



# Studies of terrestrial invertebrate diversity in Irish peatlands

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## Summary

Many terrestrial invertebrate species are known to occur exclusively in peatlands but few studies have aimed specifically to compare their diversity across a range of peatland types. This study is designed to improve knowledge of the invertebrates found in Irish peatlands by comparing raised bog, mountain blanket bog, Atlantic lowland blanket bog and fens. Particular attention is paid to taxa which are known to have significant functional roles in these ecosystems, in particular mites (Acarina), beetles (Coleoptera) – especially Carabidae – and pot worms (Enchytraeidae). Preliminary results have shown significant differences between fens and the other three peatland types. The diversity of mites is high but the diversity is limited to a small number of species in relatively intact peatlands.

**Key index words:** peatlands, terrestrial fauna, carabidae, mites, spiders

## Introduction

Peatland is one of the most characteristic landscape features in Ireland. For example, it has 8% of the world's blanket bog. However, only about 18% of Irish peatlands are relatively intact (Douglas and Ryan 2006). There is therefore an urgent need to conserve peatlands and to assess the conservation value of these peatland habitats in relation to terrestrial invertebrates (Scott *et al.*, 2006). Conducting a detailed study of the invertebrates found on peatlands will give a better understanding of the role and functions of various fauna in a peatland ecosystem. This, in turn, will allow determination of the strategies needed to promote the conservation and preservation of the invertebrates on Irish peatlands. The invertebrates found in peatlands are extremely diverse and small in size and this has resulted in a relatively small number of published studies directed at their ecological relationships (Reynolds, 1990). It has been suggested that invertebrate monitoring on peatlands may provide information on energy flow and thus may be used to indicate impacts of hydrological changes and of atmospheric pollutants (Reynolds, 1990). A number of studies on the fauna of peatlands have been conducted in Europe as a whole and particularly in the U.K. (MacFayden, 1953; Latter, 1970; Latter and Howson 1978; Cragg, 1961), but there have been few studies of the fauna of peatland in Ireland apart from those of Higgins (1984), Good (1985), Blackith (1974), Bolger (1985) and Reynolds (1990). The research carried out in the current study will add to this body of work and help to identify any unique features of the Irish fauna. Data gathered will be used to assess the compositional and structural components of the terrestrial invertebrate assemblages of peatlands.

This study focuses on four peatland taxa, beetles (Coleoptera), in particular Carabidae, which are well known

taxonomically and ecologically and have been used successfully in both agricultural and forest ecosystems (Luff *et al.*, 1989). The second taxa to be studied are mites (Acarina) where the focus is on the oribatids. These play an important role in decomposition and have been recognised among the most diverse and least studied taxa. Enchytraeidae have a special role in decomposition and in the determining the rate of leaching of DOC (dissolved organic carbon) (Briones *et al.*, 1998a). They are present in many different types of habitats, they form a large percentage of the microfauna of tundra, moorland, peatland and moorlands (Dash and Cragg, 1972).

## Materials and methods

This study consists of two surveys, the first in 2006 and the second in 2007. The first examined Carabidae, Araneae and Acarina in 12 sites and the objective was to examine possible patterns among the different taxa. In 2007 an additional twelve sites were sampled to test for the effect that habitat disturbance has on carabid beetle assemblages.

### Study sites

In 2006 twelve sampling sites were selected. These included three representatives from each of four peatland categories; raised bog, fen, mountain blanket bog and Atlantic blanket bog. Within these areas sampling took place on disturbed/restored areas and pristine areas. These twelve sites were located across Ireland. These sites were all located in the Boora Bog Complex in Co. Offaly. The twelve additional sites were all on raised bogs but they varied in terms of the degree of disturbance and vegetation cover. These sites included pristine bog, newly exposed cutaway bog, young and old grassland, Sitka spruce and oak plantations and a failed tree plantation. In the latter study only carabids were sampled.



**Sampling methods**

Sampling was carried on the original twelve sites in April and August, 2007, to allow for possible seasonal variation. The carabid fauna was sampled by placing six pitfall traps at random at each site and in both the intact and restored areas where they were available. Each trap consisted of a plastic cup, 6cm diameter and 8cm deep, containing ethylene glycol. The traps were left open for between four and seven days. The mites were sampled using soil corer which was 18cm in diameter and 20cm in depth. The mites were then extracted from the soil cores using a Kempson Bowl extractor (Kempson *et al.*, 1963)

Pitfall trapping in 2007 took place in August and September using the aforementioned method to sample for carabid fauna. Six pitfall traps were placed at random within each of these sites. The trapping period was four weeks in August and four weeks in September.

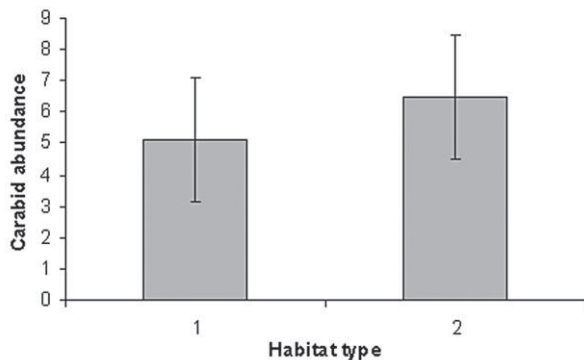
In order to make a preliminary assessment of the diversity of Enchytraeidae in peat and to determine whether they varied between peatland types, data from Healy (1976) have been used. These data were collected from 25 sites using cores which were extracted using the method designed by O'Connor (1955).

**Results**

**Pitfall sampling for carabids**

Seven species of carabids were trapped from the twelve sites during the first year: *Agonum assimile*, *Carabus clatratus*, *C. glabratus*, *C. granulatus*, *C. nitens*, *C. violaceus* and *Pterostichus melanarius*. There was little variation between sites in either the identity or the number of species captured. There was no significant difference between pristine or restored habitats in terms of the activity-abundance of carabids found ( $t = 1.339$ ,  $P > 0.05$ ) (Fig. 1). There were no significant differences between the seasons.

Preliminary results for the carabid assemblages found at the 12 additional sites in 2007 have already shown greater species diversity, with a total of sixteen carabids species being found so far (Table 1).



**Figure 1.** Carabid catches from intact (habitat 1) and restored areas of peatlands (habitat 2) in 2006

**Table 1.** Species list of the carabids found in pitfall sampling in 2007

Species Name	Species Name
<i>Abax parallelepipedus</i> (Piller and Mitterpacher)	<i>Leistus rifomarginatus</i> (Duftschmid)
<i>Calathus fuscipes</i> (Goeze)	<i>Notiophilus aquaticus</i> (L.)
<i>Calathus piceus</i> (L.)	<i>Pterostichus melanarius</i> (Illiger)
<i>Calathus micropterus</i> (Duftschmid)	<i>Pterostichus niger</i> (Schaller)
<i>Carabus clatratus</i> (L.)	<i>Pterostichus madidus</i> (Fabricius)
<i>Carabus granulatus</i> (L.)	<i>Pterostichus versicolor</i> (Sturm)
<i>Carabus nemoralis</i> (Müller)	<i>Synuchus vivalis</i> (Illiger)
<i>Cicindela campestris</i>	<i>Trechus quadristriatus</i> (Schränk)

**Mites**

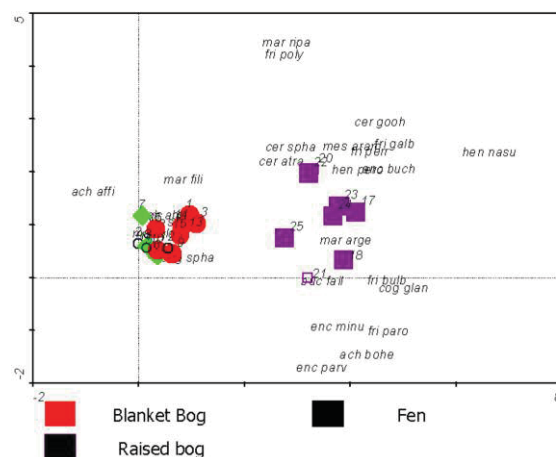
Thirty species of mite have been found. The majority of these are oribatid mites but there are also some Gamasida. One species *Limnozetes amnicus* (Behan-Pelletier) is a new record for Ireland.

**Enchytraeidae**

Healy (1976) found 28 species in peatlands. The assemblages found in fens were significantly different and more diverse, both within and between sites, than those found in blanket and raised peats (Fig. 2). The fauna of the raised and blanket peats was essentially the same in all sites with species such as *Cognettia sphagnetorum* and *Marionina clavata* occurring in virtually all sites but being absent from most of the fen sites.

**Discussion/conclusion**

The low diversity of carabids found in the first year was surprising because, based on results reported by Coll and Bolger (2007) for peatlands adjacent to forestry it was thought that the pitfall sampling would yield a much higher number of carabid species. The catches were mainly *Carabus* species. However, the peat habitats sampled by Coll and Bolger (2007) were disturbed and it was felt that this might have contributed to the diversity. The low diversity in peatlands was supported by comparing the number of species occurring in semi-intact or intact peatlands in Ireland. A study by Anderson *et al.* (2000) supported our results as they found only thirteen species in peatland habitats. In addition the number of species found in the habitat mosaic in the Boora Bog Complex, which included



**Figure 2.** Detrended Correspondence Analysis of enchytraeid assemblages in Irish peatlands. Data derived from Healy (1976).



both disturbed and intact sites, was larger with sixteen species identified to date.

The data on the taxa found within the peat (mites and enchytraeids) indicate great diversity of below-ground species. The individuality of the fen sites is reflected by the enchytraeids where the assemblages varied considerably between sites.

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