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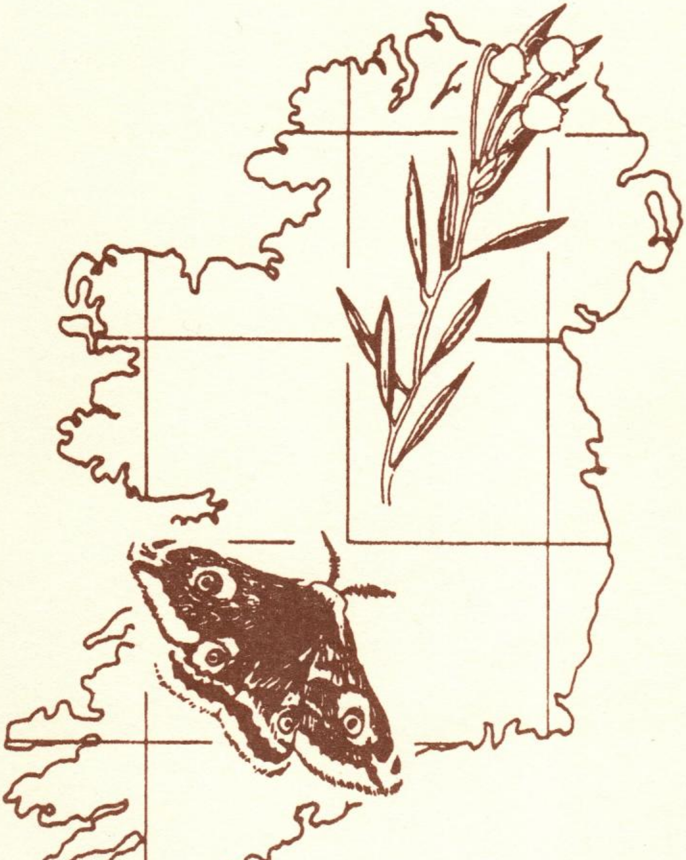

Bulletin No. 26

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THIS BULLETIN IS DEDICATED TO THE LATE PROFESSORS J. A. KITCHING AND F. J. EBLING IN RECOGNITION OF THEIR FAMOUS WORK ON THE FLORA AND FAUNA OF LOUGH HYNE.

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BULLETIN OF THE IRISH BIOGEOGRAPHICAL SOCIETY

Number 26

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EDITORIAL

This year's *Bulletin* is dedicated to the late Professors J. A. Kitching and F. J. Ebling in recognition of their remarkable and world-famous research on Lough Hyne, Co. Cork. One of our members, Mr J. M. C. Holmes, has continued the tradition of work at the lough and has published a number of papers on the crustacean fauna. It is appropriate therefore that this issue contains his seventh contribution in that series.

Bulletin Number 26 contains seventeen papers, dealing with a very diverse range of plant and animal groups and will be of considerable interest to our members. The Society is very grateful to all our contributors and the referees who have maintained a very high standard.

The Society also wishes to thank Dr Pat Wallace, Director of the National Museum of Ireland, for his support; our sponsors for their generous and essential financial assistance; Mr J. M. C. Holmes for his kindness and expertise in producing the camera-ready copy. The editor is very grateful to the members of the Committee for all their encouragement and friendship.

J. P. O'Connor
Editor
5 November 2002

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OCCASIONAL PUBLICATIONS OF THE IRISH BIOGEOGRAPHICAL SOCIETY

Number 1

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D. P. Sleeman, R. J. Devoy and P. C. Woodman (editors)

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M. J. Costello and K. S. Kelly (editors)

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Number 6

A catalogue of the Irish Chalcidoidea (Hymenoptera)

J. P. O'Connor, R. Nash and Z. Bouček

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Copies of these publications are available from the Irish Biogeographical Society, c/o Dr J. P. O'Connor, National Museum of Ireland, Kidare Street, Dublin 2, Ireland.

Bull. Ir. biogeog. Soc. No. 26 (2002)

CRUSTACEAN RECORDS FROM LOUGH HYNE (INE), CO. CORK, IRELAND: PART VII

J. M. C. Holmes
National Museum of Ireland, Kildare Street, Dublin 2, Ireland.

This is the seventh contribution in a series on the crustacean fauna of Lough Hyne (Ine) (W0928), the marine nature reserve in West Cork, and reports additions and amendments to earlier lists (Holmes, 1980, 1983, 1985, 1987, 1991, 1996). The advent of new keys and taxonomic revisions has meant that some of the names and identifications of species recorded from the lough have to be changed.

Lough Hyne has been intensively studied and written about in many papers, c.f. Kitching (1987), Costello and Holmes (1991), Greenwood *et al.* (2000). The semi-enclosed sea lough and its connection to the open sea through Barloge Creek has been mapped and described in detail. Many sites in the Nature Reserve were given place-names, notably by Prof. J. A. Kitching, and these names are to be found in many published papers, e.g. Ebling *et al.* (1962), Kitching (1987). The lough itself is divided into North and South Basins with Castle Island in the middle and the deep Western Trough along by the western side of the lough. There are submerged cliffs like Labra Cliff off the western tip of the island, and Whirlpool Cliff where the sea circles after rushing in through the Rapids. The southern shore of the lough borders the townland of Glannafeen, with named localities such as Glannafeen Quay, Scyllium Bay, Codium Bay and Renouf's Bay. Outside the lough, but still within the reserve, Barloge Creek extends to Bullock Island and Carrigathorna and the open sea.

Much of the new crustacean material for this paper comes from some light-trap samples taken in June 1997 in the deeper parts of the Western Trough. 1997 was a particularly rich year for collecting rarities. Some of the data on the species have already been published, but in a different series, and in a different format. New Irish Records are indicated by *. Voucher specimens have been deposited in the National Museum of Ireland (NMI).

CALANOIDA

Metridia lucens **Boeck, 1864**

Holmes (1983) recorded *M. longa* (Lubbock) from the lough. On re-examination, this somewhat battered ♀ should be referred to *M. lucens*. Otherwise, *Metridia* has not been seen.

Bradyidius armatus **Giesbrecht, 1897**

During 10-14 June 1997, numerous specimens of this species were taken in light-traps set in the deeper parts of the North Basin and the Western Trough, below 20m (Holmes, 2001). Curiously, no specimens were taken in traps set in similar sites in other years, before or since. This epibenthic species comes in two forms according to the structure of the fifth leg in the male - a typical form with a slender left leg and rudimentary right leg, and an inshore form, found in the upper reached of fjords (Sars, 1903, p. 163), with no trace of the right leg. This latter uniramous form of *Bradyidius* is the one which is to be found in the deeper parts of Lough Hyne.

HARPACTICOIDA

Danielssenia typica **Boeck, 1872**

Several specimens, Western Trough (W094284), light-trap, 40m, 14.vi.1997 (NMI).

******Zaus caruleus*** **Campbell, 1929**

1♀, Western Trough (W094284), light-trap, 40m, 14.vi.1997 (NMI).

This is principally an Arctic north-eastern Pacific species, but is recorded from the North coast of Norfolk and from Helgoland, in the southern North Sea area (Huys *et al.*, 1996). Further details of its distribution are given in an unpublished manuscript by Hamond *viz.*; East Canada, Hudson Bay, British Columbia, Alaska and Japan. It was described in Huys *et al.* (1996) as 'very rare in north-west Europe'. New to Ireland.

******Idyanthe*** **sp.**

1♂, Western Trough (W094284), light-trap, 40m, 14.vi.1997.

While the single male found has yet to be identified to species, the genus is new to Ireland.

Goniopsyllus **sp.**

Holmes (1980) recorded a single specimen of *Clytemnestra rostrata* (Brady), taken in a night-time plankton tow in Lough Hyne. Following a partial revision of the family Clytemnestridae

(Huys and Conroy-Dalton, 2000), it is clear that the specimen should belong to the genus *Goniopsyllus* and not *Clytemnestra*. It might indeed be *G. rostratus* Brady, 1883, which was originally described from off Argentina. Huys and Conroy-Dalton (2000) suggest that there may be several undescribed sibling species yet to be recognised. Pending further revision of the family, the specimen from Lough Hyne cannot now be identified beyond genus.

A similar *Goniopsyllus* specimen was taken in a plankton sample in Gascanane Sound (V9923), Sherkin Island, Co. Cork, on 6 July 1978.

******Tegastes flavidus* **G. O. Sars, 1904**

1♂, Whirlpool Cliff (W1000283), light-trap, 17.vii.1983; 1♀, Whirlpool Cliff (W1000283), 20m, coll. D. Minchin, 22.viii.1983; 1♂, North Basin (093285), light-trap, 20m, 11.vii.1983; 1♂, North Basin (W094287), light-trap, 20m, 23.vii.1983; 2♂♂ 3♀♀, North Basin (W095287), light-trap, 25m, 10.vi.1997, 1♀, North Basin (W095284), 25m, 14.vi.1997; 2♂♂, Western Trough (W094284), 40m, 14.vi.1997.

Following the new key by Huys *et al.* (1996), a single ♂ specimen recorded as '*Tegastes falcatus*' from Lough Hyne by Holmes (1985) should also be referred to *T. flavidus*. So too should records from Co. Dublin by O'Riordan (1966) and Holmes and O'Connor (1990). *T. falcatus* (Norman) is not now reliably known from Ireland, but *T. flavidus* is new to Ireland.

Amenophia peltata **Boeck, 1864**

1♂, Western Trough (W094284), light-trap, 40m, 14.vi.1997 (NMI).

Irish records listed by Holmes and O'Connor (1990) are from Counties Dublin and Kerry.

Dactylopusia neglecta **G. O. Sars, 1905**

Several specimens, Western Trough (W094284), light-trap, 40m, 14.vi.1997 (NMI).

The only other confirmed Irish records of this species are from Sherkin Island, Co. Cork (Holmes and O'Connor, 1990).

******Diarthrodes feldmanni*** **Bocquet, 1953**

1♂ 1♀, Curlew Bay (W095283), coll. K. Wilson, 19.ix.1981; 1♂, Whirlpool Cliff (W100283), coll. K. Wilson, 20.ix.1981; 2♂♂, South Basin (W099283), rock washing, 1m, 7.vii.1995 (NMI); 2♀♀, Western Trough (W094284), light-trap, 40m, 14.vi.1997 (NMI).

This species was described from Roscoff, Brittany, making mines in red algae (Bocquet, 1953). New to Ireland.

***Diarthrodes pygmaeus* (T. Scott and A. Scott, 1895)**

1♀, Glannafeen Quay (W097280), 1m, 15.viii.1988; 2♂♂ 4♀♀, Western Trough (W094284), light-trap, 40m, 14.vi.1997 (NMI); 1♂ 1♀, Whirlpool Cliff (W100283), weed and sponges, 21.vi.2001; 3♀♀, Curlew Bay (W095283), weed and rock, 1m, 27.vi.2002.

This species was recorded from Carrigathorna, near Lough Hyne, by Goss-Custard *et al.* (1979).

***Amphiascoides nanus* (G. O. Sars, 1906)**

1♂, Western Trough (W094284), light-trap, 40m, 14.vi.1997 (NMI).

This species is otherwise known in Ireland from Clontarf, Co. Dublin (O'Riordan, 1971).

***Filexilia attenuata* (I. C. Thompson, 1893)**

Holmes and O'Connor (1990) recorded *Ameira tenella* Sars from Barloge, with reservations about the relationship between *A. attenuata* Thompson and *A. tenella* Sars. Following a revision (Conroy-Dalton and Huys (1996), *A. tenella* is relegated to a synonym of the re-described *F. attenuata*.

***Esola bulbifera* (Norman, 1911)**

Following a revision of the genus *Esola* by Huys and Lee (2000), specimens recorded from Lough Hyne by Holmes and O'Connor (1990) under the name *E. longicauda* Edwards var. *bulbifera* Norman should now be called *E. bulbifera* (Norman). Some material from L. Hyne was examined and confirmed by Dr Huys.

***Laophonte thoracica* Boeck, 1864**

4♂♂ 1♀, Western Trough (W 094284), light-trap, 40m, 14.vi.1997 (NMI).

Previous Irish records, from Clew Bay, Co. Mayo and from Dalkey, Co. Dublin, were listed in Holmes and O'Connor (1990).

***Laophontopsis borealis* Huys and Willems, 1989**

Following a revision of the family Laophontopsidae (Huys and Willems, 1989), it is clear that *L. lamellifera* (Claus) recorded from L. Hyne by Holmes and O'Connor (1990) and by Holmes (1991) is incorrect. The material should be re-assigned to *L. borealis*, a species confined to the Atlantic coast of western Europe (Huys and Willems, 1989). While the specimens correspond to *L. lamellifera* sensu Sars (1908), it appears that *Cleta lamellifera* Claus, 1863 is a distinct species found in the Mediterranean. Probably, all *Laophontopsis* material from Ireland is

L. borealis.

CYCLOPIDA

Muceddina multispinosa Jaume and Boxshall, 1996

From time to time, specimens of this recently-described species turn up in small numbers in light-traps set in shallow water at Lough Hyne. Collecting details were listed in Holmes and Gotto (2000). It is otherwise known only from anchihaline caves in Sardinia, the Balearic Islands and the Canary Islands (Jaume and Boxshall, 1996). The morphology of the Lough Hyne material conforms closely to the description and key in Jaume and Boxshall (1996, 1997).

Agnathaner typica Canu, 1891

Specimens of this species turn up in light-traps in Lough Hyne. Collecting details were listed in Holmes and Gotto (2000).

Agnathaner Canu is a genus of male notodelphid copepods. These males are free-swimming and unmodified, and correspond to females which are relatively degenerate and ascidicolous. However, which male matches which female is uncertain in several cases, and the genus is retained provisionally. The Lough Hyne specimens have the banded arrangement of cuticular pores on the cephalon found in *Agnathaner typica* Canu, as re-described by Hipeau-Jacquotte (1980). They do not match *A. freemani* Hamond, 1968 (female unknown), or *A. minutus* Canu, 1891, which has been shown by Hipeau-Jacquotte (1980) to be an atypical male form of the notodelpyid *Pachypygus gibber* (Thorell).

Occasionally, a different form of *Agnathaner* is found in light-trap samples in Lough Hyne. These are similar to *A. typicus* in the orange colour and the arrangement of cuticular pores, but differ in the structure of the mouthparts and in the pattern of spinules on the abdomen. The mouthparts have some similarities to *A. freemani* but the general body shape and the caudal ramus is different. The specific identity of these latter forms is as yet unkown.

SIPHONOSTOMATIDA

Glannapontius maculatus J. M. C. Holmes, 1998

1♂, off Glannafeen Quay (W097280), light-trap, 4m, 4.viii.1985 (paratype 1 - NMI); 1♂, off Glannafeen Quay (W097280), light-trap, 2m, 22.viii.1985 (paratype 2 - NMI); 1♂, off Kitching

Laboratory, (W097280), light-trap, 5m, 172.vii.1986 (paratype 3 - NMI); 1♂, off Glannafeen Quay (W097280), light-trap, 2m, 25.vii.1988 (paratype 4 - Zoölogisch Museum, Amsterdam (ZMA 202057)); 1♀, South Basin (W099284), rock washing, 5m, 15.vii.1992 (paratype 5 - NMI); 4 juveniles, South Basin (W099284), rock washing, 5m, 15.vii.1992; 1♀, South Basin (W1000282), rock washing, 5m, 8.viii.1992 (paratype 6 - NMI); 1♀, South Basin (W1000282), rock washing, 5m, 11.vii.1993 (paratype 7 - NMI); 1♀, South Basin (W099283), rock washing, 2m, 12.vii.1993 (paratype 8 - Ulster Museum); 1♀, South Basin (W1000282), rock washing, 5m, 19.vii.1993 (paratype 9 - NMI); 1♂ 1♀, South Basin (W099283), rock washing, 2m, 7.vii.1995 (paratypes 10 and 11 - Natural History Museum, London); 1♀, South Basin (W099283), rock washing, 2m, 7.vii.1995 (paratype 12 - Smithsonian Institute, Washington); 2 juveniles, South Basin (W099283), rock washing, 2m, 7.vii.1995; 1♀, South Basin (W099283), rock washing, 4m, 12.vii.1995 (holotype - NMI); 1♂, South Basin (W099283), rock washing, 4m, 12.vii.1995 (allotype - NMI); 7 juveniles, South Basin (W099283), rock washing, 4m, 12.vii.1995; 1♀, South Basin (W099283), rock washing, 26.vi.1996 (paratype - 15 Amsterdam); 1 juvenile, South Basin (W099283), rock washing, 1.vii.1996; 1♀, South Basin (W099283), rock washing, 8.vii.1999; 3♀♀, South Basin (W095283), rock and weed, 1m, 22.vi.2002; 4♀♀, 8 juveniles, South Basin (W095283), rock and weed, 1m, 27.vi.2002.

All known specimens of this species have been found in the South Basin, Lough Hyne, before and since it was described (Holmes, 1998a). The collecting details were not published before.

***Sphaeronella longipes* Hansen, 1897**

1♀, Whirlpool Cliff (W100283), light-trap, 20m, with ♂ *Ampelisca diadema* (A. Costa), 22.viii.1983.

Otherwise known in Ireland from Galway Bay (Gotto and McGrath, 1980; Holmes, 1998b). It is a marsupium parasite of amphipods *Ampelisca* spp.

POECILOSTOMATIDA

***Lichomolgus marginatus* Thorell, 1859**

1♀, South Basin (W099283), from branchial cavity of ascidian *Ascidia mentula* Müller, 8.vii.1999 (NMI).

Otherwise known in Ireland from off Strangford Lough (Holmes and Gotto, 1992). It is an associate of large simple ascidians.

***Heteranthessius* sp.**

1♂, Bullock Island (W103273), Barloge, light-trap, 15m, 24.vii.2000.

Otherwise known in Ireland from two males taken in a light-trap at Knightstown, Valentia Island, Co. Kerry (Holmes and Gotto, 1992). The species in this genus exhibits marked sexual dimorphism. Until both sexes are found, it is not possibly to identify the material to species.

ISOPODA

***Aspidophryxus peltatus* G. O. Sars, 1898**

1♀, North Basin (W095287), light-trap, 25m, 10.vi.1997 (NMI); 2♂♂ 4♀♀, North Basin (W094287), light-trap, 10.vi.1997 (NMI); 1♂ 1♀, Western Trough (095284), light-trap, 14.vi.1997 (NMI).

These degenerate parasitic isopods are associated with mysids, particularly the genus *Erythrops* (Mauchline, 1980). In the above light-trap samples there were numerous specimens of the mysid *Erythrops elegans* (Sars), the probable host (de Grave and Holmes, 1998). In one instance, an isopod was found *in situ* on a specimen of *Erythrops elegans*. Presumably, it was the mysids which were attracted into the light-trap rather than the relatively immobile dajid isopod parasites.

AMPHIPODA

***Atylus guttatus* (A. Costa, 1851)**

1♂, Bullock Island (W103273), Barloge, light-trap, 15m, 24.vi.2000.

***Jassa herdmani* (A. O. Walker, 1893)**

Following the revision of the genus *Jassa* by Conlon (1989), it appears that the predominant species in the lough and particularly around the Rapids area (W100281) is *J. herdmani*, and not *J. falcata* (Montagu), as reported by many authors, e.g. Ebling *et al.* (1948), Sloane *et al.* (1957, 1961), Holmes (1980). However, *J. falcata* may well occur at the more exposed seaward end of Barloge. Within the lough, another species, *J. marmorata* S. J. Holmes, is to be found associated with buoys and boats (Holmes, 1983).

***Corophium crassicorne* Bruzelius, 1859**

2♂♂ 1♀, Bullock Island (W103273), Barloge, light-trap, 15m, 24.vii.2000 (NMI).

***Caprella fretensis* Stebbing, 1878**

5 specimens, Bullock Island (W103273), Barloge, light-trap, 15m, 24.vi.2000 (NMI).

Not found within the lough, but recorded from Carrigathorna by Norton *et al.* (1977) and by Costello and Myers (1991) from Carrigathorna and Bullock Island.

DECAPODA

***Philocheras trispinosus* (Hailstone, 1835)**

2 specimens, Bullock Island (W103273), Barloge, light-trap, 15m, 24.vi.2000 (NMI).

***Bathynectes longipes* (Risso, 1816)**

1 specimen, Labra Cliff (W095283), crevice, 12-15m, coll. I. Lawlor, 24.iii.1991.

Irish records of this scarce crab were summarised by Holmes *et al.* (1983).

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A PRELIMINARY SURVEY OF THE NON-BITING MIDGES (DIPTERA: CHIRONOMIDAE) OF NORTHERN IRELAND

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Key words: Chironomidae species inventory, northern Ireland.

Abstract

A total of 102 sites (44 lotic, 58 lentic) across northern Ireland were sampled for pupal exuviae of Chironomidae during the year 2000. Of the 253 taxa collected, 39 are new to Ireland, three of which, *Parakiefferiella scandica* Brundin, *Cryptochironomus defectus* (Kieffer) and *Polypedilum (Tripodura) aegyptium* Kieffer, are new to the British Isles. Seventeen species are new to Lough Neagh.

Introduction

Of the 588 species of Chironomidae recorded for the British Isles (Chandler, 1998), 396 were recorded for Ireland in Ashe *et al.* (1998). Apart from the work carried out at Lough Neagh (summarised by McLarnon and Carter, 2002), no systematic recording of Chironomidae had taken place in northern Ireland prior to the current research programme begun in 1998. During the year 2000 as many fresh- and brackish-water sites were sampled as time and resources permitted.

Methods

Chironomid pupal exuviae were skimmed from the surface of the water using the now standard techniques of Langton (1991). For stagnant water bodies, flotsam near the lee shore, and for running water, material accumulating in debris dams, partly submerged branches, floating rooted vegetation and in eddies are sources rich in pupal exuviae. In general a hand net with a telescopic handle sufficed, but for otherwise inaccessible rivers and streams a drift net was lowered from a bridge (mesh size 0.3 x 0.6mm). These techniques take little time and allow a number of sites to be sampled in a day's trip. On some trips adults were also swept from bankside vegetation and swarms.

The exuviae and adults were stored in 70% isopropanol until identified using the keys in Langton (1991) and Langton and Pinder (in press). Voucher specimens are mounted in Euparal and will be deposited in the Ulster Museum, Belfast.

Results

From the 102 sites investigated (Fig. 1; Table 1), over 100,000 specimens were collected. A total of 253 chironomid taxa were identified (Table 2), 237 to species, one to genus and the remaining 15 to coded taxa in Langton (1991) not so far associated with described adults. There are 17 species new to the Lough Neagh list (McLarnon and Carter, 2002), and a comparison with the lists in Ashe *et al.* (1998) and Chandler (1998) shows that there are 39 species new to the Irish list and three species new to the British Isles. One pupal taxon, *Psectrocladius* (s. str.) sp. A. Langton, first recorded for Scotland (Langton, 1991), is of a new species awaiting description, and there is evidence that another, *Corynoneura* Pe2a Langton, which is widespread in Europe, is also an undescribed species.

Observations

The published Irish list (Ashe *et al.* 1998) stood at 67% of the combined list for the British Isles (Chandler, 1998). There is little reason for such a large shortfall, so the detection of so many species new to Ireland in a single year's concerted collecting is not surprising. The 39 additional species recorded here raises the percentage of Irish species to about 74% of those now recorded for the British Isles. The species new to the British Isles, *Parakiefferiella scandica* Brundin, *Cryptochironomus defectus* (Kieffer) and *Polypedilum* (*Tripodura*) *aegyptium* Kieffer are known only from Ireland, but are widespread in continental Europe and would be expected to occur in Britain.

Table 2 suggests that some species have a western distribution (Donegal and Fermanagh): *Corynoneura lacustris* Edwards, *Paralauterborniella nigrohalteralis* (Malloch), *Polypedilum*

(Pentapedilum) nubens (Edwards), *Cricotopus* (s. str.) *pallidipes* Edwards and *Cricotopus* (s. str.) *polaris* Kieffer. However, this will have to be substantiated through further collecting, because the western collections may have coincided with the emergence periods of these species.

The site lists obtained already demonstrate an aquatic environment that is highly diverse. This project initiated a program that aims to clarify the biodiversity, habitat associations and biogeography of Irish Chironomidae.

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TABLE 1. Sites investigated during the survey of northern Ireland Chironomidae, 2000.

	Site name	grid reference	date
Lentic			
1	Lough Scalpachore	B730216	19.vii
2	Lough Altercan	B755158	19.vii
3	Lough Voriskey	B762176	19.vii
4	Lough Mullaghderg	B775199	19.vii
5	Dunglow Lough	B787117	19.vii
6	Lough Anure	B817166	19.vii
7	Lough Nacung Upper	B904191	19.vii
8	Dunlewy Lough	B926193	19.vii
9	Lough Melvin at Garrison	G938518	29.vi
10	Lough Beagh, Glenveagh National Park	C033223	19.vii
11	Lough Nadourcon	C054228	18.vii
12	Gartain Lough	C065173	18.vii
13	Lough Fern	C182247	2.vi
14	Impoundment by Lough Swilly	C306195	21.vi
15	Pond, Ballykelly Hospital	C623224	15.v
16	Artificial pool in stream, Roe Valley Country Park	C679201	9.vi 14.vii
17	Binevenagh Lake	C691305	18.v 16.ix
18	Fire Dam 1, Binevenagh Forest	C699304	18.v
19	Fire Dam 2, Binevenagh Forest	C704314	18.v
20	Pond, Lion's Gate, Downhill	C762357	22.vi
21	Downhill Lake, Bishops Gate	C762361	18.v
22	Balinrees Reservoir	C794300	9.vi
23	Lattone Lough	H003456	29.vi
24	Lough Macnean Upper	H042403	29.vi
25	Lough Macnean Lower	H085384	29.vi
26	Lower Lough Erne, Boa Island	H108626	29.vi
27	Lough Atona	H110294	29.vi
28	Upper Lough Erne at slipway	H357244	27.vi
29	Upper Lough Erne	H362242	27.vi
30	Lough Nolughage	H364243	27.vi
31	Kilturk Lough	H374255	27.vi
32	Channel connecting Kilturk and Derrymacrow Loughs	H375253	27.vi
33	Mill Lough (Killyfole Lough)	H464314	28.vi
34	Dummys Lough	H488276	28.vi
35	Summerhill Lough	H490280	28.vi

TABLE 1 (continued)

36	Kilroosky Lough	H494274	28.vi
37	Inver Lough	H518314	28.vi
38	Lough Neagh at Ballyronan	H948862	10.v 4.vii 13.x
39	Pond 1, Golf Course, Traad Point	H950873	10.v
40	Pond 2, Golf Course, Traad Point	H954873	10.v
41	Pond 3, Golf Course, Traad Point	H955874	10.v
42	Shallow pool by River Bush at Ballyhoe Bridge	D077292	2.vii
43	Lough at Nature Reserve, Rathlin Island	D095515	24.vii
44	Lughnanskan, Rathlin Island	D108524	24.vii
45	Long Pool, Rathlin Island	D148521	24.vii
46	Ally Lough, Rathlin Island	D154497	24.vii
47	Craigmacagan Lough, Rathlin Island	D154498	24.vii
48	Loughnachiule, Rathlin Island	D160521	24.vii
49	Pool close to East Lighthouse, Rathlin Island	D163521	24.vii
50	Pool to right of track to East Lighthouse, Rathlin Island	D164520	24.vii
51	Fire Dam on Black Hill	D121297	2.vii
52	Dungonnell Dam	D193170	20.vi
53	Pond, Carnfunnock Country Park	D379069	20.vi
54	Lough Neagh at Christchurch Point	J056852	13.x
55	Hillsborough Park Lake	J246583	22.v
56	Lough Henney	J348586	22.vi
57	Bow Lough	J354577	22.vi
58	Drain into Lough Swilly*	C311197	21.vi
Lotic			
59	Gweedore River (outflow of Lough Anure)	B827184	19.vii
60	Devlin River	B927190	19.vii
61	Glen River at Garrison	G943522	29.vi
62	Owennacally (stream)	C043226	19.vii
63	Owencarrow River	C043235	18.vii
64	Glashagh River	C096153	18.vii
65	River Swilly	C125092	18.vii
66	Deele River	C136028	19.vii
67	Burn-fed garden pool, Ranny House, Kerrykeel	C208322	2.vi
68	Ballykelly River	C623211	9.vi
69	Tributary of Ballykelly River at Sistrakeel Bridge	C628209	9.vi
70	Owenbeg River, Feeney Picnic Area	C645058	26.vi

TABLE 1 (continued)

71	Bessbrook River	C655212	9.vi
72	River Roe	C681202	14.vii
73	River Roe, Deerpark Wood	C682203	9.vi
74	Curly River at Artikelly Bridge	C684247	9.vi
75	Castle River at Ardmore Bridge	C706207	9.vi
76	Burn at Largantea Picnic Area	C738287	9.vi
77	Stream at Downhill beach	C754326	9.vi
78	Concrete aerator, inflow of Balinrees Reservoir	C793304	9.vi
79	Macosquin River at Black Bridge	C854256	26.v
80	Aghadowey River at Ballybritain Bridge	C859212	26.v
81	Agivey River at Glascort Bridge	C907226	16.vii
82	River Bush at Seneirl Bridge	C943362	16.vii
83	River Bush at Conogher Bridge	C963305	10.ix
84	Stuh Croppa River	H111329	29.vi
85	Belbarrinagh River	H112309	29.vi
86	Hollybrook River	H373310	27.vi
87	stream	H384306	27.vi
88	Burn Dennet at Essbeg Bridge	H509978	26.vi
89	River Finn at Lisnanesnagh Bridge	H544337	28.vi
90	Ballinderry River at Ballinderry Bridge	H928798	10.v
91	River Moyola at New Bridge	H955905	4.vii 13.x
92	River Bann near Lough Beg	H990983	13.x
93	River Bush at Stranocum	D009307	2.vii
94	River Bush at Ballyhoe Bridge	D077292	2.vii
95	Clogh River	D105109	2.vii
96	Glenravel Water	D147154	2.vii
97	Brymore Water at Brymore Bridge	D162275	2.vii
98	Glendun River	D193308	2.vii
99	Inver River/Glenariff River	D215205	2.vii
100	River main at Randalstown	J084904	13.x
101	Kells River at Shank Bridge	J126982	20.vi
102	Ravernet River	J324587	22.vi

*Site 58 is mostly stagnant with very slow through flow.

TABLE 2. Taxa encountered in the chironomid survey of northern Ireland, 2000.

	Lentic sites	Lotic sites
Tanypodinae		
Ablabesmyia longistyla Fittkau	2 3 5 8 11 12 23 24 36 39 50 59	60 63 73 91
Ablabesmyia monilis (Linnaeus)	2 3 5 6 7 8 10 11 17 25 35 36 39 46 49 52	60 81
Ablabesmyia phatta (Egger)	2 3	
Arctopelopia barbitarsis (Zetterstedt)	38	
Arctopelopia griseipennis (van der Wulp)	47 50	
Clinotanypus nervosus (Meigen)	28 37 47	87
Conchapelopia melanops (Meigen)	9 11 25 59	62 71 72 83 94 95 96
Conchapelopia pallidula (Meigen)		65 70 71 72 73 75 76 77 79 88 93 94 98 99
Conchapelopia viator (Kieffer)		60 62 63 101
Larsia atrocincta (Goetghebuer)	12	
Macropelopia adaucta Kieffer	3 8 11 27	
Macropelopia nebulosa (Meigen)	8 9 16 17 18 20 22 26 42	61 71 72 75 77 82 83 86 87 89 91 92 93 94 96
Nilotanypus dubius (Meigen)		60 63 64 65 66 97
Paramerina cingulata (Stephens)	2 10 27 45 48	61 62 64 66 99
Procladius (Holotanypus) choreus (Meigen)	3 8 11 12 16 18 20 22 31 35 45 49 58	87
Procladius (Holotanypus) sagittalis (Kieffer)	1 3 9 12 17 18 23 26 29 33 37 39 43 46 47 48 57	
Procladius (Holotanypus) signatus (Zetterstedt)	9 56	
Procladius (Holotanypus) Pe1	4 5 7 8 9 10 12 24 25 38 52 56 57	
Procladius (Psilotanypus) rufovittatus (van der Wulp)	22 29 56	
Psectrotanypus varius (Fabricius)	16 40 58	
Rheopelopia maculipennis (Zetterstedt)		60 61 63 91 101
Rheopelopia ornata (Meigen)		91
Tanypus vilipennis (Kieffer) *	35 36 37	
Thienemannimyia laeta (Meigen)/*lentiginosa* (Fries)		72 75 79 82 91 93 94 95 96
Thienemannimyia northumbrica (Edwards) +	38	
Thienemannimyia pseudocarnea Murray	4 12 24 25 26	
Trissopelopia longimana (Staeger)	19	65 66 76 85 88 99
Zavrelimyia barbatipes (Kieffer)	7 11 19	60 85
Zavrelimyia melanura (Meigen)	50	
Diamesinae		
Diamesa tonsa (Haliday)	22	68 69 70 71 73 74 75 76 79 81 88
Potthastia gaedii (Meigen)	9 26 38 54 59	60 62 63 65 76 84 88 97 101
Potthastia longimana (Kieffer)	7 9 23 38 54	72 73 91 97 98 99 101

TABLE 2 (continued)

Prodiamesinae		
Monodiamesa ekmani (Brundin)	9 38	
Prodiamesa olivacea (Meigen)	16 18 19 21	65 72 82 83 86 91
Orthocladiinae		
Acricotopus lucens (Zetterstedt)	16 51 53	
Brillia bifida (Kieffer)	7 16	60 61 62 65 66 68 69 70 71 73 75 77 79 80 81 83 89 91 94 98 99 101
Brillia flavifrons (Johannsen)		72 73
Bryophaenocladius subvernalis (Edwards)		74
Cardiocladius capucinus (Zetterstedt)		99
Cardiocladius fuscus Kieffer +	54	
Chaetocladius melaleucus (Meigen) *		84 85
Corynoneura arctica Kieffer *	3	
Corynoneura carriana Edwards	24	61
Corynoneura celtica Edwards		68 78 84
Corynoneura gratias Schlee *		61 64 66 72 82 83 94
Corynoneura lacustris Edwards	2 4 5 24 27	60
Corynoneura lobata Edwards		78 90
Corynoneura scutellata Winnertz	23	
Corynoneura Pe2a (?sp.nov.)		60 65
Corynoneurella paludosa Brundin *		60
Cricotopus (s. str.) *albiforceps* (Kieffer)		60 63 97
Cricotopus (s. str.) *annulator* Goetghebuer	8 9 24 25 38 42	60 61 62 63 66 70 71 72 73 74 75 80 83 86 88 90 93 94 96 97 98 101
Cricotopus (s. str.) *bicinctus* (Meigen) +	7 29 38 54 59	60 61 62 64 65 66 70 72 74 75 77 79 80 81 82 83 84 86 88 90 91 93 94 95 96 97 99
Cricotopus (s. str.) *curtus* Hirvenoja	7 8 18 22	61 64 65 66 70 71 72 73 76 77 78 83 84 86 88 89 90 93 97 99
Cricotopus (s. str.) *festivellus* (Kieffer)	2 4 47 50	101
Cricotopus (s. str.) *flavocinctus* (Kieffer) *	1 4	
Cricotopus (s. str.) *pallidipes* Edwards		60 62 63
Cricotopus (s. str.) *pilosellus* Brundin *	23 28 30 43 45	
Cricotopus (s. str.) *polaris* Kieffer *	2 4 5 13 23 24	
Cricotopus (s. str.) *pulchripes* Verrall		60 84 97 98
Cricotopus (s. str.) *similis* Goetghebuer	7 11	60 63 88 94
Cricotopus (s. str.) *tremulus* (Linnaeus)		60 63 64 66 70 72 73 74 75 80 88 90 91 93 94 95 96 97 98 101
Cricotopus (s. str.) *triannulatus* (Macquart)		65 83 91
Cricotopus (s. str.) *trifascia* Edwards +	38 54	61 72 75 79 80 83 91 93 94 95 100 101
Cricotopus (*Isocladius*) *intersectus* (Staeger)	1 6 31 37 43 44 56 57	

TABLE 2 (continued)

Cricotopus (*Isocladius*) *reversus* Hirvenoja	5 28	
Cricotopus (*Isocladius*) *sylvestris* (Fabricius) +	9 16 22 25 26 28 29 33 38 40 53 55 56 57	92
Cricotopus (*Isocladius*) *tricinctus* (Meigen)	43	
Cricotopus (*Isocladius*) *trifasciatus* (Meigen)	4	82 83
Eukiefferiella ancyla Svensson		61
Eukiefferiella brevicalcar (Kieffer)		68 77 79
Eukiefferiella claripennis (Lundbeck)		67 71 76 77 79 85 90 94 101 102
Eukiefferiella clypeata (Kieffer)		61 64 65 70 72 73 75 83 90 93 94 95 96 98 99
Eukiefferiella coerulescens (Kieffer)		88 98 99
Eukiefferiella devonica (Edwards)		84 85 97 99 101
Eukiefferiella dittmari Lehmann	4	64 76 91
Eukiefferiella ilkleyensis (Edwards)	4	72 73 75 77 79 80 90 91 93 95 101
Eukiefferiella minor (Edwards)/*fittkaui* Lehmann	7 8	76 84 85 97 98 99
Halocladius (s. str.) *variabilis* (Staeger)	14 58	
Heleniella ornaticollis (Edwards)		68
Heterotrissocladius marcidus (Walker)	12 17 18 19	
Krenosmittia camptophleps (Edwards)		84 90
Limnophyes pentaplastus (Kieffer)		67
Metriocnemus eurynotus (Holmgren)	38	74 76 77
Nanocladius balticus (Palmen)	5 11 52	61 64
Nanocladius bicolor (Zetterstedt)	2 38	87
Nanocladius rectinervis (Kieffer)	7 59	61 63 65 70 72 75 79 82 83 86 90 91 93 95 96 100 101 102
Orthocladius (*Eudactylocladius*) *fuscimanus* (Kieffer) +	18 24 38 54	88 99
Orthocladius (*Euorthocladius*) *ashei* Soponis	52	73 75 80 91 94 95 98 101
Orthocladius (*Euorthocladius*) *rivicola* Kieffer		68 71 94 101
Orthocladius (*Euorthocladius*) *thienemanni* Kieffer		69 80 90
Orthocladius (s. str.) *dentifer* Brundin	18	
Orthocladius (s. str.) *frigidus* (Zetterstedt)	22	69 76 77 80
Orthocladius (s. str.) *oblidens* (Walker) +	9 26 38 54	79
Orthocladius (s. str.) *pedestris* Kieffer	9 22 34	71 73 74 77 79 80 81 90
Orthocladius (s. str.) *rivinus* Kieffer		83
Orthocladius (s. str.) *rubicundus* (Meigen) +	9 18 22 38	60 63 66 71 72 73 74 75 76 77 79 80 81 83 84 86 88 89 90 91 93 94 95 97 98 99 100 101
Orthocladius (s. str.) *ruffoi* Rossaro & Prato *		64 72 83 99
Orthocladius (*Pogonocladius*) *consobrinus* (Holmgren)	4 23 26 57	
Parakiefferiella bathophila (Kieffer)	2 3 4 5 8 23 24 50 52	
Parakiefferiella scandica Brundin #		90

TABLE 2 (continued)

Parakiefferiella smolandica (Brundin) *	10	
Parametriocnemus stylatus (Kieffer)	18	66 72 76 78 81 82 90 91 98 101
Paratrichocladius rufiventris (Meigen)	9 16 24 26 38 54	60 61 71 75 76 79 80 81 86 88 89 90 101
Paratrichocladius skirwithensis (Edwards)		61 68 69 70 71 72 73 74 75 80 84 88 93 94 95 96 97 98 99 100
Psectrocladius (*Allopsectrocladius*) *obvius* (Walker)	34 35 45	87
Psectrocladius (*Allopsectrocladius*) *platypus* (Edwards)	11	
Psectrocladius (*Mesopsectrocladius*) *barbatipes* Kieffer	1 3 11 49	
Psectrocladius (s. str.) *fennicus* Storå	4 5 7 10 12	
Psectrocladius (s. str.) *limbatellus* (Holmgren)	3 6 15 45	
Psectrocladius (s. str.) *oligosetus* Wülker	1 11	
Psectrocladius (s. str.) *oxyura* Langton *	3 5 7 8 17 27	
Psectrocladius (s. str.) *psilopterus* (Kieffer)	2 3 7 8 11 12 23 24 26 27 52 59	60 63
Psectrocladius (s. str.) *sordidellus* (Zetterstedt)	21 25 28 30 43 53	87
Psectrocladius (s. str.) sp.A Langton (nov.)	52	
Pseudorthocladius curtistylus (Goetghebuer)	50	
Pseudosmittia sp.		79
Rheocricotopus (*Psilocricotopus*) *chalybeatus* (Edwards)		72 74 101
Rheocricotopus (s. str.) *effusus* (Walker) *	18	71 76 90
Rheocricotopus (s. str.) *fuscipes* (Kieffer)	16 18	64 66 67 68 69 70 71 72 74 75 76 77 79 80 81 83 84 85 86 88 89 90 94 96 97 98 99 101
Synorthocladius semivirens (Kieffer)	2 4 7 8 9 10 12 18 22 23 24 25 26 29 38 42 54 59	60 61 63 64 65 66 68 72 74 75 77 78 79 80 82 83 86 89 91 93 94 95 97 98 101 102
Thienemanniella acuticornis (Kieffer)		61
Thienemanniella vittata (Edwards)		61 64 66 78
Thienemanniella Pe2a	7	60 62 68 76 82 84 90 91 99
Thienemanniella Pe2b		61 76 78 79 83 85 86 90 99 100
Tvetenia bavarica (Goetghebuer)		71 76 99
Tvetenia calvescens (Edwards) +	18 54 59	61 62 63 64 66 69 70 72 74 75 76 77 78 79 80 81 82 83 84 86 88 89 90 91 93 94 95 96 97 98 99 100 101 102
Tvetenia discoloripes (Goetghebuer)		61 66 72 74 75 77 79 80 83 86 89 102
Tvetenia verralli (Edwards)		60 61 62 63 64 65 75 77 81 84 88 91 97 98
Chironominae		
Chironomus (*Camptochironomus*) *tentans* Fabricius	1 36 37 47	
Chironomus (s. str.) *annularius* auctt.		91
Chironomus (s. str.) *anthracinus* Zetterstedt	8 34 35 59	
Chironomus (s. str.) *bernensis* Klötzli *	16 58	72 82 90 91 100
Chironomus (s. str.) *cingulatus* Meigen	16 36 39 41	
Chironomus (s. str.) *commutatus* Keyl	17	
Chironomus (s. str.) *dorsalis* auctt.	50	

TABLE 2 (continued)

Chironomus (s. str.) *longistylus* Goetghebuer	16 34 35 36 43	
Chironomus (s. str.) *luridus* Strenzke *	36 41 58	64 91
Chironomus (s. str.) *nuditarsis* Keyl *	21 36 58	
Chironomus (s. str.) *nudiventris* Ryser, Scholl & Wülker *	4 21 22 28 29 38 39	81
Chironomus (s. str.) *obtusidens* Goetghebuer *	53	64
Chironomus (s. str.) *piger* Strenzke *	16 58	70 71 72 73 91
Chironomus (s. str.) *plumosus* (Linnaeus)	22 23 25 28 29 31 33 39 44 46 57	
Chironomus (s. str.) *pseudothummi* Strenzke	49	
Chironomus (s. str.) *salinarius* Kieffer	14 58	
Chironomus (*Lobochironomus*) *dissidens* Walker *	24	
Cladopelma krusemani (Goetghebuer)	49 50	
Cladopelma viridulum (Linnaeus)	2 5 6 22 35 39 44 59	
Cryptochironomus defectus (Kieffer) + #	25 29 34 38 52	
Cryptochironomus denticulatus (Goetghebuer) *		73
Cryptochironomus obreptans (Walker) *	1 22 25 43 52 57	
Cryptochironomus psittacinus (Meigen)	4 25 55	
Cryptochironomus supplicans (Meigen)	22 24 26 28 29 31 33 41 48	
Demicryptochironomus (s. str.) *vulneratus* (Zetterstedt)	4 10 12 23 52 59	60 70 98 101
Dicrotendipes nervosus (Staeger)	10 13 26 38 39 46 50 59	
Dicrotendipes objectans (Walker)	2 3 39	
Dicrotendipes tritomus (Kieffer)	5 12 59	
Endochironomus albipennis (Meigen)	1 4 21 22 23 25 26 28 29 30 31 33 34 35 38 41 43 56 57	
Endochironomus tendens (Fabricius)	4 40 45 48 50 56	
Glyptotendipes (*Caulochironomus*) *foliicola* Kieffer *	25 28 29 30 34 37	
Glyptotendipes (s. str.) *barbipes* (Staeger)	30 34	
Glyptotendipes (s. str.) *glaucus* (Meigen) + *	24 25 28 29 30 33 37 38 55	
Glyptotendipes (s. str.) *gripekoveni* (Kieffer)	1 21 25 35 39 40 41 43 47 50	
Glyptotendipes (s. str.) *pallens* (Meigen)	28 31 37 38 39 40 41 57	87 89
Glyptotendipes (s. str.) *paripes* (Edwards)	17 19 21 22 25 27 28 29 38 39 40 41 43 46 47 51 56	76 79 92
Harnischia curtilamellata (Malloch) *	12 25 29	
Kiefferulus tendipediformis (Goetghebuer)	32 41	
Lauterborniella agrayloides (Kieffer)	3 11	
Microchironomus tener (Kieffer) *	25	
Microtendipes britteni (Edwards) + *	38	
Microtendipes chloris (Meigen)	39	
Microtendipes rydalensis (Edwards)	59	90

TABLE 2 (continued)

Microtendipes Pe1	1 2 3 4 5 7 8 11 12 13 17 18 24 25 26 28 29 31 33 34 35 36 43 45 46 47 49 50 56 57 59	64 65 72 82 87 90 91
Nilothauma brayi (Goetghebuer)	12	
Pagastiella orophila (Edwards)	4 5 7 8 23 52 59	99
Parachironomus arcuatus (Goetghebuer)	21 25 34 35 36 37 38	
Parachironomus biannulatus (Staeger)	4 23 39	
Parachironomus frequens (Johannsen)	13 29	
Parachironomus mauricii (Kruseman) *	4	
Parachironomus monochromus (van der Wulp)	2	
Parachironomus tenuicaudatus (Malloch)	5 35 36	
Parachironomus vitiosus (Goetghebuer) + *	38 52	
Parachironomus Pe2	4 25	
Paracladopelma camptolabis (Kieffer)		82
Paracladopelma laminatum (Kieffer)	8 23 38	
Paracladopelma nigritulum (Goetghebuer)	36	
Paralauterborniella nigrohalteralis (Malloch)	24 25	
Paratendipes albimanus (Meigen)	9 25 26	64 76 80 82 91 93
Phaenopsectra Pe1	2 3 8 24 31 35 36 48 50 52 59	95
Polypedilum (*Pentapedilum*) *nubens* (Edwards)	23 24 25 26	
Polypedilum (*Pentapedilum*) *sordens* (van der Wulp)	3 4 17 24 28 29 30 35 37 39 48 51	90
Polypedilum (*Pentapedilum*) *tritum* (Walker)/ *uncinatum* (Goetghebuer)	43 45 47 49 50	
Polypedilum (s. str.) *albicorne* (Meigen)		60 61 62 65 66 68 69 70 72 81 83 88 90 98 99
Polypedilum (s. str.) *arundineti* (Goetghebuer)	50	
Polypedilum (s. str.) *laetum* (Meigen)	7	79 90 91
Polypedilum (s. str.) *nubeculosum* (Meigen)	3 16 21 25 28 34 35 36 58	
Polypedilum (s. str.) *pedestre* (Meigen)		61 77 79 86 90 94 99
Polypedilum (*Tripodura*) *aegyptium* Kieffer #	9	
Polypedilum (*Tripodura*) *bicrenatum* Kieffer	23 25 46 56	
Polypedilum (*Tripodura*) *pullum* (Zetterstedt)	1 2 6 8 12 17 18 27 29 52 59	96
Polypedilum (*Tripodura*) *scalaenum* (Schrank)/*quadriguttatum* Kieffer		76
Polypedilum (*Uresipedilum*) *convictum* (Walker)		66 72 73 75 78 79 80 82 83 90 91 93 95 98 99
Stictochironomus maculipennis (Meigen)	22 38	
Stictochironomus pictulus (Meigen)	38	72 79 90
Stictochironomus sticticus (Fabricius)	38	
Tribelos intextus (Walker) *	33 39 51	
Xenochironomus xenolabis (Kieffer)	12 59	73 91 101
Pseudochironomus prasinatus (Staeger)	3 4 5 8 23 24 25 26 46	
Cladotanytarsus atridorsum Kieffer	4 21 23 25 26 38 43 56	102

TABLE 2 (continued)

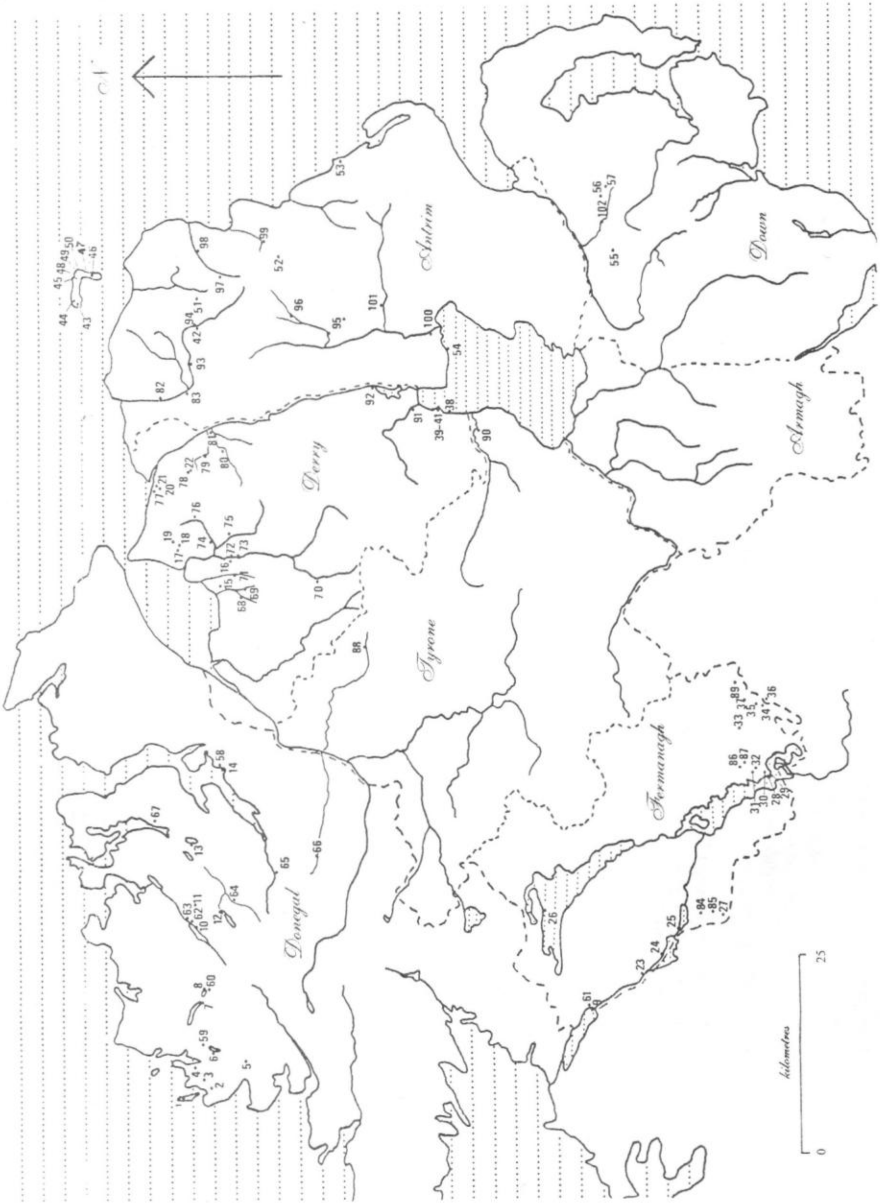
Cladotanytarsus mancus (Walker) +	8 23 25 26 35 38 39	
Cladotanytarsus nigrovittatus (Goetghebuer)	23 24 50	
Cladotanytarsus pallidus Kieffer + *	5 7 8 16 21 35 38	
Cladotanytarsus vanderwulpi (Edwards)	12	61 64 65 66 72 82 91
Micropsectra atrofasciata (Kieffer) +	16 21 54 59	60 62 66 67 69 70 71 73 74 75 76 77 79 80 82 85 86 93 94 96 98 99 101 102
Micropsectra bidentata (Goetghebuer)	9 19	60 61 64 65 66 70 71 75 84 85 88 94 96 97 98
Micropsectra contracta Reiss/*apposita* (Walker)	22	82 83 89 98
Micropsectra fusca (Meigen)	17 27	60 61
Micropsectra junci (Meigen)	27	64 65
Micropsectra lindrothi Goetghebuer	16 42	61 64 65 69 70 72 80 82 86 88
Micropsectra notescens (Walker)	16 18	61 64 66 77 81 82 86
Paratanytarsus austriacus (Kieffer)	16	64
Paratanytarsus dissimilis (Johannsen)	34 59	64 72 83 95 99 101
Paratanytarsus inopertus (Walker)	39	82 91
Paratanytarsus laccophilus (Edwards)	2 11	
Paratanytarsus laetipes (Zetterstedt) *	34 35	
Paratanytarsus lauterborni (Kieffer) *	43	
Paratanytarsus tenellulus (Goetghebuer) *	56	
Paratanytarsus tenuis (Meigen)	10	
Rheotanytarsus curtistylus (Goetghebuer)		60
Rheotanytarsus pellucidus (Walker) (=*Rh. distinctissimus* Brundin)		61 62 64 65 66
Rheotanytarsus pentapoda (Kieffer)	59	60 62 64 65 72 88 90 91 93 95 98
Rheotanytarsus photophilus (Goetghebuer)		90
Rheotanytarsus rhenanus Klink		61
Stempellina bausei (Kieffer)	8 24 25	97
Stempellinella brevis (Edwards)	4 7 10 59	60 63
Stempellinella minor (Edwards) *	4 24 25	
Tanytarsus bathophilus Kieffer	38	
Tanytarsus brundini Lindeberg	8 10 24 26 29 38 42 54	60 61 64 65 66 72 82 83 91 93 94 95 96 98 99 101
Tanytarsus curticornis Kieffer	7 12	
Tanytarsus debilis (Meigen)	56	
Tanytarsus ejuncidus (Walker) *	7 14 35	82 83 90
Tanytarsus eminulus (Walker)	18 24	61 63 64 66 72 80 82 83 86 89 90 91 96 101
Tanytarsus gregarius Kieffer	2 5 8 25 49 50 59	
Tanytarsus heusdensis Goetghebuer		61
Tanytarsus mendax Kieffer *	35 36 43 57	
Tanytarsus pallidicornis (Stephens)	16 58	72 80 83 96
Tanytarsus palmeni Lindeberg + *	5 21 22 23 24 25 38 52	

TABLE 2 (continued)

Tanytarsus signatus (van der Wulp)	2 7 10	
Tanytarsus Pe9	3 4 6 7 10 27 38 43 50 52	84 85
Tanytarsus striatulus Lindeberg	2 3	
Tanytarsus usmaensis Pagast	4 46	89
Tanytarsus verralli Goetghebuer	5 22 59	
Virgatanytarsus Pe1	9 11 59	62 63

+ Species new to Lough Neagh:	17
* Species new to Ireland:	39
# Species new to the British Isles:	3

FIGURE 1. Map of northern Ireland showing locations of sites sampled.
[Based on the map in *Northern Ireland holiday breakaways April 1998-September 1998*, published by the Northern Ireland Tourist Board ©BTA]



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BIRD AND MAMMAL MORTALITY ON ROADS IN COUNTIES CORK AND WATERFORD, IRELAND

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Introduction

Road mortality of birds and mammals has been studied in many countries (e.g. Cristoffer, 1991; Hernandez, 1988; Hodson and Snow, 1965; Holisova and Obrtel, 1986; Taylor and Mooney, 1991). Some authors have examined the possible effects on animal populations living close to roads (Clark and Karr, 1979; Reijnen *et al.*, 1995; Skinner *et al.*, 1991), while others have looked at the causes of road traffic accidents (Hodson, 1962; Pons, 2000; Taylor and Mooney, 1991). Few data on the subject are available for Ireland. Butler (1992) reported on a survey of road casualty birds, while Sleeman *et al.* (1985) reported on road casualty mammals. In addition, O'Sullivan and FitzGerald (1995) reviewed mortality (including road casualties) of otters (scientific names are given in Tables 1 and 2) and Sleeman (1988) examined road casualties of stoats. Apart from these studies, there has only been passing mention of the subject in the literature for Ireland. This paper reports on records of road casualty birds and mammals collected between 1972 and 2000.

Study area and methods

I collected road casualty data on birds and mammals, mainly in east Co. Cork and west Co. Waterford, between 1972 and 2000 (excluding a one year period, July 1984 to June 1985, see below). These data were collected mainly opportunistically, with the emphasis on recording mammals such as hedgehog, hare, red squirrel, fox, pine marten, stoat, mink, badger and otter, and birds such as raptors, owls and other scarce and locally distributed species. Records of road casualties from local taxidermists for the same species have also been used. This survey is hereafter referred to as the 'general' survey.

A more detailed survey of road casualty birds and mammals was carried out over one year (July 1984 to June 1985). Every road casualty encountered during that year was identified and logged. This survey is hereafter referred to as the 'intensive' survey. Travelling (total of 38,358km) was approximately evenly distributed across the months that year, and most travelling was carried out in east Cork and west Waterford, with only occasional visits outside this area. Few birds or mammals were aged or sexed during either of these surveys.

The N25 National Primary Road (Cork to Rosslare) passes through the study area. Regional Roads connect the many small towns, and Third Class and Other Roads complete the network (road classification taken from Ordnance Survey of Ireland maps Discovery Series). The habitat in the study area consists mainly of mixed farmland, with thick hedgerows in many cases bordering the road. Roadside trees are common along the regional and third class roads, and some woodland also occurs, both coniferous and deciduous. Wetland and estuarine habitats also border some roads, and one small lake adjoins the N25.

Results

Totals of 1002 birds and 940 mammals were recorded during the general survey (Table 1). No conclusions can be drawn as to which species was most frequently killed because of the selective nature of the survey. However, seasonal mortality patterns are evident where a reasonable sample (over 10) was available. For breeding birds such as pheasant, moorhen, woodpigeon, wren, dunnock, robin, blackbird, magpie, jackdaw, rook, hooded crow, house sparrow, chaffinch and bullfinch, peak mortality was mainly in the period April to July. Many of the deaths during this season were of juvenile birds. High mortality of woodpigeons continued from June to September, perhaps reflecting their extended breeding season. Song thrush and starling deaths peaked in January and probably mainly involved migrant birds during cold spells. All lapwings were killed during cold spells while they sought food in unfrozen areas along roadsides. Waterbirds (moorhen, black-headed gull and others) were killed mainly close to wetland areas or near the lake (Lough Aderry).

Hedgehog deaths peaked during April to June, while hare deaths peaked in December and January. Most red squirrels died in November. Fox deaths peaked during May to July and involved many juveniles, and badger deaths peaked during March to June. Most stoat deaths occurred in April and mink deaths in July. Otter deaths were mostly during January to March, while domestic cat deaths peaked in March. Seasonal distribution of rabbit and common rat deaths are not reliable because recording effort was not consistent across months.

Totals of 492 birds and 685 mammals were recorded during the intensive survey (Table 2). The rook was the most frequently killed bird, followed by the blackbird, woodpigeon and house sparrow. Just over 64% of birds were killed in the four-month period May to August. The feral pigeons were all killed in built up areas, but the house sparrow deaths were mainly in rural areas. Among the mammals, the common rat was the most frequently killed species, followed by the rabbit, domestic cat and hedgehog. Most mammals were killed in May (16%) and August (18%). There was broad agreement in the seasonal occurrence of bird mortality between the general and intensive surveys.

Discussion

It is evident that considerable numbers of various species of wildlife are killed on roads throughout the world (Slater, 1994). However, whether these deaths pose a significant threat to animal populations is unclear (e.g. badgers, Skinner *et al.*, 1991). In many studies the mortality rate from road traffic was extremely low when compared with other causes (Slater, 1994). However, such studies may seriously underestimate the true rate of mortality. Large animals may die some distance from the road if they are not killed outright, and small animal corpses may disappear rapidly or be thrown into hedgerows. On the other hand, road casualties of large animals are more likely to be noticed and reported, therefore creating a bias. Avian scavengers may remove corpses during the day, and scavenging mammals may do the same at night.

In this study (only the intensive survey is discussed) the bird species most frequently killed on the roads were representative of local breeding populations (Table 2). Butler (1992), who surveyed bird mortality on 3.9km of rural Third Class road in Tipperary over a 13 month period, obtained a similar result. Just over 64% of birds were killed in the four month period May to August, a result very similar to the 66% recorded by Butler (1992) during the same period.

In Ireland, few efforts have been made to record mammal road casualties. Sleeman *et al.* (1985) noted that the common rat, rabbit and hedgehog were the most frequently killed wild mammals. The same result was obtained in this survey (Table 2). Significant numbers of domestic cats were also found as road casualties by Sleeman *et al.* (1985) and this is also reflected in Table 2.

O'Sullivan and Fitzgerald (1995) noted that 58% of a total of 628 otter deaths investigated were road casualties. They stated that in Co. Cork, 62% of recorded deaths (n = 173) were road casualties. They also showed peaks of road traffic deaths in winter (November to February) and June. Sleeman (1988) reported that adult male stoats were killed more frequently in March, April and May. Peak mortality among adult females took place in June, September and November. Deaths of young stoats peaked in July.

While most birds and mammals are likely to be present near roads for the shelter and food provided by the hedgerow, some species may be tempted *onto* the road for food. This could be the case for woodpigeon, rook and house sparrow, all of which feed on grain. Rooks are particularly fond of germinating seeds spilled on roadside verges, and they also appear to take grit from road surfaces. Flocks of house sparrows roam fields and hedgerows after the breeding season, and many such flocks occur on roadside hedges. Peak casualties among these species takes place from July to September (Table 2), a period when there is much spilled grain on roadsides, having been lost from trailers during transport.

Common rats, young of which are very evident along roadsides in August and September, probably venture onto the road for the same reason. Sugar beet lost on roadsides may provide food for rats during the winter months. Some scavenging species may themselves become victims of traffic also as they eat road casualty corpses. Magpies and hooded crows are the most frequent avian scavengers seen on roads in this study area (Smiddy, unpublished). Foxes may get killed while carrying off dead rats or rabbits. Badgers often search for invertebrate food on roadside verges, and territorial boundaries may be marked there also. Additionally, foxes, badgers and otters, among other species, may become victims of road traffic when new roads cross traditional tracks, unless under-passes and fencing are provided.

Road traffic is on the increase throughout the world, and especially so in Ireland at present. The Irish Government's *National Development Plan* proposes many major road improvements, including the building of new roads and town by-passes. Therefore, road casualties among wildlife can be expected to increase in future years. Road planners (with the help of ecologists) must look at ways of reducing wildlife road casualties. In the meantime, ecologists can make good use of road casualties for biological recording of protected species (e.g. stoat, badger and otter), range expansion (e.g. pine marten and mink) and other studies.

It is clear there is much to be learned about and from road casualties. Broad scale studies (as reported here) give interesting information on season patterns of mortality and relative numbers of casualties, but are of limited use in elucidating underlying causes. It would be much more useful if future surveys concentrated on particular stretches of road where the adjoining habitat and hedgerow type was known. A simultaneous survey of bird and mammal populations, including marking of the animals, in the immediate vicinity of the road would also be valuable. Recording of the age and sex of each casualty animal, as well as recording prevailing weather conditions, would also enhance the value of the data obtained.

Acknowledgements

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Bull. Ir. biogeog. Soc. No. 26

TABLE 1. Bird and mammal road casualties in Cos Cork and Waterford, 1972 to 2000 (general survey). Total number and month(s) in which peak mortality was recorded are shown.

Species	Number	Peak mortality
Great crested grebe (*Podiceps cristatus* (L.))	1	Oct
Grey heron (*Ardea cinerea* L.)	1	Sep
Mute swan (*Cygnus olor* (Gmelin))	3	Nov
Mallard (*Anas platyrhynchos* L.)	8	Apr, May
Sparrowhawk (*Accipiter nisus* (L.))	9	May, Nov
Kestrel (*Falco tinnunculus* L.)	4	Jan, Feb
Pheasant (*Phasianus colchicus* L.)	32	Mar, Apr
Water rail (*Rallus aquaticus* L.)	1	Feb
Moorhen (*Gallinula chloropus* (L.))	40	Mar, Nov
Oystercatcher (*Haematopus ostralegus* L.)	2	Feb, Dec
Lapwing (*Vanellus vanellus* (L.))	29	Jan-Mar
Curlew (*Numenius arquata* (L.))	1	Dec
Little gull (*Larus minutus* Pallas)	1	Feb
Black-headed gull (*Larus ridibundus* L.)	25	Feb, Oct
Lesser black-backed gull (*Larus fuscus* L.)	1	May
Herring gull (*Larus argentatus* Pontoppidan)	3	Jul-Sep
Woodpigeon (*Columba palumbus* L.)	73	Jun-Sep
Collared dove (*Streptopelia decaocto* (Frivaldszky))	5	Jul
Barn owl (*Tyto alba* (Scopoli))	9	Jan
Long-eared owl (*Asio otus* (L.))	5	Nov
Short-eared Owl (*Asio flammeus* (Pontoppidan))	1	May
Nightjar (*Caprimulgus europaeus* L.)	1	May
Swift (*Apus apus* (L.))	1	Jul
Swallow (*Hirundo rustica* L.)	5	Jul
Meadow pipit (*Anthus pratensis* (L.))	2	Aug, Oct
Pied wagtail (*Motacilla alba* L.)	7	Jun, Oct
Wren (*Troglodytes troglodytes* (L.))	17	Apr, May
Dunnock (*Prunella modularis* (L.))	57	Apr-Jun
Robin (*Erithacus rubecula* (L.))	21	May, Jun
Stonechat (*Saxicola torquata* (L.))	6	Jun-Aug
Blackbird (*Turdus merula* L.)	168	May-Jul
Song thrush (*Turdus philomelos* Brehm)	66	Jan
Redwing (*Turdus iliacus* L.)	6	Jan
Mistle thrush (*Turdus viscivorus* L.)	5	Jun
Chiffchaff (*Phylloscopus collybita* (Vieillot))	1	Apr
Spotted flycatcher (*Muscicapa striata* (Pallas))	2	Jun, Jul
Coal tit (*Parus ater* L.)	2	Jan, Aug
Blue tit (*Parus caeruleus* L.)	8	Mar, Apr
Great tit (*Parus major* L.)	6	Jun, Jul

TABLE 1 (continued)

Magpie (*Pica pica* (L.))	24	Jun
Jackdaw (*Corvus monedula* L.)	12	Apr-Jul
Rook (*Corvus frugilegus* L.)	212	Jun
Hooded crow (*Corvus corone* L.)	16	Jun
Starling (*Sturnus vulgaris* L.)	11	Jan
House sparrow (*Passer domesticus* (L.))	32	Jun
Chaffinch (*Fringilla coelebs* L.)	24	Jun
Greenfinch (*Carduelis chloris* (L.))	5	Mar
Goldfinch (*Carduelis carduelis* (L.))	6	Apr
Siskin (*Carduelis spinus* (L.))	1	Sep
Linnet (*Carduelis cannabina* (L.))	7	Jun
Bullfinch (*Pyrrhula pyrrhula* (L.))	10	Jun
Yellowhammer (*Emberiza citrinella* L.)	6	Jul, Aug
Reed bunting (*Emberiza schoeniclus* (L.))	1	Apr
Total birds	1002	
Hedgehog (*Erinaceus europaeus* L.)	324	Apr-Jun
Natterer's bat (*Myotis nattereri* (Kuhl))	3	Jul-Sep
Rabbit (*Oryctolagus cuniculus* (L.))	84	May-Jul
Hare (*Lepus timidus* L.)	23	Dec-Jan
Red squirrel (*Sciurus vulgaris* L.)	14	Nov
Wood mouse (*Apodemus sylvaticus* (L.))	1	Sep
Common rat (*Rattus norvegicus* (Berkenhout))	80	Mar
Fox (*Vulpes vulpes* (L.))	105	May-Jul
Pine marten (*Martes martes* (L.))	4	Apr-Jun
Stoat (*Mustela erminea* L.)	104	Apr
Ferret (*Mustela furo* L.)	1	Jul
Mink (*Mustela vison* Schreber)	30	Jul
Badger (*Meles meles* (L.))	114	Mar-Jun
Otter (*Lutra lutra* (L.))	20	Jan-Mar
Domestic cat (*Felis catus* (L.))	32	Mar
Fallow deer (*Dama dama* (L.))	1	Oct
Total mammals	940	
Overall total	1942	

TABLE 2. Bird and mammal road casualties in Cos Cork and Waterford, July 1984 to June 1985 (intensive survey).

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Pheasant (*Phasianus colchicus* L.)			1	3	2			1	2				9
Moorhen (*Gallinula chloropus* (L.))		1		1	2			2		1			7
Feral pigeon (*Columba livia* Gmelin)			1	1	1		2	3	2		1		11
Woodpigeon (*Columba palumbus* L.)		1	5	1	2	3	8	10	6	1			37
Dunnock (*Prunella modularis* (L.))		2		2	3	2	2	1	1				13
Robin (*Erithacus rubecula* (L.))	1			1		1		4	1		1		9
Blackbird (*Turdus merula* L.)	2	1	1	3	21	6	6	1	1		1	1	44
Song thrush (*Turdus philomelos* Brehm)	5				5	2	4	1					17
Magpie (*Pica pica* (L.))		1			1	5	3	2					12
Rook (*Corvus frugilegus* L.)	8	13	6	10	33	22	59	55	14	5	5	7	237
Hooded crow (*Corvus corone* L.)			1		2	1	1		1	1			7
House sparrow (*Passer domesticus* (L.))			2			4	4	3	23				36
Chaffinch (*Fringilla coelebs* L.)					1	2		2	1				6
Other birds*	8	4	1	5	3	2	8	8	2	2	1	3	47
Total birds	24	23	18	27	76	50	97	93	54	10	9	11	492

TABLE 2 (continued)

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Hedgehog (*Erinaceus europaeus* L.)			3	4	26	6	3	17	3	5	6	2	75
Rabbit (*Oryctolagus cuniculus* (L.))	8	5	8	14	19	13	36	55	23	17	6	2	206
Hare (*Lepus timidus* L.)					1		3	1	2	1	1		9
Common rat (*Rattus norvegicus* (Berkenhout))	16	16	30	35	38	7	15	37	35	18	22	9	278
Domestic dog (*Canis familiaris* L.)				1	1		3			1		1	7
Stoat (*Mustela erminea* L.)	1			2			2	3	2				10
Domestic cat (*Felis catus* L.)	4	9	4	4	24	3	6	11	5	13	8	4	95
Other mammals*			1	1	1			1	1				5
Total mammals	29	30	46	61	110	29	68	125	71	55	43	18	685
Overall total	53	53	64	88	186	79	165	218	125	65	52	29	1177

* Other birds/mammals: shelduck *Tadorna tadorna* (L.) (1 August); mallard *Anas platyrhynchos* L. (4 April); lapwing *Vanellus vanellus* (L.) (5 January); woodcock *Scolopax rusticola* L. (1 November); black-headed gull *Larus ridibundus* L. (1 January, 2 August, 1 September, 1 October); herring gull *Larus argentatus* Pontoppidan (1 February); collared dove *Streptopelia decaocto* (Frivaldszky) (1 February, 1 August); barn owl *Tyto alba* (Scopoli) (1 October, 1 December); swallow *Hirundo rustica* L. (1 September); meadow pipit *Anthus pratensis* (L.) (1 January, 1 April); wren *Troglodytes troglodytes* (L.) (1 July, 2 August); stonechat *Saxicola torquata* (L.) (1 February, 1 July); redwing *Turdus iliacus* L. (1 February); blue tit *Parus caeruleus* L. (1 January, 1 March, 1 May); great tit *Parus major* L. (1 June); jackdaw *Corvus monedula* L. (1 May, 3 July, 1 December); starling *Sturnus vulgaris* L. (1 June, 1 July, 1 August); greenfinch *Carduelis chloris* (L.) (1 July); goldfinch *Carduelis carduelis* (L.) (1 May, 1 December); linnet *Carduelis cannabina* (L.) (1 July, 1 August).
Pygmy shrew *Sorex minutus* L. (1 September); fox *Vulpes vulpes* (L.) (1 August); badger *Meles meles* (L.) (1 March, 1 April, 1 May).

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SPIDERS (ARANEAE) OF MONTANE BLANKET BOG IN COUNTY WICKLOW, IRELAND

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Abstract

Montane blanket bog at a site in Co. Wicklow was surveyed using pitfall traps between May and October 1998. *Porrhomma montanum* Jackson (Linyphiidae) is new to the Irish list and 44 other species were recorded from the site, 21 of which are new county records. The survey results are discussed in relation to Irish peatland habitats and long term pitfall surveys from Antrim and Wexford. Comparison with the British spider fauna suggests the presence of a distinct montane element. This is borne out to some extent by Irish records. Numbers of species and specimens are found not to be constrained by the hostile environment that characterises montane blanket bog. Also discussed are the commonest species at the site and those which display a niche preference.

Introduction

There is a lack of general information relating to spider distribution and habitat associations in Ireland (McFerran *et al.*, 1994). Reynolds (1990) notes with regard to peatland habitats in particular that very little is known about the spatial relationships of spiders. Spiders of Irish raised bog and fenland have been subject to some investigation (Higgins, 1985; van Helsdingen, 1996a, 1997, 1998) but there seem to be no studies that have focussed on spiders of blanket bog. The present paper serves as the basis for an inventory of the spider fauna from montane blanket bog (hereafter MBB) in Wicklow and tries to make some assessment of its distribution in this habitat. Assessing the role of spiders in any eco-system is difficult because they are highly motile and opportunist feeders and are not necessarily restricted to a particular vegetation type or microhabitat.

A number of factors are necessary to the formation of blanket bog; cool summers, >1250mm of rain per annum and high humidity levels. In western parts of Ireland, blanket bog is found predominantly on mountains and along some areas of the coast. In the east of the country, the largest expanse is found on the Wicklow mountains where formation occurs at 330 metres and above. The area of MBB in Co. Wicklow has been estimated to be 15,633 hectares, 12,719 of which was at the time unmodified and 2,914 man-modified (Hammond, 1979).

Feehan and O'Donovan (1996) suggest that blanket bog is less hospitable an environment than raised bog since it is prone to periodic flooding and drying and has a shorter vegetation providing less shelter from the elements. Some of the particular characteristics of this extreme environment that may serve to influence the diversity and abundance of spiders include the altitude, the high degree of exposure, the low pH, the low nutrient value of vegetation, the high degree of precipitation and the saturated substrate. These and other factors are cited by Hammond (*op. cit.*) as constraints on the development of MBB for economic purposes.

The study site

The site of the present study is located within the mountains standing at the western end of Glenmalure valley in the Wicklow mountains. It is referred to throughout as Three Lakes. This name is found on Sheet 56 of the Ordnance Survey's *Discovery* series and refers to the presence of local lakes, two of which are permanent and one of which appears irregularly. T034983 marks the easternmost end of the area surveyed which extended west-north-west for 500-600 metres.

The area surveyed was broadly level, highly exposed and has an elevation of 630 metres (2047 feet), an altitude that represents an extreme in Ireland since only 0.3% of land on the island exceeds the 600 metre mark (Cabot, 1997). The Three Lakes site lies very close to the boundary of the Wicklow Mountains National Park which bisects the larger lake enclosing the southern half. This park covers an area of some 15,913 hectares, a portion of which is characterised by MBB.

The local topography of MBB at Three Lakes was highly varied. Broad expanses of the bog were riddled with channels or gullies, cut by the action of water. Some areas were permanently inundated while others became very dry during summer. Erosion has led to the formation of peat banks with very steep sides and extensive patches of unvegetated peat. Sections of peat had been separated from the main blanket to form freestanding 'haggs'. The process of re-colonisation by vegetation was obvious in some eroded areas. These erosion processes are a natural part of the life-cycle of MBB (McGee and Bradshaw, 1990). There was very little exposed bedrock in the area of the survey and only a small amount of loose rock. This is largely confined to areas of shallow peat or to gullies where it has been exposed or down which it has been carried by the action of water.

Large scale vegetation was dominated by three heath species, heather *Calluna vulgaris* (L.) Hull, cross-leaved heath *Erica tetralix* L. and bilberry *Vaccinium myrtillus* L. and two sedges, deergrass *Scirpus cespitosus* L. and bog-cotton *Eriophorum* species. Mosses including *Sphagnum* and *Polytrichum* species were present in substantial quantites in some areas. Vegetation was generally quite low (<20cm) due primarily to the high degree of exposure to wind and rain.

Rainfall over the survey period (18 May–8 October) for Wicklow was 94% of the monthly norm (Met Éireann, 1998). Maps from the same source showing rainfall gradients suggest an estimated 1150–1550mm fell between May and October on high ground in the area of Three Lakes and Lugnaquillia mountain.

There was no evidence of turf cutting in the immediate vicinity of the study site and the only obvious indication of man's influence was the use of the land for grazing sheep. Other grazing species such as deer, hare, pheasant and grouse were present at Three Lakes.

Methods

Pitfall traps were set with a maximum of 32 functioning throughout the survey period. Each trap consisted of a half-pint plastic catering cup sunk level with the ground. Ethylene glycol (antifreeze) was poured into this to a depth of approximately four centimetres. Detergent was added in order to decrease surface-tension and, to prevent dilution of the trap-fluid by direct precipitation, a plywood cover ($20cm^2$) was placed over each trap. This was secured by sinking a nail through each corner of the plywood into the ground leaving a gap of about 3cm between the cover and the rim of the cup.

Traps were set at eight stations (**a–h**) on 18 and 19 May and at another (**i**) on 5 June. Stations **a**, **b**, **c** and **d** were set widely apart at T034983. Station **e** was about 300 metres west north-west of **a**, **f–h** continued on the same directional axis for about 200 metres and **i** was set tending west about 40 metres away. Station **g** was set on a local summit. Four traps were set at stations **a**, **b**, **c**, **d**, **e** and **f**, three at station **g** two at **h** and three at **i**. Station **e** could not be located on 5 June and the extra station **i** was established on this date. Stations with four traps enclosed an area of about 12 to 16 sq. metres. Traps at other stations were set about 3–4 metres apart.

Traps were emptied in varying combinations on the following dates: 5 and 26 June, 14 and 27 August, 18 September and 8 October. The catch was tagged and tied and placed in 70% methylated spirits for later sorting and identification. The cup was reset and filled with fresh fluid. Stations **a**, **c**, **d**, and **i** operated for seventeen weeks and other stations for twenty, averaging out as 32 traps operating for 18.6 weeks. Stations **a**, **c** and **d** were dismantled on 18 September, the others on 8 October.

Stations were selected with a view to sampling the varied topography in order to obtain as broad a range of species as possible. Station **a**: elevated position on top of an overgrown granite prominence, relatively well drained, **b**: broad and flat. *Calluna* and *Scirpus* dominant, deep peat, **c**: slightly sheltered behind a low prominence, rather shallow peat, **d**: close to running water, inundated during part of the survey period, mosses, tall *Juncus*, **e**: *Calluna*, *Scirpus* dominated broad hag; deep peat, **f**: shallow peat, slightly stony substrate, dryest station, **g**: permanent standing water, slightly elevated (local summit), mosses, **h**: permanent standing water, slightly sheltered, mosses, **i**: broad hag, deep peat, *Calluna* and *Scirpus* dominant, western aspect.

Identification of species was carried out using Roberts (1993). Nomenclature follows Merrett and Murphy (2000). The county status of the spiders is based on van Helsdingen (1996b). A small number of additional county records are also taken into account (McFerran *et al.*, 1995; van Helsdingen, 1996a, 1998; McFerran, 1997; Smith and Costello, 1998; Merrett, 2000; Nolan, 2000, 2002; Cawley, 2001). The following dominance scale (after Kupryjanowicz *et al.*, 1997) is used to analyse the pitfall catch: Eudominant = >10%, Dominant = 5.1-10%, Influent = 2.1-5%, Recedent = 1.1-2%, Subrecedent = <1%.

Results

A total of 45 species from eight families were recorded from the survey, 22 of which are new county records and one of these (*Porrhomma montanum* Jackson, 1913) a new Irish record. This species has been recorded from a number of other sites since (Nolan, 2002). Species recorded from Three Lakes and numbers of each found are detailed in Table 1. Also shown is the % of the total catch that each species (from pitfall traps) represents and the number of counties in Ireland from which all species recorded have previously been noted. An appendix tabulates the numbers and gender of adult specimens caught in pitfalls during each trapping period.

In all, 680 adult specimens representing 40 species were identified from the pitfall catch. A single immature thomisid from the genus *Ozyptila*, possibly *O. trux* (Blackwall, 1846) or *O. atomaria* (Panzer, 1801) (determination by Mike Roberts, pers. comm.) was also trapped. Altogether, 37 specimens were taken by hand which added another four species: an immature male of *Drepanotylus uncatus* (O.P.-Cambridge, 1873) was taken on 27 August (adult 13 September) from a broad expanse of semi-submerged mosses and rushes at the southern end of the large lake, T031982. A female of *Bolyphantes luteolus* (Blackwall, 1833) was collected near station **h** on 18 September and a male of *Centromerus prudens* (O.P.-Cambridge, 1873) at station **a** on the same date. Immatures and matures of *Metellina merianae* (Scopoli, 1763) were quite common later in the year in sheltered areas e.g. underneath the fringes of haggs and gullies.

The number of species trapped at each station was fairly even, those with four traps producing between fifteen and nineteen species. Numbers of species/adult specimens from each station are as follows **a**: 16/73; **b**: 19/94; **c**: 18/102; **d**: 18/62; **e**: 15/64; **f**: 18/113; **g**: 14/76; **h**: 9/32; **i**: 18/64.

Eudominant species vary to some extent from station to station e.g. *Lepthyphantes ericaeus* (Blackwall, 1853) was eudominant at **a**, **b**, **c**, **g** and **i**, *Robertus lividus* (Blackwall, 1836) at **a**, **b** and **e** - **i**, *Diplocephalus permixtus* (O.P.-Cambridge, 1871) and *Pirata piraticus* (Clerck, 1757) at **d** and **g** with the former also eudominant at **h**. 31.9% of the catch is represented by two eudominant species, the theridiid *R. lividus* and the linyphiid *L. ericaeus*. The former was most abundant at stations **a** (n = 20) and **f** (n = 35), accounting for just under 50% of specimens gathered and the latter most abundant at **b** (n = 33) and **c** (n = 24) accounting for over 54% of specimens. The dominant species *Micrargus herbigradus* (Blackwall, 1854), *D. permixtus*, *Centromerita concinna* (Thorell, 1875), *Lepthyphantes zimmermanni* Bertkau, 1890 and *Pardosa pullata* (Clerck, 1757) constitute a further 32.78% of the pitfall catch. Four species were found at all nine stations, *R. lividus*, *C. concinna*, *L. zimmermanni* and *L. ericaeus*, with *M. herbigradus* appearing at eight and *P. pullata*, *Mecynargus* (*Rhaebothorax*) *morulus* (O.P.-Cambridge, 1873) and *Saaristoa abnormis* (Blackwall, 1841) at seven. Fourteen species are represented by a single specimen.

Station **e** was not relocated until 8 October and, surprisingly, yielded identifiable material. These results are included in Table 1 and detailed also in the appendix. If these results are excluded the dominance ratios do not alter significantly.

TABLE 1. Species recorded during survey. * = New County record. ** = New Irish record. Total caught = pitfall catch (specimens collected by hand in brackets). % figure and dominance based on pitfall catch adults only. County status, including present records, based on (McFerran *et al.*, 1995; van Helsdingen 1996a, 1996b, 1998; McFerran, 1997; Smith and Costello, 1998; Merrett, 2000; Nolan, 2000, 2002; Cawley, 2001). Dominance scale: E = Eudominant = >10%, D = Dominant = 5.1-10%, I = Influent = 2.1-5%, R = Recedent = 1.1-2%, S = Subrecedent = <1%.

Species	Total	% of catch	Dominance	County status
Theridion mystaceum L.Koch, 1870*	1	<1	S	6
Robertus lividus (Blackwall, 1836)	113	16.61	E	25
Theonoe minutissima (O.P.-Cambridge, 1879)*	1	<1	S	5
Ceratinella brevipes (Westring, 1851)*	7	1.02	R	19
Walckenaeria acuminata Blackwall, 1833*	25 (1)	3.67	I	23
Walckenaeria nudipalpis (Westring, 1851)*	1 (1)	<1	S	14
Walckenaeria cuspidata Blackwall, 1833*	7	1.02	R	7
Dicymbium tibiale (Blackwall, 1836)*	2	<1	S	6
Metopobactrus prominulus (O.P.-Cambridge, 1872)*	1	<1	S	6
Gonatium rubens (Blackwall, 1833)	2 (1)	<1	S	21
Peponocranium ludicrum (O.P.-Cambridge, 1861)	1	<1	S	17
Oedothorax gibbosus (Blackwall, 1841)	1	<1	S	18
Silometopus elegans (O.P.-Cambridge, 1872)*	3	<1	S	8
Monocephalus fuscipes (Blackwall, 1836)	10	1.47	R	25
Micrargus herbigradus (Blackwall, 1854)*	46	6.76	D	6
Diplocephalus permixtus (O.P.-Cambridge, 1871)*	36	5.29	D	21
Erigone atra Blackwall, 1833	1 (1)	<1	S	29
Mecynargus morulus (O.P.-Cambridge, 1873)*	33	4.85	I	6
Drepanotylus uncatus (O.P.-Cambridge, 1873)*	(1)	-	-	13
Hilaira frigida (Thorell, 1872)	8 (1)	1.17	R	4
Porrhomma pallidum Jackson, 1913*	1	<1	S	3
Porrhomma montanum Jackson, 1913**	1	<1	S	3
Agyneta decora (O.P.-Cambridge, 1871)*	1	<1	S	7
Agyneta olivacea (Emerton, 1882)*	31	4.55	I	5
Centromerus prudens (O.P.-Cambridge, 1873)	(1)	-	-	9
Centromerus arcanus (O.P.-Cambridge, 1873)*	4	<1	S	2
Centromerus dilutus (O.P.-Cambridge, 1875)*	2	<1	S	10
Centromerita concinna (Thorell, 1875)*	40 (1)	5.88	D	13
Saaristoa abnormis (Blackwall, 1841)	18 (1)	2.64	I	14
Bathyphantes gracilis (Blackwall, 1841)	2	<1	S	28
Bolyphantes luteolus (Blackwall, 1833)	(1)	-	-	13
Lepthyphantes tenuis (Blackwall, 1852)	1	<1	S	29
Lepthyphantes zimmermanni Bertkau, 1890	61 (18)	8.97	D	28
Lepthyphantes mengei Kulczynski, 1887*	10	1.47	R	19
Lepthyphantes ericaeus (Blackwall, 1853)	104 (2)	15.29	E	21
Metellina merianae (Scopoli, 1763)	(3)	-	-	27
Pardosa pullata (Clerck, 1757)	40 (2)	5.88	D	27
Pardosa amentata (Clerck, 1757)	2	<1	S	30
Pardosa nigriceps (Thorell, 1856)	18 (1)	2.64	I	21
Trochosa terricola Thorell, 1856	3	<1	S	29
Pirata piraticus (Clerck, 1757)	28 (1)	4.11	I	31
Antistea elegans (Blackwall, 1841)	1	<1	S	19
Agroeca proxima (O.P.-Cambridge, 1871)*	2	<1	S	12
Haplodrassus signifer (C.L.Koch, 1839)	11	1.61	R	16
Ozyptila immature	1	<1	S	?
Total = 45 species	681 (37)			

Pitfall catch

Spiders are more abundant at Three Lakes than the above results indicate. Various factors adversely affected the numbers caught. Station **d** was inundated when visited on 26 June. Traps were not emptied between June and August and some catch was lost due to flooding. This is reflected in the low numbers trapped from 5 June–14 August and 26 June–27 August. Traps at stations **a**, **c** and **d** were found to have been uprooted and emptied when the site was visited on 27 August. They were reset but were found in a similarly disrupted condition on 18 September. Thus, station **d** was properly productive only from 18 May - 5 June, flooding and interference meaning that only eleven specimens were collected there between 5 June and 18 September. Indeed every station was subject to some degree of flooding throughout the survey period and, in contrast, the fluid in two traps at station **f** was found on one occasion to have evaporated completely.

Pitfall trapping is not an absolute sampling method, reflecting rather the presence and behaviour of motile spiders. As a surveying method which reflects the distribution and abundance of spiders it is discussed and defended by McFerran *et al.* (1994, 1995). While a better substitute has yet to be suggested for sampling an isolated area over a long period of time, the fact that *Metellina merianae* was not caught in pitfall traps at all but could be taken with ease by hand at Three Lakes demonstrates the importance of varying capture methods when sampling a site.

Discussion

Spiders from Irish bog and fenland habitats

A brief survey of midlands raised bog (Higgins, 1985) trapped 43 species, sixteen of which were common to Three Lakes. All of these are commonly recorded species, with the exception of *Metopobactrus prominulus* (O.P.-Cambridge, 1872) and *Agyneta olivacea* (Emerton, 1882). The single female specimen of the latter was identified originally as *Agyneta cauta* (O.P.-Cambridge, 1902) but was examined by the present author and should be reassigned to *A. olivacea*. This specimen is held in the Natural History Museum, Dublin (NMI 22: 1990). The first noted record in Ireland of *A. olivacea* was from Teal Lough, a cut-over bog in Co. Londonderry (Cowden *et al.*, 1990). Other Irish records to-date are from Cos Antrim and

Fermanagh (McFerran, 1997). McFerran (*op. cit.*) has a record for Co. Armagh from a site named Teal Lough. This is treated here as an error and the Armagh record is not included. Given that two of the other Irish records are from bog habitats and that *A. olivacea* was influent (nearly dominant) at Three Lakes, the species may be indicative of such habitats though should not be considered a strict tyrphobiont given that it was trapped on upland vegetation ($n = 4$, of 12,268 specimens) (McFerran *et al.*, 1994). Its presence on MBB and upland vegetation might suggest an affinity for higher altitudes. Higgins (*op. cit.*) turned up two other new Irish records (excluding *A. olivacea*) on the survey.

Van Helsdingen (1998) recorded 53 species from Scragh Bog (a quaking bog) in Co. Westmeath, nine of which were common to the Three Lakes site and again all of these common and widespread species. Two new Irish records were found and a number of infrequently recorded species.

A total of 59 species have been recorded from collecting in Pollardstown Fen, Co. Kildare (van Helsdingen, 1997, incorporating Snazell, 1983) (58 is the figure given in the paper but 59 are described including two immature species). Altogether, eleven of these were found on MBB, all of them common and widespread. The general complexion of the fenland proved interesting with a number of rare species appearing and two new Irish records.

Extended pitfall surveys from Ireland

Only recently have any extended studies of spiders been conducted in Ireland. Surveys from three sites, one in the Republic (Gibson, 1982; Nolan, 2000) and two from Northern Ireland (McFerran *et al.*, 1994, 1995) provide a useful yardstick against which to gauge the results from Three Lakes. A comparison of these sites, all of which utilised pitfall traps as the principal or only collection method, illustrates a broader similarity between Three Lakes and the Northern sites.

Theonoe minutissima (O.P.-Cambridge, 1879), *Dicymbium tibiale* (Blackwall, 1836), *M. prominulus*, *M. morulus*, *Hilaira frigida* (Thorell, 1872), *Porrhomma montanum* Jackson, 1913 and *Centromerus arcanus* (O.P.-Cambridge, 1873), all found at Three Lakes, were not taken from a variety of habitats at Carnsore Point in Co. Wexford (Gibson, 1982; Nolan, 2000) or from varied upland vegetation types in Antrim (altitude <340m) (McFerran *et al.*, 1994).

Carnsore (where a range of habitats were sampled) had 28 species in common with Three Lakes and these are all common and widespread species. Upland vegetation (McFerran *et al.*, 1994) had 31 in common, including *M. herbigradus* (n = 12), *Porrhomma pallidum* Jackson, 1913 (n = 3), *Agyneta decora* (O.P.-Cambridge, 1871) (n = 33) and *A. olivacea* (n = 4). A study of *Calluna* dominated heather moorland with deep peat (altitude 240–260m) (McFerran *et al.*, 1995) recorded 70 species and also had 31 in common with Three Lakes including *T. minutissima* (n = 2), *D. tibiale* (n = 3), *M. prominulus* (n = 3), *M. herbigradus* (n = 20), *P. pallidum* (n = 1), and *A. decora* (n = 28).

The eudominant species trapped at Three Lakes are discussed below in relation to these extended surveys.

Comparison with the spider fauna of Britain

A number of spiders found at Three Lakes show that this site has a distinct montane/upland element. *Silometopus elegans* (O.P.-Cambridge, 1872), *M. morulus*, *H. frigida*, *P. montanum*, *C. arcanus* and *Bolyphantes luteolus* (Blackwall, 1833) are generally found in Britain on high ground. Recently published distribution maps (Harvey *et al.*, 2002) show these species to be largely confined to the upland and mountainous regions of Britain *i.e.* occurring for by far the greater part north of a line drawn from the Severn to the Humber estuary. *S. elegans* appears with low frequency in southern England but is far commoner in the north on high ground. *M. morulus* occurs scarcely on mountain tops in north Wales, north England and Scotland. *H. frigida* can be locally common on mountains, is widespread in north-west Scotland (where it can be found at lower altitudes) but is otherwise uncommon. There are records of *P. montanum*, a very local species, from only one site in southern England. *C. arcanus* can be common on some mountain tops and at lower altitudes is associated with acidic bogs. *B. luteolus* and *C. prudens* do occur in southern England but are largely restricted there to high ground. *A. olivacea* seems at present also to have a largely northern distribution in Britain but is not necessarily associated with mountains or uplands. Interestingly it can be frequent in Scottish blanket bog as can *M. merianae*. Other species found at Three Lakes that seem to have a northern distribution in Britain include *D. tibiale*, *P. pallidum* and *A. decora*.

Despite the presence of these montane associates at Three Lakes, their number is small compared to mountains in Scotland and northern England where two surveys between them produced nine species not yet recorded from Ireland and a number of other rarities (Horsfield, 1979; Geddes and Horsfield, 1991). Indeed, that one must exercise some caution when comparing the fauna of the two Islands is brought out by a survey of Lliwedd mountain in north Wales (Goodier, 1970). Altogether, 13 species from station III (593m) and 12 from station IV (738m) were also taken at Three Lakes, all common and widespread species. The commonest species trapped at station III were *Alopecosa* (*Tarentula*) *pulverulenta* (Clerck, 1757) and *Centromerita* species at 46.6% and 24.2% of the catch respectively. *Coelotes* (*Amaurobius*) *atropos* (Walckenaer, 1830) and *P.* (*Lycosa*) *pullata* were both dominant at the same site. *A. pulverulenta* was not recorded at Three Lakes and *C. atropos* has not yet been recorded from Ireland. Other species from Lliwedd in common with Three Lakes included *H. frigida* (n = 1), *C. prudens* (n =17) and *C. arcanus* (n = 1). The specimens of *H. frigida* and *C. arcanus* were taken at 883 metres.

An Irish montane fauna at Three Lakes

Establishing that these species represent a montane fauna in Ireland generally is made difficult by a lack of records. Data do suggest that *M. morulus* and *H. frigida* in Ireland are generally confined to mountainous areas. *M. morulus* has been taken on the summit of Slieve Donard in Co. Down (Carpenter, 1898), on the summit of Mangerton, Co. Kerry (Kew, 1910) (this record is not represented on the distribution map in Locket *et al.* (1974)), in Cos Antrim and Fermanagh (McFerran, 1997) and on the summit of Slievemore in Co. Sligo (Cawley, 2001). Specimens from Co. Antrim were found below 340 metres. *H. frigida* has been recorded in Ireland from Mangerton peak in Co. Kerry (Kew, 1910), on Tonelagee and Lugnaquillia mountains in Co. Wicklow (Pack-Beresford, 1929), from the summit of Carrauntoohil, Co. Kerry (Mackie, 1970) and more recently from Kings Mountain in Co. Sligo (Cawley, 2001).

The only previous Irish record of *C. arcanus* is from Woodford, Co. Galway (Pack-Beresford, 1924) which does not seem to be an upland site but no ecological data are offered. A small number of other Irish records of *P. montanum* suggest it has an upland/montane distribution in Ireland (Nolan, 2002). *P. pallidum* is recorded from only two counties previously in Ireland, from Kerry (Bristowe, 1939) and upland Antrim (McFerran *et al.*, 1994, 1995). British records are local and scattered, especially in the south, suggesting a northern distribution.

S. elegans is more frequently recorded in Ireland than the above species. It has a countrywide distribution and is not confined to montane or upland habitats e.g. it has been taken from bog at Teal Lough, Co. Londonderry (Cowden *et al.*, 1990) and also at Carnsore Point, Co. Wexford (Gibson, 1982; Nolan, 2000). *B. luteolus* is more frequently recorded again and also has a countrywide distribution. That it may have a northern or upland distribution in Ireland is suggested by the fact that it was not recorded at Carnsore (Gibson, 1982; Nolan, 2000) but was common on upland vegetation and heather moorland in Co. Antrim (McFerran *et al.*, 1994, 1995).

Under-recorded species

While some of the species discussed above may have a very limited or restricted distribution, others found at Three Lakes, though as yet infrequently recorded in Ireland, are very probably more common than these records indicate. *Theridion mystaceum* L. Koch, 1870 and *Micrargus herbigradus* have each been recorded from six counties to date but have a widespread and common distribution in Britain. The first record of *T. mystaceum* in Ireland is from Fermanagh (McFerran, 1997). More recently it has been recorded from gorse on a Wexford hillside and from the wall of a house in Sligo (Cawley, 2001). Other records are given in a paper in the present volume (Nolan, 2002). As such, this species is widespread and found in a variety of habitats. The lack of records may be due in part to confusion with *Theridion melanurum* Hahn, 1831 which it very closely resembles. There seem to be no early records of *M. herbigradus* in Ireland. It is noted on a distribution map as occurring in Co. Clare (Locket *et al.*, 1974). Nearly all records are very recent but, as with *T. mystaceum*, reveal a wide distribution. Recent records are mostly from Northern Ireland where it was taken in pitfall traps at Black Bog, Co. Tyrone in 1988 (Cowden *et al.*, 1990), on upland vegetation and on heathland in Antrim (McFerran *et al.*, 1994, 1995). There are records of single specimens from a damp floodplain habitat in Co. Offaly (van Helsdingen, 1996a) and from Scragh Bog in Co. Westmeath (van Helsdingen, 1998). The relatively large numbers in which it was found at Three Lakes is of interest. McFerran *et al.* (1995) suggest it is associated with older undisturbed heather stands.

There are early records of *T. minutissima* from Leenane Mountain, Co. Galway and from Co. Donegal (Carpenter, 1898). More recently it has been found in the Burren, Co. Clare (Mackie, 1970) and on heathland in Co. Antrim (McFerran *et al.*, 1995). It is associated with *Sphagnum* bogs and has a widespread but infrequent distribution in Britain (Roberts, 1993). Due to its very small size it is probable that the species can be easily missed and that present records may not accurately reflect its status in the British Isles. Kupryjanowicz *et al.* (1997) include *T. minutissima* in a list of tyrphobiont spiders and suggest that it is not found outside of raised bogs. British and Irish records of this species make it clear that this does not hold true across the whole of Europe.

Eudominant species

R. lividus and *L. ericaeus* were the two most abundant species at Three Lakes. Both of these are common and widespread in Britain and occur in a variety of habitats (Harvey *et al.*, 2002). They have not been recorded with any frequency from other peatland habitats in Ireland. *L. ericaeus* was recorded in small numbers from both Scragh Bog, Co. Westmeath (van Helsdingen, 1997) and fenland (van Helsdingen, 1998) but not from from raised bog where pitfall traps were utilised (Higgins, 1985). *R. lividus* was not recorded at any of these sites. While such habitats have as yet been very little investigated, van Helsdingen's (1997) description of *L. ericaeus* as a common bog species needs substantiation. The long term studies from Northern sites recorded both these species in relatively low numbers. On upland vegetation, *L. ericaeus* constituted 1.54% of the entire catch (McFerran *et al.*, 1994). At this site it was most abundant on upland grass (n = 84) and wet heath habitats (n = 57) (<3% from each site). It was even less abundant on heather moorland at various stages of growth (McFerran *et al.*, 1995). On upland vegetation, *R. lividus* was subrecedent (absent from wet heath) (McFerran *et al.*, 1994) and was equally uncommon on heathland (McFerran *et al.*, 1995). The situation is different at Carnsore Point where *L. ericaeus* was eudominant at two sites, on coastal cliffs and amongst *Ammophila* dunes (>15% at both sites). The species was barely influent in marsh (*circa* 2.1%). *R. lividus* was trapped at Carnsore in small numbers (n = 23), was absent from some habitats and was influent (<3%) only in marsh (Gibson, 1982).

Given the relatively high numbers in which these species occurred at Three Lakes, their low abundance on heather moorland and upland vegetation is of interest. It may indicate a preference on their part for more highly exposed situations. This suggestion perhaps gains significance from the eudominant status of *L. ericaeus* at Carnsore, which could indicate that it thrives in exposed habitats with extreme local conditions e.g. high salinity or low pH. *R. lividus* is associated with high moorland and mountainous habitats (amongst others) in Britain (Harvey *et al.*, 2002). However, at Lliwedd, both these species were subrecedent with three *R. lividus* and two *L. ericaeus* taken and these at station III or below (Goodier, 1970).

Naturally, establishing that particular species are eudominant/abundant annually in a particular habitat would necessitate longer term studies. McFerran *et al.* (1994) suggest that the species composition at sites examined in earlier survey work did not alter significantly over time.

Spider abundance

Spiders from Three Lakes do not seem to be constrained with respect to the number of individuals found there compared to some sites from lower altitudes. This can be seen by comparing the number of specimens from Three Lakes with studies of upland vegetation types and heather moorland where 72 and 70 species were trapped respectively (McFerran *et al.*, 1994, 1995). Comparison is made with a simple calculation of numbers of specimens caught per trap per week: heather burnt in 1982 = 0.98 (1373/18/78), heather burnt in 1988 = 0.39 (545/18/78), heather unburnt = 0.52 (736/18/78) (McFerran *et al.*, 1995), grass heath = 0.99 (1553/15/104), upland grass = 2.11 (3290/15/104), wet heath = 1.73 (2708/15/104), heather moorland = 1.02 (1596/15/104), reseeded pasture = 2.00 (3121/15/104) (McFerran *et al.*, 1994), Three Lakes = 1.06 (680/32/18.6).

The number of species recorded at Three Lakes also compares well with these studies where between 43 and 55 species were recorded from each of the eight sampling stations. Given the ease with which the 41 species caught in pitfalls at Three Lakes was supplemented with another four gathered through very limited hand collecting, it is certain that more species remain to be identified from this location. Only future survey work will tell as to whether this number would rise to 70 species or more. Goodier (1970) recorded a decline in species and abundance of spiders with increasing altitude, though the decline at the Welsh site may be attributed to the increase in the amount of bare rock at higher altitudes. Geddes and Horsfield (1991) observed no discernible decline in abundance but a steady decline in numbers of species recorded between 655 and 885 metres. Given this, it may be surmised that the altitude of MBB at Three Lakes may not be significant enough to strongly effect the number of species or specimens found there.

Niche partitioning

Clear niche partitioning may be observed in three species *viz.*, *D. permixtus*, *P. piraticus* and *M. merianae*. Over 80% of *D. permixtus* specimens and just under 90% of *P. piraticus* were trapped at the three wettest stations, **d**, **g** and **h** which suggests a preference for very wet or semi-inundated areas. A survey biased toward or away from such sites would produce results that are not indicative of actual proportions of species present. *D. permixtus* is generally a wetland species and, at Carnsore Point, where it was present in low numbers, was at its greatest abundance on wet grassland and marsh (Gibson, 1982). This species was influent/dominant on reseeded upland pasture but was barely present at other stands (McFerran *et al.*, 1994) and was absent from heathland (McFerran *et al.*, 1995). This could suggest pioneering behaviour (or the influence of land management?) at the first site and that the second was essentially dry. *M. merianae*, a species typical of shaded and cool habitats, occupied a very specific niche at Three Lakes, making use of damp gullies shaded by overhanging vegetation.

M. herbigradus and *M. morulus* appeared at station **e** in disproportionately large numbers. The traps from this station were not emptied between 19 May and 8 October and it is assumed that some catch was either lost to flooding or simply disintegrated *c.f.* the low numbers of *L. ericaeus* trapped. When the station was relocated the four traps were heavily overgrown. The presence of *M. herbigradus* and *M. morulus* in quantity may suggest that they were late advents to the traps and perhaps have a preference for denser undisturbed stands of heath, as suggested by McFerran *et al.* (1995).

Conclusions

It is not surprising that the present survey turned up a new Irish record, a number of uncommonly recorded species and a good number of new county records. Spiders are still strongly under-recorded in Ireland and almost any intensive or long term survey may be expected to add to the growing Irish species list.

While far more work needs to be done on spiders from the various peatland habitats before their respective faunas can be properly compared, it would seem at present that raised bog, fenland and eastern MBB have quite different spider faunas. This is not unexpected by virtue of the significant differences between the sites in terms of altitude and vegetation and with regard to fenland in particular since it has an alkaline environment. None of the spiders from Three Lakes can really be considered strict tyrphobionts. As such, while the spider fauna from this site may be representative of MBB, it could possibly be characteristic of Irish montane habitats in general. *H. frigida* and *M. morulus* are near strict montane species in Ireland and the presence of other species with a strong montane/upland presence in Britain adds to this characterisation. Possibly the fact that *R. lividus* and *L. ericaeus* were eudominant at Three Lakes may be attributed to the chemically hostile conditions of MBB. It is also of interest that *A. olivacea* and *M. merianae* are found in comparable abundance (and the latter in the same niche) on Scottish blanket bog (Harvey *et al.*, 2002).

While altitude was an influential factor on the spider fauna at Three Lakes, it does not seem to have been a constraint on their abundance. Investigating the extent to which this factor influences species diversity and abundance would necessitate sampling from higher altitudes around the country. Such work could well turn up new records and some of the rare alpine species that characterise some such habitats in Britain.

Future investigations of MBB could attempt to quantify the relative amounts of 'dry' to 'wet' substrate in order to gain a better sense of the relative distributions of hygrophilous species and those that are merely water tolerant. Comparing the spider fauna from different sward heights even over a relatively small area may reveal distinct distribution patterns. While the present survey was less comprehensive than it could have been by depending heavily on a single sampling method, it may be of use in assessing the quality of MBB sites that have been disturbed through afforestation or turf-extraction.

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APPENDIX. Number and gender of adult specimens (male/female) caught at all stations during each trapping period.

Trapping period	17/18 May –5 June	5 June -26 June	5 June –14 Aug	26 June –27 Aug	14 Aug –18 Sep	27 Aug –18 Sep	18 Sep –8 Oct	18 May –8 Oct
Stations	**a–d, f–h**	**a–d**	**f–i**	**a–d**	**f–i**	**a–d**	**b, f–i**	**e**
T. mystaceum	f 0/1	–	–	–	–	–	–	–
R. lividus	a 6/1, b 4/1, c 6/0, d 2/0, f 16/0, g 6/2, h 1/0	a 11/0, b 2/2,	f 18/0, g 2/0, h 3/1, i 9/2	a 2/0, b 1/2	f 0/1	b 0/1	–	e 11/0
T. minutissima	b 1/0	–	–	–	–	–	–	–
C. brevipes	c 2/1, d 1/0, h 1/0	b 1/0	i 0/1	–	–	–	–	–
W. acuminata	a 0/3, f 0/3, g 0/1	a 0/1, b 0/1	f 0/1, i 0/1	a 0/2, b 0/4	g 0/1	b 1/0	f 0/1, i 1/0	e 0/4
W. nudipalpis	–	–	–	–	–	–	i 1/0	–
W. cuspidata	c 0/2, d 0/1	–	i 0/1	–	–	–	–	e 0/3
D. tibiale	d 0/1	–	–	–	–	d 0/1	–	–
M. prominulus	–	–	–	–	–	–	–	e 1/0
G. rubens	–	–	–	–	f 1/0, g 0/1	–	–	–
P. ludicrum	b 1/0	–	–	–	–	–	–	–
O. gibbosus	d 1/0	–	–	–	–	–	–	–
S. elegans	d 2/1	–	–	–	–	–	–	–
M. fuscipes	a 1/0, f 0/1, g 1/0	–	f 0/1	–	f 0/1	–	f 2/3	–
M. herbigradus	a 2/0, b 3/0, c 3/0, d 4/0, f 5/1, g 2/1	a 1/0	g 3/0, i 3/0	c 0/1	i 1/0	–	f 0/1	e 12/3
D. permixtus	c 1/2, d 5/3, g 4/2, h 2/4	c 0/1	g 0/2, h 0/6	c 0/1	h 0/1	–	b 0/1, g 1/0	–
E. atra	–	–	–	c 1/0	–	–	–	–
M. morulus	a 3/2, f 0/3, g 1/3	a 1/0, c 0/1	f 0/1, g 0/2, i 0/2	b 0/3	–	c 1/0	b 1/0	e 0/9
H. frigida	b 1/0, g 1/0	–	f 0/1	–	i 0/1	–	b 0/1, i 1/0	e 2/0
P. pallidum	–	–	–	–	–	–	f 0/1	–
P. montanum	a 0/1	–	–	–	–	–	–	–

APPENDIX (continued)

Trapping period	17/18 May –5 June	5 June -26 June	5 June –14 Aug	26 June –27 Aug	14 Aug –18 Sep	27 Aug –18 Sep	18 Sep –8 Oct	18 May –8 Oct
Stations	**a–d, f–h**	**a–d**	**f–i**	**a–d**	**f–i**	**a–d**	**b, f–i**	**e**
A. decora	–	–	**i** 0/1	–	–	–	–	–
A. olivacea	**a** 4/0, **c** 7/3, **d** 2/2, **f** 5/0	**c** 1/4	**f** 0/1	**a** 0/2	–	–	–	–
C. arcanus	**d** 2/0	–	**f** 1/0, **i** 1/0	–	–	–	–	–
C. dilutus	**f** 0/1	–	–	–	–	–	–	**e** 0/1
C. concinna	**a** 0/4, **b** 0/2, **c** 0/5, **d** 0/5, **f** 0/3, **g** 0/5, **h** 0/1	**a** 0/2, **c** 0/1	**f** 0/1, **g** 0/5, **h** 0/1, **i** 0/2	–	**h** 0/1	–	**b** 0/1	**e** 0/1
S. abnormis	–	–	**f** 4/1, **i** 2/0	**a** 1/0, **c** 1/0	**f** 1/0, **h** 1/0, **i** 1/0	**c** 1/0, **d** 2/0	**i** 1/0	**e** 2/0
B. gracilis	–	–	**g** 1/0, **i** 1/0	–	–	–	–	–
L. tenuis	–	–	–	**b** 1/0	–	–	–	–
L. zimmermanni	**a** 2/0, **d** 0/2	**a** 1/1, **c** 0/2	**f** 4/2, **g** 3/0, **h** 2/0, **i** 5/4	**a** 0/1, **b** 1/0, **c** 1/0	**f** 3/0, **g** 1/1, **i** 2/0	–	**f** 3/2, **g** 2/0, **h** 0/2, **i** 4/4	**e** 4/2
L. mengei	**b** 0/2	**b** 0/1, **c** 0/1	**g** 1/0	**a** 1/0, **b** 1/1	–	–	**b** 0/2	–
L. ericaeus	**a** 5/3, **b** 2/6, **c** 9/3, **d** 1/0, **f** 3/0, **h** 0/1	**a** 0/1, **b** 2/5, **c** 1/8	**f** 1/6, **g** 6/6, **h** 1/1, **i** 3/3	**b** 3/11, **c** 0/2	**i** 0/1	**a** 1/0, **b** 0/1, **c** 1/0	**b** 1/2, **f** 0/1	**e** 0/3
P. pullata	**a** 2/0, **b** 1/1, **c** 9/5, **d** 3/2	**c** 0/1	–	**a** 0/2, **b** 0/2, **c** 3/1, **d** 1/0	**i** 0/2	**b** 0/1, **c** 0/2	**f** 0/1	**e** 1/0
P. amentata	–	–	–	**d** 1/1	–	–	–	–
P. nigriceps	**b** 1/4, **c** 1/2, **f** 3/3	**b** 0/1	–	–	–	–	–	**e** 0/3
P. piraticus	**d** 6/4, **g** 1/4	–	**g** 0/1, **h** 0/1, **i** 0/1	**d** 4/0	**g** 0/1, **i** 0/1	**a** 0/1, **d** 0/1	**g** 0/2	–
T. terricola	**d** 1/0, **h** 1/0	–	–	**c** 1/0	–	–	–	–
A. elegans	–	–	–	–	–	**b** 1/0	–	–
H. signifer	**a** 0/1, **b** 1/1, **c** 0/1	**c** 0/2	**i** 0/1	**b** 0/2	–	–	–	**e** 1/1
A. proxima	–	–	–	–	–	**a** 1/0, **b** 1/0	–	–

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A RECENT IRISH RECORD OF THE WOODLOUSE *ACAEROPLASTES MELANURUS* (BUDDE-LUND, 1885) (ISOPODA: PORCELLIONIDAE), CONSIDERED TO BE EXTINCT IN THE BRITISH ISLES

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Introduction

Woodlice are the only terrestrial Crustacea native to the British Isles (Harding, 1976). The moist, generally mild climate of Ireland permits the survival of 27 species in the open air (Doogue and Harding, 1982). One species, *Acaeroplastes melanurus* (Budde-Lund, 1885) (*Metoponorthus melanurus*, family Porcellionidae), known to occur in southern France, Corsica and other Mediterranean coastlines (Edney, 1954) as well as Lusitania (Sutton, 1972), is considered to be the rarest of all species of woodlice in Britain and Ireland ($<0.01\%$ of all records) (Harding and Sutton, 1985). It was first discovered in 1909 (Scharff, 1910) on the southern cliffs of Howth (Co. Dublin) (Harding, 1976) and recorded there until 1934. However, no observations have since been reported despite several attempts to re-find it (Doogue and Harding, 1982). This species is now considered extinct in the British Isles (Harding and Sutton, 1985).

Material, methods and results

On 25 April 2002 the authors were searching for woodlice on the Howth peninsula near Baily, Co. Dublin (OS Ref: O 295 366). The studied area is natural maritime grassland close to the cliffs and the Baily lighthouse. The chosen site was on a southwest-facing slope and it contained a few loose stones. It was sampled at about 10.45 am and the weather was warm and sunny. The vegetation in the area included *Calluna vulgaris*, *Festuca rubra*, *Leontodon* sp., *Armeria maritima*, *Sedum* sp., *Silene dioica* and *Daucus carota*.

The soil under the vegetation and beneath the stones was examined for a total of 20 minutes. All visible invertebrates were collected with a pair of soft forceps. Woodlice were found under three of twelve stones examined, two of these in the shade. All woodlice were killed and preserved in 70% ethanol as described by Hopkin (1991).

The woodlice were examined and measured under a dissecting microscope (x 10 – x 40). Two species were identified among the 11 specimens, using the keys of Edney (1954), Sutton (1972) and Hopkin (1991). Ten specimens were identified as *Porcellio scaber* (Latreille, 1804), all were females and six of them carried eggs. One woodlouse was identified as *Acaeroplastes melanurus*, and confirmed by Mr J. M. C. Holmes (National Museum of Ireland). This specimen was a female with no visible eggs. The body was about 5mm long from the head to the uropods; head width was about 0.75mm. The specimen appeared rather straight and slim and it looked relatively pale with a dark pattern on its dorsal surface. These observations differ from Edney's (1954) comment about *Metoponorthus melanurus* "judging by the figure published by Beresford and Foster (1911) this would be dark, with a number of lighter longitudinal markings and a similar median streak".

Discussion

Acaereoplastes melanurus has been recorded on the Atlantic coast of France, northern Spain, and Portugal, and also from the Mediterranean coast of France and northern Italy (Doogue and Harding, 1982; Sutton, 1972). The species is considered to be a native species in the British Isles and is only known from the Hill of Howth, near Dublin (Sutton, 1972), where it has not been recorded since 1934 (Doogue and Harding, 1982). Other literature is more detailed about the locations on Howth where it has been found, namely under grass on Howth Cliffs (Edney, 1954), at Broad Strand (Harding, 1977), under stones at Knox's Bay and at Millionaire's Pool (Doogue and Harding, 1982). These place names apply to a one kilometre stretch on the southern coast of Howth (Doldrum Bay on maps) (Doogue and Harding, 1982). Repeated searches on cliffs and shore at Doldrum Bay, Howth from 1972 and onwards failed to reveal any trace of the species (Doogue and Harding, 1982). It was therefore believed to no longer occur at Howth nor in the British Isles, and is not described in "*A key to the woodlice of Britain and Ireland*" (Hopkin, 1991).

Harding and Sutton (1985) grouped threatened species of woodlice into six defined categories. *A. melanurus* was listed as the only extinct species in Britain and Ireland. It was placed in threat category six indicating that the taxon was not definitely located in the wild during the past fifty years. There have been speculations about the extinction of *A. melanurus* on Howth. These have concerned the possibility that the species was an introduction (possibly with soil on imported plants), that it may have became extinct during the very cold winter of 1947 or that it became extinct as a result of over-collecting (Doogue and Harding, 1982). We are now happy to confirm that *A. melanurus* is not extinct at Howth, Co. Dublin, and that it still exists in the British Isles.

The National Museum of Ireland has 32 specimens, and the British Museum (Natural History) six specimens, collected during 1909 and 1929 (Doogue and Harding, 1982). This newly found specimen has been deposited in the National Museum of Ireland (NMI 46: 2002).

Acknowledgements

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VASCULAR PLANT RECORDS FROM VARIOUS IRISH VICE-COUNTIES

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Introduction

This note comprises records for uncommon or otherwise interesting vascular plants, most gathered between 1992-2002, although with a few going back to 1989. Some of these appear to constitute new or second vice-county records. Also included are a few records for casuals, and poorly naturalised garden escapes. Unless otherwise stated, plants were identified with, and nomenclature follows, Stace (1997). Many of the records from Co. Sligo, and a few from other counties, have been incorporated into the distribution maps contained in Preston *et al.* (2002). **DBN** indicates that voucher specimens will be deposited in the National Botanic Gardens, Glasnevin, Dublin.

The author's impressions of the status of non-native plants at the sites in question have been indicated as follows: * certainly introduced, ‡ probably introduced, † possibly introduced, # casual.

Botrychium lunaria **(L.) Sw.**

H25, Roscommon. Garrow, Curlew Mountains, G796053, 12 June 1999. One plant on an area of limestone heath.

******Papaver somniferum*** **L.**

H27, West Mayo. Ballina, G2418, 26 August 1994, numerous plants on a patch of waste ground. Although rather scarce, and invariably near houses or on waste ground, this is the most widespread *Papaver* in north-west Ireland, all other species being extremely local.

‡*Papaver dubium* **subsp.** ***dubium*** **L.**

H26, East Mayo. Ballyhaunis, M4879, 27 September 1996, frequent as a weed in a newly sown lawn.

H34, East Donegal. Bundoran, G8259, 24 July 1994, a few plants on a neglected area adjacent to golf course.

‡***Papaver dubium* subsp. *lecoqii* (Lamotte)**

H24, Longford. Longford, N1375, 30 May 1996, waste ground.

****Pseudofumaria lutea* (L.) Borkh.**

H25, Roscommon. Carrick-on-Shannon, M9298, 24 July 1991, railway station walls.

H26, East Mayo. Ballyhaunis, M4979, 1 June 1995, naturalised on a bridge in town centre.

****Ficus carica* L.**

H04, Mid Cork. Kinsale, W641602, 3 October 1999, one clearly self-sown plant, growing from a crevice in a sea wall. There are a number of plants growing in suspicious circumstances in Cork City and, in particular, a large tree growing from a wall, on waste ground at Gas Works Road, W682714, 21 March 1999, which would seem most likely to be self sown.

****Soleirolia soleirolii* (Req.) Dandy**

Now widely naturalised on urban walls and as a garden weed.

H07, South Tipperary. Carrick-on-Suir, S4021, 13 January 1995, abundant on walls along the River Suir.

H09, Clare. Ennis, R3476, 27 July 1995, numerous plants between paving stones in a yard.

H15, South-east Galway. Gort, M4501, 25 July 1995, garden walls.

H25, Roscommon. Boyle, G8002, 22 August 1990. On walls near the river.

****Cerastium tomentosum* L.**

H07, South Tipperary. Caher, S0525, 3 June 2001, a few clumps on disturbed ground in quarry.

H22, Meath. Enfield Railway Station, N7741, 1993-2001, well established along the track and adjacent disturbed ground in the railway station.

H28, Sligo. Rosses Point, G6339, 2 January 1993, present on a small area of exposed coastal grassland. By 1999 had spread onto an adjacent low sea cliff. Ballina, Co Mayo (but vice-county H28, Sligo), G244181, 11 June 1999, about 20 clumps on a grassy waste area along the east bank of the River Moy.

There are surprisingly few published records of this very common, if somewhat old-fashioned, garden plant as an escape in Ireland. However, it appears well established at some of the above localities.

***#Lychnis coronaria* (L.) Murray**

H05, East Cork. Claycastle, Youghal, X1076, 15 July 1996, one plant on disturbed sandy waste ground. **DBN**.

***#Agrostemma githago* L.**

H28, Sligo. Belladrihid Bridge, G673303, 31 May 1999, nine plants on a weedy patch of ground which had been disturbed during the construction of the Ballysadare bypass. An anomalous record for this once common, but now endangered, arable weed. Presumably introduced during road work operations. Also present were a few plants of *Papaver rhoeus* L. and *Chrysanthemum segetum* L., both typical associates of *A. githago*, and both rare in Co. Sligo.

****Persicaria wallichii* Greuter and Burdet**

H29, Leitrim. Aghamore, N0294, 5 October 1993, a few plants in a hedgerow.

***Hypericum elodes* L.**

H28, Sligo. Drumfad, G6951, 12 July 1992, present in one field drain. The only other Sligo record is from a nearby coastal site (Cotton and Cawley, 1993). **DBN**.

***Draba incana* L.**

H28, Sligo. A few plants restricted to a small bare scrape, on the south facing side of a hillock, just east of Curraghmore Lake, G639407, 1 June 1999.

****Draba muralis* L.**

H26, West Mayo. Castlebar Military Barracks, M1490, 26 April 2002. Well established on an old wall. **DBN**.

***#Camelina sativa* (L.) Crantz *sensu stricto*.**

H05, East Cork. Tivoli Docks, W7272, 5 July 1998, one plant on a heap of compacted soil. Various other aliens in the vicinity, including *Chaenorhinum minus* (L.) Lange and *Cichorium intybus* L. Previously reported from Cork City by Scully (1895). Determined using Rich (1991). Irish records of this rare casual are reviewed by Rich (1995), and an additional record for *Camelina sativa* agg. is listed by Doogue *et al*. (1998). Confirmed by Tom Curtis. **DBN**.

***#Iberis umbellata* L.**

H26, East Mayo. Charlestown, G4701, 16 September 1993, one plant on waste ground, some distance from the nearest house.

#Lepidium heterophyllum **Benth.**

H28, Sligo. Knoxspark, G6728, 19 May 1999, one plant on a railway track. No doubt a recent arrival with railway ballast. **DBN**.

****Lepidium draba*** **L.**

H06, Waterford. Passage East, S7009, 10 June 2001. Frequent along a short length of sandy ground behind coastal shingle. **DBN**.

‡Coronopus didymus **(L.) Smith**

H29, Leitrim. Dromod, N0589, 12 September 1994, waste ground near the railway station.

‡Reseda lutea **L.**

H11, Kilkenny. Waterford City, S6112, 30 June 1996, single plant on gravelly area adjacent to the railway track, on the northern bank of the River Suir. **DBN**.

****Sedum forsterianum*** **Smith**

H24, Longford. Edgeworthstown, N2671, 8 September 1995, well established on a stone wall.

****Fragaria*** **x** ***ananassa*** **(Duchesne) Duchesne**

H28, Sligo. Maugheraboy, G6734, 12 May 1991. Well established on a grassy bank along the Sligo-Dublin railway line. My father, Ted Cawley, identifies this precise spot as a known source of excellent 'wild' strawberries, going back to his childhood. This suggests that *F.* x *ananassa* has been established here for over 50 years. **DBN**.

****Alchemilla mollis*** **(Buser) Rothm.**

H28, Sligo. Finisklin, G6737, 18 June 1999, scattered plants on waste ground, on what was, until recently, the municipal refuse tip. Determined using Rich and Jermy (1998). Population likely to be obliterated in the near future by construction work. **DBN**.

****Melilotus albus*** **Medikus**

H28, Sligo. Ballysadare, G6629, 4 July 1992, scattered plants on waste ground. **DBN**.

#Medicago sativa **L.**

H05, East Cork. Cobh, W7966, 2 August 1995. One plant on waste ground adjacent to the railway station. **DBN**.

Cytisus scoparius subsp. ***maritimus*** **(Rouy) Heywood**

H03, West Cork. Ringalurisky Point, W6141, 10 July 1997. A few plants on a narrow band of cliff-top heath, fenced off from cattle.

***Euphorbia paralias* L.**

H34, East Donegal. Tullan Strand, 7 September 1989. A few plants in sand dunes, much outnumbered by *E. portlandica* L. **DBN**.

***_Oxalis articulata_ Savigny**

H28, Sligo. Rosses Point, G6339, 26 June 1995, a small population of self sown plants present, with other garden escapes, on a sea wall.

‡_Geranium rotundifolium_ L.

H12, Wexford. Rosslare Harbour, S1312, 29 July 1999, six plants on disturbed road verge.

‡_Geranium purpureum_ Villars

H06, Waterford. Dungarvan, X261932, 27 June 1999, scattered on a sea embankment wall immediately adjacent to the east side of Devonshire Bridge. Determined using Rich and Jermy (1998). Confirmed by Sylvia Reynolds. **DBN**.

#_Tropaeolum majus_ L.

H01, South Kerry. Beenbane, V4598, 13 August 1998. One plant on rocks below a sea cliff. No houses in the immediate vicinity.

***_Myrrhis odorata_ (L.) Scop.**

H28, Sligo. Breaghwy, G6247, 18 May 1994, a few plants in a hedgerow. Apparently, this is the only recent Sligo record.

#_Carum carvi_ L.

H12, Wexford. Ballyhack, S7010, 20 May 2001, single plant on roadside verge. **DBN**.

***Carum verticillatum* (L.) W. D. J. Koch**

H28, Sligo. Rinroe, G650495, 18 June 1993, abundant over a small area of damp grassland on the northern bank of the Grange River. Otherwise known in north-west Ireland from single sites in West Mayo and West Donegal. **DBN**.

#_Pastinaca sativa_ L.

H28, Sligo. Lenstown, G3337, 29 June 1993. A small number of plants on fallow ground.

***Calystegia soldanella* (L.) R. Br.**

H34, East Donegal. Tullan Strand, G8361, 14 August 1996, several plants on a steep sandbank on the northern edge of the dunes. Confirms an old record from the vicinity of Ballyshannon, listed by Allingham (1879), which has been treated as doubtful by Praeger (1901) and Scannell and Synnott (1987).

***#Borago officinalis* L.**

H04, Mid Cork. Crosshaven, W8061, 20 May 1998, two plants on road verge.

H12, Wexford. Duncannon, S7208, 23 September 1998, one plant on disturbed sandy ground near the Quay.

***#Lamiastrum argentatum* Smejkal**

H28, Sligo. Ballisodare, 19 June 2000, single clump behind a wall at abandoned railway station. **DBN**. Determined using Rich and Jermy (1998).

****Lamium album*** L.

H28, Sligo. Knockbeg, G6624, 25 April 1993, road verge. Lissadell, G6144, 21 April 1994, growing among *Urtica dioica* L. in an abandoned orchard. **DBN**.

***‡Lamium amplexicaule* L.**

H03, West Cork. Baltimore, W047267, 20 August 1996, two plants on waste ground.

***†Galeopsis angustifolia* Ehrh. ex Hoffm.**

H25, Roscommon. Gallows Hill, Athlone, N0241, 6 October 1996. A few plants, mostly in seed, at the base of a gravelly bank. This plant is protected in the Republic of Ireland under the Flora (Protection) Order (1999).

****Clinopodium vulgare* L.**

H28, Sligo. Mullaghroe, G6903, 15 August 1990. A small population on a disturbed grassy bank. Frequent over an area of about 12 square meters, with a few outliers. Persistent at this site from 1990 until last checked in 1998, and clearly of more than casual occurrence. Confirmed by Donal Synnott. **DBN**.

****Verbascum virgatum* Stokes**

H05, East Cork. Mallow, W5598, 11 August 1996, two plants on roadside waste area. Recent Cork records for this plant are listed by Akeroyd *et al.* (1996) and O'Mahony (1998, 1999).

****Chaenorhinum minus* (L.) Lange**

H28, Sligo. Billa, G6425, 19 August 1990, growing on cinders along the abandoned Sligo-Limerick railway line. Kilmacowen, G6730, 19 June 1992, growing on cinders along railway track. Evidently maintaining a precarious foothold in the north-west.

***Linaria vulgaris* Miller**

H28, Sligo. Corkaghmore, G4934, 3 August 1994, road verge. Apparently the first Sligo record for many years.

***Linaria purpurea* (L.) Miller**

H26, East Mayo. Charlestown, G4701, 16 November 1993, on walls of an abandoned railway station, with a few outliers on nearby walls.

***Leycesteria formosa* Wallich**

H12, Wexford. Wexford, T0322, 9 October 1994, well naturalised on roadside banks.

H24, Longford. Edgeworthstown, N2671, 8 September 1995, scattered in hedgerow.

***Valerianella carinata* Loisel**

H10, North Tipperary. Nenagh Bridge, Ballyvillane, R8681, 24 April 2002, base of wall adjacent to bridge. **DBN**.

H11, Kilkenny. Kilkenny, S5156, 18 April 2001. Single plant on a low wall. **DBN**.

***Centranthus ruber* (L.) DC.**

H25, Roscommon. Castlerea, M6978, 27 April 2002, well established on walls.

***Centaurea scabiosa* L.**

H06, Waterford. Dungarvan, X2594, 12 July 1998, one large plant on a narrow verge of grassland along the west bank of the Colligan River.

***Tragopogon pratensis* L.**

H28, Sligo. Tonaforte, G6833, 7 June 1992, along road verge below the railway track. **DBN**. Knockadalteen, G6419, 18 June 1992, a few plants growing along the railway track. Clooneen, G6415, 20 June 1993, road verge.

***Cicerbita macrophylla* (Willd.) Wallr.**

H24, Longford. Longford, N1374, 8 June 2001, abundant in a ditch along the Sligo-Dublin railway line.

H25, Roscommon. Boyle, G7902, 22 August 1990, along a few metres of road verge.

***Erigeron karvinskianus* DC.**

H02, North Kerry. Tralee, Q8314, 8 September 1996. Scattered plants, but seems well established, on walls near the railway station.

***Erigeron acer* L.**

H25, Roscommon. Gallows Hill, Athlone, N0241, 6 October 1996. About 40 plants in a small area of calcareous grassland, now entirely surrounded by roads. Considered by Curtis and McGough (1988) as apparently threatened. Very near the *Galeopsis angustifolia* site listed above.

***Conyza sumatrensis* (Retz.) E. Walker**

H05, East Cork. Kent Railway Station, W6872, 11 September 2002, and present also in 2001. Numerous plants on a somewhat neglected portion of the railway platform, immediately adjacent to the Chetwynd Viaduct. Determined using Mundell (2001). **DBN**.

***#Artemisia absinthium* L.**

H04, Mid Cork. Kilmichael, W7958, 25 October 1998. One plant on road verge.

***‡Anthemis cotula* L.**

H28, Sligo. Rosses Point, G6539, 12 October 1990. In a field which is heavily disturbed by pigs. Still present at this site in 2001. Confirmed by Donal Synnott. **DBN**.

****Leucanthemum* x *superbum* (Bergmans ex J. W. Ingram) D. H. Kent**

H28, Sligo. Finisklin, G6737, 10 July 1996, numerous clumps, and seemingly well naturalised on waste ground at what was, until recently, the municipal refuse tip. Population likely to be obliterated in the near future by construction work. Sligo Railway Station, G6835, 17 August 2002, single plant on the railway track.

****Matricaria recutita* L.**

H04, Mid Cork. Ballyphehane Refuse Tip, W6869, 1 June 1998, frequent over a small area of disturbed ground. **DBN**.

****Senecio fluviatilis* Wallr.**

H28, Sligo. Knockadalteen, G6418, 11 July 1992. A small population in a roadside ditch. Noted as having apparently increased in June 2000. Confirmed by Sylvia Reynolds. **DBN**.

****Senecio squalidus* L.**

H28, Sligo. Sligo Docks, G6836, 13 September 1992, one plant on a wall adjacent to a spur of the Sligo-Dublin railway line. **DBN**. Noted at this site most years to 1996, when the population had increased to six plants. Maugheraboy, G6735, May 1999, three plants on the railway track.

***Senecio viscosus* L.**

The following sites are additional to those listed by Nash (1995).

H09, Clare. Ennis Railway Station, R3476, 27 July 1995, on the railway track and adjacent gravelly path.

H11, Kilkenny. Waterford City, S5913, 14 July 1996, waste ground adjacent to the railway line, on the north bank of the River Suir.

H17, North-east Galway. Tuam, M4351, 16 October 1993, gravelly area at the disused railway station.

***Delairea odorata* Lemaire**

H04, Mid Cork. Fountainstown, W7858, 18 October 1998, rampant along hedgerows, in association with *Humulus lupulus* L. and *Clematis vitalba* L., and noted in January 2000 along about 150m of nearby low sea cliff.

#*Helianthus annuus* L.

H05, East Cork. Ballyvolane, Cork City, W6873, 15 October 2000. Single plant on waste ground.

***Carex pseudocyperus* L.**

H28, Sligo. Feenagh Lake, G6912, 14 June 2000. A small population of plants present in lakeshore marsh.

#*Phalaris canariensis* L.

H05, East Cork. Youghal, X0979, 22 September 1998, refuse tip.

H06, Waterford. Dungarvan, X2494, 12 July 1998, refuse tip. Tramore, S5901, 26 July 1998, refuse tip. **DBN**.

H28, Sligo. Sligo, G6935, 1 August 1999, five plants on a recently disturbed lawn. **DBN**.

***Allium vineale* L.**

H09, Clare. Inishmore, L8809, 21 July 1996. Four plants growing through *Rubus* near houses at Kilronan. Otherwise reported in the Aran Islands from Inishmann (Webb and Scannell, 1983).

***Tamus communis* L.**

H28, Sligo. Ballysadare, G6826, 5 August 1991, a few plants scattered in a hedgerow.

Pseudorchis albida **(L.) Á. & D. Löve**

H25, Roscommon. Garrow, Curlew Mountains, G795054, 16 June 1999. Five plants in rough acid pasture.

H28, Sligo. Lough Availe, Bricklieve Mountains, G741116, 15 June 2000, eight plants on calcareous heath. Also, about thirty plants on low hillocks between Curraghmore Lake and Doonweelin Lake, G640407, 17 June 2000.

H29, Leitrim. Banagher, G803355, 25 June 1994, three plants on a small area of limestone heath. A protected species under the Flora (Protection) Order 1999.

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THE DISTRIBUTION AND HABITAT OF THE COMMON LIZARD, *LACERTA VIVIPARA* JACQUIN, IN IRELAND

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Introduction

The Irish herpetofauna is quite limited compared to that of our nearest neighbours in Britain and France (Arnold, Burton and Ovenden, 1992). Three species of amphibians and two reptiles make up our complement although the leatherback turtle (*Dermochelys coriacea* (L.)), which migrates annually along our coast, can be justifiably included as well (Marnell, 2001). Previous papers in this journal and elsewhere have examined the Irish distributions and habitats of the smooth newt (*Triturus vulgaris* L.), common frog (*Rana temporaria* L.) and natterjack toad (*Bufo calamita* Laurenti) (Marnell 1998a, 1998b, 1999; Korky and Webb, 1993, 1999). A recent analysis of the status of our other terrestrial reptile, the little known slow-worm (*Anguis fragilis* L.), has also been published (McGuire and Marnell, 2000). The present paper is the first to describe the distribution and habitat of the common or viviparous lizard (*Lacerta vivipara* Jacquin) in Ireland.

The viviparous lizard has one of the widest distributions of any vertebrate in the world, extending from Ireland and northern Spain in the west to Lapland in the north and the China Sea in the east (Beebee and Griffiths, 2000; Gasc, 1997). Following early papers in the British Journal of Herpetology which included distribution maps of amphibians and reptiles in Britain and Ireland (Taylor, 1948, 1963), the Irish Biological Records Centre produced a distribution map of the lizard (Crichton, 1974). This was superceded five years later by a provisional atlas of the distribution of amphibians, reptiles and mammals in Ireland (Ní Lamhna, 1979). A number of British atlases have also included distribution maps for the lizard in Ireland (Arnold, 1973, 1995). However, none of these previous distributions of the lizard in Ireland contained data from targeted surveys. The present work combines the results of a dedicated survey effort carried out by Irish Wildlife Trust and Ulster Wildlife Trust members (in 1996 and 1997) together with other records received from naturalists and the public in response to newspaper articles and radio interviews.

Results

Over 250 records dating from the period 1990 – 2002 were received. A total of 27 counties, from the four corners of the island, produced sightings (Fig. 1). The five counties from which no lizards were recorded were Armagh, Carlow, Derry, Longford and Tyrone. Notable gaps are also evident, however, in large parts of Cork and Tipperary, in east Galway and south Down and many counties are represented by a single record. Wexford returned the most sightings (67), over one quarter of all returns, followed by Wicklow (43), Cork (33), Donegal (26) and Mayo (25). Lizards were recorded on several islands, including Clare Island, Cape Clear, Sherkin and Dursey.

Bogland (with 22% of all records) would appear to be the most important habitat for the lizard in Ireland, with a further 10% of records coming from heathland. Rural gardens were surprisingly popular (16%) and records from sand dunes (15%) and stone walls (13%) were also numerous. Roadside verges/hedgerows (8%) and scrub (5%) also produced a fair number of sightings. From the results of this survey, woodland, improved grassland, quarries and golf courses do not appear to be habitats that suit the lizard in Ireland.

Only a handful of roadkills were reported and the data suggest that cats are probably a more serious threat than cars. On a number of occasions, however, cats were observed holding wriggling tails while lizards escaped to fight again.

Most of the records received were concentrated in the months of June, July and August. However, the earliest sighting of a lizard was of a basking animal on the 8 March at the Breeches in Kilcoole, Co. Wicklow and the latest record came from Wexford on the 20 October suggesting quite an extensive active season.

Discussion

The lizard is commonly mistaken for the newt, and *vice versa*, and this can lead to some uncertainty in the validation of records. However, together with location information, contributors in the present survey were asked to supply details of habitat and behaviour. These parameters are often more helpful in distinguishing the superficially similar amphibian and reptile than descriptions of size and colour. In simple terms, when newts are not in their breeding ponds they are slow-moving and are only to be found in cool, damp microhabitats. Lizards, by contrast, are normally sighted in warm, sunny locations and tend to move quickly when disturbed. Notwithstanding their habit of basking in open locations, lizards are elusive. They are well camouflaged, seldom venture far from cover and often go unnoticed. Indeed, it is remarkable how many Irish naturalists have never seen this species.

The first map to show the distribution of the animal in Ireland was published by Taylor (1948). This vice-county collation of sightings suggested that the lizard was mostly confined to coastal counties, but was absent from Clare, Sligo and west Donegal. In an updated version 15 years later (Taylor, 1963), the author asserted that "...the Viviparous Lizard is widely distributed and there are few areas in England, Wales, Scotland and Ireland from which it has not been recorded." The map accompanying this statement tells a different story, however, showing no more than 16 lizard records from Ireland for the period 1948–1963 [a rate of one record per annum] and only 21 records from before 1948. In 1974, a map was produced by the Irish Biological Records Centre showing all the records from 1950-1973 (Crichton, 1974). That map, and the one published five years later (Ní Lamhna, 1979), which effectively contains the same data, showed that the viviparous lizard was in fact found throughout the country. Ní Lamhna (*op. cit.*) suggested it had a coastal distribution, but that is also occurred inland quite extensively. Crichton (1974) believed the species to be widespread. Those maps, notwithstanding a marked concentration of records from in and around Waterford, show a very similar spread of records to the present work, with comparable gaps in north Cork, Tipperary, east Galway and much of Derry, Fermanagh, Tyrone and Armagh.

It seems likely that the earlier distribution maps of the lizard in Ireland were as much representations of the spread of the activities of recorders around the country as of the animal itself. This phenomenon is by no means singularly Irish; in Britain, the distributional changes of the common amphibians and reptiles over the last 50 years as seen in the national distribution maps (e.g. Taylor, 1948; Arnold, 1995) have been largely explained by the increase in recording effort (Beebee, 1996). To some degree, recorder bias is also represented in the results of the present study. Unlike the work carried out previously for the frog and the newt (Marnell, 1998a, 1999), where an objective survey formed the basis for the data, these lizard records are the result of public participation in a national recording scheme and must, therefore, to some degree, reflect the distribution of the recorders and their efforts. This must certainly explain the cluster of records from Dublin and north Wicklow. Given that most of the sightings come from the summer months, this map must also demonstrate to an extent where Irish people spend their holidays. The cluster of records from the Wexford coast in particular would support this assertion. Nonetheless, other records are dotted around the country, suggesting that the lizard must indeed be widespread. While the gaps in the map may reflect to some extent the dearth of suitable habitats, they must also indicate areas of low human density and low recording effort.

That the lizard was recorded from a number of islands is not surprising. Scharff (1912) reported the presence of the animal on Clare Island during the original survey of that island 90 years ago. He felt that the animal, being adapted to cold climates, was long established in the country and that it might well have colonised off-shore islands post-glacially when they were still connected to the mainland. Ní Lamhna (1979) also reported records from several islands, including Arranmore (Co. Donegal) and Cape Clear (Co. Cork).

Viviparous lizards can be found in a wide range of habitats, but closer investigation shows that these share some common structural features. Topographically diverse, undisturbed ground, with short, dense vegetation which is open to the sun and containing some south-facing slopes is ideal (Beebee and Griffiths, 2000). These authors go on to list roadside verges, uncultivated field margins, moorlands, heathlands, forest glades, railway embankments and sand dunes as typical habitats of the lizard in Britain while human habitation was generally avoided. A predilection for sites near water has previously been noted e.g. grassy tussocks in areas of bog (Beebee and Griffiths, *op. cit.*) and this may be explained by the abundance of insect prey associated with such habitats. There appears to be considerable overlap between the habitats occupied by the lizard in Britain and those reported from the present survey, notably heathland/bogland, sand dunes and roadside verges. Nonetheless, some differences are apparent: forest habitats were not found to be commonly used by the lizard here while the animal was regularly encountered in and around human habitation in rural areas. In fact, a significant number of lizards were seen on garden walls, on patios and doorsteps, (there were even a few indoor records including one from a bedroom!), suggesting that the lizard may be relatively tolerant of human presence in rural Ireland.

The distribution of the lizard in Britain is patchy, a situation which Beebee and Griffiths (2000) explain by the absence of suitable habitat in extensive areas of intensive farming and dense woodland. These conclusions echo those of Gasc (1997) who stated that the ecological plasticity of this species allows it to successfully colonise landscapes strongly influenced by man, with the exception of farm land and forest monoculture. Beebee and Griffiths (2000) considered upland fires in areas of heath and moor to be responsible for the absence of the lizard from otherwise suitable localities, while acknowledging that recolonisation in those habitats can be rapid given favourable conditions. In Ireland, the loss of suitable coastal habitats to recreational and holiday development is not likely to be reversed. Similarly, the large scale changes to bogland habitats as a result of the industrial harvesting of peat and the spread of commercial forestry must have removed large tracts of lizard habitat from many parts of Ireland over the years.

Cats have been widely recognised as a significant predator of lizards near human habitation (Bray and Gent, 1997). Birds of prey also take their share and lizard remains have been recorded at merlin plucking posts (D. Norriss, pers. comm.).

This is the first paper to present an account of the distribution and habitat of the viviparous lizard in Ireland. The 250 records analysed indicate that this reptile is relatively widespread, both around the coast and inland. However, the present paper is not based on an objective survey and consequently records are clustered to some extent around centres of human activity while many of the apparent gaps in the animal's distribution coincide with areas of low human densities. Further field work is required before we can be sure of the areas where the lizard is genuinely absent and it is hoped that the gaps apparent in Fig. 1 will provoke renewed survey effort and further records leading to a more complete picture of the spread of the viviparous lizard in Ireland in the near future. The lizard shows some flexibility in habitat choice and does not appear to be completely anthropophobic, although there are very few records of the animal from urban or suburban areas. The loss of coastal and peatland habitats is likely to have altered the distribution pattern of the lizard, but further study is required to establish the extent of these impacts.

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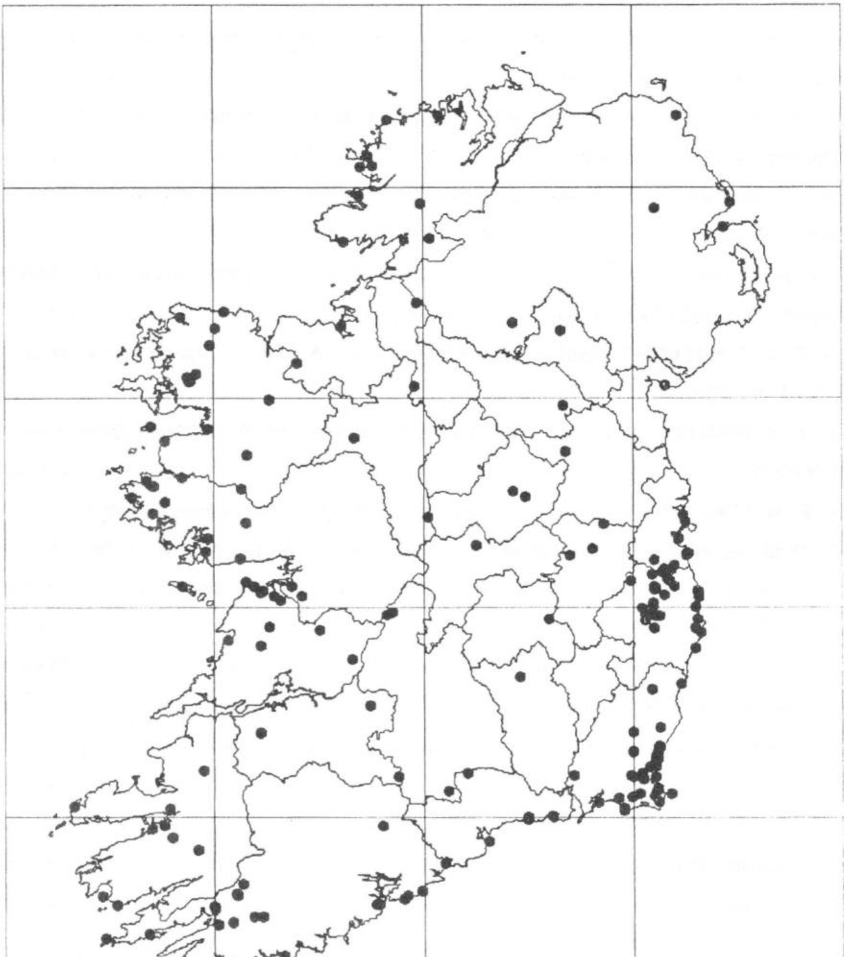
FIGURE 1. Distribution of the common lizard (*Lacerta vivipara*) in Ireland, 1990-2002.



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GROUND BEETLE (COLEOPTERA: CARABIDAE) AND PLANT COMMUNITIES OF ATLANTIC BLANKET BOG IN CONNEMARA, IRELAND

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Abstract

Four sites exhibiting different stages of *Calluna* growth (Pioneer Sites 1 and 2, Topiary Site and Degenerate Site) at Bencullagh, Connemara, Co. Galway were sampled (July – October, 1997) using pitfall traps and quadrats (2m X 2m) for ground beetles and plants respectively. Total plant species richness was greater at Pioneer Sites 1 (34) and 2 (41) than at the Topiary (31) and Degenerate (31) Sites but there was no significant difference between their medians. A total of 2007 carabids (18 species) was captured and total carabid species richness was greater at Pioneer Sites 1 (14) and 2 (16) than at the Topiary (11) and Degenerate (10) Sites. However, median carabid species richness per pitfall trap was significantly greater at the Topiary Site (8.5, $p<0.01$) and Pioneer Site 2 (7.5, $p<0.05$) than at the Degenerate Site (5.0). There was a significant positive relationship (r_s: +0.464) between percentage soil moisture and carabid species richness and a significant negative correlation (r_s: -0.316) between mean *Calluna* height and ground beetle species richness. The results suggest that plant community composition and vegetation structure in the study are influenced by grazing pressure and the carabid communities appear to be influenced by vegetation structure and soil moisture content.

Introduction

Connemara is about 2,000 square kilometers in size (Whilde, 1994) and comprises vast areas of blanket bog dominated by *Calluna vulgaris* (L.) Hull and *Molinia caerulea* (L.) Moench. Dependency on farming has always been strong and EU agri-policies were introduced in the 1970s and 80s to increase the standard of living of farmers and to stem rural depopulation. The result of these policies was a dramatic increase in sheep numbers on the hills. Bleasdale and Sheehy Skeffington (1992) report that numbers of sheep in Co. Galway almost doubled from

1980 to 1989 and their investigations suggest that grasslands in Connemara appeared to be expanding at the expense of more important heathland plant communities. While most work on the blanket bogs of Connemara has concentrated on plant communities (Bleasdale and Sheehy Skeffington, 1992, 1995; MacGowan and Doyle, 1996 and McKee, 2000), less has been published on the equally important terrestrial invertebrate communities. In Northern Ireland, McFerran *et al.* (1994) investigated the effects of grazing on ground beetle communities in a variety of upland vegetation types including wet heath and mature heather moorland. Their results suggest that carabid abundance and diversity varied between years, vegetation type and grazing intensity. Species with a preference for disturbed areas (e.g. *Nebria salina* Fairmaire and Laboulbene) were predominant on the most heavily grazed sites, while typical coloniser species (e.g. *Pterostichus niger* (Schaller)) were found on sites where grazing had ceased. In north-east Scotland, Gimingham (1985) examined the diversity of phytophagous invertebrates associated with the four different structural stages of *Calluna* growth (pioneer, building, mature and degenerate). The results indicated a greater diversity in invertebrate populations within the pioneer and degenerate phases of *Calluna* than in the building and mature stages. It was suggested that the lower diversity of invertebrates in the building and mature stands could have been associated with a lesser floristic diversity which showed the same pattern in diversity as the fauna. Gardner *et al.* (1997) found that carabid communities on heather moorlands in north-east Scotland were strongly influenced by *Calluna* height and soil organic content. Carabids with a preference for shaded areas were less abundant on heavily grazed sites, while species associated with open unshaded ground increased in number. Studies of heathlands in southern England by Webb *et al.* (1984) demonstrated that invertebrate diversity was generally greater on heathlands surrounded by more structurally diverse vegetation. Gardner (1991) indicated that the distribution of carabids on *Calluna*-dominated heaths of the North York Moors National Park was influenced by site wetness and vegetation structure. In addition, she suggested that the presence of all phases of *Calluna* development would be likely to increase the diversity of ground beetles present. Refseth (1980) states that insects 'should be included in any classification regarding the conservation of natural resources' and Gardner (1991) suggests that the status of a carabid community cannot be predicted from a classification of the vegetation alone. This provided the incentive for the present investigation where both plant and carabid beetles were examined at sites affected, over a long period of time, by different grazing pressures.

In this study, four sites on the western slopes of Bencullagh, Connemara (L740540) were selected on the basis of the predominant stage of *Calluna* growth adapted from Gimingham (1985). This divides the growth of *Calluna* into three main phases as follows: Pioneer - characterised by low growing prostrate *Calluna* plants which create an open, unshaded environment; Topiary (given in Gimingham (1985) as building/mature) - where *Calluna* begins to form a closed stand with a dense canopy giving rise to a shaded environment, the production of green shoots is at a maximum and the plants are highly competitive; Degenerate - where the central branches of *Calluna* eventually begin to die back creating shaded conditions at first followed by a more open microhabitat. In the absence of management, *Calluna* progresses naturally through these growth stages over a period (depending on local conditions) of *circa* 30 years. Two Pioneer Sites (1 and 2), one Topiary Site and one Degenerate Site, situated between 170m - 300m OD, were chosen for the study. All sites were grazed to some extent, apart from the Degenerate Site which consisted of a 20m wide strip adjacent to a conifer plantation and has been protected from grazing by a fence since 1978. There is no recorded history of burning in the area (John Mannion, pers. comm.).

Methods

Ten polypropylene pitfall traps (11cm diameter x 12cm height) were placed 15m apart in two rows of five at each site. Each trap contained a 200ml solution of one part ethylene glycol to four parts water, to which a drop of scentless soap was added to reduce surface tension. Traps were protected by corri-board covers (15cm x 15cm) supported by four nails at 2cm (approx.) above ground level. Trapping was carried out continuously (1 July - 20 October 1997) and traps were emptied and replaced once every two weeks. Carabids were separated from other invertebrates and preserved in 70% alcohol and beetles identified using Joy (1932), Lindroth (1974) and Forsythe (1987). The vegetation at each site was investigated using 2m x 2m quadrats placed around each centrally located pitfall trap. *Calluna* structure was examined by taking five height measurements per quadrat in addition to noting both the presence and percentage cover of each of its different growth phases (pioneer, topiary and degenerate). For

Molinia, the percentage cover and height of tussocks in each quadrat were noted and all plant species were recorded. The Braun – Blanquet cover scale (Mueller and Dombois, 1974) was used and vegetation data were analysed using the computer programme NPHYTO (O'Connell, National University of Ireland, Galway), which produces a vegetation table with distinct groups of species and quadrats defined by the constant occurrence of the species. Higher plants and mosses were identified using Webb *et al.* (1996) and Watson (1989) respectively. Soil pH, moisture and depth to maximum of 1.8m were measured at each pitfall trap. Non-parametric statistics (using SYSTAT®, Version 10) were used to analyse the results, as some of the data displayed heterogenous variances. Kruskal – Wallis tests (*K*) were undertaken to detect significant differences between medians at all sites and where significant differences were recorded, non-parametric multiple comparison tests for equal/unequal sample sizes (q/Q) were carried out (Zar, 1999). The Spearman Rank test was used to determine correlation coefficients.

Results

Vegetation

Although total plant species richness (Table 1) was greater at Pioneer Sites 1 and 2 (34 and 41, respectively) than at the Topiary (31) and Degenerate (31) Sites, there was no significant difference between the medians (Table 1). Classification of the vegetation data (Table 2) shows the Braun – Blanquet cover abundance values for each species recorded in every quadrat. Four broad groupings are presented based on the co-occurrence of species of high to medium frequency. Due to similarities in plant species composition, Pioneer Sites 1/2 and the Topiary/Degenerate Sites are combined for analysis of cover abundance using NPHYTO. The first group (Pioneer Group) consists of ten species found predominantly on the Pioneer Sites. These include *Galium saxatile* L. and *Deschampsia flexuosa* (L.) Trin. which are present in 70% of the pioneer quadrats. The Topiary/Degenerate Group contains those species which were recorded predominantly at the Topiary and Degenerate Sites. It contains four species including *Daboecia cantabrica* (Huds.) K. Koch which is restricted to west Galway and southwest Mayo in Ireland (Webb *et al.*, 1996). The Common Group consists of species common to all sites and includes *M. caerulea* and *Potentilla erecta* (L.) Rauschel, both of which were present in 97.5%

of all quadrats. Also present in this group were *C. vulgaris*, *Erica cinerea* L. and *Erica tetralix* L. with 90%, 72.5% and 42.5% frequency respectively. Additional species are given as companion species at the bottom of Table 2.

Figure 1 illustrates the mean percentage cover of the three different stages of *Calluna* growth at the four study sites. Mean percentage cover of the pioneer stage was greatest on Pioneer Sites 1 and 2 (9.3% and 14.2% respectively) and only the pioneer growth phase was found at these sites. At the other two sites, all stages occurred but mean percentage cover of the topiary and degenerate stages were predominant at the Topiary (11.9%) and Degenerate (29.0%) Sites respectively. Median *Calluna* height (Table 3) was significantly shorter on Pioneer Sites 1 (8.0cm) and 2 (7.0cm) than on the Topiary Site (20.0cm). On the Degenerate Site, median height (48.0cm) was significantly greater than on both Pioneer sites and the Topiary Site. However there was no significant difference between Pioneer Sites 1 and 2.

Median *Molinia* tussock height is also shown in Table 3 and there was no significant difference between the study sites. At Pioneer Site 2, on the other hand, median percentage cover of *Molinia* tussocks (38.5%) was significantly greater than at the Degenerate Site (2.5%).

Carabids

Table 4 shows the carabid abundance and percentage of total catch, caught at the four study sites. A total of 2007 individuals was captured with 38%, 33%, 18% and 11% of the total catch trapped at the Degenerate, Topiary, Pioneer 2 and Pioneer 1 Sites respectively. A total of eighteen carabid species was caught, eight of which were common to all of the study sites. These included the two most common species *Abax parallelepipedus* (Piller and Mitterpacher) and *Pterostichus niger* (Schaller). Five species (*Nebria brevicollis* (Fabricius), *Patrobus assimilis* Chaudoir, *Notiophilus biguttatus* (Fabricius), *Loricera pilicornis* (Fabricius) and *Notiophilus germinyi* Fauvel) were found solely on the Pioneer Sites. Of these, *N. brevicollis* accounted for 5.08% of the total catch and was found on both Pioneer Sites. *P. assimilis*, an upland species, was confined to Pioneer Site 1. The abundances of the final three species, *N. biguttatus* (two individuals), *L. pilicornis* (two individuals) and *N. germinyi* (one individual) were low. No carabid species were restricted to the Topiary Site but one individual of *Carabus clatratus* L. was caught on the Degenerate Site. This species is thought to be very locally distributed and in decline in Ireland (Anderson *et al.*, 2000). Ninety four percent of the *Carabus glabratus* Paykull individuals were caught at the Topiary and Degenerate Sites combined. Overall carabid species richness (Table 5) was greater at Pioneer Site 1 and 2 (14 and 16 respectively) than at the Topiary (11) and Degenerate (10) Sites. However, median carabid species richness per pitfall trap was significantly greater at the Topiary Site (8.5) and Pioneer Site 2 (7.5) than at the Degenerate Site (5.0).

Physical Parameters and Correlations

Table 6 gives the median percentage soil moisture which was significantly less at the Degenerate Site (61.6%) than at Pioneer Site 1 (82.7%), Pioneer Site 2 (82.2%) and the Topiary Site (86.5%). There was no significant difference between the soil pHs or soil depths at the study sites (Table 6).

A weak negative correlation between mean *Calluna* height and carabid species richness and a modest positive correlation between soil moisture content and carabid species richness was apparent with r_s (Spearman Rank Correlation Coefficient) = -0.316 and +0.464 ($p<0.05$ and $p<0.01$) respectively (Table 7).

Discussion

Vegetation

Although there was a greater total plant species richness at the Pioneer Sites, the medians were not significantly different. Nevertheless, this higher overall species richness could be the result of grazing where part of the vegetation canopy is opened up allowing both shade-tolerant/intolerant plant species to thrive. At the Degenerate Site (protected from grazing by a fence since 1978), median *Calluna* height is, not surprisingly, significantly taller than at the other three study sites. In addition, the absence of management has resulted in the progression of *Calluna* to its final stage of development i.e. the mature degenerate stage, which was most frequent at the Degenerate Site. Sporadic grazing of the Topiary Site has probably restricted the natural development of *Calluna* resulting in the dominance of the topiary growth stage. Grazing of the Topiary Site (which up until 1990 had been protected from grazing for up to 12 years) is also reflected in the *Calluna* height which was significantly shorter than on the unmanaged

Degenerate Site but significantly longer than on the continuously grazed Pioneer Sites. This continuous grazing at both Pioneer Sites is preventing the growth of *Calluna* beyond its first stage of development i.e. the pioneer stage.

Median percentage cover of *Molinia* tussocks is greater at Pioneer Site 2 (grazed by cattle during the summer months and sheep all year round) than at Pioneer Site 1 (grazed by sheep all year round), the Topiary Site (sporadically grazed by sheep) and the Degenerate Site (protected from grazing by a fence). This difference is significant between Pioneer Site 2 and the Degenerate Site. These results could suggest that the percentage cover of *Molinia* tussocks is linked, at least in part, to grazing pressure. However, further studies in this area are required before any definite conclusions can be made. There is no significant difference in tussock height between the study sites.

On examination of plant species composition, further conclusions can be drawn. Four species of the Pioneer Group in this study (*G. saxatile*, *Rhytidiadelphus squarrosus* (Hedw.), *Agrostis capillaris* L. and *Carex echinata* Murray) correspond to species defined by MacGowan and Doyle (1996) as species that invade grazed areas of Atlantic blanket bog in Connemara. *G. saxatile* is a shade-intolerant species (Grime *et al.*, 1996) and hence attains its highest frequencies on the Pioneer Sites where continuous year-round grazing ensures open conditions. *A. capillaris* is an invasive species which produces very high densities of small tillers (Grime *et al.*, 1996) that enable rapid renewal after heavy grazing. In addition, *Deschampsia caespitosa* (L.) Beauv., was found only on the Pioneer Sites in this study. The species is generally avoided by sheep due to the high silica content of the leaves (Grime *et al.*, 1996) and is therefore likely to have thrived on the grazed Pioneer Sites where competition with more palatable species is reduced. The species of the Topiary/Degenerate Group include the nationally important *D. cantabrica*, which may have a preference for the closed shaded microhabitat afforded by the topiary and degenerate *Calluna* growth stages.

Carabids

Ground beetle activity and resistance of the vegetation to horizontal movement can influence capture rates (Greenslade, 1964) and different combinations of species, some of which occur in large numbers, will affect overall abundances. It would therefore be unwise to make direct comparisons regarding carabid abundances between the different sites and more useful to examine species richness and individual species ecology (see below). However, although the height of the pioneer growth stage is shorter than the topiary/degenerate stages, the former would present more resistance to ground invertebrate movement as the majority of the growth in the later stages of *Calluna* development is aerial with minimal basal growth. In this study, more carabid individuals were caught at the Topiary /Degenerate Site which may be reflective of the resistance of the pioneer stage to carabid movement. Total carabid species richness, on the other hand, was greater at the Pioneer Sites than at the Topiary and Degenerate Sites. This is reflected in the negative correlation between mean *Calluna* height and carabid species richness. As the *Calluna* height increased from the Pioneer to the Topiary to the Degenerate Sites, the carabid species richness decreased. This is in line with similar work done in England (Gardner, 1991), Wales (Holmes *et al.*, 1993) and Northern Ireland (McFerran *et al.*, 1994). Although total plant species richness was also greater at those sites where total carabid species richness was greatest, no significant correlation was found between these two variables. In addition, median carabid species richness per pitfall trap was significantly greater at Pioneer Site 2 than at the Degenerate Site. The significantly shorter *Calluna* height and dominance of the pioneer growth stage created open unshaded conditions at Pioneer Site 2 which allowed species that have a preference for open areas such as *N. brevicollis* to establish. Also, the significantly greater percentage cover of *Molinia* tussocks at this site is likely to have created shaded areas which enabled shade-tolerant carabid species such as *A. parallelepipedus* to thrive. Therefore Pioneer Site 2 is capable of supporting both shade-tolerant carabid species and species which have a preference for open areas. Although similar conditions prevailed at Pioneer Site 1, it was at a higher altitude than Pioneer Site 2 and exposure may have been a factor limiting carabid species richness at this site. There was no significant difference in median carabid species richness per pitfall trap between Pioneer Site 1 and the other study sites. At the Degenerate Site on the other hand, both the *Calluna* and *Molinia* gave rise to shaded conditions and this site lacked the species that are characteristic of more open unshaded areas. This may explain the significantly greater median carabid species richness per pitfall trap at Pioneer Site 2 than at the Degenerate Site. Although those species which have a preference for open areas were also absent from the Topiary Site, median carabid species richness per pitfall trap here is surprisingly, significantly greater than at the Degenerate Site. This could be the result of a significantly higher percentage soil moisture at the Topiary Site which may be promoting strongly hygrophilous species (see below) that are absent from the drier Degenerate Site.

A total of five carabid species (*N. brevicollis*, *P. assimilis*, *L. pilicornis*, *N. biguttatus* and *N. germinyi*) was caught solely on the Pioneer Sites. Of these, *N. brevicollis* accounted for over 5% of the total catch. This eurytopic species is strongly associated with disturbed situations (Anderson *et al.*, 2000) which may explain its restricted distribution to the pioneer sites in this study. On blanket bog in Wales, Holmes *et al.* (1993) also captured this species on managed sites while it was absent from the unmanaged ones. Catches of *P. assimilis* were restricted to Pioneer Site 1 which is at an altitude of 300m OD. This species has been characterised as an upland carabid (Anderson *et al.*, 2000) with a preference for open disturbed areas (Gardner *et al.*, 1997 and McFerran *et al.*, 1994) which probably explains the restricted distribution of this species to Pioneer Site 1 in this study. Although catches of *L. pilicornis*, *N. biguttatus* and *N. germinyi* were also restricted to the Pioneer Sites, the abundances of these species were low (one or two individuals). However, in similar studies in Scotland (Ings and Hartley, 1999), England (Gardner *et al.*, 1997) and Wales (Holmes *et al.*, 1993), these species also showed a strong preference for open disturbed habitats.

No carabid species were restricted to the Topiary Site in this study. However, at the Degenerate Site, one *C. clatratus* individual was captured. This species is thought to be in decline in Ireland and western Europe and is believed to be extinct in England and parts of Northern Ireland (Derry, Tyrone and Antrim). It is thought to have a strong preference for very wet areas (Anderson *et al.*, 2000). Although, the Degenerate Site had the lowest percentage soil moisture content, this species is likely to be associated with a stream margin that runs adjacent to the site. This carabid species can adopt an amphibious mode of life and enter water in search of prey. Water snails, small freshwater crustaceans, insect and amphibian larvae, leeches and small fish are taken. Individuals can stay submerged for more than 17 minutes and air is stored beneath the elytra at the tip of the abdomen (Thiele, 1977).

Two notable absentees from the Degenerate Site are *Agonum fuliginosum* (Panzer) and *Pterostichus minor* (Gyllenhal) which were present at the other sites. The ecology of these species suggest that they are strongly hygrophilous (Anderson *et al.*, 2000) and their absence is likely to be a result of the drier conditions at the Degenerate Site. This is also reflected in the positive correlation between soil moisture content and carabid species richness. Although *C. glabratus* was found on all sites, 94% of its total catch was confined to the Topiary and Degenerate Sites. This species would appear to have a strong preference for the shaded conditions afforded by the topiary and degenerate *Calluna* stages which is in agreement with McFerran *et al.* (1994) who also found this species in greatest numbers on mature heather moorland in Northern Ireland.

Conclusions

The conclusions drawn here can only be related to the particular sites studied (Hurlbert, 1984) and not to Atlantic blanket bog in general. Nevertheless, the following points can be made. Grazing pressure appears to be a major factor influencing plant species composition and structure on the Atlantic blanket bog sites investigated in this study. The natural development of *Calluna* through its different growth stages appears to be strongly influenced by grazing intensity. At sites which are heavily grazed, development beyond the pioneer stage was prevented while in the fenced site, *Calluna* progressed naturally to the degenerate stage. Invasive plant species (e.g. *A. capillaris*), shade-intolerant species (e.g. *G. saxatile*) and less palatable species (e.g. *D. caespitosa*) also thrived on the grazed areas.

In terms of carabids, this study has highlighted two factors which play a major role in determining community composition. These are vegetation structure and soil moisture content. McFerran *et al.* (1994), Gardner *et al.* (1997) and Dennis *et al.* (1997) also emphasize the importance of vegetation structure in determining carabid distribution on upland areas in Northern Ireland, England and Scotland respectively. Its impact, however, is likely to be an indirect one with different growth forms creating different microhabitats that are preferred by particular carabid species. On the lowland area in this study, where the pioneer stage predominated, both shade-tolerant and intolerant carabid species thrived. The low growing pioneer *Calluna* probably accommodated those species (e.g. *N. brevicollis*) which have a preference for open areas while *Molinia* tussocks are likely to have ensured suitable conditions for shade-loving carabids (e.g. *A. parallelepipedus*). In the more upland area, on the other hand, where the pioneer growth stage predominated, exposure might be an important factor limiting carabid species richness. In areas where the topiary and degenerate stages prevailed, both the *Calluna* and *Molinia* tussocks created a shaded environment and species typical of open areas were subsequently absent. However, this shaded microhabitat appears to favour *C. glabratus* which has a relatively restricted distribution in Ireland, having a strong preference for upland and *Calluna*-dominated habitats (Anderson *et al.*, 2000). Nationally scarce carabids such as *C. clatratus* may also frequent blanket bog at the margins of water bodies e.g. streams and bog pools. The importance of soil moisture content in determining carabid communities has also been highlighted. Species such as *A. fuliginosum* and *P. minor* which are strongly hygrophilous were absent from the drier parts of Atlantic blanket bog in this study. This is in line with similar work carried out in Northern Ireland (McFerran *et al.*, 1994) and England (Gardner, 1991; McCracken, 1994 and Gardner *et al.*, 1997).

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Personal Communication

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TABLE 1. Total plant species richness with mean (± S.D.) and median species richness per quadrat at Bencullagh, Co. Galway.

	Pioneer Site 1	**Pioneer Site 2**	**Topiary Site**	**Degenerate Site**
Total	34	41	31	31
N	10	10	10	10
Mean ± S.D.	14.6 ± 2.7	16.3 ± 2.0	13.1 ± 2.8	15.2 ± 2.4
Median	15.0	16.0	13.0	15.5

$K = 6.4$; not significant, Kruskal–Wallis test.

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TABLE 2. Vegetation Table for the four study sites at Bencullagh in Connemara. Braun-Blanquet values represent percentage cover within each quadrat as follows: 5 = 76-100% cover, 4 = 51-75% cover, 3 = 26-50% cover, 2 = 5-25%, 1 = 1-4% and + = <1% cover.

	Pioneer 1										Pioneer 2										Topiary										Degenerate									
Quadrat Number ->	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	31	32	33	34	35	36	37	38	39	40
PIONEER GROUP																																								
Deschampsia flexuosa	1	2	2	2	.	2	2	2	2	.	1	.	1	.	1	.	.	2	2	2	.	.	.	.	1	.	2	.	.	.	.	.	.	.	.	1	2	1	1	1
Galium saxatile	.	1	1	1	1	.	.	2	2	.	1	1	+	.	1	.	1	1	1	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Eriophorum vaginatum	.	.	.	.	.	2	.	.	1	1	1	2	2	2	2	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.
Eriophorum angustifolium	.	2	.	1	.	1	.	2	1	1	.	+	+	1	.	+	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhytidiadelphus squarrosus	.	+	1	.	2	.	.	.	1	.	.	.	+	.	.	+	2	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Trichophorum caespitosum	1	1	1	1	.	2	.	.	.	2	.	.	.	1	1	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agrostis capillaris	.	1	1	1	4	.	.	1	.	.	.	.	.	.	.	1	1	.	1	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Deschampsia caespitosa	.	1	.	2	.	.	2	.	.	.	.	.	.	.	.	+	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Juncus effusus	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	1	1	.	1	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Carex echinata	1	.	.	1	.	+	.	.	.	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
TOPIARY/ DEGENERATE GROUP																																								
Pleurozium schreberi	+	.	.	.	1	.	.	1	1	+	.	.	.	.	.	.	.	1	+	+	+	1	+	1	+	1	+	+	+	+	+	1	1	1	1	1	1	+	1	1
Succisa pratensis	.	.	.	.	.	.	.	.	.	+	.	1	.	1	.	+	.	.	.	.	.	1	+	.	1	+	+	.	.	+	1	.	+	1	1	1	1	1	.	+
Breutelia chrysocoma	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	2	1	2	2	2	1	1
Daboecia cantabrica	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1	.	.	.	.	.	.	.	1	.	1	1	1	1

TABLE 2 (continued)

	Pioneer 1										Pioneer 2										Topiary										Degenerate									
Quadrat Number ->	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	31	32	33	34	35	36	37	38	39	40
COMMON GROUP																																								
Molinia caerulea	4	3	3	3	2	4	4	4	3	2	3	3	3	2	3	2	3	4	3	5	5	4	2	4	4	4	4	4	3	5	3	2	4	1	1	1	3	3	3	.
Potentilla erecta	1	1	1	1	1	2	1	2	1	1	1	1	.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Calluna vulgaris	2	2	2	1	1	2	2	1	2	2	3	1	2	2	2	2	3	.	1	.	2	2	4	2	1	.	1	.	1	1	3	3	2	4	4	3	2	2	2	1
Hypnum jutlandicum	1	1	1	1	.	+	1	1	1	1	.	+	+	+	+	1	.	1	+	2	1	1	1	1	1	.	+	+	1	+	1	2	1	2	2	1	1	1	1	1
Rhytidiadelphus loreus	1	1	.	+	1	+	+	1	1	+	1	.	.	.	.	+	1	1	1	+	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1	+	1	2	1
Erica cinerea	2	1	1	.	.	+	.	.	.	1	1	2	2	2	1	1	1	.	+	.	1	1	1	2	1	.	+	.	.	.	1	1	1	1	1	1	2	1	2	2
Hylocomium splendens	+	+	.	.	1	+	1	1	1	.	+	.	.	.	.	.	.	.	1	.	1	1	+	1	+	1	1	1	1	1	.	1	+	1	1	1	+	1	.	1
Plagiothecium undulatum	+	.	.	.	.	.	+	1	1	.	1	.	+	.	.	.	+	1	1	.	.	.	+	.	.	.	.	1	+	+	+	1	+	+	.	+	+	.	+	.
Polygala serpyllifolia	+	1	.	.	.	1	+	.	.	1	.	1	+	1	.	.	+	.	.	.	1	+	1	+	1	+	1	.	1	.	.	1	.	.	.	.	.	.	.	.
Sphagnum capillifolium	1	.	1	.	.	.	.	.	.	1	1	1	+	+	1	+	.	.	.	.	.	+	2	.	.	.	+	.	.	.	1	1	.	.	1	1	1	.	.	.
Erica tetralix	.	1	.	1	.	+	1	.	.	1	.	+	1	1	.	1	.	.	.	.	1	+	1	.	.	.	.	.	.	.	1	1	.	.	1	+	.	.	1	.
Racomitrium lanuginosum	.	.	.	.	.	.	.	.	.	+	+	.	1	+	+	.	+	.	.	.	1	+	+	.	.	.	.	.	.	.	1	.	.	.	1	1	.	.	.	.
Sphagnum subnitens	.	+	.	+	.	.	+	.	.	.	.	.	.	.	1	.	1	1	1	.	+	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	1	.	.

TABLE 2 (continued)

	Pioneer 1										Pioneer 2										Topiary										Degenerate									
Quadrat Number ->	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	31	32	33	34	35	36	37	38	39	40
COMPANION SPECIES																																								
Agrostis canina	.	.	.	1	.	.	.	.	.	.	2	.	1	.	.	.	.	1	.	1	1	.	.	.	.	1	2	1	1	1	.	.	.	.	.	.	.	.	.	.
Blechnum spicant	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	+	+	1
Thuidium tamariscinum	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	+	2	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	1	1
Sphagnum palustre	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	1	+	.	.	.	.	1	.	1	1	.	.	.	.	.	.	.	.	.	.	.
Vaccinium myrtillus	.	.	.	.	.	.	.	.	1	.	2	.	.	.	1	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2	1
Polytrichum commune	.	.	.	.	.	.	.	.	1	.	.	+	.	.	.	.	.	.	1	.	.	.	+	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Pseudoscleropodium purum	.	.	.	.	1	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.
Anthoxanthum odoratum	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Campylopus atrovirens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.
Sphagnum papillosum	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1
Sphagnum quinquefarium	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Drosera rotundifolia	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Agrostis stolonifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Sorbus aucuparia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
Pteridium aquilinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2
Narthecium ossifragum	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leucobryum glaucum	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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TABLE 3. Mean (± S.D.) and median *Calluna* heights (cm), *Molinia* tussock heights (cm) and percentage cover of *Molinia* tussocks at Bencullagh, Co. Galway.

		Pioneer Site 1	**Pioneer Site 2**	**Topiary Site**	**Degenerate Site**
(A) *Calluna* Height	N	50	40	35	44
K= 110.4	Mean (±S.D.)	9.0 ± 4.1	7.7 ± 2.6	20.7 ± 10.5	51.3 ± 18.9
p<0.001	Median	8.0	7.0	20.0	48.0
	Pioneer Site 1	-	-	-	-
	Pioneer Site 2	-	-	-	-
	Topiary Site	*3.97**	*4.60***	-	-
	Degenerate Site	*8.77****	*9.18****	*4.14**	-
(B) *Molinia* Tussock Height	N	34	50	38	23
K=1.7	Mean (±S.D.)	47.9 ± 19.0	45.4 ± 16.5	47.1 ± 12.7	41.7 ± 11.5
Not significant	Median	42.5	45.0	45.0	40.0
(C) % Cover of *Molinia* Tussocks	Mean (±S.D.)	18.9 ± 20.1	36.9 ± 19.9	22.0 ± 26.6	5.1 ± 9.0
n=10	Median	10.0	38.5	10.0	2.5
K=15.6	*Pioneer Site 1*	-	-	-	-
p<0.001	*Pioneer Site 2*	-	-	-	-
	Topiary Site	-	-	-	-
	Degenerate Site	-	*5.53****	-	-

K= Kruskal – Wallis test. *Q/q* values (unequal/equal sample sizes), given in italics, indicate significant differences between sites at the 5% (*), 1% (**) and 0.1% (***) levels.

TABLE 4. Total abundances and percentage of total catch of carabid species caught at Bencullagh, Co. Galway.

Species	Pioneer Site 1	Pioneer Site 2	Topiary Site	Degenerate Site	Total Abundance	% Catch
Abax parallelepipedus (Piller and Mitterpacher)	54	116	294	446	**910**	**45.34**
Agonum fuliginosum (Panzer)	3	10	11	-	**24**	**1.20**
Carabus clatratus Linnaeus	-	-	-	1	**1**	**0.05**
Carabus glabratus Paykull	7	3	111	59	**180**	**8.97**
Carabus problematicus Herbst	15	10	30	3	**58**	**2.89**
Cychrus caraboides (Linnaeus)	-	2	-	6	**8**	**0.40**
Leistus terminatus (Hellwig)	-	2	4	-	**6**	**0.30**
Loricera pilicornis (Fabricius)	1	1	-	-	**2**	**0.10**
Nebria brevicollis (Fabricius)	52	50	-	-	**102**	**5.08**
Notiophilus biguttatus (Fabricius)	1	1	-	-	**2**	**0.10**
Notiophilus germinyi Fauvel	-	1	-	-	**1**	**0.05**
Patrobus assimilis Chaudoir	6	-	-	-	**6**	**0.30**
Pterostichus diligens (Sturm)	8	13	16	3	**40**	**1.99**
Pterostichus melanarius (Illiger)	2	2	28	52	**84**	**4.19**
Pterostichus minor (Gyllenhal)	3	14	5	-	**22**	**1.10**
Pterostichus niger (Schaller)	22	95	107	195	**419**	**20.88**
Pterostichus nigrita agg. (Paykull)	14	32	14	2	**62**	**3.09**
Trechus obtusus Erichson	30	17	32	1	**80**	**3.99**
No. of individuals	**218**	**369**	**652**	**768**	**2007**	
Percentage of total catch	**11%**	**18%**	**33%**	**38%**		

TABLE 5. Total carabid species richness with mean (± S.D.) and median species richness per pitfall trap at Bencullagh, Co. Galway (n = 10).

	Pioneer Site 1	Pioneer Site 2	Topiary Site	Degenerate Site
Total	14	16	11	10
Mean ± S.D.	6.9 ± 1.5	7.4 ± 1.7	7.8 ± 1.7	5.1 ± 0.9
Median	6.5	7.5	8.5	5.0
Pioneer Site 1	-	-	-	-
Pioneer Site 2		-	-	-
Topiary Site	-	-	-	-
Degenerate Site	-	*4.02**	*4.73***	-

K = 13.6; p<0.01, Kruskal-Wallis test. q values (given in italics) indicate significant differences between the sites at the 5% (*) and 1% (**) level.

TABLE 6. Mean (± S.D.) and median percentage soil moisture, soil pH and soil depth at Bencullagh Co. Galway (n = 10).

		Pioneer Site 1	Pioneer Site 2	Topiary Site	Degenerate Site
(A) % Soil Moisture	Mean (±S.D.)	81.5 ± 4.2	80.9 ± 4.2	86.8 ± 2.3	63.2 ± 10.4
K=26.6	Median	82.7	82.2	86.5	61.6
p<0.001	*Pioneer Site 1*	-	-	-	-
	Pioneer Site 2	-	-	-	-
	Topiary Site	-	-	-	-
	Degenerate Site	*4.10**	*3.67**	*7.28****	-
(B) Soil pH	Mean (±S.D.)	4.9 ± 0.1	4.9 ± 0.1	4.8 ± 0.3	4.8 ± 0.1
K=6.3 *Not significant*	Median	4.9	4.9	4.8	4.8
(C) Soil Depth	Mean (±S.D.)	0.9 ± 0.5	0.9 ± 0.5	0.5 ± 0.1	1.1 ± 0.6
K=4.9 *Not significant*	Median	0.7	0.9	0.6	0.9

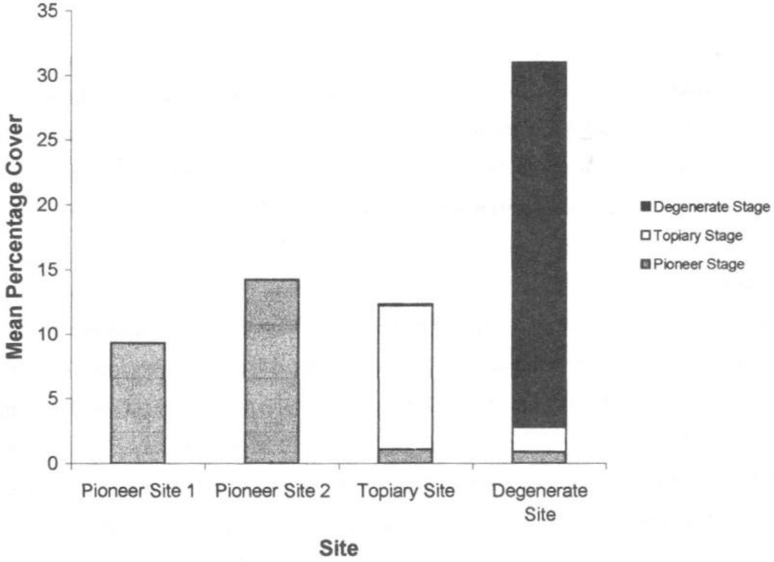
K= Kruskal – Wallis test. *q* values given in italics indicate significant differences between sites at the 5% (*) and 0.1% (***) levels.

TABLE 7. Spearman Rank Correlation Coefficients (r_s) for carabid species richness and vegetation/physical parameters at Bencullagh, Co. Galway.

	Carabid Species Richness
Mean *Calluna* height	-0.316*
Mean *Molinia* tussock height	+0.025
% cover *Molinia* tussocks	+0.161
Plant species richness	-0.132
Percentage soil moisture	+0.464**

* significant at $p < 0.05$; ** significant at $p < 0.01$.

FIGURE 1. Mean percentage cover of the different growth stages of *Calluna* at Bencullagh, Co. Galway.



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A REVIEW OF THE IRISH HARVESTMEN (ARACHNIDA: OPILIONES)

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Abstract

This article considers the status and distribution of the 18 species of harvestman currently recorded from Ireland, and compares the Irish fauna with that of Great Britain. Included are a bibliography of the fauna, a summary of the history of the study of this group in Ireland and updated vice-county checklists. Distribution maps are also included for each species.

Introduction

The harvestmen, also known as the harvestspiders, constitute the Order Opiliones of the Phylum Chelicerata, Class Arachnida. They are spider-like in general appearance, but are distinctive in a number of ways, notably in having only two eyes, segmented abdomens and inability to manufacture silk. One Irish species, *Anelasmocephalus cambridgei* (Westwood), is more reminiscent of a large mite than of a spider. Although little is known in detail about harvestmen feeding preferences, they may be generally regarded as predators of invertebrates, although they will also feed on some plant material, especially plant juices. A total of eighteen species have been recorded in Ireland, three of which, *Odiellus spinosus* (Bosc), *Opilio parietinus* Degeer and *Dicranopalpus ramosus* (Simon) are not native here. This compares with an Irish native spider fauna of just under 400 species (van Helsdingen, 1996 and more recent additions).

History of harvestman recording in Ireland

Although the harvestmen are a small group, presenting little difficulty with identification, they have received very little attention from Irish naturalists. Most publications concerning them are based on incidental observations, often by workers primarily interested in documenting the spiders. George Carpenter recorded the harvestmen around the turn of the 19th century and it is clear from a reference in Anon. (1894a), repeated by Pack-Beresford (1926), that he had planned to write an account of the Irish species. In the event, however, he published relatively little other than brief notes on the group, passing on his numerous records instead to Denis Robert Pack-Beresford who included these in his review of the Irish species (1926). Pack-Beresford was one of the most significant naturalists during the heyday of natural history in Ireland, the last decade of the 19th and first decade of the 20th centuries. Some aspects of his career can be gleaned from Harding (1980, 1981). He is now best remembered for his work on spiders and woodlice. Pack-Beresford's review of the opiliones summarised all available records, most of which had been generated by his correspondence with other active workers of the time. The review also included distribution maps, based on Praeger's vice-county divisions. In January 2002, the author had the opportunity of examining the opiliones section of the Pack-Beresford archive, housed in the library of the Royal Irish Academy. It proved possible to trace an outline of the sources of the vice-county records used to compose these maps. Over 65% of these had been supplied by G. Carpenter, with about 10% each coming from D. Pack-Beresford and R. A. Phillips. Contributions also came from N. H. Foster, A. W. Stelfox, R. Welch and others. In addition, the Pack-Beresford archive contains details of 33 new vice-county records, mostly collected after publication of the 1926 review. The great majority of these were generated by the activities of R. A. Phillips and, in the intervening years, all but a handful have lost their currency. A small number of new vice-county records for *Megabunus diadema* (Fabricius) are, however, still valid, and these have been included in the species account below.

Virtually nothing appeared in print subsequent to the 1920's, an exception being an article summarising the Irish and British harvestmen by Bristowe (1949), which added a previously overlooked leiobunid, *Nelima gothica* Lohmander, to the Irish list. The appearance of a Linnean Society key (Sankey and Savory, 1974) generated a minor upsurge in interest, co-ordinated by Carmel Mothersill (1978). Sankey and Savory (1974) featured a table summarising the county distribution of harvestmen in Ireland. However, this contained a number of errors, most notably the complete omission of *M. diadema* as an Irish species. A significant recording milestone was achieved with the publication of a provisional distribution atlas covering the Irish as well as the British faunas (Sankey, 1988). The distribution maps were reprinted by Hillyard and Sankey (1989), without the inclusion of any additional Irish information. The poor state of recording of the group in Ireland at the time can be gauged by the fact that the distribution maps comprised a grand total of under 500 10km square records. An approximately similar number of records was generated during a survey of the harvestmen of Cos Sligo and Leitrim, a survey which uncovered the presence of *O. spinosus* in Ireland (Cotton and Cawley, 1997). Cawley (1999) listed a large number of new vice–county records, including a small number from Co. Laois, which had in fact previously been reported by Mothersill (1983). The present state of recording at the 10km square level is summarised in Table 1.

The Irish harvestman collection in the National Museum of Ireland

Through the kindness of Dr Jim O'Connor, I had the opportunity to examine the harvestman collection in the National Museum of Ireland which, at the end of 1999, comprises about 300 tubes of specimens, representing every Irish species with the exception of *A. cambridgei*. The great bulk of the specimens appear to derive from the collections of late 19th and early 20th century workers, especially G. H. Carpenter. Other specimens from this period were donated by D. R. Pack-Beresford, T. Workman, N. H. Foster, R. A. Phillips, R. L. Praeger and A. W. Stelfox. A few specimens derive from the early 19th century collections of Templeton. Some more recent specimens had been donated by L. Gibson, D. W. Mackie, D. G. Higgins and M. Cawley. Also present is a collection of specimens from Sligo-Leitrim donated by D. C. F. Cotton. In many instances labels on late 19th and early 20th century specimens had completely faded or bore very little information. Often labels bore simply a place or county name. Among the interesting specimens in the collection are the first Irish vouchers for *Mitostoma chrysomelas* (Hermann), *Oligolophus hanseni* (Kraepelin), *O. parietinus*, *Opilio saxatilis* C. L. Koch, *O. spinosus*, and *D. ramosus*. Also present are animals collected during the Irish Field Club Union triennial meetings, as well as specimens collected during the Lambay and Clare Island surveys. A collection of specimens gathered during my own fieldwork will shortly be deposited at the museum.

The harvestmen of Irish offshore islands

The harvestman faunas of offshore islands are of some interest because, unlike spiders, these animals cannot colonise islands by ballooning, but must instead reach islands by direct colonisation, before the island separated from the mainland, or subsequently with human or other assistance. Literature (bibliography reference 1, 12, 18, 36, 37, 39, 40) records exist for no fewer than 12 Irish offshore islands. More recent information has been supplied by Don Cotton (Inishmurray), Jon Daws (Blaskets and Inishmore), and M. Cawley (Cape Clear, Inishmore, Inishmurray and Tory). A total of 11 species have been recorded, with no surprising absentees. However, *Leiobunum blackwalli* Meade has only been recorded from one island. The most frequently recorded harvestmen on offshore islands, *Nemastoma bimaculatum* (Fabr.), *Mitopus morio* (Fabr.) and *Phalangium opilio* L. are all widespread on the mainland. *N. gothica* was overlooked by early workers but recent fieldwork suggests that it is a predictable and common species on offshore islands.

Species account

***Nemastoma bimaculatum* (Fabricius, 1775)**

N. bimaculatum occurs widely and commonly throughout Ireland, and will be familiar to anyone who samples for terrestrial invertebrates. It is a small but very distinctive animal, completely black except for two conspicuous silvery spots on the cephalothorax. It is perhaps most abundant in deciduous woodlands, where it occurs in leaf litter, under stones in moss, etc. However, it is also frequent in grasslands, blanket bogs, and synanthrophic sites. It regularly turns up on mountain summits, including that of Carrantuohill (Kew, 1910). *N. bimaculatum* is strictly a ground dwelling animal, only very rarely climbing vegetation or walls.

Unlike most harvestmen, *N. bimaculatum* occurs in the adult stage throughout the year. I have observed animals mating in January, March and September, with first instar nymphs occur from early spring. Occasionally specimens occur where the characteristic cephalothoracic spots are reduced or completely absent. The latter specimens are referred to as var. *unicolor* Roewer, and have been reported in Ireland by Anon. (1895a), Carpenter (1908) and Cotton and Cawley (1997), to which I can add six records from vice-counties Mid Cork, Kilkenny, Clare, Westmeath, Sligo and Tyrone. There are further specimens in the National Museum, collected by D. R. Pack-Beresford at Fenagh, Co. Carlow, and by Leslie Gibson in Co. Wexford. Specimens with reduced spots occur fairly regularly and it is probably best to regard the unicolorous specimens as representing an extreme form of the normal variation which occurs within populations. *N. bimaculatum* has been recorded widely in western Europe, from northern

Iberia to Norway (Martens, 1978).

Offshore island records: Cape Clear, Co. Cork, Blasket Islands, Co. Kerry, Inishmore, Co. Galway, Clare Island, Co. Mayo, Inishmurray, Co. Sligo, Tory Island, Co. Donegal, Lambay, Co. Dublin and Ireland's Eye, Co, Dublin.

Vice-county checklist: recorded from all Irish vice-counties, H01-H40. Fig. 1.

Irish bibliography: 5, 9, 12, 16, 17, 18, 19, 21, 22, 24, 28, 29, 30, 31, 32, 35, 36, 37, 38, 40, 45, 46, 47, 48.

***Mitostoma chrysomelas* (Hermann, 1804)**

M. chrysomelas is very dissimilar in general appearance to the other Irish nemastomatid, *N. bimaculatum*, being smaller bodied, but with much longer legs, and with the dorsal surface covered by rows of tubercles. As with *N. bimaculatum*, it occurs as an adult throughout the year. The first Irish record was from Feenagh, Co. Carlow (Pack-Beresford, 1926) and it has since been reported from 10 vice-counties, with records coming from a total of 14 10km squares. It may be significant that the few Irish records have tended to come from hilly areas and from acid soils. *M. chrysomelas* is a surprisingly elusive animal which requires to be deliberately searched for, especially in rank grasslands, and many of the Irish records have been made by visiting British workers who were experienced in finding it. It is likely to be the most under-recorded Irish harvestman. *M. chrysomelas* is widespread in Great Britain and widely recorded in Europe (Martens, 1978).

Vice-county checklist: recorded from vice-counties H02, H06, H07, H10, H12, H13, H20, H23 and H33. Fig. 1.

Irish bibliography: 21, 23, 28, 35, 40, 44, 45, 46, 47.

***Anelasmocephalus cambridgei* (Westwood, 1874)**

A. cambridgei is a small, slow moving, short-legged animal, in general appearance more like a large mite than a harvestman. It is a ground living animal, associated with grasslands, and especially with woodlands, and is not likely to be met with unless carefully searched for, for example by sieving leaf litter. The first Irish record was from South Kerry where Jon Daws collected a specimen at The Gap of Dungloe, V8786, on 20 May 1992. This is the record which is mentioned in Sankey (1993). However, it appears certain that *A. cambridgei* had been collected in Ireland in the 1930's, for a letter from A. R. Jackson, dated 14 May 1936, and in the Pack-Beresford archive, refers to a specimen having been sent from Killarney. This record appears never to have made its way into print. *A. cambridgei* has been reported from sites in Cos Cork, Waterford and Galway by Cawley (1999). Further records are from moss on boulders in Reenadinna Yew Wood, Killarney National Park, Co. Kerry, V9586, from moss in sand dunes at Inchydoney, W4038, leaf litter under Japanese knotweed *Reynoutria* on waste ground at Glasheen, W6570, and from deciduous leaf litter at Bandon, W4754, all in Co. Cork, as well as from leaf litter in mixed woodland at Cheekpoint, Co. Waterford, S6713. In addition, Myles Nolan has a specimen from sand dunes at Brittas Bay, Co. Wicklow, T3080, November 1998. Searches at a fair number of woodland sites in Munster and south Leinster have drawn a blank. However, this is an inconspicuous animal and inevitably under-recorded. *A. cambridgei* is a southern species in Great Britain, and the Galway site is likely to be close to the northern limit of its distribution in Ireland. A related species, *Trogulus tricarinatus* (L.), occurs in southern Britain and could yet turn up in Ireland.

Vice-county checklist: H02-H06, H17 and H20. Fig. 2.

Irish bibliography: 21, 46.

***Oligolophus tridens* (C. L. Koch, 1836)**

O. tridens is typically found in the ground layer, occurring in woodlands, grasslands, gardens etc. However, it also turns up on vegetation, and sometimes on walls and tree trunks. It has a well-developed trident, and usually a well marked saddle, and can bear a strong resemblance to *Lacinius ephippiatus*. Adults occur from the end of July until late October, with some individuals surviving into December. During the autumn months, *O. tridens* is widespread and fairly common in Ireland, although distinctly less abundant than *Paroligolophus agrestis*. I have one observation of an individual feeding on a specimen of the ground beetle *Agonum marginatum* L.

Offshore island records: Tory and Lambay.

Vice-county checklist: recorded from all vice-counties except H30 (Cavan). Fig. 2.

Irish bibliography: 5, 6, 12, 14, 16, 17, 18, 19, 21, 22, 28, 31, 35, 36, 40, 45, 47.

***Oligolophus hanseni* (Kraepelin, 1896)**

Pack-Beresford (1929) added this species to the Irish list with the discovery of a male in Co. Carlow. A number of Pack-Beresford specimens collected at Feenagh, Co. Carlow in 1928 and

1929 are in the NMI. In 1984, specimens were collected by A. J. Rundle in Co. Kilkenny, and by E. B. Rands in Co. Kildare, these records being mapped by Sankey (1988). It has subsequently been recorded from 24 widely scattered 10km squares in 14 vice-counties (Cawley, 1999). So far, despite considerable fieldwork, it has not been found in Cos Cork, Sligo or Leitrim, suggesting that *O. hanseni* may be absent or genuinely rare in these areas. In Great Britain, this is a local harvestman which tends to have a northern distribution. In Ireland also, it appears to be much commoner in Ulster than elsewhere. A high proportion of Irish records have come from synanthrophic habitats, typically garden walls in suburban areas, and searches of more natural sites near known populations have tended to draw a blank. This suggests that many Irish populations may have stemmed from introductions. Some records, especially from woodlands in Ulster are, however, suggestive of natural occurrence, and it is an undoubted native in Great Britain. Adults occur until about mid-November, usually on walls, or under stones. It often turns up with *P. agrestis*, from which it can usually be distinguished in the field by its dark ocularium and dark green abdomen. However, a few atypically marked specimens do occur. At a number of sites in south Ulster, it occurred abundantly on whitewashed pebble-dashed walls in mid-autumn.

Vice-county checklist: H02, H08, H11, H13, H15, H19, H22, H23, H25, H30, H32-H34, H36-H38 and H40. Fig. 3.

Irish bibliography: 21, 28, 41, 45, 47.

***Paroligolophus agrestis* (Meade, 1855)**

P. agrestis is a medium sized harvestman, of rather non-descript appearance, but with a characteristic notch on the genital operculum, especially in females. It occurs both in the ground layer and on vegetation, and it turns up in a great variety of habitats, including blanket bogs and mountain summits. Mature specimens occur from mid July and, during the autumn months, this is the most abundant and widespread harvestman in Ireland. It is equally common in Great Britain (Hillyard and Sankey, 1989). Most specimens have died off by November. However, individuals regularly survive into January, often turning up on walls in sheltered coastal areas. Published Irish records for this ubiquitous invertebrate are surprisingly few, perhaps because it tended to be overlooked by early workers or was not felt worthy of mentioning in print. It has however been recorded from 271 Irish 10km squares, making this the second most widespread harvestman in Ireland, with only *N. bimaculatum* being more frequently encountered.

Offshore island records: Cape Clear, Inishmore and Tory.

Vice-county checklist: recorded from all Irish vice-counties, H01-H40. Fig. 3.

Irish bibliography: 12, 16, 19, 20, 21, 22, 27, 28, 37, 40, 46, 47.

***Lacinius ephippiatus* (C. L. Koch, 1835)**

L. ephippiatus, along with *Rilaena triangularis*, is unusual among Irish harvestmen in having an early season, adults occurring in greatest abundance during May-July. However, specimens can still be found into September. It has tended to be under-recorded because few specimens are in evidence during the main period of harvestman recording, September- October. *L. ephippiatus* is associated with woodlands and can be common in beech *Fagus sylvatica* L. leaf litter. However, it also turns up in grasslands, hedgerows, waste ground and gardens. It is widespread, but not common, even during the peak of its season and is usually found in small numbers. *L. ephippiatus* bears a superficial resemblance to *O. tridens*, from which it is most easily separated by an examination of the pedipalps.

Offshore island records: Inishmore and Clare Island.

New vice-county record: WEST DONEGAL: Magherarority, B8833, 15 July 2002, two specimens under stones on coastal shingle.

Vice-county checklist: H01, H03-H06, H08-H10, H13-H15, H17, H18, H20, H21, H23, H25-H29, H32-H35, and H39. Fig. 4.

Irish bibliography: 2, 12, 21, 22, 25, 28, 34, 35, 37, 40, 45, 47, 48.

***Odiellus spinosus* (Bosc, 1792)**

The only Irish records for this large and conspicuous harvestman are from walls at the railway depôt on Sligo Docks, G686365, where Dr D. C. F. Cotton collected single specimens on 7 and 16 September 1992 (Cotton and Cawley, 1997). Repeated searches by the author at this site in autumn 1992-1997 failed to produce any additional specimens. However, Dr Cotton collected a single specimen in August 1995. Clearly a small population is established at this site, most of which is inaccessible. This animal has a marked south-eastern distribution in Britain, and there is a good likelihood that it could have become more thoroughly established and spread, had the introduction taken place somewhere in the south-east of Ireland. So far, searches for it in urban areas in the south-east has proved fruitless.

Vice-county checklist: H28 (Sligo) only. Fig. 4.

Irish bibliography: 22.

***Mitopus morio* (Fabricius, 1799)**

M. morio is widespread and common throughout Ireland, occurring in the ground layer and on vegetation in a wide variety of habitats, including upland blanket bog. Adults occur from July to mid-October. However, surprisingly few individuals manage to survive into November.

Sankey (1988) maps *Mitopus ericaeus* Jennings as occurring in Co. Waterford, based on specimens collected by A. J. Rundle in September 1984. Hillyard and Sankey (1989) treat *M. ericaeus* as a variety of *M. morio*. Scharff and Carpenter (1899), Carpenter (1902, 1908), Anon. (1907), Kew (1910), Pack-Beresford (1910, 1926), Bristowe (1949) and Cotton and Cawley (1998) all report the occurrence in Ireland of upland forms of *M. morio*, variously named as *M. morio* var. *alpinus*, *M. alpinus*, *Oligolopus alpinus*, *O. morio* var. *alpinus*. It is likely that many of these specimens are referable to *Mitopus morio* var. *ericaeus* Jennings. Further work, especially in the uplands, is needed in order to assess the status of this variety in Ireland.

Offshore island records: Cape Clear, Dursey, Co. Cork, Inishmore, Caher Island, Co. Mayo, Clare Island, Inishmacdara, Tory and Lambay.

Vice-county checklist: recorded from all Irish vice-counties, H01-H40. Fig. 5.

Irish bibliography: 7, 9, 10, 12, 14, 16, 17, 18, 19, 21, 22, 25, 28, 29, 31, 35, 36, 37, 39, 40, 45, 47, 48.

***Phalangium opilio* Linnaeus, 1758**

P. opilio is one of the most widespread and frequently encountered of the Irish harvestmen. It is especially common in open habitats such as sand dunes, blanket bogs, and grasslands, and is usually common also in synanthrophic habitats such as quarries and waste ground. Most specimens turn up in the ground layer, or on walls, especially in autumn. Identifiable subadults occur from early June, and adults can be recorded until the end of November. It has now been recorded from all 40 Irish vice-counties, and from a total of 188 10km squares, making this the fourth most widespread harvestman.

Offshore island records: Cape Clear, Inishmore, Clare Island, Inishmacdara, Inishmurray, Tory, Lambay and Dalkey Island, Co. Dublin.

Vice-county checklist: recorded from all Irish vice-counties, H01-H40. Fig. 5.

Irish bibliography: 1, 8, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 26, 27, 28, 30, 31, 32, 35, 36, 37, 40, 45, 47, 49.

***Opilio parietinus* (Degeer, 1778)**

O. parietinus is regarded as being a long established alien in western Europe and to have originated in the Caucasus and Asia Minor (Gruber and Hunt, 1973). The history of this harvestman in Ireland is complicated by the fact that there was early confusion between it and the smaller native *O. saxatilis*. In particular, records for *O. parietinus* listed by Carpenter (1904) and Pack-Beresford (1926) from sand dunes at Strandhill, Co. Sligo and Blacksod, Co. Mayo, are backed up by specimens in the National Museum of Ireland and, in fact, refer to *O. saxatilis*. Pack-Beresford's records of *O. parietinus* from the Dublin suburban localities are also authenticated by specimens in the NMI collections. These had been donated by G. H. Carpenter and R. L. Praeger. Records from Fenagh, Co. Carlow (Pack-Beresford, 1926) and Woodenbridge, Co, Wicklow (Anon. 1894d) probably refer to *parietinus*. However, I have been unable to trace vouchers, so these must remain unconfirmed. There are, however, recent valid records from both counties. Carpenter (1908) refers to the presence of both *O. parietinus* and *O. saxatilis* in Co. Dublin. Bristowe (1949) reports *O. parietinus* from Cos Westmeath, Roscommon and Leitrim, and records have been submitted to the Opiliones Recording Scheme from Mid Cork, Waterford and Dublin. The distribution map contained in Sankey (1988) plots *O. parietinus* as occurring in ten 10km squares, of which three are to be deleted as they refer to the *O. saxatilis* records mentioned above. A record from Glenade, Co. Leitrim, is also clearly erroneous and should be discounted. Also, a record contained in Mothersill (1983), from grassland at Ballycoolan hills, Co. Laois, is almost certainly based on misidentification. Recent records from Sligo Town are contained in Cotton and Cawley (1997). Cawley (1999) details a number of new localities and gives a list of the 24 vice-counties from which *O. parietinus* has been reliably recorded. All in all, and deleting the erroneous records referred to above, the number of valid 10km square records stands at 40.

In my experience, *O. parietinus* is relatively frequent in urban areas of north-east Ulster, whereas it tends to be generally quite scarce though widespread, elsewhere in Ireland. It appears to be an exclusively synanthrophic animal in Ireland, and is almost always found on walls in towns and villages, especially suburban garden walls. The similarly sized alien harvestman *Dicranopalpus ramosus* (Simon) is being increasingly recorded from urban walls, especially in south Leinster and parts of Munster and it will be interesting to see if the two species can co-exist. In my experience, *O. parietinus* tends to be noticeably scarce in areas where *D. ramosus* is in evidence and, while the evidence is flimsy, it does suggest that the long established *parietinus* may be in the process of being supplanted by the newcomer.

Vice-county checklist: H04-H08, H12, H13, H15-H17, H19-H23, H25, H28-H29, H33, and H35-H40. Fig. 6.

Irish bibliography: 4, 12, 19, 21, 22, 28, 35, 40, 45, 47.

***Opilio saxatilis* C. L. Koch, 1839**

As mentioned above, *O. saxatilis* was at one time treated as being a subadult instar of *O. parietinus* and was listed under that species by Pack-Beresford (1926). It is, in fact, quite a distinctive animal, if somewhat variable, rather smaller than *parietinus*, usually with well-developed central abdominal white patches, and with a distinctive penis. Also it is a native species, unlike the synanthrophic *O. parietinus*, which is a long established alien in western Europe. The first Irish record was from Rush, Co. Dublin, where it was collected by George Carpenter during a Dublin Naturalists' Field Club outing (Anon., 1894c). As mentioned above, sand dune records for *O. parietinus* listed by Carpenter (1904) and Pack-Beresford (1926) also refer to *O. saxatilis*. More recent fieldwork has shown *O. saxatilis* to be widespread, but quite local in the northern half of the country, where it is almost exclusively coastal and usually associated with sand dunes. It becomes noticeably more frequent and less exclusively coastal as one moves southwards and eastwards. Along south and east coasts, *O. saxatilis* can be a reasonably common animal, especially in dry habitats, such as waste ground. However, even in southern sand dune systems, it tends to be outnumbered by *P. agrestis*. So far, there are no records from offshore islands, despite a number of searches.

Vice-county checklist: H01-H07, H09-H14, H18-H23, H25, H27, H28, H31 and H38. Fig. 6.

Irish bibliography: 3, 12, 17, 19, 20, 21, 22 28, 34, 35, 40, 45, 47.

***Megabunus diadema* (Fabricius, 1779)**

M. diadema is one of the more attractive and distinctive of the Irish harvestmen, being of a mottled colouration and with massively developed spines on the ocularium. These spines are very obvious, even in early instar animals, which can be found in autumn and winter. *M. diadema* is unusual among the Irish harvest-spiders in that it is distinctly anthrophobic, virtually unknown in synanthrophic habitats, although it does occur on old lichen-covered stone walls and on abandoned stone buildings. It is also unusual in that it usually reproduces by parthenogenesis (Phillipson, 1959). Males are rare. However, Mackie and Millidge (1970) and Mackie (1972) have reported them in Ireland. *M. diadema* is usually associated with lichen-rich sites, and it is distinctly more common in the uplands than in the lowlands. It seems to be genuinely more common also in exposed areas along the west coast than in the east of the island. It often turns up in association with rock exposures, and also turns up in damp woodlands, conifer plantations and blanket bogs.

M. diadema has now been recorded from 35 vice-counties. However, plottable records are available for only 53 10km squares. It would appear that *M. diadema* was rather more frequently encountered by earlier naturalists than by modern recorders. Pack-Beresford (1926) reported that he had numerous records of this species and he listed its occurrence in a number of counties, including some from which, despite searching, there have been few if any recent reports. My own fieldwork suggests that, over most of the country, this is now a very scarce animal. It was usually found only after a deliberate, sometimes prolonged search, and was often absent from lowland sites which seemed suitable for it. The scarcity of records was all the more surprising, given that it is such a distinctive animal, and reasonably large. Only in the north-west does it seem to be anyway common, and I have only one record from the south-east, although Sankey (1988) plots a fair number of records from south-east England. While inevitably the evidence is of a rather tenuous nature, it does suggest that *M. diadema* has become less common in Ireland over the last hundred years or so. The fact that the only new vice county records contained in the Pack-Beresford archive (listed below) which still retain their currency refer to this species is also suggestive of a decline since the early 20th century, at least in the south-east.

Offshore island records: Inishmore, Clare Island, Inishmacdara and Inishbofin, Co. Galway.

New vice-county records: WATERFORD: Ballyvoony Bridge, X3897, 23 March 2000, immature under a piece of wood in hazel *Corylus* scrub. KILKENNY: 20 September 1931, R. A. Phillips, D. R. Pack-Beresford. WEXFORD: Rosslare, 10 May 1931, R. A. Phillips, D. R. Pack-Beresford. LAOIS: 11 June 1927, R. A. Phillips, D. R. Pack-Beresford. SOUTH-EAST GALWAY: 14 November 1926, R. A. Phillips, D. R. Pack-Beresford. TYRONE: Ballygawley, H6257, 28 March 2002, subadult on a wall in town centre.
Vice-county checklist: H01-H04, H06, H08-H21, H23 and H25-H39. Fig. 7.
Irish bibliography: 11, 16, 19, 21, 22, 28, 30, 31, 32, 35, 37, 38, 40, 43, 45, 48.

***Rilaena triangularis* (Herbst, 1799)**

R. triangularis is medium sized, fairly non-descript harvestman, which has a characteristic protuberance on the pedipalp, and a well developed ocularium. These features are quite obvious on immature animals, so that it is possible to name even the very earliest instars, thereby greatly extending the season during which this species can be recorded. Mature animals occur in spring and, at that time of year, *R. triangularis* is a reasonably common animal, turning up in the ground layer of woodlands, grasslands, synanthrophic habitats, etc. Occasionally, specimens are found on vegetation. Surprisingly few adults manage to survive beyond the first week of June, and I have no July records. First instar nymphs start to appear in early September. However, I have found nymphs as early as mid-July. Sub-adults can be recorded throughout autumn and winter.
Offshore island records: Inishmore and Clare Island.
Vice-county checklist: recorded from all Irish vice-counties, H01-H40. Fig. 7.
Irish bibliography: 16, 19, 21, 22, 23, 24, 28, 30, 31, 32, 37, 40, 45, 46, 47.

***Dicranopalpus ramosus* (Simon, 1909)**

D. ramosus is a large harvestman, which is usually found on house and garden walls. It is native to parts of the western Mediterranean, but is now naturalised in various parts of north-west Europe. It is a very distinctive animal, especially at rest, when it tends to hold its legs stretched at right angles to the body and close together. It was first reported in Ireland from Enniscorthy, Co. Wexford (Cawley, 1995). However, information provided by Myles Nolan indicates that *D. ramosus* has been established in the Dublin suburbs since the early 1990's. It is now widespread in towns and villages in the southern half of Ireland, especially near the coast, with records as far north as Co. Sligo (Cawley, 1999). Although there are records from Cos Roscommon and Laois, *D. ramosus* is likely to be significantly under-recorded in the midlands. My own fieldwork suggests that *D. ramosus* has become distinctly commoner in Cork City over recent years. The first British record had come in 1957 (Sankey and Storey, 1969), and it now occurs widely in south England and south Wales, where it is continuing to spread. It has been suggested that *D. ramosus* arrived in Britain as eggs or adults carried in horticultural products. It is likely that a similar explanation holds for Ireland, and the horticultural trade also probably assisted its spread within Ireland. Records from the foliage of a young oak *Quercus* near Inishannon, Co. Cork, from pine *Pinus*, yew *Taxus* and oak *Quercus* in Killarney National Park, and the Tipperary site listed below suggests that *D. ramosus* may be in the process of invading woodlands, at least in the mildest part of the country. Adults regularly occur as late as mid-December, and Myles Nolan has Dublin suburban records for January and February. *D. ramosus* could be anticipated from urban areas along the coast in all parts of Ireland, although as yet there are no records from Ulster.

New vice-county records: SOUTH TIPPERARY: Caher Park Wood, S0522, 24 June 2001, early instar immature beaten from yew *Taxus* in mixed woodland. LAOIS: Port Laoise, S4090, 29 August 2001, garden walls. ROSCOMMON: Roscommon, M8864, 12 December 2001, one specimen on a garden wall. MEATH: Ashbourne, O0652, 11 September 2002, frequent on garden walls.

Vice-county checklist: H01-H09, H11-H14, H16, H20-H22, H25 and H28. Fig. 8.

Irish bibliography: 20, 21.

***Leiobunum rotundum* (Latreille, 1798)**

L. rotundum is one of the commonest Irish harvestmen and the most frequently encountered of the small bodied, very long-legged leiobunids. It turns up in a great variety of lowland habitats, both synanthrophic and natural. It is very frequent in the ground layer, and specimens are also frequently beaten from vegetation, especially nettles, thistles and brambles. It also regularly turns up on walls, as well as on tree trunks. Adults occur from about mid August until November. However, there are no December records.

Offshore island records: Cape Clear, Inishmore, Inishmacdara and Lambay.

Vice-county checklist: recorded from all Irish vice-counties, H01-H40. Fig. 8.

Irish bibliography: 11, 12, 14, 15, 16, 18, 19, 21, 22, 28, 31, 35, 37, 40, 43, 45, 47, 48.

***Leiobunum blackwalli* Meade, 1861**

L. blackwalli is a somewhat smaller animal than *L. rotundum*, with distinctive pale rims on the ocularium. Cotton and Cawley (1997) have drawn attention to the ease of confusing immatures of this species with immature *N. gothica*. However, no difficulty is experienced with adults. *L. blackwalli* is widespread and common in Ireland, often turning up with *L. rotundum* on coarse vegetation, especially thistles and nettles. It is generally somewhat less in evidence than *L. rotundum*. It turns up in the ground layer of a variety of habitats, as well as on walls and tree trunks. Adults occur from August to October. However, this animal is markedly more frost-resistant than *L. rotundum*, with individuals regularly surviving into November and December. Cotton and Cawley (1997) give a record for early January and I have twice collected adult specimens in April in Co. Cork. Clearly, individuals can survive the winter in milder parts of the country. Surprisingly, the only offshore island record is from Cape Clear, Co. Cork.

Offshore island records: Cape Clear only.

Vice-county checklist: recorded from all Irish vice-counties, H01-H40. Fig. 9.

Irish bibliography: 6, 11, 12, 16, 19, 20, 21, 22, 23, 28, 33, 34, 35, 37, 40, 45, 47.

***Nelima gothica* Lohmander, 1945**

N. gothica was first recorded in Ireland by Bristowe (1949), based on specimens collected at Bantry Bay, Co. Cork, and subsequently in Cos Clare, Roscommon, and Longford. The first British record had only come in 1930's (Bristowe 1935). Unlike the other leiobunids, *N. gothica* is rarely found away from the ground layer. I have never found it on vegetation, and have only twice encountered it on walls. It is typically found in open habitats, such as grasslands and waste ground, although it also turns up in hedgerows, gardens and at the edge of woodlands. Cotton and Cawley (1997) report it from just above the HWM on shingle beaches and, in fact, it is often common in exposed coastal areas, and on offshore islands. It is, for example, the commonest harvestman, and only leiobunid, on Tory Island, Co. Donegal. Adults occur from August to mid-October, with individuals lingering into mid-November. *N. gothica* is widely and commonly recorded in Ireland where, despite being a relatively recent addition to the fauna, it is the fifth most widespread species, accounting for just over 8% of Irish harvestman 10km square records. This is in distinct contrast to the situation in Great Britain, where it is regarded as being quite local, if widely scattered. At the time of the provisional atlas (Sankey, 1988), *N. gothica* accounted for just 1% of opiliones 10km square records from Great Britain. It is clearly significant that *N. gothica* has somewhat of a western distribution in Great Britain, with a relatively large number of offshore island records.

Offshore island records: Cape Clear, Blasket Islands, Inishmore, Inishmurray and Tory.

Vice-county checklist: recorded from all vice-counties except H18 (Offaly), H37 (Armagh) and H40 (Derry). Fig. 9.

Irish bibliography: 12, 21, 22, 23, 25, 28, 34, 35, 44, 45, 47.

Discussion

Recent years have seen a significant improvement in the recording of harvestmen in Ireland, bringing the number of 10km square records from the less than 500 available for the provisional atlas (Sankey, 1988), to over 2200. This brings the state of recording of this group in Ireland to comparable levels with that of Great Britain. Harvestman records are now available from 508 Irish 10km squares, over 50% of the total. This compares very well with other invertebrate groups. Opiliones are now far and away the best recorded of the arachnids. However, the traditionally popular groups like butterflies and woodlice are still very much better surveyed. The most under-recorded areas are along the western seaboard, the midlands, and in the north east.

A number of species are clearly frequent and very widespread in Ireland, and these are likely to be found wherever harvestmen are collected. These are: *N. bimaculatum*, *O. tridens*, *P. agrestis*, *M. morio*, *P. opilio*, *L. rotundum*, *L. blackwalli* and *N. gothica*, as well as the spring maturing *R. triangularis*. The two alien synanthrophic species are much less in evidence. However, *O. parietinus* is relatively frequent in Ulster, and *D. ramosus* quite widespread in southern coastal urban areas. *O. saxatilis* is widespread in the south, especially near the coast, and *O. hanseni* is not infrequent in the north. *M. diadema* and *L. ephippiatus* are both widespread but uncommon, especially the former. In fact, the status of all these species closely mirrors the situation in Great Britain, as reported by Sankey (1988) and Hillyard and Sankey (1989), but with two exceptions. *M. diadema* appears, very surprisingly, to be commoner in

Great Britain than over much of Ireland. On the other hand *N. gothica* is distinctly scarcer in Great Britain than in Ireland, where it is one of the commonest harvestmen.

Comparisons of the Irish and British opilionid faunas are complicated by the presence of a relatively high proportion of aliens. Of the Irish fauna of 18 species, three *viz. O. spinosus, O. parietinus* and *D. ramosus* are naturalised aliens. The British fauna comprises 26 species, of which *Centetostoma bacilliferum, O. parietinus, D. ramosus* and the recently discovered *Opilio canestrinii* (Thorell) are naturalised aliens, with some doubt about the status of *Sabacon viscayanum ramblaianum* Martens. Averaging out, it emerges that the Irish fauna represents approximately 70% of the British fauna. The comparable updated figures for pseudoscorpions is 68% (Legg and O'Connor, 1997) and spiders (Araneae) 62%. The spider figure is surprisingly low, especially given the ease with which these animals can extend their range by ballooning, and suggests that this group is significantly under-recorded in Ireland. One might anticipate that at least 65-70% of the British fauna might eventually be found here, suggesting that 25-50 spiders remain to be added to the Irish list.

Of the eight harvestspiders recorded from Britain but not from Ireland, three have marked southern or coastal distributions. These are *Trogulus tricarinatus* (L.), *Homalenotus quadridentatus* (Cuvier) and *Paroligolophus meadii* (O. Pickard-Cambridge). It might be expected that the more continental climate of southern Britain favours these animals, or that they failed to colonise Ireland at the end of the last glaciation. However, the presence in Ireland of another generally southern species, *A. cambridgei*, raises the possibility that any of these species could yet turn up here as rare natives. Of the remaining species, *Lophopilio palpinalis* (Herbst) is a most surprising absentee. It is widespread in Great Britain, occurring as far north as central Scotland, and there is even a record from the remote offshore island of St Kilda. It is, however, quite local and not a very distinctive animal, which could easily be over-looked. *L. palpinalis* is perhaps the most likely harvestman to yet turn up in Ireland, again either as a rare native or, more likely, as an introduction. The recently discovered alien *Opilio canestrinii* (Thorell) has been increasing its range in north west Europe for a number of years, and its eventual discovery in Britain has been anticipated for some time. It must be a likely species for eventual establishment in Ireland, most likely in a southern urban locality.

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TABLE 1. Summary of Irish 10km square records for harvestmen.

Species	Number of Irish 10km square records	Rank in Ireland
Nemastoma bimaculatum	384	1
Mitostoma chrysomelas	14	15
Anelasmocephalus cambridgei	11	16
Oligolophus tridens	153	7
Oligolophus hanseni	26	14
Paroligolophus agrestis	271	2
Lacinius ephippiatus	47	11
Odiellus spinosus	1	17
Mitopus morio	167	6
Phalangium opilio	188	4
Opilio parietinus	40	13
Opilio saxatilis	87	9
Megabunus diadema	53	10
Rilaena triangularis	145	8
Dicranopalpus ramosus	42	12
Leiobunum rotundum	238	3
Leiobunum blackwalli	167	6
Nelima gothica	181	5
Total 10km squares records	2215	

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FIGURE 1. Distribution maps for *Nemastoma bimaculatum* and *Mitostoma chrysomelas*.

Nemastoma bimaculatum

Mitostoma chrysomelas

FIGURE 2. Distribution maps for *Anelasmocephalus cambridgei* and *Oligolophus tridens*.

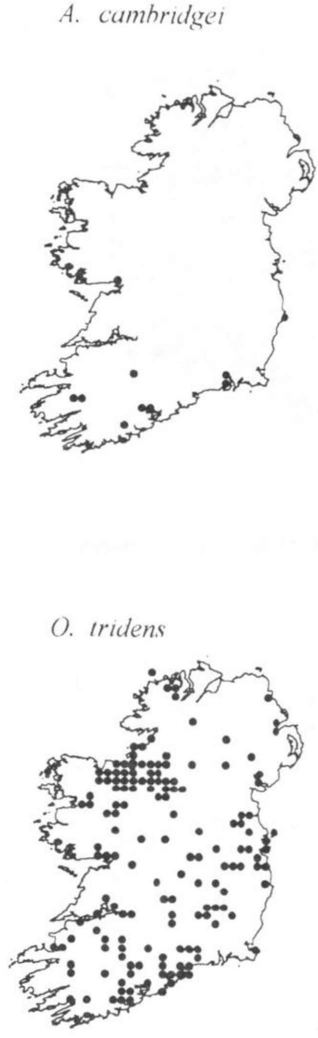


FIGURE 3. Distribution maps for *Oligolophus hanseni* and *Paroligolophus agrestis*.

O. hanseni

P. agrestis

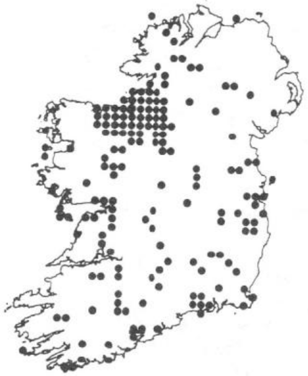
FIGURE 4. Distribution maps for *Lacinius ephippiatus* and *Odiellus spinosus*.

L. ephippiatus

O. spinosus

FIGURE 5. Distribution maps for *Mitopus morio* and *Phangium opilio*.

M. morio



P. opilio

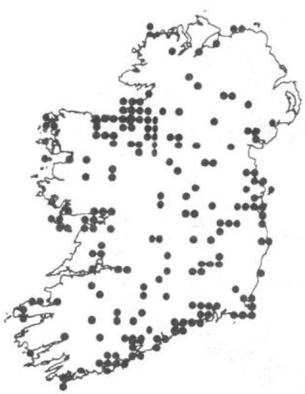


FIGURE 6. Distribution maps for *Opilio parietinus* and *O. saxatilis*.

O. parietinus

O. saxatilis

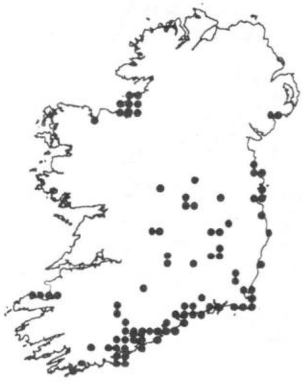
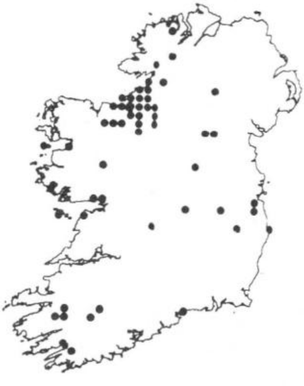


FIGURE 7. Distribution maps for *Megabunus diadema* and *Rilaena triangularis*.

M. diadema



R. triangularis

FIGURE 8. Distribution maps for *Dicranopalpus ramosus* and *Leiobunum rotundum*.

D. ramosus

L.rotundum

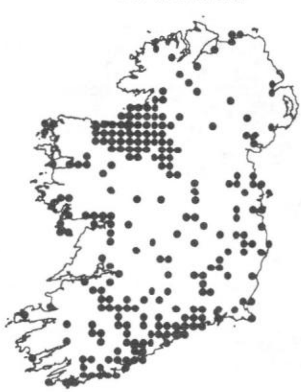


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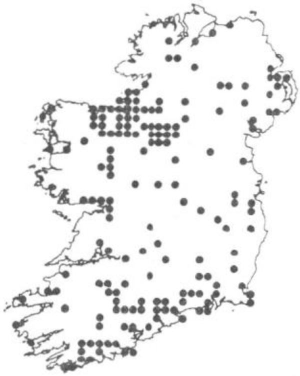
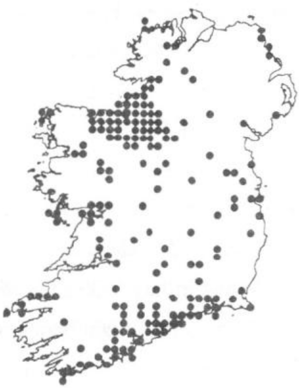
FIGURE 9. Distribution maps for *Leiobunum blackwalli* and *Nelima gothica*.

L. blackwalli



N. gothica



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AMMOPHILA SABULOSA (LINNAEUS, 1758) AND *BOMBUS DISTINGUENDUS* MORAWITZ, F., 1869 (HYMENOPTERA: ACULEATA) ON THE MULLET PENINSULA, CO. MAYO, IRELAND

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Ammophila sabulosa (Linnaeus) (Sphecidae), a large black and red solitary wasp, was first recorded in Ireland (as *Sphex sabulosa*) by C. W. Oldham on the Mullet peninsula near Annagh Head (F63) in west Mayo (V. C. H27) in 1933. He reported his sightings to A. W. Stelfox at the National Museum of Ireland (NMI), who visited the area with his son in June 1936 (Stelfox and Stelfox, 1937). They describe the wasp as being: '...abundant over most of the sandy areas from Annagh Head to Aghleam' (F63 and F62) ', a distance of about nine miles'.

On 20 July 2000, a female of *A. sabulosa* was hand-netted by the author in an area of high sand dunes (F616218) overlying rocky outcrops, south of Newtown on the Mullet peninsula, west Mayo (H27). This was the only specimen located during a four-hour search of selected areas between Elly Bay (F6325) and Aghleam (F6120), a distance of approx. 4km. The specimen was identified using Lomholdt (1984) and was confirmed by comparison with specimens in the collections of NMI. The specimen has been lodged in NMI.

Weather conditions at the time were almost ideal for finding adult Aculeate Hymenoptera, with warm sunshine and a moderate westerly breeze. Two previous searches in 1997 and 1998, trying to re-locate *A. sabulosa* on the Mullet were both unsuccessful, possibly due to poor weather conditions at the time. Those short searches concentrated on the area between Annagh Head and Termoncarragh Lake. However Stelfox and Stelfox (*op. cit.*), noted that '...not even a gale and the complete absence of sun kept them' [*A. sabulosa*] ' entirely hidden...'. So how might the scarcity of *A. sabulosa* on the Mullet in July 2000 be accounted for? The relatively late date of the visit, towards the end of the presumed flight period of *A. sabulosa* (Edwards, 1997), could perhaps be one reason. An imperfect search technique, for an unfamiliar species, might be another. A more plausible explanation however relates to the major changes in land management that have taken place on the Mullet since the Stelfoxs' 1937 paper. Enclosure and subdivision of the machair and management for permanent grass-rich swards, have eliminated areas of open loose sand within the pasture. Where some erosion of the sward has happened, straw bales have been used to help bind the sand until re-vegetation occurs (pers. obs.). Areas of open sand are the wasp's preferred nesting habitat. It is perhaps not surprising then, that the single specimen of *A. sabulosa* found was in one of the areas that has remained less amenable to management for permanent grass cover and still has areas of open, sparsely vegetated sand.

Enclosure has encouraged a more grass-rich sward, and presumably also reduced general plant bio-diversity. This may also have reduced the available supply of the wasp's prey, lepidopteran caterpillars, including the caterpillar of the Belted Beauty moth (*Lycia zonaria* (Denis and Schiffermüller)), which Stelfox and Stelfox (*op. cit.*) noted as an important prey item.

A. sabulosa has been recorded at one other location in Ireland *viz*. WEXFORD (V. C. H12): The Raven (T1124) 1♂ 'running on *Ammophila* dunes', 24 May 1975, coll. and det. M. C. D. Speight. (specimen in the Ulster Museum, Belfast). Several intensive searches at the Raven NNR, and other coastal dune systems in south-east Ireland in 1999, by the author and members of the Bees, Wasps, and Ants Recording Society (Ronayne, 1999, 2000) failed to find *A. sabulosa*. In light of this, and the more recent discoveries of other 'migrant' insects on the Raven NNR e.g. Migrant Hawker dragonfly (*Aeshna mixta* Latreille) (Odonata), and the Comma butterfly (*Polygonia c-album* (L.)) (Lepidoptera), the possibility that the specimen collected by Speight might also have been a lone vagrant has to be considered.

A. sabulosa is a common and widespread species throughout Europe up to 2000m (Bitsch *et al.*, 1997). In Great Britain, it is most common in the south of England, but occurs widely as far north as Lancashire and Yorkshire. Of particular interest from an Irish point of view, are isolated records from Moray and Galloway in Scotland, both from coastal sand systems (Edwards, 1997). These isolated Irish and Scottish populations might suggest that *A. sabulosa* in the British Isles, suffered a major contraction from the edges of a former range, a possibility also noted by Stelfox and Stelfox (1937).

From a biogeographical perspective, the continuing presence of *A. sabulosa* on the Mullet peninsula is important, and the wasp merits inclusion on an Irish national list of threatened or endangered insects.

Land management changes have also had a major impact on the distribution of bumblebees in Ireland. *Bombus distinguendus* Morawitz (Great Yellow bumblebee) was formerly recorded from many eastern and scattered southern, midlands and western sites (Stelfox, 1927; O'Rourke, 1957, 1979). There are however no records of the bee from eastern Ireland since 1980, and the species is now absent from previously recorded sites in Northern Ireland (B. Nelson, pers. comm.). In Great Britain, *B. distinguendus* has declined dramatically and is now confined to the Hebrides, Orkneys, and the extreme northern coast of mainland Scotland (Edwards and Telfer, 2001). It was therefore a pleasant surprise while undertaking the search for *A. sabulosa* to see workers of *B. distinguendus* in an area of low disturbed dunes (F631251), west of Elly Bay on the Mullet peninsula on the 20 July 2000. The area was enclosed by a stock fence and appeared to have been used for over-wintering cattle, but had not been recently grazed, allowing plants to flower and attract six species of bumblebee (Table 1). The workers of *B. distinguendus* were foraging primarily at Knapweed (*Centaurea nigra* L.), but also at Spear Thistle (*Cirsium vulgare* (Savi) Ten.). They ignored two other species then in flower, namely Red Bartsia (*Odontites verna* (Bellardi) Dumort.), which was abundant in the area, and Devil's Bit Scabious (*Succisa pratensis* Moench) which was only starting into flower, that were attracting other bumblebee species present at the time (Table 1). *B. distinguendus* has previously been recorded from Inish Glora to the west of the Mullet (ITE, 1980), and approx. 6km from the site of the present record. *B. distinguendus* was not seen at other locations on the Mullet during the author's search for *A. sabulosa*. Two workers of *B. distinguendus* were taken as vouchers and have been lodged in NMI.

The other species of Aculeate Hymenoptera that were noted by the author at two locations on the Mullet are included in Table 1. None is rare in Ireland, but what is noteworthy, is the small number of species seen throughout the area.

Acknowledgements

I am grateful to Brian Nelson (Ulster Museum), for drawing my attention to the *Ammophila sabulosa* specimen in the Ulster Museum and discussion on the distribution of *B. distinguendus* in Northern Ireland; Robert Nash (Ulster Museum), for access to the insect collection in the Museum; Gerry Sharkey (Castlebar) for his hospitality and lively discussions; Mike Edwards

(Bumblebee Working Group) for copies of the U.K. Biodiversity Action Plan Bumblebee Working Group reports, and Dr J. P. O'Connor (NMI) for comments on an initial draft of this note and for access to the insect collections in the National Museum, Dublin.

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TABLE 1. Aculeate Hymenoptera of the Mullet Peninsula, 20 July 2000.

FAMILY	**SPECIES**	**LOCATION/GRID REFERENCE**	
		W. of Elly Bay	S. of Newtown
		F631251	F616218
Pompiliidae	*Arachnospila anceps* (Wesmael)	♀	♀
Sphecidae	*Mellinus arvensis* (L.)	-	♂♀
	Ammophila sabulosa (L.)	-	♀
Colletidae	*Colletes floralis* Eversmann	♂♂♀♀ common	♂♂♀♀ common
Apidae	*Bombus lucorum* (L.)	2☿☿	☿
	Bombus lapidarius (L.)	♀♀☿☿	-
	Bombus jonellus (Kirby)	☿☿ common	☿☿ common
	Bombus distinguendus Morley	☿☿ common	-
	Bombus muscorum (L.)	☿☿ common	☿☿ common
	Bombus rupestris (Fabr.)	♀♀ common	2♀♀

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TWO CONTROVERSIAL ADDITIONS TO THE IRISH INSECT LIST: *MICRODON MYRMICAE* SCHÖNROGGE *ET AL.* AND *PIPIZA FESTIVA* MEIGEN (DIPTERA: SYRPHIDAE)

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Introduction

The most recently published list of Irish Syrphidae is that in Speight (2000a), which indicates the presence of 173 syrphid species on the island. The following two species represent additions to that list. There is a degree of complexity to the Irish records of both of them, as explained in the notes that follow. In the case of *Pipiza festiva* this has entailed a *de facto* review of the Irish *Pipiza* species. Including the *Pipiza* species recognised here, the Irish syrphid fauna now stands at 178 species.

It is unlikely that all syrphid species currently occurring in Ireland have yet been found. Syrphid species have been added to the Irish list at an average rate of slightly more than one per year, throughout the period 1975-2002, despite the fact that a major revision of the Irish syrphid list was published in 1975 (Speight *et al.*, 1975). The better-studied British syrphid fauna evidences a similar accretion rate (Speight, 1988, 2000b).

Microdon myrmicae Schönrogge *et al.*, 2002

This taxon was separated from the well-known and supposedly widely distributed European species *M. mutabilis* by Schönrogge *et al.* (2002a, b). Their description of *M. myrmicae* is based entirely on British material of the species. Here, the occurrence of *M. myrmicae* in Ireland is reviewed.

In effect, Schönrogge *et al.* (2002a) restrict application of the name *Microdon mutabilis* (L.) to a taxon exhibiting particular developmental features and ecology, an undeclared nomenclatural act of uncertain significance, since the original description of this species is based only on the adult insect and the only available type material of *M. mutabilis* is of questionable status (Thompson *et al.*, 1982). But whether or not their interpretation of *M.*

mutabilis is justified, the work of Schönrogge *et al.* (2002a) does provide a basis for re-examining the occurrence of *Microdon mutabilis* complex species in Ireland. Given the restricted application of the name *mutabilis* (L.) employed by Schönrogge *et al.* (2002a), it becomes necessary to refer to their concept of this taxon as *M. mutabilis sensu* Schönrogge *et al.*, a practice adopted here. Since they have in part based this concept upon material from *Formica lemani* Bondroit nests from the Burren (Co. Clare), they have themselves confirmed the presence of *M. mutabilis sensu* Schönrogge *et al.* in Ireland. But they do not record *M. myrmicae* from Ireland and, indeed, provide no indication that they searched potentially appropriate Irish localities for this species.

Publication of the description of *M. myrmicae* has been unusual, in more ways than one. Firstly, the species is jointly described by eight authors, which is a record in itself in relation to European syrphids. Secondly, there was some sort of mix up that occurred with the text so that, as it first appeared (Schönrogge *et al.*, 2002a) in the *Biological Journal of the Linnean Society*, the description of *M. myrmicae* was incomplete, lacking designation of both type material and type localities, thus rendering the taxon a *nomen nudum*. An addendum has since been published rectifying these omissions (Schönrogge *et al.*, 2002b). Thirdly, and of more enduring interest, *M. myrmicae* is distinguishable from other European *Microdon* on the basis of characters of its developmental stages and ecology, but the adult insect cannot, as yet, be consistently distinguished from related species. Andries (1912) earlier described two other European *Microdon* taxa based only on features found in the developmental stages and the subsequent synonymisation of these two taxa by Doczkal and Schmid (1999) could well prove to have been premature. Certainly, the status of these two taxa requires re-evaluation in the light of the work by Schönrogge *et al.* (2002a).

In the revision of European *Microdon* species by Doczkal and Schmid (1999), the adults of both *M. mutabilis sensu* Schönrogge *et al.* and *M. myrmicae* would key out as *M. mutabilis*, and Schönrogge *et al.* (2002a) were unable to find morphological features of the adult insect that separate these two species. They do offer morphometric features to aid in separation of the adults however, one of which, in particular (the ratio median length of scutellum: distance between tips of scutellar microdonts), seems to show no overlap between the two taxa. However, the measurements were taken only from bred material of *M. mutabilis sensu*

Schönrogge *et al.* derived from nests of the ant *F. lemani*, in the Burren and various parts of Britain, and bred material of *M. myrmicae* from nests of the ant *Myrmica scabrinodis* Nylander in various localities in England. Whether these morphometric data apply to populations of these flies in other parts of Europe (or derived from nests of other ant species) is untested. The differences they observed, between Scottish and Irish *M. mutabilis sensu* Schönrogge *et al.* bred from *F. lemani* nests, suggests that their morphometric data should, indeed, be treated with circumspection, when applied elsewhere. The question of alternative ant hosts is even more confusing, it now being open to question whether the *Microdon* species found living with one ant species should be regarded as different from the *Microdon* living with any other ant species. This has a particular bearing on the question of the identity of *M. mutabilis*, which, based on determination of adults, can live in nests of the ant *Lasius niger* (L.), as well as with *F. lemani*. The present author has found *M. mutabilis sensu lato* in nests of *L. niger* in Ireland, in the same habitat in which *M. mutabilis sensu* Schönrogge *et al.* lives with *F. lemani*. Measurement of 15 specimens of apparently *M. mutabilis*, all bred from the same nest of *L. niger* in the same year, showed a range of values for the scutellar feature referred to above (the ratio median length of scutellum: distance between tips of scutellar microdonts) that would consign most of the specimens to *M. mutabilis sensu* Schönrogge *et al.* but the others to *M. myrmicae*. Whilst this result has no bearing on the status of *M. mutabilis sensu* Schönrogge *et al.* and *M. myrmicae* as discrete species, which has to be regarded as firmly established on the basis of other criteria, it does suggest that either:

the adults of *M. mutabilis sensu* Schönrogge *et al.* are more variable, morphometrically, than has been established by Schönrogge *et al.* (2002a) and that this variability is likely to be affected by whichever ant is hosting the *Microdon*, or:

the *Microdon* living in nests of *L. niger* is a different taxon from *M. mutabilis sensu* Schönrogge *et al.* and as an adult can exhibit morphometric values intermediate between those of *M. mutabilis* and *M. myrmicae*.

Whichever of these alternative explanations is correct, the specimens bred from the *L. niger* nest show that adult *Microdon* that would currently be regarded as *M. mutabilis sensu lato*, but showing values for morphometric characters that would consign them to *M. myrmicae*, can evidently be found in the same habitat as *M. mutabilis sensu* Schönrogge *et al.* The habitat data are in this instance critical, because Schönrogge *et al.* were unable to find *M. myrmicae* living with *M. scabrinodis* in grassland sites where *M. mutabilis sensu* Schönrogge *et al.* was found with *F. lemani*, despite the presence of both ants. Similarly, they did not find *M. mutabilis sensu* Schönrogge *et al.* living in wetland sites where *M. myrmicae* was found with *M. scabrinodis*, despite presence of *F. lemani*. This ecological segregation of *M. mutabilis sensu* Schönrogge *et al.* and *M. myrmicae* suggests strongly that, whatever *Microdon* lives with *L. niger* in localities where *M. mutabilis sensu* Schönrogge *et al.* is found with *F. lemani*, it is not *M. myrmicae*.

Adults belonging to the *Microdon mutabilis* complex, showing morphometric values consistent with their interpretation as belonging to *M. myrmicae*, have been collected in Ireland. But the paragraphs above show that adult morphometric data alone cannot be relied upon to demonstrate the presence of *M. myrmicae*. Incontrovertible proof of the presence of *M. myrmicae* could be obtained from mature larvae or entire puparia, since the morphology of the anterior respiratory processes and larval mouthparts can both be used to separate *M. myrmicae* from *M. mutabilis sensu* Schönrogge *et al.* A key to the identification of puparia of European *Microdon* is provided by Schönrogge *et al.* (2002a). A modified version of that key, drawing also upon information in Doczkal and Schmid (1999) and incorporating additional features based on morphology of the larval mouthparts, is provided by Speight (2002).

Empty *Microdon* puparia have been collected from a *M. scabrinodis* nest in Ireland. But these puparia lack the plates carrying the anterior respiratory process - the parts of the puparium from which the anterior respiratory processes protrude are burst apart during eclosion of the adult fly and do not normally remain attached to the puparium thereafter. A second puparial feature potentially of use in distinguishing *Microdon* species is the larval mouthparts, which remain attached to the inner, ventral wall of the puparium. The larval mouthparts of *M. myrmicae* are not figured by Schönrogge *et al.* (2002a), but nonetheless exhibit one feature in which they differ from the mouthparts of *M. mutabilis sensu* Schönrogge *et al.* This feature is illustrated by Speight (2002). However, following eclosion of the adult *Microdon*, *M. scabrinodis* tends to progressively destroy the empty puparium (Schönrogge, pers. comm.), and the larval mouthparts are also missing from the puparia collected from the *M. scabrinodis* nest in Ireland, presumably removed by the ants. Finally, it might be assumed that to find *Microdon* puparia in a nest of *M. scabrinodis* should itself be sufficient to indicate the presence of *M. myrmicae*, based on the premise that it is only *M. myrmicae* that occurs with this ant. But this thesis is untenable, since ants may take over each other's nests, providing for the possibility of *Microdon* larvae then finding themselves living with the "wrong" ant, or empty *Microdon* puparia remaining in an *M. scabrinodis* nest from when it was occupied by some other ant. Small numbers of occurrences, of both *M. mutabilis sensu* Schönrogge *et al.* and *M. myrmicae*, are recorded by Schönrogge *et al.* (2002a) in nests of ants other than their primary hosts. So, although it is likely that an empty *Microdon* puparium, lacking its diagnostic features, but found in a nest of *M. scabrinodis*, would belong to *M. myrmicae*, its identity remains nonetheless uncertain. Even site ecology is, in this instance, unhelpful, since the puparia were found in a nest in humid grass-heath, not the characteristic habitat for either *M. mutabilis sensu* Schönrogge *et al.* or *M. myrmicae*. So far, no entire puparium of *M. myrmicae* has yet been found in Ireland.

At present, the most reliable evidence for the occurrence of *M. myrmicae* in Ireland comes from site ecology. Schönrogge *et al.* (2002a) demonstrate there is strict ecological segregation of *M. myrmicae* from *M. mutabilis sensu* Schönrogge *et al.*, with *M. myrmicae* being the only taxon of the *M. mutabilis* complex that they found in strictly wetland habitats in Britain. They are not very precise about the wetland types involved, referring to them merely as "boggy areas". Localities from which Irish material of *M. mutabilis sensu lato* has been derived fall into four ecological groups:

a) sites of unknown character.

b) limestone pavement grassland.

c) low-altitude, oligotrophic, unimproved, non-calcareous grassland/heath.

d) raised bog, cutover blanket bog and fen.

On the basis of available evidence, all Irish records of "*M. mutabilis*" from habitats in category d above should be referred to *M. myrmicae*, i.e. there is no justification for assuming that any *M. mutabilis* complex species other than *M. myrmicae* might occur in strictly wetland situations.

Review of Irish *M. mutabilis* complex material collected from wetlands shows that all specimens involved show values for morphometric features that correspond with what is expected for *M. myrmicae* and all are of "small size". The consistently small size of *M. myrmicae* specimens, as compared with specimens of *M. mutabilis sensu* Schönrogge *et al.*, is alluded to by Schönrogge *et al.* (2002a), but not quantified by them. Body length in *M. mutabilis sensu* Schönrogge *et al.* reared from *F. lemani* nests in Ireland varies from 10-12mm for the males and 10-15mm for females, whereas putative Irish *M. myrmicae* from wetlands vary in body length from 8-10mm, with the majority of specimens closer to 8mm than to 10mm.

Final confirmation of the presence of *M. myrmicae* in Ireland may have to await the collection of at least one mature larva or complete *Microdon* puparium, from a nest of *M. scabrinodis* in wetland. But, even though an entire puparium or mature larva is at present lacking, the array of data presented above amounts to a good case for regarding adult specimens of *M. mutabilis sensu lato*, derived from strictly wetland sites in Ireland, as belonging to *M. myrmicae*. It is thus the considered opinion of the present author that *M. myrmicae* should be added to the Irish list, based on what we know already. The following Irish records are in this way taken to refer to *M. myrmicae*:

CORK: 5 July 1977, V9153 (MT4); larvae and empty puparia in nest of *Myrmica scabrinodis* under stone; humid grassland/cutover bog, MS

GALWAY: 29 June 1994, L7475 (MV2), Kylemore, Connemara National Park, cutover blanket bog/*Betula* woods, MS.

KILDARE: 1 June 1993, N7715 (PU1), Pollardstown fen, swept, edge of unimproved pasture/*Schoenus-Molinia* fen, MS.

LAOIS: 22 May 1976, S3380 (PU1), Grantstown lake, seasonally-flooded *Schoenus-Molinia* grassland with large *Lasius* mounds, at edge of wet woodland, MS.

OFFALY: 2 June 2002, N0010 (NU3), All Saints bog, ancient *Betula* woods in centre of raised bog/fen, with massive tussocks of mosses and *Carex*, MS. Male and female deposited in collections of NMI.

Most Irish males referred to *M. myrmicae* have black, bristly hairs intermixed with the paler hairs on the anterolateral surface of the mid femora. While this cannot be regarded as diagnostic, since other males from the same localities have an entirely pale hair covering to the same part of the leg, the presence of these black hairs does seem to be confined to *M.*

myrmicae. Despite considerable time being spent in attempting to find additional features, to aid in separation of adults of *M. myrmicae* from adults of *M. mutabilis sensu* Schönrogge *et al.*, none were found.

This note begs the question of the identity of *M. mutabilis sensu lato* specimens reared from *Lasius niger* nests in Ireland. Unfortunately, no associated puparia have been retained with the reared material currently available and no consistent morphological differences can be found between them and specimens of either *M. mutabilis sensu* Schönrogge *et al.* or *M. myrmicae*. They thus remain of uncertain identity. The same is true of Irish *M. mutabilis sensu lato* specimens collected as adults from any locality that is neither limestone pavement nor wetland - or collected from an unknown habitat. This is particularly true for specimens of an intermediate (i.e. *circa* 10mm body length) size.

***Pipiza festiva* Meigen, 1822**

This species is not known from Britain and on the continent reaches its northern limit in the Atlantic region in the Netherlands and northern Germany. The Irish record is as follows:

ANTRIM: 30 May/2 June 1985, female, Rea's Wood, J1485 (PA3), Malaise trap, coll. M. Boston and R. Nash, in UM.

This record is from a Malaise trap installed in deciduous woodland beside Lough Neagh. The most disconcerting feature of this record is that it is from the same locality, trap and date as *Mesembrina mystacea* (L.), another insect not known from Britain and also known in Ireland only from that one locality (Speight and Nash, 1993). The obvious inference to be drawn is that this particular Malaise trap catch somehow became confused with material from elsewhere - presumably some continental locality - prior to labelling. But that explanation for the occurrence of these unlikely species in the sample is not as convenient as it might at first appear, since *M. mystacea* and *Pipiza festiva* are not species that would usually be expected to occur together. Whatever may be the explanation for this Irish record of *P. festiva*, it would seem necessary to make its existence known.

There is, at present, no English-language key that includes *P. festiva*. The need to produce a key to aid in the separation of *P. festiva* from other known Irish *Pipiza* species, for purposes of this note, has entailed an attempt at a review of the Irish *Pipiza* species. The nomenclatural confusion, that surrounds the ill-defined species concepts currently operating in this baffling genus, is alluded to by Speight (2000a). The key to Irish *Pipiza* presented here represents a *de facto* listing of the Irish species, but in this respect has to be treated with caution - the need for revision of the European *Pipiza* species remains.

Typical specimens of *P. festiva* are an exception to the rule that *Pipiza* species are difficult to identify - their bright yellow tarsi and the broad yellow band on the second abdominal tergite make them highly distinctive. So there is only minimal risk that this record is based on some unexpected variant of a *Pipiza* species already known from Ireland, since the specimen involved conforms very well with typical *P. festiva* from the continent. But, assuming the specimen is both correctly named and correctly labelled, the question remains as to why there are no other recorded occurrences of this distinctive species in Ireland. Until and unless more Irish material of *P.festiva* is found, some doubt must attach to the validity of this record.

As mentioned earlier, the nomenclature of European *Pipiza* species requires comprehensive revision, so although the number of taxa covered by the key given here may be correct for Ireland the names used for them have to be regarded as provisional. The names used have been applied *sensu* Stubbs and Falk (1983), rather than *sensu* Verlinden (1991), to conform with their usage in Britain. One difference from the key in Stubbs and Falk (1983) is that no attempt is made here to distinguish males of "*P. bimaculata*" and "*P. noctiluca*", which, in the opinion of the author, cannot at present be reliably separated. If *P. festiva* were to occur in Britain, its presence would not be recognised using the keys in Stubbs and Falk (1983), where it would be identified as *P. luteitarsis* (Zetterstedt).

Provisional key to Irish *Pipiza* species

1. Hind femora apico-ventrally with a pair of shallow, longitudinal ridges, separated by the flat, bare ventral surface of the femur **2**

---- hind femora apico-ventrally flat, without outstanding spinose, longitudinal, ridges (legs with tarsi extensively yellowish) .... ***luteitarsis* (Zetterstedt)**

2. males (eyes meeting on frons) **3**
---- females **5**

3. Distance from posterior edge of eyes to edge of occiput distinctly narrower, posterior to the ocelli, than at the outer extreme of the eyes, when viewed from above **4**
---- distance from posterior edge of eyes to edge of occiput the same, posterior to the ocelli, as posterior to the outer extreme of the eyes (hind tarsi extensively darkened; depth of hind femora usually progressively increasing until shortly before apex, then decreasing in depth abruptly) .... ***austriaca* Meigen** (male)

4. Hind femora entirely black; abdominal tergites extensively black-haired .... ***noctiluca* (L.)** (male) and ***bimaculata* Meigen** (male)
---- hind femora yellow apically; abdominal tergites yellow-haired (all tarsomeres of hind legs normally entirely yellow) .... ***festiva* Meigen** (male)

5. Wings with most of surface of 2nd basal cell bare of microtrichia **6**
---- 2nd basal cell almost entirely covered in microtrichia .... ***bimaculata*** (female)

6. Abdominal tergite 2 with either no pale markings or a pair of yellowish spots **8**
---- tg2 with a transverse yellow band **7**

7. Body hair silver grey (with some black hairs on frons and abdominal tergites etc); basitarsus and apical tarsomeres darkened, so that tarsi do not appear unicolorous yellow; anterior margin of yellow band on tg2 receding from anterior margin of the tergite at a distance one eighth or more of the width of the tergite from its lateral margin .... ***noctiluca*** (female, *pro parte*)
---- body hair golden yellow/brownish-yellow; all tarsomeres of all legs unicolorous yellow; anterior margin of yellow band on tg2 not usually receding from anterior margin of tergite until within 0.1 of the width of the tergite from its lateral margin (if the yellow band recedes from the anterior margin of the tergite at a greater distance from the

lateral margin of the tergite, it does so very gradually, in a gentle curve; a pair of narrow, yellow, transverse marks often present on tg3) .... ***festiva*** (female)

8. Ventral surface of hind femora almost straight from base to apex, hardly descending below a line drawn from its apico-ventral extremity to its junction with the apex of the trochanter, ventrally .... ***noctiluca*** (female, *pro parte*)

---- hind femur considerably extended ventrally, just before apex, so that a straight line drawn between its apico-ventral extremity and its junction with the trochanter, ventrally, leaves approximately one third of the vertical height of the femur ventral to that line .... ***austriaca*** (female)

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UNCOMMONLY RECORDED SPIDERS (ARANEAE) FROM IRELAND, INCLUDING ONE SPECIES NEW TO THE COUNTRY

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Introduction

The following paper follows a format used by Cawley (2001) and offers records of a number of spider species that are under-recorded or uncommon in Ireland. One species, *Milleriana inerrans* (O. P.-Cambridge), has not been recorded previously from Ireland. The single Irish record of *Psilochorus simoni* (Berland) is from Northern Ireland (Fürst and Blandenier, 1993) but offers no details as to when or where it was identified or as to whether voucher specimens are available. The records of this species presented here confirm that it is resident in Ireland. Specimens were identified using Roberts (1993). Nomenclature follows Merrett and Murphy (2000). Voucher specimens are in the author's collection unless otherwise stated. New county records are denoted by *.

Records

Psilochorus simoni (Berland, 1911)

*DUBLIN: Schoolhouse Lane (off Kildare Street), Dublin 2, O162336, 1981. The specimen was collected by Pat O'Sullivan of the Natural History Museum, Dublin, from the Museum's spirit store which was located in a basement room on Schoolhouse Lane. It was identified in 2002 by the author as a male of *P. simoni*. This specimen is in the Museum's collection (NMI 26: 2002); the Mansion House, Dawson Street, Dublin 2, O162336, 25 June 2002. Two females were found by the author in a basement room during a clearout in preparation for extensive renovations. One of the females was carrying eggs. Both specimens were in their webs at the base of a wall a few inches above floor level. This agrees with observations of the species in Britain (Harvey *et al.*, 2002). The latter site is a short distance from the former.

The only previous record of the species in Ireland is from Northern Ireland and occurs on a distribution map indicating the species' European status (Fürst and Blandenier, 1993). No details are provided regarding the provenance of this record. Van Helsdingen (1996) cites Fürst and Blandenier as indicating the species' occurrence in Northern Ireland but does not specify a county. McFerran and Ross (1993) do not list *P. simoni* as an Irish species, instead including it in an appendix of species that may well occur in the region but have not yet been found. McFerran (1997) does list the species as Irish and this is probably based on the Fürst and Blandenier paper *via* van Helsdingen (1996). This may be suggested since in this same work McFerran also has *P. simoni* listed in an appendix of species *not* yet found in the region suggesting that he was unaware of any record prior to reading van Helsdingen (1996). The status of the above record is currently being investigated. The records in the present paper at least confirm the presence of *P. simoni* in Ireland but may possibly represent the first Irish specimens.

P. simoni has a widespread but rather local distribution in the southern half of Britain. Merrett (1979) suggested that it may have been carried into cellars in Britain with wine shipments and has since then spread to other similar habitats.

***Oonops domesticus* Dalmas, 1916**

DUBLIN: 31 Anne Devlin Park, Rathfarnham, O132279, 3 November 1998, 12 November 1999, 21 April 2001. A single female on each occasion. The latter two records from an upstairs bathroom. This species was recently added to the Irish list (Smith, 1999; Nolan, 2000). Also recorded from Sligo (Cawley, 2001).

***Hyptiotes paradoxus* (C. L. Koch, 1834)**

KERRY: Killarney National Park, V966864, 18 September 1999. A single female found in her triangle web on a trained yew *Taxus* near a public path. More recent records from the park are given by Cawley (2001).

***Steatoda bipunctata* (Linnaeus, 1758)**

DUBLIN, Edmonstown Road, Dublin 16, 9 September 1997, O1326. A single male found under a window ledge on the outside of a roadside derelict building.

It is curious that this species, which is so widely distributed, has not been met with more frequently in Ireland. This statement slightly paraphrases comments made by Pack-Beresford (1920). His and the present note are the only records of the species in Ireland. It is fairly common and widespread in Britain and Europe.

***Steatoda nobilis* (Thorell, 1875)**

*DUBLIN: Newgrove Avenue, Sandymount, O192327, 18 April 1999. A submature male from his retreat on the ornamental upright spike of a garden railing. This spider can often be found under the 'eave' that tops tall walls along the path that leads to the coast; Dodder Road Lower, Rathfarnham, O147296, 12 September 1999. A submature male from his web on railings running along the river Dodder. Other specimens seen in the same situation on subsequent occasions, especially at night when they emerge from their retreats; Harbour Road, Dalkey, O266273, 4 September 2000. One female from her web built under a wall 'eave'; 5 Newgrove Avenue, Sandymount, O192327, 24 September 2000. One female from her retreat behind a drainpipe fixed to the wall in the back garden. The species has been seen in this garden on a number of occasions; Kilvere, Templeogue, O131285, August 2001. A female, again from her retreat under the 'eave' atop a tall wall; Royal Hospital, Kilmainhaim, O133337, 31 Aug 2000. One immature on a large iron gate leading into a cemetary. Specimen not taken.

First recorded from Co. Wicklow (Nolan, 2000) and subsequently Co. Cork (Cawley, 2001). The species is clearly widespread in Dublin city. It would not be surprising if it was found at numerous sites along the south and east coasts of the country. It is perhaps surprising that there are not more records of it in Britain, where it has been established for some time, but is as yet recorded from only four 10k grid squares on the southern coast (Harvey *et al.*, 2002).

***Theridion mystaceum* L. Koch, 1870**

*DUBLIN: Royal Hospital, Kilmainhaim, O133337, 9 July 1998. One female from her retreat on an Ash *Fraxinus* in the meadow on the west side of the building; 31 Anne Devlin Park, Rathfarnham, O132279, 23 May 1999. One female on outside wall of house; Kilvere, Templeogue, O131285, 29 May 2000. One male on a wall.

*CORK: Castletownshend, W186312, 7 July 2000. Female from retreat on streetside doorway.

Essentially an under-recorded species that would seem to be widespread in Ireland. It has been found in natural habitats (McFerran, 1997; Cawley, 2001; Nolan, 2002) but clearly has some synanthropic inclination. The same general pattern is observed in Britain (Harvey *et al.*, 2002).

***Silometopus reussi* (Thorell, 1871)**

DUBLIN: 4 Oldbridge View, Lucan, O0333, 9 June 2001. One male from the back garden.

Construction of the house had finished in the previous year and the soil was badly drained. It had been recently rotovated in preparation for growing a lawn.

This species has a local and scattered distribution in Britain where it is most common in eastern England. It is associated with cut vegetation and manure heaps (Harvey *et al.*, 2002). Previously recorded from four Irish counties, Down, Dublin, Meath and Carlow (van Helsdingen, 1996), it would seem to exhibit an eastern inclination in Ireland also.

***Evansia merens* O. P.-Cambridge, 1900**

*KERRY: Lóthair ringfort on the Iveragh peninsula, V506615, 11 July 2001. A single female under a stone with ants on a relatively well trampled area of grass. Previous records from Howth Head in Co. Dublin (Pack-Beresford, 1909) and the Burren (Mackie and Millidge, 1970) where it was also found under stones with ants.

Apparently a myrmecophilous species, the spider is found infrequently in Britain and has a northern orientation. Possibly under-recorded on account of its preferred habitat (Harvey *et al.*, 2002).

***Milleriana inerrans* (O. P.-Cambridge, 1885)**

*CORK: Baltimore, W052265, 6 and 7 July, 2000. Two males were found, one on each date, crawling on the patio outside a holiday cottage.

This species is new to Ireland and not unexpected since it is a frequent aeronaut (Harvey *et al.*, 2002). Merrett (1979) notes that its spread through southern England has been remarkably consistent and it will be of interest to see where the next records appear in Ireland though it is highly unlikely the present ones represent its first or only occurrence here. In England it is often associated with burnt heathland and arable land.

***Porrhomma montanum* Jackson, 1913**

*CLARE: Burren, M135024, 4 May 2001. One female abseiling from moss on the trunk of a conifer on the edge of a plantation. Elevation 230 metres.

*DUBLIN: Cruagh forest, Co. Dublin, O127224, 29 March 2002. One female under a large stone resting on pine needles. Elevation 380 metres.

WICKLOW: Lough Bray, O140159, 16 May 1998. A female swept from heather *Calluna*. Elevation 500 metres.

Only recently recorded from Ireland, the first specimen identified was found on montane blanket bog in Wicklow and is described in a paper in the present volume (Nolan, 2002). Present records certainly suggest the upland/montane association that characterises the species' distribution in Britain (Harvey *et al.*, 2002).

***Taranucnus setosus* (O.P.-Cambridge, 1863)**

*CLARE: Travaun beach near Miltown Malbay, R038804, 23 July 1998. A single female from her web amongst long grasses on the cliffside.

*LONGFORD: Lough Gowna, N297866, 21 March 1999. A single female from a discarded plastic sheet on the lakeshore.

Previously noted in Ireland from saltmarsh in Co. Kerry (Mackie, 1972) and from wetland and urban sites in Co. Cork (Smith and Costello, 1998; Cawley, 2001). The species is very local and somewhat infrequent in Britain (Harvey *et al.*, 2002) where it is associated primarily with old wetland sites.

***Larinioides sclopetarius* (Clerck, 1757)**

(synonym *Larinioides sericatus* (Clerck, 1757))

*GALWAY: Department of History, Tower 1, Arts and Science Building, Galway University, M2926, 28 August 2000. Two females and three males taken from the ceiling of an office and adjacent corridor on the second floor. Numerous specimens could be seen through the windows on the external structures of the building at the same elevation. When railings alongside the nearby river were investigated, *Larinioides cornutus* (Clerck, 1757) was present in large numbers but *L. sclopetarius* was not seen.

This species is a relatively recent addition to the Irish spider fauna with the first observation coming from Co. Antrim (Taylor, 1986). There are also records from Cos Derry (Merrett, 1995) and Tipperary (Cawley, 2001). It can be numerous locally in Britain (Harvey *et al.*, 2002).

***Mangora acalypha* (Walckenaer, 1802)**

CORK: Baltimore, W051268, 6 July 2000. One female from an orb web on gorse *Ulex* in a very well vegetated area.

All previous records are from Cos Cork and Kerry (van Helsdingen, 1996; Cawley, 2001).

***Philodromus dispar* Walckenaer, 1826**

*DUBLIN: 31 Anne Devlin Park, Rathfarnham, O132279, 27 May 2002. A single male found on a wall of the downstairs toilet. Previously recorded from three other counties with recent records from Co. Cork (Cawley, 2001). Some of these records were also from synanthropic situations.

Pseudeuophrys lanigera **(Simon, 1871)**

DUBLIN: Irish Museum of Modern Art, Royal Hospital, Kilmainhaim, O133337, 25 June, 1997. Female on first floor wall inside building; 6 April 1998, another female on sash window of second floor room; 15 October 1998, a male from the east wing first floor gallery. The species has been noted from this building on many occasions subsequently; 23 The Drive, Woodpark, Ballinteer, O169264, 13 June 2000. Kitchen ceiling.

Probably more common in Ireland than records indicate, it is now also known from Cos Cork and Sligo (Cawley, 2001).

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RAYLESS RAGWORT, *SENECIO JACOBAEA* VAR. *FLOSCULOSUS* LAM. AND DC. (ASTERACEAE), IN IRELAND

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Introduction

The occurrence in Ireland of a coastal variant of Ragwort, *Senecio jacobaea* L. (Asteraceae), characterised by the absence of ray florets, has been long recognised. The first notice of the variant in Ireland was published by Ray (1696), based on a record from near Drogheda (Cos Meath or Louth) by the English botanist William Sherard – "*copiossime nascens in sabulosis prope littus, tribus vel quatuor milliaribus a Drogheda, adeo ut e mille plantis vix unum flore radiato reperiens*" (Nelson, 1979), translated as "[grows] most copiously on sands by the shore three or four miles from Drogheda, so that of a thousand plants you shall scarce find one with a radiant flower" (Colgan and Scully, 1898). Although the record is undated, it was certainly made between 1690 and 1694, the years in which Sherard was resident in Ireland (Mitchell, 1975), and has been given as *circa* 1693 by Nelson (1979). This rayless dune plant is not restricted to Ireland, its range including coastal sites in Britain, Belgium, The Netherlands, Germany, Denmark, Norway, Sweden (Meijden, 1976; Kadereit and Sell, 1986) and France (Lamarck and de Candolle, 1805).

The occurrence of rayless variants of species of Asteraceae is not restricted to *Senecio jacobaea*; other species in where this type of variation is known include *Anthemis tinctoria* L. (Druce, 1928, 1932), *Aster tripolium* L. (Druce, 1928; Gray, 1966; Marren, 1999), *Bellis perennis* L. (Scully, 1916; McClintock, 1984, 1985), *Leucanthemum vulgare* Lam. (Druce, 1928), *Pulicaria dysenterica* (L.) Bernh. (Druce, 1928), *Senecio aquaticus* Hill (Praeger, 1900; Druce, 1926, 1928), *S. erucifolius* L. (Chester, 1917; Druce, 1928) and *S. sylvaticus* L. (Cobbe, 1925; Druce, 1928).

Apart from the rayless variety and the type, the other named variant of *Senecio jacobaea* reported from Ireland (Banbridge, Co. Down) is var. *stenoglossus* Brenan and Simpson, distinguished by its narrow ligulate florets (1-1.5mm wide) which are gradually narrowed to a distinctly subacute tip (Brenan and Simpson, 1949) and its deeply and narrowly laciniate leaves (Harper and Wood, 1957). The taxonomic and distributional status of plants with this type of morphology is unclear - Allen (1961) suggested that they may comprise a distinct ecogeographical race meriting taxonomic recognition. My own opinion is that they probably represent no more than an extreme form of the type, var. *jacobaea*. A variety with downy leaves reported by K. S. Baily (Anon., 1846) from woods about Collon, Co. Louth also falls within the compass of the variable type variety and does not appear to merit separate taxonomic status. A further variant, var. *condensatus* Druce, of British coastal dunes, shingle and sea cliffs was recognised by Kadereit and Sell (1986). This has not been confirmed from Ireland, although Kadereit and Sell (1986) did suggest its possible occurrence at Skull, Co. Cork and Kincaslough, Co. Donegal on the basis of work carried out by Böcher and Larsen (1955).

Distinguishing features

The pattern of morphological variation displayed by *Senecio jacobaea* in Ireland and Britain was examined and described by Kadereit and Sell (1986). These authors recognised two main lines of variation which they treated as subspecies, i.e. subsp. *jacobaea* var. *jacobaea*, the typical plant of inland pastures and other grassy places with ray florets 7-9mm long, and subsp. *dunensis* (Dumort.) Kadereit and P. D. Sell, a variant of coastal sand dunes whose ray florets are rudimentary or, more usually, absent. Additional distinguishing characters cited by these authors are the number of stems (1-3 in subsp. *jacobaea*, solitary in subsp. *dunensis*), the height of stems (up to 150cm in subsp. *jacobaea*, 30 (to 60) cm in subsp. *dunensis*), the density of arachnoid (cobwebby) hairs on the peduncles ("more or less numerous" in subsp. *jacobaea*, "often...dense" in subsp. *dunensis*) and the hairiness of the outer row of achenes (glabrous in subsp. *jacobaea*, hairy in subsp. *dunensis*). Nelson (2001) described several additional features of subsp. *dunensis* from a site in Co. Galway - stems hairy, leaves dark green, deeply lobed and hairless, and rosette leaves dying before the flowers appear.

It is clear that for stem number, stem height and peduncle pubescence, the two subspecies overlap and are not effectively distinguished by these characters; this is confirmed by an examination of living and herbarium material that I carried out - 1) number of stems recorded per plant was in the range 1 to 9 for both subsp. *jacobaea* and subsp. *dunensis*. While single-stemmed plants of subsp. *dunensis* are not uncommon, multi-stemmed plants occur frequently. Often the plant bases are covered by blown sand and multi-stemmed individuals can appear to be single-stemmed. Many herbarium specimens that I examined did not include the plant base and appeared to be single-stemmed, but could actually have been derived from multi-stemmed plants. 2) Stem height varies greatly in both subspecies; I recorded stem heights in the range 25 to 120cm for subsp. *jacobaea* and 15 to 115cm for subsp. *dunensis*. Scully (1916) noted that, in Co. Kerry, subsp. *dunensis* "grows quite as tall and luxuriant as rayed *S. jacobœa*". 3) A wide variation in the density of the peduncle pubescence (sparse to dense) was recorded in both subspecies. This examination also showed that those features of subsp. *dunensis* described by Nelson (2001) are not unique to the subspecies. It was found that plants with hairy stems, dark green, deeply lobed stem leaves and with dead rosette leaves at flowering time occur commonly in both subspecies. I recorded no plants with hairless leaves - mostly the leaves of both subspecies are sparsely arachnoid hairy, especially below and on the veins above.

As regards the hairiness of the achenes, those of the ray florets are glabrous and those of the disc florets hairy in subsp. *jacobaea* (Chater and Walters, 1976; Praeger, 1897), while in subsp. *dunensis* the achenes of the disc florets are hairy. The presence or absence of pubescent achenes is therefore correlated with the presence or absence of ray florets, and as such I do not regard it as an additional distinguishing character. Thus, of the characters which have been proposed to distinguish the two subspecies, only one character is of use, i.e. the presence or absence of ray florets with hairless achenes.

The situation is, however, complicated by the presence of plants with short rays (rays mostly 1-4mm long) and all achenes hairy that are to be found amongst populations of rayless plants. Such plants with "rudimentary" ray florets were included in subsp. *dunensis* by Kadereit and Sell (1986). However, a different view is taken here and these plants are considered to have originated through hybridisation between subsp. *jacobaea* and subsp. *dunensis*. Harper and Wood (1957) also regarded short-ray plants as of hybrid origin.

Hybridisation between subsp. *dunensis* and subsp. *jacobaea*

Subsp. *dunensis* and subsp. *jacobaea* are certainly to some extent inter-fertile and cross-breed to give rise to plants with short ray florets - Allen (1966) noted that artificial crossing gave rise to a "mid-ray" form. My examination of herbarium material of short-ray plants from Counties Kerry, Galway, Mayo and Sligo showed a wide variation in the length of the ray florets between plants, strongly suggesting hybridisation. This was reinforced by examination in the field of mixed populations of subsp. *dunensis* and subsp. *jacobaea* in Kerry, Wexford and Meath. Here, amongst plants of both parents, were plants which displayed a complete gradation between the parents with regard to ray floret length and which must be regarded as comprising F_1 and backcross hybrids, that is, hybrid swarms. The comments of Praeger (1905) and Webb and Scannell (1983) also strongly point to the occurrence of hybrid swarms on the Aran Islands, Co. Galway and the Mullet Peninsula, Co. Mayo. Given that subsp. *dunensis* and subsp. *jacobaea* are inter-fertile, it seems reasonable to expect the occurrence of hybrids wherever they grow together (in most sites for subsp. *dunensis* the type subspecies is also present or growing close by). However, as plants with short ray florets are not always encountered in such situations, it seems that there may be some barrier to hybridisation in operation. The fact that hybrids have not been noted at all sites for subsp. *dunensis* may be attributed to a number of possible reasons - an unknown barrier to hybridisation, the absence or extreme rarity in certain sites of subsp. *jacobaea* (as on the Louth sand dunes (Praeger, 1897: p. 94), amongst other sites), and the lack of critical recording. My own view is that lack of critical recording is the most important reason for the paucity of records for hybrids, as I recorded hybrid plants at most of the sites for subsp. *dunensis* that I visited. Hybrid plants can be distinguished by the outermost row of florets which are, to varying degrees, intermediate in form between ray florets and disc florets and which have short rays and pubescent achenes.

Rayless plants from inland sites

Rayless plants of inland sites are very rarely encountered and are considered not to correspond to subsp. *dunensis*, but to an unrelated monstrous form (Harper and Wood, 1957), referred by Kadereit and Sell (1986) to subsp. *jacobaea* var. *jacobaea* and treated by Meijden (1976) as a non-heritable form of no systematic value. I examined rayless specimens collected by D. A. Webb from near Mullingar, Co. Westmeath and lodged in the herbarium of Trinity College, Dublin. While these plants did lack ray florets, they did not bear close resemblance to the plants of coastal sites, having slender, few-flowered capitula (mostly 6 to 10 florets) which gave the plants a rather abnormal appearance. I concur with the views of the above authors and regard the inland rayless plants as aberrant forms of subsp. *jacobaea* var. *jacobaea*.

Taxonomic rank

The paucity of characters to satisfactorily distinguish subsp. *dunensis* and subsp. *jacobaea* raises the question of appropriate taxonomic rank for these taxa. As subsp. *dunensis* is not well distinguished other than through the presence or absence of long ray florets and, being a taxon with a strong habitat preference, it is felt that it is most properly placed at a taxonomic rank of no higher than the varietal. This choice follows the general approach to the selection of appropriate rank of infraspecific taxa taken in *Flora Nordica* (Jonsell, 2001) and discussed in detail in Grundt *et al.* (2000). This view of the coastal taxon as a variety rather than a subspecies is in accordance with that of all of the authors that include records for it (other than Kadereit and Sell) in the reference list below; it should be noted, however, that Meijden (1976), although treating the taxon as a variety, did suggest that it may merit subspecific rank. Other authors treating the taxon at the varietal rank include Stace (1997), who regarded it as representing only one line of variation, Webb (1943, 1953, 1959, 1963, 1967, 1977) and Webb, Parnell and Doogue (1996). The taxon has been tested in cultivation and found to retain its distinguishing features when grown from seed (Allen, 1966).

Nomenclature

There are a number of epithets potentially available for the rayless coastal plants at the rank of variety. The earliest would appear to be var. *nudus* Weston, common name "Ragwort without Rays" (Weston, 1772). However, as noted by Kadereit and Sell (1986), this epithet is not appropriate for the coastal plants as in the original description ("*vulgaris, flore nudo*") no habitat or locality details were cited and it is possible that this name was based on an inland rayless plant of var. *jacobaea*. The next available epithet is var. *flosculosus* Lam. and DC. (Lamarck and de Candolle, 1805) which "croît dans les dunes et les lieux sablonneux" (grows in dunes and sandy places) in France. Var. *flosculosus* appears to be the earliest available, legitimate and correctly applied epithet for the taxon at the rank of variety. Another epithet that appears in the literature is var. *discoideus* Wimmer and Grab., but this was based on an inland plant (Kadereit and Sell, 1986) and, in fact, its publication postdates that of var. *flosculosus* by twenty-four years.

Irish records

Kadereit and Sell (1986) listed (as subsp. *dunensis*) Irish sites for var. *flosculosus* from counties Galway (vice-counties H9 [Aran] and H16), Kerry (both H1 and H2, although only H1 was indicated), Mayo (H27) and Wexford (H12). It is pity, however, that they availed of only a few of the many published sources of information relating to this taxon in Ireland and that they did not consider the many specimens held in Irish herbaria, since the Irish distribution of var. *flosculosus* is, in fact, much wider than their work would suggest. The purpose of the present article is to draw together both published and unpublished records of rayless *Senecio jacobaea* in order to provide a more complete picture of its Irish distribution pattern.

All Irish records that have been traced for *Senecio jacobaea* var. *flosculosus* from coastal sites are presented below and mapped in Figure 1. Records of hybrids between var. *flosculosus* and var. *jacobaea*, and of rayless var. *jacobaea* from inland sites are listed separately. Records are ordered chronologically within vice-county and take the form: record number, locality, recorder, date of record (when known), national grid reference (10 x 10km square/s) and record source (publication or herbarium). Where two or more publications refer to a particular record, these are listed in chronological order following the record. Records with no source provided are field records - for these a six-figure grid reference is given. Grid references separated by a forward slash indicate that a record from a site is not detailed enough to assign to a single grid square. In order to map these records on Figure 1, an examination of 6 inch to 1 mile maps was undertaken. These maps show areas of habitat in the vicinity of the record site that are suitable for var. *flosculosus* - such areas were assigned a grid reference and mapped on Figure 1. It was necessary to employ this approach for some records from the following areas: Inishmore (vice-county H9), The Mullet (H27), Strandhill (H28), Doagh (H34) and Culdaff (H34). Where a record is unlocalised, e.g. "County Kerry", no grid reference is given. The following abbreviations are employed: MWJ = the present author; DBN = Herbarium, National Botanic Gardens, Glasnevin; TCD = Herbarium, Trinity College, University of Dublin; BM = Herbarium, British Museum (Natural History); OXF = Herbarium, Botany

School, University of Oxford; CGE = Herbarium, Botany School, University of Cambridge.

Irish records for *Senecio jacobaea* var. *flosculosus*

H1 South Kerry. 1) Ferriter's Cave [*sic* = Cove]. A. G. More. Q30 (More, 1872: p. 273; More, 1873: p. 110). **2)** County Kerry [= H1/H2]. D. Moore, 7.1873. Specimen at DBN. **3)** Dry sandy pastures west of Lough Gill. H. C. Hart, 7.7.1883. Q51 (Hart, 1885: p. 217). **4)** "Common on the Kerry sand-hills. R. W. Scully (Colgan and Scully, 1898: p. 189). **5)** "Abundant on most of the Kerry sandhills" (Scully, 1916: p. 156; Kadereit and Sell, 1986: p. 23). **6)** Sand dunes, Rossbehy. J. Braun-Blanquet and R. Tüxen, 7.1949. V69 (Braun-Blanquet and Tüxen, 1952: p. 337 and table 46). **7)** Fermoyle. J. L. Farquharson, 1955. Q51. Specimen at BM (Kadereit and Sell, 1986: p. 23). **8)** Sandy pasture, Kilshannig, Castlegregory. M. J. P. Scannell, 16.6.1970. Q61. Specimen at DBN. **9)** Sand dunes, Smerwick side of Béal Bán, Dingle Peninsula. D. M. Synnott, 7.8.1973. Q30. Specimen at DBN. **10)** Sand dunes, 1.5km east of Castlegregory. MWJ, P. S. Wyse Jackson and D. A. Webb, 5.8.1990. Q635128. **11)** Sand dunes at Trabeg, south-east of Dingle. P. S. Wyse Jackson and D. A. Webb, 25.6.1991. V486989. **12)** Dune grassland, 0.5km south of Murreagh, Smerwick Harbour. P. S. Wyse Jackson, 5.7.1991. Q382060. **13)** Sand dunes, Smerwick Harbour. S. Wolfe-Murphy, 12.7.1992. Q350059. **14)** Sand dunes, west side of the Magharees Peninsula. MWJ, 11.7.1993. Q615170. **15)** Sand dunes, Smerwick Harbour. MWJ, P. S. Wyse Jackson, R. FitzGerald and the Botanical Society of the British Isles, 1.8.1993. Q382056 and Q358056 (Wyse Jackson and Wyse Jackson, 1994: p. 60). **16)** Sand dunes, Inch. MWJ, P. S. Wyse Jackson and D. A. Webb, 2.8.1993. Q648005. **17)** Corca Dhuibhne barony, Dingle Peninsula - "ray florets... sometimes absent in seaside populations" (Uí Chonchubhair, 1995: p. 227). **18)** Sand dunes near Lough Naparka, north of Castlegregory. MWJ, 3.7.1995. Q618168, Q618172, Q625169 and Q625171. **19)** Sandy ground, Rough Point, north-east end of the Magharees Peninsula. MWJ, 23.7.1996. Q627201. **20)** Sandy ground near Kilshannig church, north-west end of the Magharees Peninsula. MWJ, 24.7.1996. Q625194. **21)** Sand dunes, 1km north-north-west of Aughacasla. MWJ, 28.7.2000. Q643123. **22)** Sand dunes, Fermoyle. MWJ, 15.7.2001. Q551122. **23)** Sand dunes north of Tullaree, near Castlegregory. MWJ, 16.7.2002. Q636129 and Q635130.

H2 North Kerry. **1)** County Kerry [H1/H2]. D. Moore, 7.1873. Specimen at DBN. **2)** Very plentiful near the northern head of the Fenit peninsula. R. W. Scully, 7/8.1887. Q71 (Scully 1888: p. 75). **3)** Barrow Harbour. R. W. Scully, 7/8.1887. Q71 (Scully, 1888: p. 76). **4)** Between Akeragh Lough and Ballyheigue. R. W. Scully, 7/8.1887. Q72 (Scully, 1888: p. 76). **5)** Ballyheigue sandhills. R. W. Scully, 12.7.1888. Q72. Specimen at DBN. **6)** Ballyheigue sandhills. R. W. Scully, 18.7.1888. Q72. Specimen at DBN. **7)** Banna sandhills. R. W. Scully, 7.1888. Q72. Specimen at OXF (Kadereit and Sell, 1986: p. 23). **8)** Near Barrow Harbour. R. W. Scully, 27.8.1892. Q71. Specimen at DBN. **9)** "Common on the Kerry sand-hills". R. W. Scully (Colgan and Scully, 1898: p. 189). **10)** "Abundant on most of the Kerry sandhills" (Scully, 1916: p. 156; Kadereit and Sell, 1986: p. 23). **11)** Sandy ground, Ballybunnion. A. Rutherford, 7.1975. Q84. Specimen at DBN. **12)** Sand dunes, Beal Point. M. J. P. Scannell and the Botanical Society of the British Isles, 8.7.1978. Q84/Q94 (Scannell, 1980: p. 93). Specimen at DBN: Sand dunes, Beal Point, north of Listowel. M. J. P. Scannell, 8.7.1978. **13)** Sand dunes at Carrahane Strand, south of Banna. MWJ, P. S. Wyse Jackson, R. FitzGerald and the Botanical Society of the British Isles, 31.7.1993. Q747213 (Wyse Jackson and Wyse Jackson, 1994: p. 60). **14)** Sand dunes north-west of Fenit. P. S. Wyse Jackson, 8.8.1987. Q722160. **15)** Sand dunes south of Ballybunnion. MWJ and the Botanical Society of the British Isles, 24.7.1999. Q860385. **16)** Sand dunes south of Ballybunnion. S. Reynolds, S. Wolfe-Murphy and the Botanical Society of the British Isles, 24.7.1999. Q862416. **17)** Sand dunes, Beal Point. MWJ and the Botanical Society of the British Isles, 25.7.1999. Q903486. **18)** Limestone rocks by the sea, Samphire Island, Fenit. MWJ, 27.7.1999. Q728147. **19)** Sand dunes, north-western side of Fenit Island. MWJ, 27.7.1999. Q713176. **20)** Calcareous grassland, *circa* 500m from the sea, north side of Barrow Harbour. MWJ, 28.7.1999. Q738183.

H6 Waterford. **1)** Sandy track to the east of Tramore. J. Woods, 23.7.1855. S50 (Woods, 1855: p. 210; More, 1872: p. 273; More, 1873: p. 119; Colgan and Scully, 1898: p. 189). **2)** Sandhills, Tramore. R. M. Barrington, 22.8.1871. S50/S60. Specimen at DBN. **3)** Tramore. R. Ll. Praeger, 1899. S50/S60 (Praeger, 1902: p. 71). **4)** Sand dunes at Tramore Strand. L. F. Ferguson and I. K. Ferguson, 3.8.1978. S60. Specimen at DBN.

H9 Clare (Co. Clare). 1) Moher. G. C. Druce, 1928. R09 (Druce, 1929: p. 743). **2)** Grassland by the sea, Poulsallagh, Burren. M. J. P. Scannell, 3.8.1971. M00. Specimen at DBN.

H9 Clare (Aran Islands, Co. Galway). 1) Great Isle of Arran [*sic*], neighbourhood of Kilronan. D. Oliver, 8.1850. L80/L81 (Oliver, 1851: p. 128; More, 1872: p. 273; More, 1873: p. 119; Hart, 1875: p. 9). **2)** Great Isle of Arran [*sic*]. J. H. Balfour, 8.1852. L71/L80/L81/L90 (Balfour, 1853: p. 1006). **3)** Inisheer, Aran Islands. H. C. Hart, 1869. L90 (Hart, 1875: p. 23). **4)** Inishmaan, Aran Islands. H. C. Hart, 1869. L90 (Hart, 1875: p. 23). **5)** Inishmore, Aran Islands. H. C. Hart, 1869. L71/L80/L81/L90 (Hart, 1875: p. 23). **6)** Frequent in Aran. H. C. Hart. L71/L80/L81/L90 (More, 1872: p. 273; More, 1873: p. 119; Colgan and Scully, 1898: p. 189; Praeger, 1909: p. 157). **7)** The predominant variant on Aran. L71/L80/L81/L90 (Webb, 1962: p. 125). **8)** Inisheer, Aran Islands. D. A. Webb *et al.*, 1969-1976. L90 (Webb, 1980: p. 72). **9)** Inishmaan, Aran Islands. D. A. Webb *et al.*, 1969-1976. L90 (Webb, 1980: p. 72). **10)** Inishmore, Aran Islands. D. A. Webb *et al.*, 1969-1976. L71/L80/L81/L90 (Webb, 1980: p. 72). **11)** "On Aran ... the variant without ligulate florets (var. *flosculosus* DC.) predominates, but every grade of intermediate between it and the typical form is usually to be found near by." L71/L80/L81/L90 (Webb and Scannell, 1983: p. 115; Kadereit and Sell, 1986: p. 23).

H12 Wexford. 1) Near Churchtown. J. Waddy. T10 (More, 1872: p. 273; More, 1873: p. 119; Boswell-Syme, 1878: p. 85). **2)** Sand hills *circa* 1km south of Cahore Point. H. C. Hart, 8.7.1881. T24 (Hart, 1881b: p. 342; Hart, 1883: p. 138; Colgan and Scully, 1898: p. 189). **3)** Sand hills, tip of Rosslare Point. H. C. Hart, 28.7.1882. T11 (Hart, 1883: p. 118; Colgan and Scully, 1898: p. 189). **4)** Sandy ground, "Bar of the Lough", Ballyteige Burrow, 3km west of Crossfarnoge Point. H. C. Hart, 31.7.1882. S90 (Hart, 1883: pp. 123 and 138). **5)** Rosslare. G. C. Druce, 9.1906. T11 (Druce, 1907: p. 149). **6)** Rosslare. G. C. Druce, 17.9.1926. T11. Specimen at BM (Kadereit and Sell, 1986: p. 23). **7)** Sandy ground, Ballyteige. M. J. P. Scannell, 11.7.1972. S90. Specimen at DBN. **8)** Frequent on sand dunes, Ballyteige. M. J. P. Scannell, 8.9.1976. S90. Specimen at DBN. **9)** Rosslare Spit. D. A. Webb and J. R. Akeroyd, 10.1980. T01/T11 (Kadereit and Sell, 1986, p. 23). **10)** Carnsore Point. D. A. Webb and MWJ, 14.8.1981. T101043. **11)** South-eastern end of Ballyteigue Burrow, near Kilmore Quay.

J. R. Akeroyd, R. FitzGerald and D. A Webb, 5.7.1989. S90. **12)** Ballyteigue Burrow. J. Hurley (Hurley, 1994: photograph p. 10). S90. **13)** Roadside, Burrow, Rosslare. MWJ, 6.8.2002. T094163 and T093172. **14)** Sand dunes, Curracloe. MWJ, 6.8.2002. T112267. **15)** Sand dunes south of Cahore Point. MWJ and N. D. Lockhart, 27.9.2002. T205420, T208434, T213444 and T218444.

H16 West Galway. 1) At Roundstone [undoubtedly Dog's Bay]. R. Graham, 1840. L63 (Graham, 1840). **2)** On several islands off Connemara. A. G. More (More, 1872: p. 273; More, 1873: p. 119; Colgan and Scully, 1898: p. 189; Praeger, 1909: p. 157). **3)** Dog's Bay. E. F. Linton and W. R. Linton, 8.1886. L63 (Linton and Linton, 1886: p. 20). **4)** Knocknagoneen [a hill 1.5km east of Barna]. R. Ll. Praeger, 27.8.1899 [see Praeger, 1900: p. 149]. M22 (Praeger, 1902: p. 71; Praeger, 1909: p. 157). **5)** Dog's Bay, Roundstone. G. C. Druce, 9.1906. L63 (Druce, 1907: p. 149). **6)** Roundstone [undoubtedly Dog's Bay]. L63 (Praeger, 1909: p. 157). **7)** Plentiful near the coast at Roundstone [undoubtedly Dog's Bay]. G. C. Druce, 8.1911. L63 (Druce, 1911: p. 314). **8)** Sandy coast, Dog's Bay near Roundstone. W. C. Barton. 14.8.1913. L63 (Barton, 1914: p. 474). **9)** On grassy lands near the sea, Barna. D. J. Evans, 29.8.1923. M22 (Evans, 1924: p. 392). **10)** Dog's Bay, Roundstone. C. E. Raven, 9.9.1955. L63. Specimen at CGE (Kadereit and Sell, 1986: p. 23). **11)** Sandy pastures at end of road, Dog's Bay, Roundstone. M. J. P. Scannell, 11.9.1973. L63. Specimen at DBN. **12)** Sandy meadows by the shore, west side of Aughrusbeg Lough, north-west of Claddaghduff. M. J. P. Scannell, 4.11.1975. L55. Specimen at DBN. **13)** "On ... most of the Connemara dunes the variant without ligulate florets (var. *flosculosus* DC.) predominates, but every grade of intermediate between it and the typical form is usually to be found near by." (Webb and Scannell, 1983: p. 115; Kadereit and Sell, 1986: p. 23). **14)** Dunes at Dog's Bay, Roundstone. E. C. Nelson, 23.9.1986. L63. Specimen at DBN. **15)** Dog's Bay. E. C. Nelson, 9.1986. L63 (Nelson, 2001: photograph p. 110). **16)** Coastal grassland, Mweenish Island. N. D. Lockhart, 25.8.2002. L753298.

H20 Wicklow. 1) On the east side of the lower Broad Lough. M. J. P. Scannell and A. Folan, 1967. T39 (Carvill and Curtis, 1973: p. 387). Specimen at DBN: sand bank east of Broad Lough. M. J. P. Scannell, 7.9.1967.

H21 Dublin. 1) North of Balbriggan. R. Ll. Praeger, 7.1893. O16. Specimen at DBN. **2)**

Shore north of Balbriggan, Co. Dublin. N. Colgan, 7.1893. O16. Specimen at DBN. **3)** Sandy seashore north of Balbriggan. N. Colgan, 1893. O16 (Colgan, 1904: p. 115).

H22 Meath. 1) See H22 Meath or H31 Louth, below. **2)** Sandhills between Gormanstown and Maiden Tower, in many places. A. G. More. O16, O17 (More, 1872: p. 273; More, 1873: p. 119). **4)** Mornington. R. Ll. Praeger, 8.1893. O17. Specimen at DBN. **3)** North of Laytown. R. Ll. Praeger, 1896. O17 (Praeger, 1902: p. 71). **5)** Short coastal grassland, Laytown. MWJ, 15.8.2002. O165713. **6)** Fixed dune grassland, Bettystown. MWJ, 15.8.2002. O161733. **7)** Roadside, Bettystown. MWJ, 15.8.2002. O159737. **8)** Abundant on sand dunes, Mornington. MWJ, 15.8.2002. O158758. **9)** Short coastal grassland, Maiden Tower, Mornington. MWJ, 15.8.2002. O155762.

H22 Meath or H31 Louth. 1) Sandy ground by the shore three of four miles from Drogheda. W. Sherard, *circa* 1693. O17 (Ray, 1696: p. 82; Dillenius, 1724: p. 177; Threlkeld, 1726 and 1727: p. 106; Moore, 1878: p. 199; Moore and More, 1878: p. 206; Colgan and Scully, 1898: p. 189; Druce, 1911: p. 314; Mitchell, 1974: p. 5; Nelson, 1979: p. 60; Synnott, 1997: p. 161). Specimen at OXF (Herb. Morrison) labelled "*Jacobaea apetalos Sherardi, ex. Hibernia, D. Sher.*" (Nelson, 1979: p. 60).

H27 West Mayo. 1) Mullet. A. G. More. F61/F62/F63 (More, 1873: p. 119). **2)** Sandy ground. Dugort, Achill Island. R. Ll. Praeger, 31.7.1904. F60. Specimen at DBN. **3)** About Old Dugort, Achill, with the type. R. Ll. Praeger. F60 (Praeger, 1904: p. 284; Praeger, 1909: p. 157; Synnott, 1984: p. 86). **4)** Valley Strand, Achill Island. R. Ll. Praeger, 31.7.1904. F70. Specimen at DBN. **5)** Sandy bank, Valley Strand, Achill Island. R. Ll. Praeger, 31.7.1904. F70. Specimen at DBN. **6)** About Valley, Achill, with the type. R. Ll. Praeger. F70 (Praeger, 1904: p. 284; Praeger, 1909: p. 157; Synnott, 1984: p. 86). **7)** Mullet. Abundant on the dunes with the type and every intermediate stage. R. Ll. Praeger, 7.1905. F61/F62/F63 (Praeger, 1905: p. 234; Praeger, 1909: p. 157; Synnott, 1984: p. 86). **8)** Sand hills, Mullet. R. Ll. Praeger, 7.1905. F61/F62/F63. Specimen at BM (Kadereit and Sell, 1986: p. 23) and DBN. **9)** Sandy waste, South Inishkea. R. Ll. Praeger, 7.1905. F52. Specimen at DBN. **10)** Sandy ground, South Inishkea. R. Ll. Praeger, 7.1905. F52. Specimen at DBN. **11)** On close cropped sward, bay south of Annagh Head, Mullet Peninsula. M. J. P. Scannell, 4.10.1957. F63. Specimen at DBN. **12)** Sand dunes, Elly Bay, Mullet Peninsula. D. M. Synnott, 29.7.1965.

F62. Specimen at DBN. **13)** Mullet. Common on the sand hills and roadside banks, particularly south-west of Leam Lough. T. G. F. Curtis, H. N. McGough and J. R. Akeroyd, 6.1979. F62. (Curtis, McGough and Akeroyd, 1981: p. 41).

H28 Sligo. 1) Sand dunes, Strandhill. R. Ll. Praeger, 1897. G53/G63 (Praeger, 1902: p. 71, 1909: p. 157). **2)** Rosses Point. I. M. Roper, 8.1928. G64. (Roper, 1929: p. 168; Druce, 1929: p. 743). **3)** Strandhill dunes, with intermediate forms. D. A. Webb, 23.8.1952. G53/G63. Specimen at TCD.

H31 Louth. 1) See H22 Meath or H31 Louth, above. **2)** "Immensely abundant from the Boyne to Clogher, covering hundreds of acres of sandhills and pasture; the normal form completely absent." R. Ll. Praeger, 1896. O17, O18 (Praeger, 1897: p. 94; Colgan and Scully, 1898: p. 189). **3)** Sandhills, Port, Clogherhead. D. M. Synnott, 18.9.1977. O18. Specimen at DBN. **4)** Sand dunes, Baltray. MWJ, 15.8.2002. O148773 and O153770.

H34 East Donegal. 1) Doagh. H. C. Hart, 5.8.1898. C35/C45/C34/C44 (Hart, 1899a: p. 76; Hart, 1899c: p. 155). **2)** Culdaff. H. C. Hart, 13.8.1898. C55/C54. (Hart, 1899b: p. 130; Hart, 1899c: p. 155). **3)** Sandy ground, very sparingly, above Lady's Bay, Buncrana. J. Hunter. C33. (Hart, 1899c: p. 155; Praeger, 1902: p. 71).

H35 West Donegal. 1) Abundant and unmixed with the rayed form, north-western shore of Trawenagh Bay. H. C. Hart, 1880/81. B70 (Hart, 1881a: p. 235; Hart, 1898: p. 180; Colgan and Scully, 1898: p. 189).

H38 Down. 1) Groomsport. S. A. Stewart, 1886. J58 (Praeger, 1902: p. 71; Wear, 1923: p. 57; Praeger and Megaw, 1938: p. 121). **2)** Groomsport. R. Ll. Praeger, 22.9.1886. J58. Specimen at DBN. **3)** Groomsport. S. A. Stewart, 1888. J58 (Hackney, 1992: p. 286). **4)** Bar Hall Bay, Ards Peninsula. R. Ll. Praeger, 7.1903. J64 (Praeger, 1903: p. 263; Wear, 1923: p. 57; Praeger and Megaw, 1938: p. 121). **5)** Groomsport. R. Ll. Praeger, 1935/37. J58 (Praeger and Megaw, 1938: p. 121; Hackney, 1992: p. 286). **6)** Killard Point. M. P. H. Kertland and D. S. Lambert, 1970. J64 (Kertland and Lambert, 1972: p. 17; Hackney, 1992: p. 286).

Irish records for hybrids between var. *flosculosus* and var. *jacobaea*

H1 South Kerry. 1) Sand dunes, Smerwick side of Béal Bán, Dingle Peninsula. D. M. Synnott, 7.8.1973. Q30. Specimen at DBN. **2)** Sand dunes, Smerwick Harbour. MWJ, P. S. Wyse Jackson, R. FitzGerald and the Botanical Society of the British Isles, 1.8.1993. Q382056. **3)** Sand dunes, Fermoyle. MWJ, 15.7.2001. Q551122.
H2 North Kerry. 1) Sand dunes at Carrahane Strand, south of Banna. MWJ, P. S. Wyse Jackson, R. FitzGerald and the Botanical Society of the British Isles, 31.7.1993. Q747213. **2)** Calcareous grassland, *circa* 500m from the sea, north side of Barrow Harbour. MWJ, 28.7.1999. Q738183.
H9 Clare (Aran Islands, Co. Galway). 1) Aran Islands. D. A. Webb *et al.*, 1969-1976. L71/L80/L81/L90 (Webb, 1980: p. 72). **2)** "On Aran ... every grade of intermediate between [var. *flosculosus*] and the typical form is usually to be found near by." L71/L80/L81/L90 (Webb and Scannell, 1983: p. 115; Kadereit and Sell, 1986: p. 23).
H12 Wexford. 1) Roadside, Burrow, Rosslare. MWJ, 6.8.2002. T093172. **2)** Sand dunes south of Cahore Point. MWJ and N. D. Lockhart, 27.9.2002. T205420, T208434, T213444, T218444.
H16 West Galway. 1) Dunes at Dog's Bay, Roundstone. E. C. Nelson, 23.9.1986. L63. Specimen at DBN. **2)** Coastal grassland, Mweenish Island. N. D. Lockhart, 25.8.2002. L753298.
H22 Meath. 1) Fixed dune grassland, Bettystown. MWJ, 15.8.2002. O161733.
H27 West Mayo. 1) Sand dunes, Mullet. Var. *flosculosus* is as abundant as the type, accompanied by every intermediate stage. R. Ll. Praeger, 7.1905. F61/F62/F63 (Praeger, 1905: p. 234; Synnott, 1984: p. 86). **2)** Sand dunes, Elly Bay, Mullet Peninsula. D. M. Synnott, 29.7.1965. F62. Specimen at DBN.
H28 Sligo. 1) Strandhill dunes. D. A. Webb, 23.8.1952. G53/G63. Specimen at TCD. The presence of plants with short ray florets recorded by D. A. Webb from Co. Sligo (undoubtedly his Strandhill site) was noted by Harper and Wood (1957: p. 630) and on a specimen at DBN collected from Béal Bán, Dingle Peninsula (H1) by D. M. Synnott, 7.8.1973.

Irish records for rayless var. *jacobaea* from inland sites

H2 North Kerry. 1) "Sparingly beside the old Killarney road about three miles south of Tralee." R. W. Scully, 1892. Q80 (Scully, 1916: p. 156).
H10 North Tipperary. 1) Dromineer. R. A. Phillips, 1900. R88 (Praeger, 1902: p. 71).
H23 Westmeath. 1) Dry canal at Kildallan bridge, north-west of Mullingar. D. A. Webb, 8.1957. N35. Specimen at TCD.
H34 East Donegal. 1) By the River Finn near Lifford. H39. (Hart, 1898: p. 180).
H39 Antrim. 1) Waste ground, Deramore Drive, Belfast. J. W. White, 27.7.1926. J37 (White, 1927: p. 384; Brenan and Simpson, 1949: p. 69; Hackney, 1992: p. 286). This site lies some 6 to 7km from the coast (Belfast docks). Brenan and Simpson (1949) cited a specimen (Herb. N. D. Simpson, no. 45.3061), which is probably at BM, where the bulk of Simpson's herbarium is held.

Discussion

It is clear from the records listed above that var. *flosculosus* is very much more widespread in Ireland than was indicated by Kadereit and Sell (1986). Those authors listed the taxon (as subsp. *dunensis*) from five Irish vice-counties, while this work shows it to occur in most, and no less than fifteen, coastal vice-counties. Given that var. *flosculosus* is of widespread occurrence in Ireland, it is perhaps surprising that it does not occur in many apparently suitable sand dune sites. According to More (1876) the variety is not to be found on Inishbofin (vice-county H16) nor is it on the islands of Roaringwater Bay (H3) (Akeroyd, 1996). On the sand dune sites that I investigated I failed to record var. *flosculosus* at Ventry (H1), Inchydoney (H3), Clonea, Bunmahon (both H6), Courtown (H12), Askintinny, Arklow, Buckroney, Brittas, Greystones (all H20), Bull Island, Portmarnock, Malahide, Portraine (all H21), while other workers also failed to record it on dunes at Barley Cove (H3) (D. O'Donnell pers. comm., 2002), Dooaghtry (H27), Aillebrack, Finish Island and Mannin Bay (all H16) (N. D. Lockhart pers. comm., 2002).

This review of its Irish sites has shown that var. *flosculosus* occurs predominantly on coastal sand dunes (generally on the older fixed dunes, to a lesser extent on Marram dunes) and machairs. However, it occasionally also occurs on other coastal grassland types, as, for example, at Barrow Harbour (H2). It is sometimes to found growing on roadsides close to dune systems, as at Rosslare (H12) and Bettystown (H22), and on coastal rocks, as at Samphire Island (H2). As such, the taxon can be regarded as a good example of a coastal ecotype.

It is gratifying to know that this distinctive and attractive plant occurs on many of our sand dune systems and, indeed, is still to be found in abundance on dunes by the River Boyne over three hundred years since first recorded here by William Sherard.

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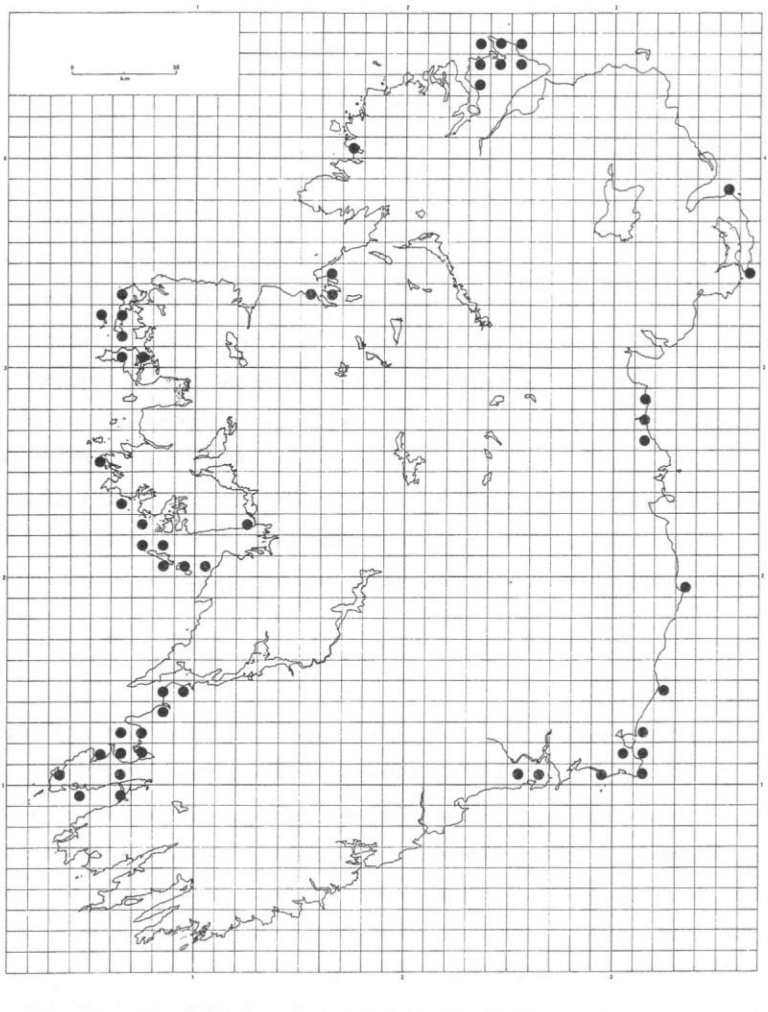
FIGURE 1. Distribution of *Senecio jacobaea* var. *flosculosus* Lam. and DC. in Ireland.



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SIZE, ISOLATION AND ANCIENT STATUS IN WOODLAND: STAPHYLINIDAE, CARABIDAE AND LUCANIDAE (COLEOPTERA) AT RINDOON WOOD, CO. ROSCOMMON, IRELAND

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Abstract

A total of 51 species of Staphylinidae, 19 species of Carabidae, and one species of Lucanidae, was recorded from a 12ha sheep-grazed Corylo-Fraxinetum woodland, with areas of *Alnus*, *Salix* and *Betula*, adjacent to Lough Ree. Two species (*Gyrophaena hanseni* Strand and *Sinodendron cylindricum* (L.)) were considered indicators of ecologically well-developed wooded lakeshore or wooded farmland habitat, but could not be considered to be restricted to woodland *per se*. Despite its small size and isolation, the *Alnus/Salix/Fraxinus* ecotone of the wood has conservation value as part of Lough Ree shore habitat complex. Equally, despite having several centuries of tree cover, Rindoon Wood cannot be regarded as an ecologically well-developed example of woodland. *Gyrophaena hanseni* is recorded from Ireland for the first time.

Introduction

There are a number of small areas of woodland near the shores of Lough Ree, of which St John's Wood and Rindoon Wood, on a peninsula on the west (Co. Roscommon) side of the lake, were described by Rackham (1995) as "The best-preserved ancient woods that I have seen in Ireland". Rindoon (or Rindown) Wood occupies *circa* 12ha of the townland of Warren. It is much smaller than St John's Wood, and isolated from it by some 1.5km of pastoral farmland including the site of a medieval town (see Bradley, 1998). Ecological theory (the Theory of Island Biogeography (MacArthur and Wilson, 1967)) predicts that a patch of habitat of small size and historical, as well as contemporary, isolation, such as Rindoon Wood, will have low species richness. Irish naturalists rarely use ecological theory in site conservation evaluation, preferring site survey as a means of assessing site value. Given the prediction of island biogeography theory, the question must be asked whether a small, isolated woodlot, even if ancient, is worth surveying. Can it be dismissed as being of low value *a priori*, saving survey time and expense for more important habitats? An autumn survey of selected Coleoptera (Staphylinidae, Carabidae, Lucanidae) at Rindoon Wood in October 1999, commissioned by the Heritage Council, provided the opportunity to examine this apparent conflict between putative ancient status and detractory small size and isolation.

Rindoon Wood consists primarily of oak-ash-hazel woodland (Corylo-Fraxinetum) dominated by hazel (*Corylus avellana* L.) and ash (*Fraxinus excelsior* L.)), with small areas dominated by birch (*Betula pubescens* Ehrh.), oak (*Quercus robur* L.), aspen (*Populus tremula* L.), alder (*Alnus glutinosa* (L.)) and sallow (*Salix cinerea* L.). The woodland is on the apex of a peninsula, and is surrounded on three sides by Lough Ree, with a sheep-grazed grassy lake shore, grading through low blackthorn scrub (*Prunus spinosa* L.) to woodland. The vegetation understorey of the wood is poorly developed, due to sheep, goat and cattle grazing. There are many mature trees (ash, oak, aspen), but old overmature trees (i.e. with much decomposing wood) are absent. However, quite a few storm-felled ash and also old alder stumps occurred in 1999, providing extensive dead wood habitat.

Methods

Although the name 'Rindown' is used in the O.S. 1: 50,000 map, 'Rindoon' is used here because it appears to be more frequently used, and is closer to the Irish name *Rinn Duin* (Bradley, 1998). Sampling was carried out in autumn due to time constraints of the contract; however, this seasonality does not affect the beetle groups selected. This is because particular emphasis was placed on staphylinids associated with fungal fruiting-bodies as indicators of wood decomposer biodiversity (see Anderson, 2001), which are well represented during autumn, and have been used elsewhere in Ireland (Good and Butler, 1995).

Six microhabitats were selected for sampling:- (1) Tree fungi: 5, 16 and 17 October 1999. Fungal fruiting bodies growing on standing dead wood: *Daedalopsis confragosa* (Bolt. ex. Fr.) Schroet. on *Salix cinerea* (N009539), *Flammulina velutipes* (Curt. ex Fr.) Karst. on *S. cinerea* (N009539), *Gymnopilus junonius* (Fr.) Orton on *Alnus glutinosa* (N009538), and *Pholiota squarrosa* (Müll.: Fr.) Kummer (host and location unrecorded); (2) Ground fungi: 5 and 16

October 1999. Fungal fruiting bodies growing on the ground surface amongst grass, but in association with living trees: *Agaricus arvensis* Schaeff. ex Secr. under *Fraxinus excelsior* (N008541), *Pluteus salicinus* (Pers. ex Fr.) Kummer on ground near *Corylus avellana* and *Betula pubescens* (N007537); (3) Ash-hazel stand, N008538, 5-16 October 1999. Plastic cup pitfall traps with rain covers (n=6, ethylene glycol preservative), set in an area of leaf litter and bare soil on sandy dry soil under *Fraxinus excelsior* and *Corylus avellana* canopy; (4) Willow stand, N009539, 5-16 October 1999. Pitfall traps (as above), set in an area of moss and leaf litter on loamy moist soil under *Salix* canopy; (5) Dead and fallen timber, N008537, 5 and 16 October 1999. 'Mulm' (decomposed particulate wood) in the dead fallen part of an *Alnus glutinosa* trunk, and more fibrous, spongy, partially decomposed wood ('morschen' wood) in the standing trunk of the same tree (both German words are taken from Horion (1967)); (6) Moss on limestone boulders and the base of tree stumps, N008540, 17 October 1999. Moss sieved, sorted and further extracted using Tullgren funnels.

Species were selected as indicators of well-developed habitat on the basis of the combination of two attributes:- (1) they have a restricted habitat preference to a particular type of wood decomposition or woodland microhabitat; and, (2) they are reported in the literature as being local or rare, suggesting that they are less likely to survive in historically degraded ecosystems. 'Well-developed habitat' is taken to mean that the ecosystem has been sufficiently unmodified by human activity to allow it retain many local stenotopic species.

Macrofungi were identified using Lange and Hora (1965) and Phillips (1981); their nomenclature follows Courtecuisse and Duhem (2000). Nomenclature of Staphylinidae and Lucanidae follows Anderson *et al.* (1997), and Hansen (1996) for species not recorded as Irish. Nomenclature of Carabidae follows Anderson *et al.* (2000), and of vascular plants follows Stace (1997). Voucher specimens of *Gyrophaena hanseni* and *Sinodendron cylindricum* will be deposited in the National Museum of Ireland.

Results

In total, 51 species of Staphylinidae, 19 species of Carabidae, and one species of Lucanidae, were recorded from Rindoon Wood in October 1999 (Tables 1-3). Two of these species (*Gyrophaena hanseni* and *Sinodendron cylindricum*) are considered to be indicators of well-developed wooded habitat (although not necessarily restricted to woodland *per se*; see discussion).

The staphylinid *Gyrophaena hanseni* has not been previously recorded from Ireland (Anderson *et al.*, 1997). In Britain it occurs only in southern England, where it is local (Hyman and Parsons, 1994). It is also local in Denmark (Hansen, 1996). *G. hanseni* was described in 1946, and its distribution and habitat ecology in Europe had not been established at the time that Benick (1952), Horion (1967) or Palm (1968) reviewed the genus, but more recently Koch (1989) has summarised the information on the species from Central Europe. There it was recorded only from Hannover and Brandenburg (i.e. apparently local) and Koch (1989) describes it as eurytopic in agaric fungi in woodlands. However, Koch (1989) cites only five of the 25 *Gyrophaena* species listed as stenotopic. This is unusual for a genus which, by its dietary restriction to spores of living fungi, mostly in woodlands, is intrinsically specialised. However, in using the term eurytopic, Koch (1989) is referring to biotope rather than to microhabitat. It is argued here that a species such as *G. hanseni*, restricted to living woodland fungi, is stenotopic as regards microhabitat. In stating this, it is recognised that *G. hanseni* is not considered to be a saproxylic indicator species in Britain (Fowles *et al.*, 1999), probably because it has been recorded from ground fungi such as *Russula* and *Boletus* (Hyman and Parsons, 1994), which are not directly associated with dead wood habitats. The important point, nonetheless, is that the species is restricted to two wooded biotope microhabitats: living tree fungi and living ground fungi under trees. In Rindoon Wood, seven individuals were recorded from a tree (*Alnus*) and a ground fungus under *Betula*/*Salix* (Table 1), and at least one of these individuals was teneral (recently emerged), demonstrating that this species was breeding at the site, and not just feeding or vagrant. The species was not recorded in *Fraxinus* or *Corylus* in the wood, and can probably survive in strips of lakeshore *Alnus* and *Salix*.

The lucanid *Sinodendron cylindricum* was represented by adults and larvae in moist, rotten wood in dead trunks of both *Alnus glutinosa* and *Fraxinus excelsior*. It is a saproxylic species restricted to dead wood of broadleaf trees (Koch, 1989; Philp, 1991; Fowles *et al.*, 1999) including trees in grazed parkland in the absence of a closed woodland canopy (Lott, 1995). Koch (1989) describes it as a species of old permanent deciduous woodland, and it is reputed to be associated with ancient woodland sites (Jones, 1999). Nevertheless, it can apparently breed in sycamore, birch, hawthorn and elder, as well as thin stands of alder (Elton, 1966), so it may be able to survive in hedgerows with old specimens of these and other trees, and lake margins with alder and possibly willow (Halbert (1898) records it "on willow" at Mote Park, Co. Roscommon). The species has been recorded from similarly isolated woodland patches elsewhere, such as on Killiney Hill, Co. Dublin (Male and female, 23 May 1983, leg. R. Mulcahy, det. J. A. Good). But it has also been taken from floating stumps in a lake in the Lake District in England (Jones, 1999), suggesting that it is possible that adults could have recolonised Rindoon Wood (e.g. from Hare Is. where it has been previously recorded (Johnson and Halbert, 1902)), as opposed to having an ancient (i.e. continuously present) population in the wood.

Although previously regarded as common, *S. cylindricum* has recently been proposed as a local species in Britain (Fowles *et al.*, 1999). Johnson and Halbert (1902) described it as local in Ireland, and, being a distinctive beetle, it is unlikely to have been ignored by entomologists when seen. It is considered an indicator species because of its apparent local distribution and its saproxylic habit.

Atheta crassicornis (Fabricius) is not listed as being recorded in Ireland by Anderson *et al.* (1997). However, *A. inoptata* (Sharp) was recorded from Killarney by Bullock (1932), and is now synonymised with *A. crassicornis* (see Pope, 1977). The species was recorded from the fungus *Gymnopilus junonius* at Rindoon (Table 1), but its habitat requirements are not specialised, occurring in most types of decomposing plant material (Koch, 1989).

Discussion

It can be predicted, *a priori*, that small isolated woodlots such as Rindoon Wood, especially those that have been disturbed historically, will have a low woodland biodiversity value for a number of reasons. Many species dependant on woodland microhabitats may have small populations by virtue of the size of the wood, and small populations are more susceptible to local extinction (Shafer, 1987). An analysis of staphylinid species-richness in nine of the Westmann Islands, off Iceland (Curry and Good, 1991, Fig. 2; based on data from Lindroth *et al.*, 1973), showed that small isolated islands have fewer species compared to either large isolated islands or small islands contiguous to the mainland. But even more than just loss of species number, it has been shown for other groups of forest beetles (Klein, 1989; Rukke, 2000) that the habitat-characteristic species are the first group to be impacted by habitat fragmentation and isolation. Recolonisation probability is also low in isolated habitat patches (e.g. Celada *et al.*, 1994). Rindoon Wood is *circa* 1.5km to the south of St John's Wood. Successful dispersal from St John's Wood would be facilitated by northerly airflows, which are not the prevailing winds during seasons when flying insects disperse (see Rohan, 1986). Furthermore, the fact that Rindoon Wood is heavily grazed, and surrounded on three sides by a lake, probably increases the microclimatic variations within the wood due to wind penetration (see Geiger, 1965).

Despite the possible continuity of woodland cover since the Civil Survey of 1656 (Rackham, 1995), and the proven continuity since 1836 (Bleasdale and Conaghan, 1998), questions must be raised against the historical continuity of the woodland as a fully diverse coppiced woodland ecosystem. The occurrence of collapsed drystone wall boundaries within the wood (Bradley, 1998) indicates non-woodland cover at some stage historically. The probable establishment of a pre-Norman fort south of the castle (Bradley, 1998) suggests that it is unlikely that mature woodland existed over much of the area of the current woodland, since it would obscure the view to the south from the fort. Furthermore, it is likely that any woodlot occurring so close to the medieval town of Rindoon (see Bradley, 1998) would have been heavily utilised by townspeople and their livestock. Also, the presence of a ruined windmill *within* the wood argues against extensive mature woodland at the time of its use. Even if there was continuity of woodland cover, this does not mean continuity of the age-classes of trees or tree-stools necessary to support a characteristic fauna of decaying wood microenvironments, and harvesting of oak standards from both Rindoon and St John's Wood has occurred during the last century up to the early 1980s.

Although deforestation has impacted severely on the dead wood fauna in Ireland generally (e.g. Speight, 1988, 1989), a small suite of species remains which may indicate historical continuity of habitat. The two indicator species recorded here, *G. hanseni* and *S. cylindricum*, may indeed indicate ancient status, but of what? Do they indicate ancient woodland *sensu stricto*, or ancient wooded lakeshore or ancient wooded farmland? Speight *et al.* (2001) define forest macrohabitat as: "natural or semi-natural formations of trees, incorporating stands of overmature, mature and young (saplings/scrub) trees, used in contradistinction to plantations, hedges and scattered trees." Fossitt (2000) separates hedgerows and treelines as "linear strips of woodland or scrub that are less than 4m wide." There are difficulties in distinguishing species which are restricted to 'true' woodland or forest in the sense of a self-sustaining extensive tract of trees, as opposed to species which can survive in tree-lines or small copses in a landscape dominated by farmland, urban areas, or non-woodland habitat. The syrphid *Sphegina elegans* Schummel, for instance, would be considered as an indicator species on the criteria used here (see methods), being local in Ireland and restricted to overmature trees in humid *Fagus* and *Quercus* forest (Speight, 2001a, 2001b). Yet (although its presence as a breeding species was not confirmed) it has been recorded in improved farmland (Speight, 2001b) with lines of overmature beech (*Fagus sylvatica* L.) and oak (*Quercus* x *rosacea* Bechst.). Both *G. hanseni* and *S. cylindricum* may also be able to survive in treelines, wooded hedgerows or wooded lakeshore copses, in addition to blocks of woodland (see discussion of their autecology in the results section above). If this is so, then Rindoon Wood may only represent a wooded farmland or lakeshore habitat, in terms of its decomposer ecology, rather than woodland or forest *sensu stricto*. It is noteworthy that a large proportion of the species (especially the carabids (Table 3)) were typical of non-woodland habitats including grasslands, wetlands and hedgerow. If 'habitat' is taken to mean a lakeshore wetland habitat complex, with wooded strips, grassland, scrub and hedgerows, then the *Alnus*, *Salix*, *Betula* and *Fraxinus* ecotone of Rindoon Wood has conservation value for wood decomposer communities *as part of* Lough Ree shore habitat complex, but the site does not have such value as a woodland entity in itself, nor as an outlier for St John's Wood, a wood of recognised ecological value (Kelly and Iremonger, 1997).

In conclusion, it appears that both the theoretical island biogeography approach, and the woodland-as-continuity-of-cover approach, when used alone, are naive in ascribing either completely negative or positive attributes to Rindoon Wood. For the wood decomposer fauna, as indicated by the beetle taxa recorded here, Rindoon Wood appears to be an ecologically well-developed example of wooded lakeshore habitat, or wooded farmland (cf. Alexander and Foster, 1999), but not of woodland habitat *per se*. This raises the question as to what species do comprise a true woodland indicator assemblage. Having opened with a quotation from Rackham (1995), it is apt to end with a further question from the same paper, but here addressed to the fauna as well as the flora: "what plants [or invertebrates] are there which occur in ancient woodland but not in ancient hedges [or lakeshores]?".

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TABLE 1. Staphylinid beetles from macrofungi at Rindoon Wood. Nomenclature of Staphylinidae follows Anderson *et al.* (1997) and Hansen (1996). Abbreviations of fungi: *A.arv.* - *Agaricus arvensis*; *D.con.* - *Daedaleopsis confragosa* ; *F.vel.* - *Flammulina velutipes*; *G.jun.* - *Gymnopilus junonius*; *P. squ.* - *Pholiota squarrosa*; *P.sal.* - *Pluteus salicinus*. Indicator species are marked with an asterisk.

Species	*A.arv*	*D.con.*	*F.vel.*	*G.jun.*	*P.squ.*	*P.sal.*
Atheta amplicollis (Mulsant and Rey)	1	-	-	-	-	-
Atheta crassicornis (Fabricius)	-	-	-	4	-	-
Atheta fungi (Gravenhorst)	-	-	-	2	-	-
Atheta graminicola (Gravenhorst)	-	-	-	1	-	-
Gyrophaena fasciata (Marsham)	-	-	16	-	-	-
Gyrophaena hanseni Strand *	-	-	-	3	-	4
Oxypoda alternans (Gravenhorst)	-	-	-	1	-	-
Proteinus brachypterus (Fabricius)	1	-	1	31	-	7
Proteinus ovalis Stephens	11	-	-	2	-	23
Lordithon thoracicus (Fabricius)	-	-	-	4	-	-
Lordithon trinotatus (Erichson)	-	-	-	3	-	-
Stenus tarsalis Ljungh	-	-	-	1	-	-
Tachinus humeralis Gravenhorst	-	-	-	-	-	2
Tachinus marginellus (Fabricius)	-	-	-	-	-	1
Tachyporus dispar (Paykull)	-	-	-	1	-	-

TABLE 2. Staphylinid beetles from Rindoon Wood (excluding those collected on macrofungi). Nomenclature follows Anderson *et al.* (1997). Microhabitat abbreviations: Mulm - mulm in *Alnus* trunk; m.r.w. - moist, rotten wood in *Alnus* trunk; Moss - sieved moss on boulders and stumps; *Salix* - pitfall traps under *Salix*; *Frax.* - pitfall traps under *Fraxinus excelsior*. Indicator species are marked with an asterisk.

Species	Mulm	m.r.w.	Moss	*Salix*	*Frax.*
Acrotona aterrima (Gravenhorst)	1	-	2	-	-
Aloconota gregaria (Erichson)	1	-	-	-	-
Atheta fungi (Gravenhorst)	1	-	12	-	1
Geostiba circellaris (Gravenhorst)	1	-	4	4	-
Omalium italicum Bernhauer	2	-	-	2	2
Omalium rivulare (Paykull)	1	-	-	-	-
Philonthus intermedius (Lacordaire)	-	1	-	-	1
Amischa analis (Gravenhorst)	-	-	4	-	-
Anthobium atrocephalum (Gyllenhal)	-	-	2	-	-
Atheta amplicollis (Mulsant and Rey)	-	-	2	-	1
Atheta celata (Erichson)	-	-	1	-	-
Atheta cinnamoptera (Thomson)	-	-	1	-	-
Dilacra luteipes (Erichson)	-	-	1	-	-
Ischnopoda atra (Gravenhorst)	-	-	1	-	-
Lathrobium terminatum Gravenhorst	-	-	1	-	-
Lathrobium boreale Hochhuth	-	-	2	-	1
Myllaena minuta (Gravenhorst)	-	-	1	-	-
Ocypus aeneocephalus (DeGeer)	-	-	1	-	-
Othius punctulatus (Goeze)	-	-	1	-	2
Oxypoda elongatula Aubé	-	-	5	1	-
Philonthus carbonarius (Gravenhorst)	-	-	4	-	-
Philonthus cognatus Stephens	-	-	5	-	-
Philonthus fimetarius (Gravenhorst)	-	-	4	-	-
Philonthus varians (Paykull)	-	-	1	-	-
Stenus brunnipes Stephens	-	-	12	-	-
Tachinus signatus Gravenhorst	-	-	6	-	2
Tachyporus chrysomelinus (Linnaeus)	-	-	1	-	-
Tachyporus dispar (Paykull)	-	-	9	-	-
Tachyporus obtusus (Linnaeus)	-	-	1	-	-
Xantholinus linearis (Olivier)	-	-	1	-	3
Carpelimus corticinus (Gravenhorst)	-	-	-	1	-
Mycetoporus longicornis Mäklin / *splendidus* (Gravenhorst)	-	-	-	1	-
Ocypus olens (Müller)	-	-	-	40	293
Oxypoda lividipennis Mannerheim	-	-	-	3	-
Quedius fuliginosus (Gravenhorst)	-	-	-	3	3
Quedius molochinus (Gravenhorst)	-	-	-	4	-
Stenus juno (Paykull)	-	-	-	1	-
Othius myrmecophilus Kiesenwetter	-	-	-	-	1
Tachinus laticollis Gravenhorst	-	-	-	-	4

TABLE 3. Carabid and lucanid beetles from Rindoon Wood. Nomenclature follows Anderson *et al.* (2000). Microhabitat abbreviations: Mulm - mulm in *Alnus* trunk; m.r.w. - moist, rotten wood in *Alnus* trunk; Moss - sieved moss on boulders and stumps; *Salix* - pitfall traps under *Salix*; *Frax.* - pitfall traps under *Fraxinus excelsior*. Indicator species are marked with an asterisk.

Species	Mulm	m.r.w.	Moss	*Salix*	*Frax.*
Bembidion mannerheimii Sahlberg	3	-	-	-	-
Loricera pilicornis (Fabricius)	1	-	-	1	-
Ocys harpaloides (Audinet-Serville)	1	-	-	-	-
Platynus albipes (Fabricius)	1	-	-	-	-
Carabus granulatus Linnaeus	-	1	-	-	-
Sinodendron cylindricum (Linnaeus) *	-	7	-	-	-
Agonum fuliginosum (Panzer)	-	-	2	-	-
Calathus rotundicollis Dejean	-	-	1	-	-
Nebria brevicollis (Fabricius)	-	-	2	35	35
Notiophilus biguttatus (Fabricius)	-	-	2	-	-
Pterostichus crenatus (Duftschmid)	-	-	1	-	-
Pterostichus madidus (Fabricius)	-	-	1	2	4
Abax parallelepipedus (Piller and Mitterpacher)	-	-	-	6	27
Carabus nemoralis Müller	-	-	-	4	-
Pterostichus anthracinus (Illiger)	-	-	-	3	-
Pterostichus minor (Gyllenhal)	-	-	-	1	-
Pterostichus nigrita (Paykull)	-	-	-	1	-
Pterostichus rhaeticus Heer	-	-	-	1	-
Pterostichus melanarius (Illiger)	-	-	-	-	1
Synuchus vivalis (Illiger)	-	-	-	-	1

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AN ANNOTATED LIST OF THE SYRPHIDAE (DIPTERA) OF POLLARDSTOWN FEN, CO. KILDARE, IRELAND

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Introduction

Pollardstown Fen, in Co. Kildare, may be known as a site of scientific interest, but little has been published on its fauna and flora. This is inevitably particularly true of its invertebrate fauna. The present text provides a list of the species of one family of flies, the Syrphidae, or hoverflies, known from Pollardstown Fen, together with some comment on that list.

The hoverflies collected from Pollardstown Fen total 77 species, as compared with 94 for Co. Kildare in general (Speight, 2000). The Irish list for this fly family now comprises 178 species. Very few of the syrphid records from the fen have been published previously. One exception is the occurrence of *Platycheirus amplus* Curran, which was, at the time, the first published record for this species in Europe (Speight and Vockeroth, 1988).

Detailed information on the Irish syrphid species is available elsewhere, and has been brought together by Speight (2000), so the comments presented here are more concerned with what the hoverfly fauna of the Fen may tell us about the Fen, than with the species themselves. Essentially, the text is focussed on the question of whether the species observed reflect the habitats observed. The potential contribution of Pollardstown Fen habitats to maintenance of syrphid diversity, within the local landscape, is also considered. These processes are mediated by the data coded into the Syrph the Net (StN) database spreadsheets. Examples of the use of the StN database in interpretation of species lists are provided by Speight and Castella (2001a).

Methods

Collection of hoverflies from Pollardstown Fen has been carried out by direct methods i.e. use of a hand net to collect the adult insects from flowers etc, and a sweep net to collect them from low-growing vegetation. These processes have been augmented latterly by use of Malaise traps and, to a minor extent, emergence traps. The records span the period 1975-2001 and determinations have been carried out by the author. The product of this collecting activity is a list of the syrphid species observed on the Fen, which can be used for comparison with the list of species predicted to occur on the Fen. The nomenclature used follows Speight and Castella (2001b), updated as necessary.

Given that habitat associations of the Irish species are known and the Pollardstown syrphid fauna can be regarded as a subset of the Irish syrphid fauna, the Irish species associated with the habitats present on the Fen together comprise a list of the syrphids that would be predicted to occur on the Fen. This list of predicted species can then be compared with the list of species observed, following the basic procedure described in Speight *et al.* (2000).

Using the methodology employed here, production of a list of the species predicted to occur on a site involves the use of a list of the habitat categories present on that site. And, in order to use the StN database for predicting the fauna, the habitat categories referred to require to be those employed in the database. All habitat categories referred to in the database are defined in its Macrohabitats glossary (see Speight *et al.*, 2001a) and habitat survey of the Fen has been carried out (during 2000 and 2001) using those definitions.

Results

The list of syrphid species observed is given in Appendix 1. The syrphid macro-habitat categories observed are as follows:-

<u>forest categories:</u>

- *Fraxinus*, overmature/mature/saplings, with springs, drainage ditches, flushes and streams.
- conifer plantation, with drainage ditches.
- isolated mature/sapling *Fraxinus* and *Salix*.
- Atlantic scrub: *Ulex* thickets.

<u>wetland categories:</u>

- transition mire, with springs and flushes.
- acid fen, with flushes, pools and drainage ditches.
- rich fen, with springs, flushes, streams, pools and drainage ditches.
- reed beds, with springs, flushes, streams and drainage ditches.
- tall sedge beds, with springs, flushes, streams and drainage ditches.

- tall herb communities.

open ground categories:

- unimproved, humid/flooded oligotrophic *Molinia* grassland, with springs, streams, flushes, temporary pools and drainage ditches, lightly-grazed by horses and cattle.
- improved grassland, grazed by cattle, with drainage ditches.
- intensive grassland.

other categories:

- hedges.

Using the habitat association data coded into the Macrohabitats file of the StN database the number of observed species associated with each of these habitat categories can be totalled. The number of species on the Irish and Co. Kildare lists associated with each of these habitat categories can similarly be totalled. Taking the Co. Kildare list as the species pool from which the Pollardstown Fen syrphid fauna is derived, the number of Kildare species associated with each of the Pollardstown habitats is taken as the number of species predicted to occur with each of those habitats on any fen in the Co. Kildare region. Similarly, taking the Irish syrphid list as the species pool from which the Pollardstown Fen syrphid fauna is derived, the number of Irish species associated with each of the Pollardstown habitats is taken as the number of species predicted to occur with each of those habitats on any fen nationally.

Of the 77 syrphid species recorded from the Fen, the occurrence of only three (i.e. less than 5% of the species) would not be predicted there from their habitat associations. The three exceptions are: *Cheilosia bergenstammi* Becker, *C. variabilis* (Panzer) and *Paragus haemorrhous* Meigen. They are excluded from further analysis of the Pollardstown Fen fauna but are considered briefly in Appendix 2.

Basing prediction on all of the habitats represented there, Pollardstown Fen would be expected to support 85 of the species recorded from Co. Kildare and fully 133 of the species known from Ireland in general. This would mean that 85% of the expected Kildare species are recorded from the Fen (including its periphery), as compared with 55% of the expected Irish species in general. But some of the habitat categories observed on the Fen and at its periphery cannot realistically be regarded as either natural/semi-natural or wetland-related. Conifer plantation, *Ulex* thickets, hedges, improved grassland and intensive grassland would fall into this category and have, for these reasons, been excluded from further analysis. Suffice it to say that none of the syrphid species recorded from Pollardstown Fen would be predicted to disappear from the Fen if the conifer plantation habitat were lost from the Fen. Similarly, loss of improved grassland and intensive grassland from the Fen's periphery would be predicted to cause loss of only one species, *Eupeodes corollae* (Fabr.), from the existing species list. The contribution of these habitats to maintaining the present fauna of the site could thus be regarded as negligible. Loss of hedges and *Ulex* scrub from the Fen periphery might be expected to cause loss of four species: *Baccha elongata* (Fabr.), *Dasysyrphus albostriatus* (Fallén), *Melangyna lasiophthalma* (Zetterstedt) and *Meliscaeva cinctella* (Zetterstedt).

The proportion of the predicted syrphid fauna that has been observed at Pollardstown Fen for habitats other than conifer plantation, improved and intensive grassland, *Ulex* scrub and hedges, is shown in Table 1, at both levels of prediction - regional (i.e. Co. Kildare) and national. The habitats represented by the more-or-less isolated trees of *Fraxinus* and *Salix* found scattered around the Fen are also omitted, since they are predicted to have very few associated species, all of which would be predicted to occur on the Fen in association with other habitats covered by Table 1.

Table 1. Number of syrphid species in the observed and predicted lists for Pollardstown Fen, associated with each of various habitats occurring on the fen.

Habitat	**number of species**			**% of predicted spp observed**	
	observed	**predicted Kildare**	**predicted IRL**	**Kildare**	**IRL**
Fraxinus forest	25	28	35	89	71
transition mire	13	14	15	93	87
acid fen	35	38	44	92	79
rich fen	44	48	54	92	82
reed beds	19	22	26	86	73
tall sedge beds	33	36	40	92	83
tall herb communities	16	19	21	84	76
unimproved *Molinia* grassland	42	48	63	88	67

In Table 2, microhabitat data are summarised, for the observed and predicted syrphid faunas of Pollardstown Fen, using the information coded into the Microsite Features file of the StN database (see Speight *et al.*, 2001b). The species covered are those associated with the habitats covered by Table 1, but taken all together, rather than habitat by habitat. The categories recognised are not true micro-habitats, but physical features of sites (microsite features) that are used as proxies for micro-habitats. The array of categories shown is a selection of those covered by the StN database, in which species associations for more than 80 micro-site feature categories are coded.

Table 2. Number of syrphid species in the observed and predicted lists for Pollardstown fen, associated with each of various micro-habitats/microsite features.

Microsite feature	**Number of species**		**o/p as %**
	observed (o)	**predicted (p)**	
terrestrial			
timber	2	3	67
overmature trees	4	7	57
tree foliage	14	23	61
understorey trees	5	8	63
shrubs/bushes/saplings	10	16	63
lianas	4	5	80
tall herb-layer plants (on)	20	28	71
low-growing herb-layer plants (on)	11	15	73
within herb-layer plant tissues	8	16	50
ground-surface debris	17	18	94
nests of social insects	2	4	50
grass-root zone	10	13	77
aquatic			
on emergent plants	13	20	65
on submerged plants	4	12	33
submerged sediment/debris	23	33	67
water-sodden plant debris	22	27	82

Discussion

It was earlier suggested that conifer plantation, improved and intensive grassland, *Ulex* scrub and hedges, although present, together play but a minor role in maintenance of the existing Pollardstown Fen syrphid fauna. In addition, it can be observed that improved and intensive grassland, with associated hedges, is a predominant feature of the Kildare landscape in the surround to Pollardstown Fen, so the presence of these habitats on the periphery of the Fen itself cannot be said to add to the uniqueness of the contribution of the Fen to maintenance of the Co. Kildare fauna. Excluding these habitats from consideration results in reduction of the effective Pollardstown syrphid fauna to 71 species, from the gross total of 77 species on the observed list. And this restricted list of habitats has a predicted fauna of 106 Irish species, 78 of which are known from Co. Kildare. The effective total of observed species is further reduced to 68 species by exclusion of the three species observed from, but not predicted to occur on, the Fen.

With conifer plantation, improved/intensive grassland, *Ulex* scrub and hedges excluded from consideration, 64% of the Irish syrphid species predicted to occur in association with the array of habitats occurring on Pollardstown Fen have been observed there. This is not a particularly high proportion of the expected Irish species, even though 86% of the expected Co. Kildare species are represented. Essentially, this would suggest that, in terms of biodiversity maintenance, Pollardstown Fen has considerable regional significance, but, overall, would be of lesser significance nationally. It follows that a closer examination of the fauna is warranted, to see whether particular habitats of those present on the fen might seem to be "underperforming", in comparison to others.

Table 1 shows that, when considered separately, the various habitats present at Pollardstown apparently support a higher proportion of their expected syrphid species than they do when considered together, suggesting there is more sharing of habitats among the species predicted and observed than among the species predicted but absent. This is indeed the case: on average, the species observed are each associated with 3.4 of the habitat categories observed there, while the species predicted but absent are associated with 2.3 of the habitat categories observed. However, Table 1 also shows that more than 75% of the Irish species associated with each of the habitats present on the Fen have been found there, except in the case of the species of

Fraxinus forest, reed beds and unimproved, oligotrophic grassland. This makes Pollardstown Fen an exceptional site for the Irish syrphids associated with most of the habitats shown in Table 1.

Once again grouping together the Fen habitats covered by Table 1, as a single entity, allows comparison between the representation of syrphids associated with different fen microhabitats in the observed and predicted lists. This comparison shows that syrphids with four different types of larval micro-habitat are particularly under-represented on the observed list, the micro-habitats involved being as follows:

- overmature trees/rotten wood;
- internal tissues of herb-layer plants;
- colonies of social insects;
- submerged, aquatic plants.

The lack of species associated with overmature trees and rotten wood would seem a reasonable reflection of the condition of the ash woodland and other trees around the edge of the Fen and probably also indicates it is of recent origin. Syrphids that feed internally in the tissues of flowering plants are generally intolerant of flooding, since they nearly all pass the winter free in the soil in an immobile, resting phase (the puparium) of the life history that makes them susceptible to drowning. Those predicted for the Fen would mostly be expected to occur in the peripheral grasslands and may do so, further from the Fen and outside the influence of seasonal high-water levels. Similarly, nests of ants and other social insects would be expected more in the peripheral grasslands than the Fen itself and the under-representation of associated syrphids on the Fen list could be interpreted as a consequence of the susceptibility to flooding of the nests of their hosts. The recently-described syrphid *Microdon myrmicae* Schönrogge *et al.* is an exception to this generalisation, living as it does in nests of the ant *Myrmica scabrinodis* Nylander in large tussocks within the periphery of Fen. It is one of the species observed from Pollardstown. The apparent under-representation of species whose larvae are associated with the submerged parts of aquatic plants (this microhabitat category excludes rotting vegetation on the bottom of a water body) might seem rather odd, until it is realised that areas of (permanent) standing water have been few and far between on the Fen. Similarly, there is very little *Typha* on the Fen, a plant with which many of the syrphids with aquatic larvae are frequently associated. The situation of the species associated with that larval microhabitat contrasts sharply with the species whose larvae are associated with water-sodden vegetation and peat (i.e. with temporary pools or situations where the ground-water level is more or less co-incident with the ground surface). The latter group of species is very well represented on the Fen, highlighting the significance of this micro-habitat there. Some of these species can use cow dung as an alternative larval micro-habitat, at least on wet sites, so the contingent of species associated with cow dung is also well-represented in the Pollardstown list.

Turning to the issue of the conservation status and management of the Pollardstown Fen syrphid fauna, the great majority of the observed species is clearly associated with categories of habitat dependent for their survival upon the wetland status of the site. Change in site hydrology, particularly drainage of the fen or reduction in the water supply to it, would thus be expected to adversely impact upon its existing syrphid fauna. While some of the nationally scarce species that would be predicted to occur at Pollardstown seemingly do not do so, an example being *Eristalis cryptarum* (Fabr.), which may now have been entirely lost from the Irish fauna, others do. The latter group comprises *Lejogaster tarsata* (Meigen), *Microdon myrmicae*, *Platycheirus amplus* Curran and *P. immarginatus* (Zetterstedt). *Orthonevra geniculata* (Meigen) is a borderline case. Some of the Pollardstown Fen syrphids are scarcer elsewhere than Ireland in the Atlantic Region of the EU, examples being *Melanogaster aerosa* (Loew) and *Parhelophilus consimilis* (Malm). But there are no syrphids whose presence in Ireland is apparently confined to Pollardstown Fen. Pollardstown Fen is probably best seen as one of the very few Irish sites where all of these species have been found together. In this regard its "biodiversity maintenance" function has to be regarded as exceptional, supporting as it does 75% and more of the Irish species associated with various categories of wetland habitat.

Pollardstown Fen is today an island of wetland habitats isolated in a sea of farmland. Problems of species dispersal through today's farmland landscape in Ireland have been alluded to by Good (1998) and Speight and Good (2001), and while the Fen may be larger than the average farm, it is debateable for how long it might maintain its present flora and fauna without interchange of wetland species with other sites. That it is an ancient system, with some of its present habitats continuously *in situ* for a time measurable in hundreds of years, rather than decades, is suggested by some of the species present there today, one example being the snail

Vertigo geyeri Lindholm. In Ireland this mollusc exhibits a relict distribution pattern (E. Moorkens, pers. comm.). The same could be said for the syrphids *M myrmicae* and *P. amplus* (see Speight, 2000 and Speight, 2002, this volume). Such data do not prove that species can survive for prolonged periods of time within Pollardstown Fen, without re-inforcement of their populations from elsewhere, but they do suggest it. However, the considerable distances such species would now have to travel in order to re-establish themselves on the Fen, were they once lost there, suggests that, unaided, their re-establishment would be virtually impossible. And there are no current trends in landscape change that would suggest landscape permeability will increase for such species in the forseeable future. Sadly, both *M. myrmicae* and *P. amplus* may have been lost from the Fen during the last few years. Attempts to relocate them have failed and the parts of the Fen where they were found have changed in character, in one case probably due to cessation of grazing and in the other probably due to eutrophication.

It was stated earlier that habitats peripheral to the Fen (hedges, *Ulex* scrub, improved and intensive grassland) support very few species additional to those associated with wetland habitats on the Fen. But there are other faunistic relationships potential to the interaction between the Fen and its surround than that described by considering simply what species may be added to the Pollardstown Fen list from its surround. In particular, species that can be shared by the Fen and surrounding habitats would be expected to survive on the Fen when affected adversely in its hinterland. Similarly, were any of these species to be lost from the Fen it would be expected that they could re-establish themselves there from adjacent populations when conditions were once more favourable.

Of the fen-habitat (i.e. the habitats covered in Table 1) syrphids observed on the Fen, 23 species would be expected to occur in association with improved/intensive grassland and or hedges and *Ulex* scrub in its surround. To those species, then, the surrounding landscape may remain permeable. But for the rest of the species associated with fen habitats on Pollardstown Fen - by far the majority of the syrphids recorded there - the converse would seem more true. For the 45 species in the latter group loss of the population inhabiting the Fen could well mean more-or-less permanent loss of the species from the area, due to lack of other local populations from which to repopulate the Fen. This group also represents almost half of the syrphid species on the Co. Kildare list (which totals 94 species). While it would be unjustified to extrapolate this statistic to other taxonomic groups, it would none-the-less seem possible that, at least for Syrphidae, Pollardstown Fen is responsible for maintaining the presence of nearly 50% of the diversity of the Kildare fauna within its local landscape. By contrast, the species for which it shares maintenance with the surrounding farmland amount to approximately 25% of the Kildare syrphid fauna, while the farmland by itself is able to support only an additional 5%.

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APPENDIX 1. List of the Syrphidae (Diptera) recorded from Pollardstown Fen. Nomenclature used follows Speight (2001) updated as necessary.

* = threatened species (IRL)

Anasimyia lineata (Fabricius, 1787)
Baccha elongata (Fabricius, 1775)
Cheilosia bergenstammi Becker, 1894
Cheilosia illustrata (Harris, 1780)
Cheilosia impressa Loew, 1840
Cheilosia nebulosa (Verrall, 1871)
Cheilosia pagana (Meigen, 1822)
Cheilosia variabilis (Panzer, 1798)
Cheilosia vernalis (Fallén, 1817)
Chrysogaster coemiteriorum (Linnaeus, 1758)
Chrysogaster solstitialis (Fallén, 1817)
Chrysotoxum bicinctum (Linnaeus, 1758)
Chrysotoxum fasciatum (Müller, 1764)
Dasysyrphus albostriatus (Fallén, 1817)
Episyrphus balteatus (DeGeer, 1776)
Eristalinus sepulchralis (Linnaeus, 1758)
Eristalis abusiva Collin, 1931
Eristalis arbustorum (Linnaeus, 1758)
Eristalis interrupta (Poda, 1761)
Eristalis intricaria (Linnaeus, 1758)
Eristalis lineata (Harris, 1776)
Eristalis pertinax (Scopoli, 1763)
Eristalis tenax (Linnaeus, 1758)
Eumerus strigatus (Fallén, 1817)
Eupeodes bucculatus (Rondani, 1857)
Eupeodes corollae (Fabricius, 1794)

APPENDIX 1 (continued)

Eupeodes latifasciatus (Macquart, 1829)
Eupeodes luniger (Meigen, 1822)
Ferdinandea cuprea (Scopoli, 1763)
Helophilus hybridus Loew, 1846
Helophilus pendulus (Linnaeus, 1758)
Lejogaster metallina (Fabricius, 1781)
Lejogaster tarsata (Meigen, 1822)*
Leucozona laternaria (Müller, 1776)
Leucozona lucorum (Linnaeus, 1758)
Melangyna lasiophthalma (Zetterstedt, 1843)
Melangyna umbellatarum (Fabricius, 1794)
Melanogaster aerosa (Loew, 1843)
Melanogaster hirtella (Loew, 1843)
Melanostoma mellinum (Linnaeus, 1758)
Melanostoma scalare (Fabricius, 1794)
Meliscaeva cinctella (Zetterstedt, 1843)
Microdon myrmicae Schönrogge *et al.*, 2002*
Neoascia geniculata (Meigen, 1822)
Neoascia podagrica (Fabricius, 1775)
Neoascia tenur (Harris, 1780)
Orthonevra geniculata (Meigen, 1830)
Paragus haemorrhous Meigen, 1822
Parhelophilus consimilis (Malm, 1863)
Pipiza noctiluca (L., 1758)
Platycheirus albimanus (Fabricius, 1781)
Platycheirus amplus Curran, 1927*
Platycheirus angustatus (Zetterstedt, 1843)
Platycheirus clypeatus (Meigen, 1822)

APPENDIX 1 (continued)

Platycheirus fulviventris (Macquart, 1829)
Platycheirus granditarsus (Forster, 1771)
Platycheirus immarginatus (Zetterstedt, 1849)*
Platycheirus manicatus (Meigen, 1822)
Platycheirus occultus Goeldlin, Maibach and Speight, 1990
Platycheirus rosarum (Fabricius, 1787)
Platycheirus scambus (Staeger, 1843)
Platycheirus scutatus (Meigen, 1822)
Rhingia campestris Meigen, 1822
Riponnensia splendens (Meigen, 1822)
Scaeva pyrastri (Linnaeus, 1758)
Sericomyia silentis (Harris, 1776)
Sphaerophoria interrupta (Fabricius, 1805)
Sphaerophoria philantha (Meigen, 1822)
Sphegina clunipes (Fallén, 1816)
Sphegina elegans Schummel, 1843
Syritta pipiens (Linnaeus, 1758)
Syrphus ribesii (Linnaeus, 1758)
Syrphus vitripennis Meigen, 1822
Trichopsomyia flavitarsis (Meigen, 1822)
Tropidia scita (Harris, 1780)
Volucella bombylans (Linnaeus, 1758)
Xylota segnis (Linnaeus, 1758)

APPENDIX 2. The syrphids recorded from Pollardstown Fen but whose presence would not be predicted on the basis of known habitat associations.

Cheilosia bergenstammi

C. bergenstammi is associated with ragwort (*Senecio jacobaea)*, its larvae feeding internally on the tissues of this plant. This hoverfly was common and widely distributed in Ireland until recently, but has become scarcer since ragwort control measures have been more rigorously enforced (the plant is toxic to both cows and horses). There is less need to control ragwort on sheep-grazed pasture. The predictive procedure would not predict *C. bergenstammi* from cattle-grazed, improved grassland, but would predict the species for sheep-grazed grassland. The records of *C. bergenstammi* from the Fen date from when sheep were present. It is not known whether this syrphid still occurs there, but its presence would be expected in the vicinity, given the propensity of ragwort to occur along the hedge margins of minor roads.

Cheilosia variabilis

C. variabilis also has larvae that feed internally in plant tissues, in this instance in *Scrophularia* spp., which is not found on the Fen and would be expected only at its margins. *C. variabilis* was collected from the edge of the fen, but the record remains anomalous.

Paragus haemorrhous

P. haemorrhous was recorded from a part of the periphery of the fen that has since changed in character. It was then (some 15 years ago) grazed and burned *Molinia* grassland, whereas today this area is fenced from grazing and no longer burned. Since these changes took place there have been no records of *P. haemorrhous* from the Fen.

Bull. Ir. biogeog. Soc. No. 26 (2002)

DISTRIBUTION RECORDS FOR FALSE-SCORPIONS (ARACHNIDA: PSEUDOSCORPIONES), INCLUDING *NEOBISIUM CARPENTERI* (KEW) AND *PSELAPHOCHERNES SCORPIODES* (HERMANN)

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Introduction

The pseudoscorpions consist of a small order of arachnids, 17 species of which are recorded from Ireland (Legg and O'Connor, 1997). A number of species, notably *Kewochthonius halberti* (Kew), appear to be very rare both in Ireland and generally. Few records exist also for a group of species which occur in association with man, for example in compost heaps and in farms. These animals are however phoretic on flies, and they are probably greatly under-recorded here. My own pseudoscorpion data consists of 155 records of 11 species, gathered over the course of three separate collections. The first of these (1990-1993) comprises 29 records of five species. All of the specimens were identified by Dr Gerald Legg. This material is not considered any further here as these records were incorporated into Legg and O'Connor (1997). The second collection (1993-1996) comprises 60 records of six species, again all determined by Dr Legg. The third collection (1997-2002), comprising 66 records of nine species, was determined by myself, using Legg and Jones (1988), and named material. The following note comprises my previously unpublished pseudoscorpion records. New county records are indicated by an asterisk (*). Irish 10km square records for pseudoscorpions are summarised in Table 1. Species are also ranked on this table, taking into account number of 10km square records, geographical spread and proportion of old records.

Chthonius tetrachelatus (Preyssler, 1790)

CORK: Lissamona, Clear Island, V9622, 19 August 1996, under stones on grassy road verge. Middleton, W8873, 15 May 2001, frequent in dry leaf litter under *Rhododendron* in town park. Churchtown, W9173, 6 October 1999, sieved from debris collected in a cowshed. St Gobnat's Wood, W1977, 3 July 2002, at base of woodrush *Luzula* in deciduous woodland.

KERRY: Oakpark, Tralee, Q8415, 8 September 1996, under a piece of wood in mixed planted woodland.

KILKENNY: *Lough Macask, S4957, 10 March 2001, in moss on an old stone wall at the edge of a field.

SLIGO: *Doonee Rock, G7232, 8 September 1993, in beech *Fagus* leaf litter, mixed lakeshore woodland.

WESTMEATH: *Lough Derravaragh near Crookedwood, N4662, 25 April 1996, mixed deciduous woodland.

***Chthonius ischnocheles* (Hermann, 1804)**

CLARE: Kilronan, Inishmore, L8809, 21 July 1996, under stones at base of low limestone cliff.

CORK: Ballincollig, W5670, 29 May 1995, sieved from litter in mixed woodland. Cloonee, V9643, 17 April 1996, under a log in small hazel *Corylus* copse. Ballyieragh, Clear Island, V952208, 11 October 1996, sieved from debris collected in a cowshed. Inchanadreen, W1954, 21 September 1997, under a stone in conifer plantation. Ballycotton, W9963, 6 March 1998, coastal heath. Shanagarry, W9866, 31 July 1998, coastal grassland. Middleton, W8873, 15 May 2001, in dry leaf litter under *Rhododendron* in town park. Bandon, W4754, 13 June 2001, leaf litter in mixed woodland. Belvelly, W7970, 17 June 2001, edge of saltmarsh. Summerfield, Youghal, X0975, 4 June 2002, sandy foreshore. Buttevant, R5408, 29 August 2002, beech *Fagus* leaf litter in planted woodland.

DERRY: Roe Park, C6621, 24 October 1996, under a stone in mixed woodland.

DUBLIN: National Botanic Gardens, Glasnevin, O1437, 25 March 1995, under a stone in heated palm house.

GALWAY: Ballinasloe, M8231, 16 February 1996, in moss at edge of field.

KERRY: Reenadinna Yew Wood, V9586, 3 June 2002, in moss on boulder.

LAOIS: *Abbeyleix, S4282, 3 May 1996, sieved from leaf litter.

LIMERICK: *Adare, R4646, 18 April 2002, under stone in graveyard.

LONGFORD: Castleforbes, N0979, 29 March 1995, sieved from leaf litter in mixed woodland.

SLIGO: Pollinadivva Pier, G4434, 12 February 1993, in moss on sea cliff. Cummeen, G6436, 6 June 1993, in leaf litter, mixed deciduous woodland. Sligo Docks, G6836, 3 August 1993, waste ground. Union Wood, G6728, 20 August 1993, in beech *Fagus* leaf litter. Grange, G6549, 11 October 1993, sieved from debris collected in cowshed. Enniscrone, G2729, 2 September 1994, under a stone in sand dunes. Knockroe, G2623, 2 September 1994, under a stone in rank hedgerow. Killaspugbrone Point, G6037, 19 April 1994, under a stone in sand dunes. The Slish wood record for this species contained in Legg and O'Connor (1997) should have grid reference G7432, not G4732.

TIPPERARY: Brittas, S1261, 5 February 1996, sieved from beech *Fagus* leaf litter. Caher Park Wood, S0523, 5 April 1996, beech *Fagus* leaf litter.

TYRONE: *Dungannon, H7962, 9 October 1995, under a stone at edge of field.

WATERFORD: Portlaw, S4515, 22 May 1996, sieved from leaf litter in oak *Quercus* woodland, and present also under a stone in nearby hedgerow. Rincrew, X0881, 27 July 1997, under stones in mixed deciduous woodland. Monatray West, X1177, 26 April 1998, coastal erosion bank. Newtown, X5699, 26 July 1998, deciduous woodland. Ballyvoyle Bridge, X3394, 9 November 1999, vegetated coastal shingle. The Cunniger, X2691, 11 May 2000, sand dunes. Ballyvoony Bridge, X3797, 12 July 2000, leaf litter in hazel *Corylus* scrub. Carricknabrone, S2421, 25 October 2000, leaf litter in mixed woodland. Cheekpoint, S6713, 20 June 2001, oak *Quercus* leaf litter in mixed woodland. Ferrypoint, X1178, 21 July 2001, coastal shingle.

WEXFORD: Lady's Island, T1007, 25 October 1994, in leaf litter, small shrubby area at castle ruins. Bunclody, S9157, 23 November 1997, leaf litter in mixed woodland, along the banks of the River Slaney.

***Neobisium maritimum* Leach, 1812**

SLIGO: *Cooanmore Point, G3938, 28 September 2002. Single specimen collected from an inter-tidal rock fissure. Eating a springtail.

***Neobisium carpenteri* (Kew, 1910)**

CORK: Carrigadda Bay, W7753, 17 May 1998, under a stone on a grassy sea cliff. Carrigaline, W749628, 26 October 1998, on a south facing rock face, sheltering under overhanging gorse *Ulex*. Inishannon, W5357, 12 September 1999, in moss on tree branches in deciduous woodland along the east bank of the Bandon River. Sunning Hill, Inishannon, W5357, 10 November 2000, beaten from vegetation in deciduous woodland on a steep hillside.

Also, present in moss on an old stone wall, west bank of the Bandon River, south of Inishannon, W5555, 10 September 2000. Inchanadreen, W1954, 14 December 2000, in moss on tree branches, small deciduous fringe to conifer plantation, with *N. carcinoides* present in leaf litter. Bandon, W4754, 13 June 2001, beaten from vegetation in mixed woodland along the banks of the Bandon River.

A rare species, previously known in Ireland only from the Glengarriff area of Co. Cork. The above records suggest that it is widespread in mid and west Cork.

***Neobisium carcinoides* (Hermann) Beier**

CARLOW: Bunclody, S8957, 22 November 1997, in leaf litter, mixed woodland.

CLARE: Cratloe Wood, R4861, 2 August 1996, mixed woodland.

CORK: Bandon, W4754, 24 February 1995, in leaf litter, *Quercus-Fagus* woodland. Lough Rahavarrig, W3234, 4 February 1996, in leaf litter, planted woodland on sand dunes. Blarney, W6075, 12 February, 1995, *Quercus-Fagus* leaf litter in mixed woodland. Knockaroura, Mallow, W5796, 3 November 1997, under pieces of wood in conifer plantation. Shanagarry, W9966, 21 May 1998, sandy coastal grassland. Cloghphilip, W5876, 22 November 1998, mixed deciduous woodland. Myrtleville, W797590, 27 January 2000, in leaf litter under Japanese knotweed *Reynoutria* on coastal shingle. Inchydoney, W4038, 16 May 2000, sieved from moss collected in sand dunes. Island Strand Intake, W3939, 23 July 2000, beaten from gorse *Ulex* in hedgerow. Clashatrake Bridge, W3191, 16 November 2000, hazel *Corylus* leaf litter. The Long Strand, Rosscarbery, W3234, 9 May 2001, sand dunes. St Gobnat's Wood, W1977, 22 February 2002, leaf litter in deciduous woodland.

FERMANAGH: Aughrim, Belcoo, H0939, 5 November 1996, in leaf litter, hillside *Corylus-Fraxinus* scrub.

KERRY: Ballinruddery, R0232, 7 March 2002, under a stone in a small patch of deciduous woodland.

KILKENNY: Fiddown Island, S4619, 23 May 2001, at base of vegetation in willow *Salix* dominated marsh. Ballykeefe Hill, S4151, 23 November 2001, leaf litter in deciduous woodland.

LEITRIM: Drumard, N0688, 20 October 1993, sieved from leaf litter in damp mixed woodland. Balloor, G7554, 31 October 1993, in leaf litter, *Quercus-Fagus* woodland.

Lisseghan, M9698, 17 November 1993, hazel *Corylus* scrub. Cornagillagh, N0687, 22 June 2002, in *Sphagnum* on lowland blanket bog.

The Drumsna record for this species contained in Legg and O'Connor (1997) should have grid reference M9898, not N9898.

LIMERICK: Knightsgrove, R5918, 17 August 1997, conifer plantation.

MAYO: Barnalyra Wood, M4495, 2 February 1994, in leaf litter, acid woodland.

OFFALY: *Portarlington, N5410, 27 March 1995, in moss on old stone wall. Charleville Wood, N3121, 25 May 1997, sieved from leaf litter in oak *Quercus* woodland.

SLIGO: *Castlegal, G7240, 2 April 1993, sieved from beech *Fagus* leaf litter. Bunduff Bridge, G7557, 7 December 1993, in oak *Quercus* leaf litter, scrub woodland. Dooney Rock, G7232, 1 June 2000, in leaf litter, mixed woodland. Killerry, G7533, 21 January 2002, in *Sphagnum* on rocky lakeshore heath.

WATERFORD: Grace Dieu, S6006, 3 February 1995, in leaf litter, *Quercus-Fagus* woodland. Portlaw, S4515, 22 May 1996, sieved from leaf litter in oak *Quercus* woodland. Ballyvoony Bridge, X3897, 23 March 2000, hazel *Corylus* leaf litter. Helvick Head, X3189, 13 July 2000, rank coastal grassland. Carricknabrone, S2421, 25 October 2000, leaf litter in mixed woodland. Loughaniska, X2996, 7 November 2000, in leaf litter, mixed woodland. Monatray West, X1177, 8 November 2000, under pieces of wood on vegetated coastal shingle. Tramore Burrow, S6100, 16 August 2001, under stones etc in sand dunes. Abbeyside, X2894, 3 November 2001, disturbed area at estuarine HWM. Glenshelane Wood, X1199, 21 November 2001, leaf litter in mixed woodland.

WEXFORD: Mountgarrett Castle, New Ross, S7229, 26 October 1994, leaf litter. Rosslare, T1412, 25 October 1994, under a piece of wood in sand dunes.

***Roncus lubricus* L. Koch, 1873**

CORK: Crosshaven, W7761, 30 December 1995, sieved from leaf litter in *Quercus-Fagus* woodland. Inishannon, W5456, 12 September 1999, sieved from beech *Fagus* leaf litter, small hilly woodland on the west bank of the Bandon River.

WATERFORD: *Tramore, S5801, 27 October 1994, in leaf litter, small *Quercus-Acer* scrub.

WEXFORD: *Ballyhack, S7110, 20 May 2001. Single specimen sieved from stonecrop *Sedum* on rock exposure, heathy hillside.

Clearly widespread along the south coast of Ireland, but very local.

***Cheridium museorum* (Leach, 1817)**

CORK: *Churchtown, W9173, 6 October 1999. Three specimens sieved from debris collected in an old cowshed.

***Lamprochernes nodosus* (Schrank, 1803)**

TIPPERARY: *Ferryhouse, Clonmel, S237229, 25 October 2000. Sieved from debris collected from a large heap of leaves which was acting as a compost heap.

***Pselaphochernes scorpiodes* (Hermann, 1804)**

CORK: *Inchybegga, W047461, 18 April 1996, single specimen sieved from leaf litter in small *Quercus-Ilex* woodland. The only other Irish record is from Co. Carlow (Kew, 1921).

***Dinocheirus panzeri* (C. L. Koch, 1837)**

CORK: *Ballyieragh, Clear Island, V952208, 11 October 1996. Knockaroura, Mallow, W5796, 3 November 1997. Macroom, W3272, 15 August 2002. Clogheen, R5607, 29 August 2002.

KILKENNY: *Ballykeefe, S410498, 23 November 2001.

LEITRIM: *Port, G9503, 14 October 1993. Jamestown, M9897, 17 November 1993. Lisseeghan, M9698, 22 November 1993. Lough Scannall, N0490, 12 September 1994. Knockbrack, G7657, 3 October 1994, sieved from debris collected in an old chicken coop and present also in an adjacent cowshed.

LONGFORD: *Longford, N1375, 17 October 1994.

MEATH: *Ashbourne, O0652, 11 September 2002. Two specimens sieved from pigeon *Columba livia* L. guano, collected inside a now derelict grain store.

ROSCOMMON: *Corlis, M7181, 27 April 2002.

SLIGO: Templeboy, G4633, 12 February 1993. Grange, G6549, 11 October 1993. Corbally, G2925, 19 October 1993. Killanly, G2625, 2 September 1994. Skreen, G5333, 9 September 1994. Rathedmond, G6836, 17 October 1993.

The Sligo Quay record contained in Legg and O'Connor (1997) refers to specimens collected in a cowshed.

WEXFORD: *Ballina, T113315, 10 October 1994.

Unless otherwise stated, the above specimens were obtained by sieving debris collected in cowsheds or stables. Previously reported in Ireland by Kew (1914), Jones (1975), Cawley

(1996) and Legg and O'Connor (1997), and described as rare by the last authors. However, this clearly not the case in Ireland where *D. panzeri* is widespread, and indeed to be expected when specifically searched for on farms.

Discussion

The above information suggests that only two false-scorpions, *C. ischnocheles* and *N. carcinioides* could be described as common in Ireland, with *C. tetrachelatus* widely distributed but distinctly local and *D. panzeri* a predictable species around farms. A comparison of the counties where my fieldwork has been most concentrated, namely Sligo and Cork/Waterford, suggests to me that these animals are distinctly more freqent in southern parts, although it is difficult to quantify the extent of this. It is noticeable that *N. carcinioides* is quite local in Co. Sligo, and more or less unknown away from woodlands. It is widespread along the coast in Cork/Waterford, as well as in woodlands. In Co. Sligo, the only species I have found together have been *C. ischnocheles* and *D. panzeri*, in cowsheds. By contrast, in Co. Cork, and even in natural habitats, one regularly encounters mixed populations of *C. ischnocheles* and *N. carcinioides* and, rarely, in woodlands, these are joined by *N. carpenteri*.

While pseudoscorpions have received little attention from Irish naturalists, especially since the early 20th century, it is still remarkable that 12 species, representing 70% of the fauna have been recorded from eight or fewer Irish 10km squares. Clearly a number of these, notably *Lamprochernes* and *Cheridium*, are probably greatly under recorded. However, most of the rest would seem to be genuinely rare or, as in the case of *N. carpenteri* and *P. dubius*, of restricted distribution. Some species are of potential conservation concern, especially *K. halberti* and, in an Irish context, *P. scorpioides*.

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TABLE 1. Summary of Irish 10km square records for pseudoscorpions.

Species	**Number of Irish 10km square records**	**Rank in Ireland**
Kewochthonius halberti (Kew)	1	17
Chthonius tetrachelatus (Preyssler)	28	3
Chthonius ischnocheles (Hermann)	92	1
Chthonius orthodactylus (Leach)	1	16
Neobisium maritimum (Leach)	12	5
Neobisium carpenteri (Kew)	6	9
Neobisium carcinioides (Hermann) Beier	90	2
Roncus lubricus L. Koch	8	6
Roncocregas cambridgei (L. Koch)	8	7
Cheridium museorum (Leach)	7	8
Lamprochernes savignyi (Simon)	3	12
Lamprochernes nodosus (Schrank)	3	10
Pselaphochernes scorpioides (Hermann)	2	14
Pselaphochernes dubius (O. P.-Cambridge)	3	11
Allochernes powelli (Kew)	1	15
Dinocheirus panzeri (C. L. Koch)	23	4
Chelifer cancroides (L.)	3	13
Total 10km square records	291	

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MODERN RECORDS OF *HYDRAENA MINUTISSIMA* STEPHENS, 1829 AND OF *AGABUS BIGUTTATUS* OLIVIER, 1795 (COLEOPTERA) FROM IRELAND

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Introduction

Extensive collections of macroinvertebrates were taken from selected rivers in 1999 and 2000 as part of an effort to compile species inventories for reference, clean-water sites in Ireland. Multihabitat kick samples were taken. This involved sampling all riverine habitats at a given site over a three-minute period in proportion to their relative occurrence. Marginal aquatic vegetation was included in the sampling.

A male of *Hydraena minutissima* Stephens was collected in the Glencullen River, Co. Wicklow and eleven specimens of *Agabus biguttatus* Olivier in the Clodaigh River, Co. Tipperary. Few previous Irish records exist for these species.

Hydraena minutissima Stephens, 1829

Johnson and Halbert (1902) make reference to three Irish records of *Hydraena minutissima* under the synonym *H. atricapilla* Waterhouse, 1833. The listed records are:- River Faughan, Co. Derry (Buckle, 1900), Co. Armagh (no location) (Johnson, 1890) and Queenstown (now Cobh), Co. Cork (Walker, 1895). Balfour-Browne (1958) lists *H. minutissima* as being present in the previously mentioned locations with two additional records *viz*. Wicklow and North Kerry. The latter is for the River Flesk (Foster, pers. comm.). Foster *et al.* (1992) list no post 1949 records for this species. Of the 185,000 records held electronically by the Balfour-Browne Club, 50 relate to *H. minutissima* of which there are now four Irish records (Derry, North Kerry, Cork and the present one) (Foster, pers. comm. May 2001). To date, the Wicklow and Armagh records have not been encountered in Balfour-Browne's journals or card indices (Foster, pers. comm.). A study of the aquatic Coleoptera in Northern Ireland (Nelson *et al.*,

1998) did not reveal new records for the species. It is worth mentioning that the name *H. flavipes* Sturm, 1836 has been given priority over *H. minutissima* in the *World Catalogue of Insects* (Hansen, 1998).

The recent record was taken from the Glencullen River, Co. Wicklow (O212182) in June 1999. This is a fast flowing circum-neutral coastal river. The main geology influencing the ionic composition of the water is granite but limestone drift also has an influence. Conductivity values are in the region of 200μS/cm. The substrates are predominantly compacted cobbles with scattered boulders. Instream vegetation is predominantly *Fontinalis* sp. *H. minutissima* is usually found among the gravels and moss covered stones of rapid flowing streams (Balfour-Browne, 1950: Friday, 1988). Adults are little more than 1mm in length and this may in part be the reason why this species is rarely encountered.

***Agabus biguttatus* Olivier, 1795**

Johnson and Halbert (1902) make reference to a record of *Agabus biguttatus* from Armagh. However, Balfour-Browne (1950) suggests that this record may be erroneous. In 1946, the species was recorded in the Cloghereen River, Co. Kerry (Balfour-Browne, 1950). There was a male, deposited in the Natural History Museum, Dublin, from Armagh and it was dated 29.10.1887 according to Balfour-Browne (1950). Co. Dublin was also marked in the distribution map for *A. biguttatus* in the same paper. Neither of these records is currently mentioned in the Balfor-Browne electronic data. Foster *et al.* (1992) report two post 1949 records for the beetle. Both sites were in Co. Antrim at Ess Bridge and above Loughreema. They are included in Nelson *et al.* (1997) with an additional records from the River Blackwater, Co. Tyrone and from Boho Cave, Co. Fermanagh, dating from 1997 and 1966 respectively. Foster (pers. comm., 2000) related two further localities for *A. biguttatus* from Co. Antrim *viz.* Greenshields River (C985267) and Ladyhill Burn (J176918) by Roy Anderson dating from 1997. Of the 169,000 records held electronically by the Balfour-Browne Club (as of September 2000), 144 relate to *A. biguttatus* of which there are six from Ireland (including the current one). The records for Cos Tyrone and Fermanagh are not yet incorporated into the database.

The present eleven specimens were collected in the Clodiagh River, Co. Tipperary

(R955612), 2.5km from the source, in May 1999. The Clodiagh is a headwater stream, *circa* 4m in width, in the Suir catchment. The site geology is largely greywacke and slate. The concentrations of the major ions are higher than the Glencullen River yielding conductivity values in the region of 250μS/cm. The gradient is fairly steep with boulder, cobble and gravel substrates. Specimens of *A. biguttatus* are usually encountered in springs and small streams (Balfour-Browne, 1950; Friday, 1988). The majority of records cited by Balfour-Browne (1950) were from streams and low altitude sites. It was presumed that the species spent most of the time subterranean in the flow that remains in gravel banks after a stream dries up. Its occurrence in rivers is attributed to it being washed out of its usual habitat. Adults are approximately 9mm in length. However, its subterranean habit may be the reason why this species is not often encountered.

Acknowledgement

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BOOK REVIEW

BIOLOGICAL COLLECTIONS AND BIODIVERSITY edited by B. S. Rushton, P. Hackney and C. R. Tyrie. Linnean Society Occasional Publications Number 3. pp i-x, 1-326. ISBN 1-84103-005-8. Published in 2001 by Westbury Academic and Scientific Publishing, Ilkley Road, Otley, West Yorkshire LS21 3JP, England. Price £35 Sterling.

This is an edited volume arising from papers presented at a joint symposium between The Linnean Society of London and the Royal Horticultural Society. The meeting was held during August 1996. The publication represents a selection of the given papers. There are abstracts of the remaining ones and of the posters. The range of topics is impressive. For convenience, the book is divided into five sections. The first deals with traditional specimen collections. Commencing with the Economic Botany Collections at Kew, there are also chapters on the conservation of ancient tropical rainforests, hidden secrets in the Royal Society Archive, a botanical odyssey: the evacuation of the Hamburg Herbarium 1943-1900, using herbarium specimens for floristic mapping in South-West Germany, lichen herbarium resources in Ireland, two 18th century illustrated anthologies of cultivated plants and finally, Irish palaeontological illustrations of the 19th century. The subject matter is delightful and include an account of Leeuwenhoek's writings and slides. His botanical sections were of exceedingly high quality, well matched to the demands of modern microscopy despite having been made in 1674. The history of the Hamburg Herbarium is astounding. Large parts were evacuated in 1943 to Central Germany. Subsequently in 1945, they went to Leningrad in Russia and then in the 1950's to East Berlin. Finally, they were returned to Hamburg in 1990. Happily, the bulk of the material is now once again available for loan or inspection.

The second section is composed of six papers on the topic of living collections and conservation. In the last one hundred years, three-dimensional models in museum collections have made a small but significant contribution to biological education. These include the world-famous Blaschka glass models. In his chapter on "Botanical sculpture: a life-saving alternative?", the author argues that botanical and ecological sculptures will be needed to make information more accessible in the future especially because of the huge increase in student and research demands for live and herbarium specimens. These are adding to the pressure on many declining or naturally rare populations. Next, there is a short account of the problems of classification of the interspecific genetic variability of plants, followed by a history of the two hundred and eighty five year old Botanical Garden of the Komarov Botanical Institute. The section ends with plant cataloguing in the National Trust, the Millennium Seed Bank Project and the establishment of the Threatened Irish Plant Seed Bank. Section three consists of three papers on Molecular Diversity.

By contrast, the fourth covers the uses of collections. The chapters range over the roles of zoos, the educational use of botanical collections, the need for a multipurpose approach to such collections to botanical artistry and cell research. Systematics and the National Pinetum in Bedgebury, fruit identification and the importance of fruit cultivar, and plant pathogens are also dealt with. The section concludes with an interesting account of the botanical content in the landscape watercolours collection of the Ulster Museum. While in general, such works contained insufficient detail for precise identification of individual species, they can be useful in terms of such obvious landscape features as the extent of woodlands. Intriguingly, the author mentions a view of a windmill at Holywood, Co. Down. This includes a marsh and a pond with what are clearly beds of common reed. The renowned entomologist A. H. Haliday lived in Holywood and collected many rare species in the area. Perhaps, this painting illustrates one of his collecting sites.

The last section is on data logistics and problems. There is a diverse mixture of topics such as botanical illustrations at the National Museums and Galleries of Wales, the conservation of botanical photographs and the monetary value of herbarium collections. The contrasts are great. On one hand, there is an article about materials and methods for the preservation of illustrations on paper. On the other, there is an account of marine phytoplankton in a subtropical lagoon system in Baja California Sur, México, from 1980-1989. The chapters on environmental recording in Northern Ireland, the Linnean Task (the documentation and preservation of the world's biological diversity) and insect collections (a strategy for databases and acquisitions) will be of more general interest. The abstracts of other presented papers are grouped at the back. Surprisingly, there is no index.

This well-produced book represents excellent value for money. The editors have done a marvellous job of drawing together such a varied range of subjects - a herculean task. The result is a fascinating assemblage of often thought-provoking articles. While of most interest to botanists, the volume can also be recommended to anyone with an interest in biodiversity.

J. P. O'CONNOR

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2. Manuscripts should be submitted as typed copy on A4 paper, using double-spacing and 2.5cm (1 inch) margins. Whenever possible, also submit the text on diskette. Wordperfect 5.1 is preferred.

3. Figures should be submitted in a size suitable for reduction to A5 without any loss of detail.

4. Records: please ensure that, when possible, the following information is incorporated in each record included in a manuscript:-
(a) latin name of organism.
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(5). Manuscripts should be submitted to the Editor, Dr J. P. O'Connor, at the following address:- National Museum of Ireland, Kildare Street, Dublin 2, IRELAND.

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NOTICES

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