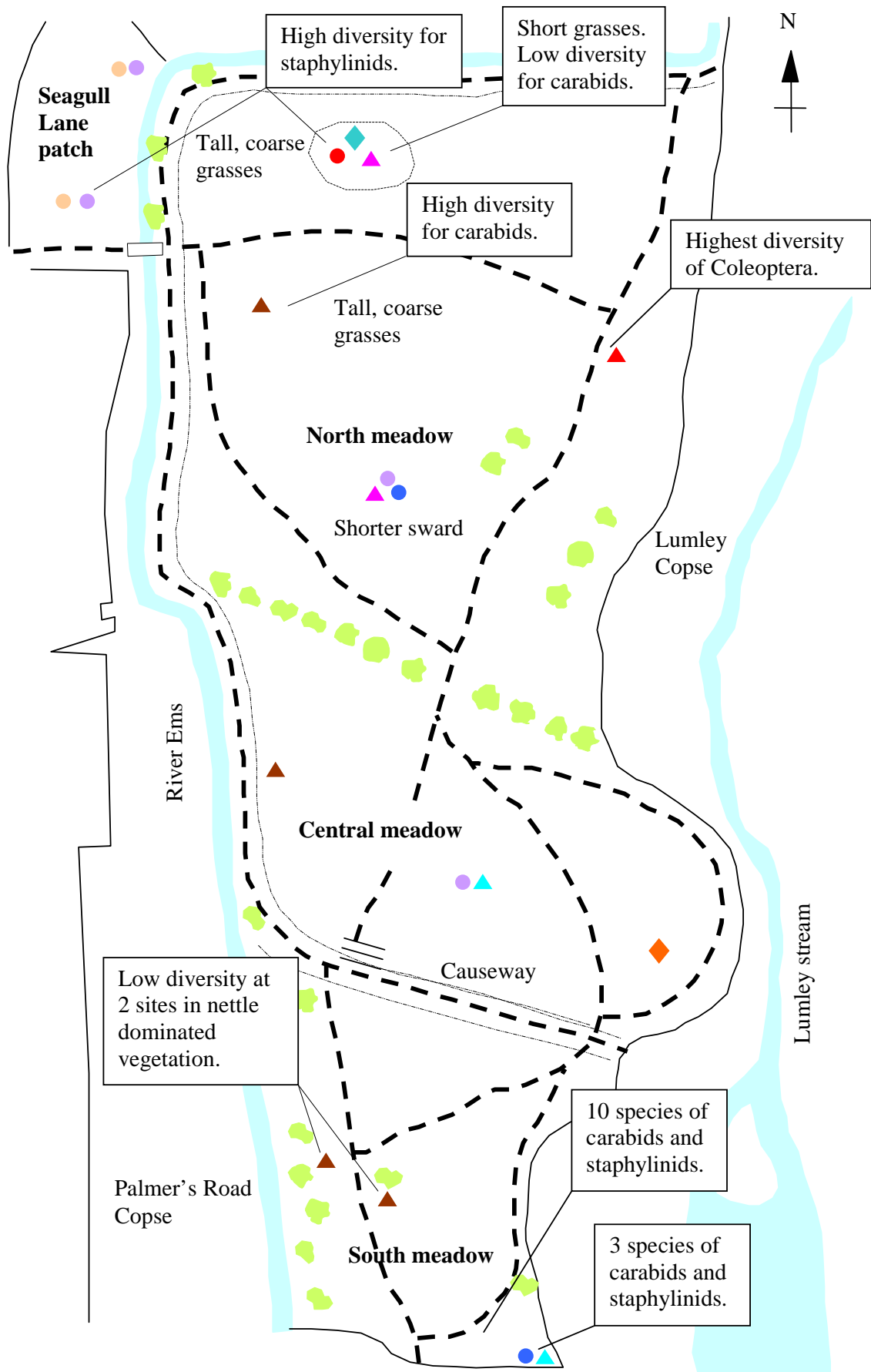


Figure 1. Diagram of Brook Meadow showing some notable results.

Key to figure 1.

Carabidae:	Staphylinidae:
● <i>Harpalus rufipes</i>	▲ <i>Platydracus erythropterus</i>
● <i>Poecilus cupreus.</i>	▲ <i>Drusilla canaliculata</i>
● <i>Pterostichus madidus</i>	▲ <i>Tachinus signatus</i>
● <i>Pterostichus niger</i>	▲ <i>Paederus riparius</i>
<hr/>	
Species representing other families:	
◆ <i>Anacaena globulus</i>	◆ <i>Agriotes obscurus</i>

Hemiptera.

Results also include a few hemiptera although the chosen method of pitfall trapping produced very low numbers because these insects are adapted for climbing. However, with the exception of a single specimen, the turtle bug *Podops inuncta* was site specific and preferred dry conditions with False Oat-grass *Arrhenatherum elatius*, present at the north end of the Seagull lane patch. Furthermore, these also came from the same trap.

**Table 3**

Hemiptera: ind. = total number of individuals caught, freq. = number of sites with occurrences.

Species		ind.	Freq.
<i>Aphrodes bicinctus</i>	(Schrank)	8	6
<i>Coreus marginatus</i>	(Linnaeus)	1	1
<i>Peritrechus geniculatus</i>	(Hahn)	1	1
<i>Podops inuncta</i>	(Fabricus)	5	2
<i>Nabis rugosus</i>	(Linnaeus)	1	1
<i>Notostira elongata</i>	(Geoffroy)	2	1

Summary.

Beetle activity was shown to positively correspond with the hours of sunlight and diminished abruptly with a drop in temperature. This was particularly noticeable during periods of torrential rain this summer. It was interesting to note that 9 species of the carabids found, and 3 species of the staphylinids are characterized as wetland species. Results indicated that an area of coarse grasses on the west side of the north meadow was shown to have the greatest diversity for carabids. However, the number of individuals for each species here was low, for both carabids and staphylinids with the exception of *Tachinus signatus*. Marginal areas also harboured more of the wetland species, which appeared to exist at low densities. This includes the south meadow although in areas of nettle, the diversity is poor. *Loricera pilicornis* and all 13 specimens of *Agonum*

*fuliginosum* were identified from the damp and cooler habitats towards the margins and the south meadow as opposed to the drier and hotter areas of the open meadow.

Previous research by others suggests that habitat age as well as structure is important. It is therefore important to retain uncut areas during the winter period. Areas should be cut in rotation., which could lead to the establishment of small areas, up to 3 to 4 years old. It was also noticeable that staphylinids appeared later during the study period. This fact further emphasized the need to consider the time of year and duration when sampling.

It should be remembered that it can difficult to compare species based on these results to determine their relative abundances. This is because of reasons as suggested and traps randomly placed in the different vegetation types. Small species in particular were caught in lower numbers. These beetles have what is known as a smaller displacement; that is they do not travel as far as larger beetles. Therefore, distance between traps may interfere or influence the species and the number of which, are caught. However, it is clear from the results that some species are dominant and may prefer specific habitats.

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#### References.

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