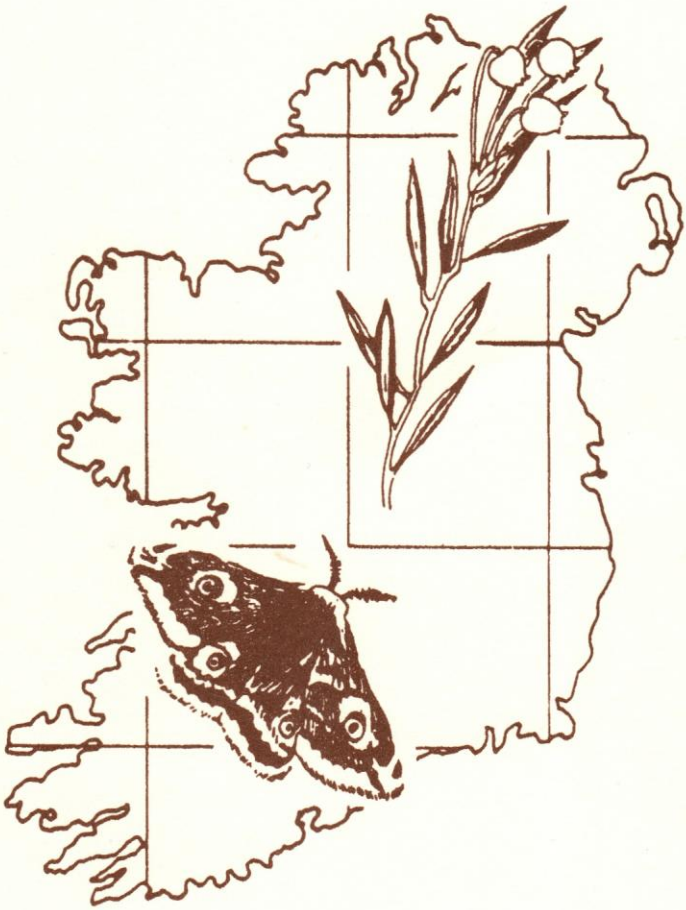
IRISH BIOGEOGRAPHICAL SOCIETY



Bulletin No. 28

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BULLETIN OF THE IRISH BIOGEOGRAPHICAL SOCIETY

Number 28

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Bull. Ir. biogeog. Soc. No. 28 (2004)

EDITORIAL

Members will notice changes in the format of this year's *Bulletin*. It became necessary to change from using Word Perfect to Word for its production. While the former was more user-friendly, it had become outmoded. It is hoped that our readers will like the new lay-out.

On 29 March 2004, the Society published its seventh *Occasional Publication* entitled *A catalogue of the Irish Platygastroidea and Proctotropoidea (Hymenoptera)* by J. P. O'Connor, R. Nash, D. G. Notton and N. D. M. Fergusson. Data are provided on the 316 species of these parasitic wasps which are known to occur in Ireland. It also contains figures of some of the species and an attractive colour plate. Sponsored by the National Museum of Ireland, it was issued free to all paid-up members. The Committee wishes to remind subscribers that the 2004 subscription rate is 15 euro or £10 Sterling. It is important that standing orders should be changed to the new amount.

Bulletin **Number 28** contains a fascinating mixture of articles and we are indebted to the authors for their contributions and to our referees for their reports. The Society also wishes to thank Dr Pat Wallace, Director of the National Museum of Ireland, for his invaluable support and to our sponsors for their essential financial assistance. The Editor is very grateful to Mr J. M. C. Holmes for his help with the *Bulletin* and to the Committee for their encouragement.

J. P. O'Connor

Editor

20 September 2004

OCCASIONAL PUBLICATIONS OF THE IRISH BIOGEOGRAPHICAL SOCIETY

Number 1. *Proceedings of The Postglacial Colonization Conference*

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

Published 1986. 88pp. Price 4 euro*.

Number 2. *Biogeography of Ireland: past, present and future*

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

Published 1993. 149pp. Price 15 euro*.

Number 3. *A checklist of Irish aquatic insects*

P. Ashe, J. P. O'Connor and D. A. Murray

Published 1998. 80pp. Price 7 euro*.

Number 4. *A catalogue of the Irish Braconidae (Hymenoptera: Ichneumonoidea)*

J. P. O'Connor, R. Nash and C. van Achterberg

Published 1999. 123pp. Price 6 euro*.

Number 5. *The distribution of the Ephemeroptera in Ireland*

M. Kelly-Quinn and J. J. Bracken

Published 2000. 223pp. Price 12 euro*.

Number 6. *A catalogue of the Irish Chalcidoidea (Hymenoptera)*

J. P. O'Connor, R. Nash and Z. Bouček

Published 2000. 135pp. Price 10 euro*.

Number 7. *A catalogue of the Irish Platygastroidea and Proctotrupoidea (Hymenoptera)*

J. P. O'Connor, R. Nash, D. G. Notton and N. D. M. Fergusson

Published 2004. 110pp. Price 10 euro*.

*for postage outside Ireland, please add 4 euro.

Copies of these publications may be obtained from the Irish Biogeographical Society c/o Dr J. P. O'Connor, National Museum of Ireland, Kildare Street, Dublin 2, Ireland.

Bull. Ir. biogeog. Soc. No. 28 (2004)

FUNGAL SPOROCARP PRODUCTION IN FOUR DECIDUOUS WOODLAND SITES IN NORTHERN IRELAND

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Summary

Fungal sporocarp production was recorded using a transect method and monthly visits from July to October at four sites in Northern Ireland representing a young oak (*Quercus robur*) plantation, a beech (*Fagus sylvatica*) plantation, a hazel (*Corylus avellana*) woodland and a mixed, largely deciduous woodland with a dominance of alder (*Alnus* spp.) and willow (*Salix* spp.).

The mixed alder and willow woodland (Reas Wood) and the oak plantation (Movanagher Forest) had the more diverse fungal flora whilst the hazel woodland (Glenariff) and the beech plantation (Portglenone Forest) had the least diverse fungal flora.

A large number of fungal taxa were restricted to one site (63% of all taxa) and 86% were restricted to either one or two sites. Sporocarp diversity (as measured by the Shannon Index of Diversity) was significantly different between sites but even the least diverse site had an important number of unique taxa. This was the hazel wood site (a very old site which had

been originally coppiced) where 44% of the 32 taxa recorded were unique to the site.

It was therefore concluded that diversity must not be used as the single criterion for the conservation of the fungal flora but that consideration should also be given to the rarity of individual taxa.

Introduction

In 1974, a project was initiated by Dr David W. Eveling, of the Department of Biological and Biomedical Sciences, University of Ulster into the relationships between fungal sporocarp (fruiting body) formation and environmental patterns. This work involved the periodic (weekly) monitoring of sporocarp production at a local spruce (*Picea*) and mixed broadleaved forest, Tardree in Co. Antrim, Northern Ireland. The fieldwork was completed in late 1990 and subsequently the data have been analyzed and published (Eveling *et al.*, 1990). An unpublished manuscript is also in existence (Bataille and Wilson, 1992). The general conclusion of this monitoring work was that there was a very high statistical correlation between sporocarp counts and the means of average daily temperatures for the period two to four months prior to recording dates over a ten-year period. Three to five months after rainfall was the significant lapse of time that triggered sporocarp formation but the total yearly count did not significantly correlate with the total amount of rainfall.

This particular paper is largely concerned with the diversity of the sporocarps produced and with similarities and differences between the sporocarp production at four contrasting deciduous woodlands each with a different canopy type and tree age in Northern Ireland. As McHugh *et al.* (2001) point out, surveys of fungal populations, particularly in Ireland, have been scarce and it is hoped that the findings reported here will add to our knowledge of mycological diversity in Irish woodlands.

Methods

1. The sites

In order to fulfil the ultimate aims of the work, it was necessary to choose sites that were, as far as possible, relatively uniform with respect to tree composition, contained only one dominant tree species and were semi-natural. Inevitably, as Northern Ireland has less than 5% native broadleaved woodland, it was not possible to find exactly suitable woods and two of the woodlands utilised were plantations. A further factor was the intensive nature of the fieldwork which meant that only a limited number of sites could be surveyed. Eventually, after visiting fifteen sites, four sites were chosen for detailed investigation in 1992:-

Movanagher Forest, Kilrea (grid reference C928158), Watsonian vice-county H40 (Londonderry).

The forest was planted in 1938 and is maintained by the Forest Service. It covers 17.4ha and is essentially a ribbon of woodland stretching along the River Bann on a silt-clay deposit dredged from the river following drainage schemes. The altitude is 10m. The woodland is comparatively damp underfoot. Thinning took place in 1969.

The dominant tree species are conifers except for an area of oak (*Quercus robur*) which formed the focus of the present survey. Because of irregular establishment and thinning, the oak area resembles a young semi-natural woodland. The average tree diameter (at breast height) was 0.3m and the crowns of the trees were rather sparse. The canopy allows enough light through to ground level to permit a diverse ground flora to develop including brambles (*Rubus* spp.), willow-herbs (*Epilobium* spp.), cranesbills (*Geranium* spp.), primrose (*Primula vulgaris*), etc. Regeneration of sycamore (*Acer pseudoplatanus*) and blackthorn (*Prunus spinosa*) has started to take place.

Reas Wood, Antrim (grid reference J143856), Watsonian vice-county H39 (Antrim).

Reas Wood is a National Nature Reserve situated about 2km south of the town of Antrim. The reserve extends to about 26.5ha with an altitude of 20m. It has both scrub woodland

and fen developed as a linear feature along the shores of Lough Neagh with much of it on the old shorelines exposed as Lough Neagh was lowered during the last 70 years or so (Anon, no date; Anon, 1986; Harron and Rushton, 1986). The woodland is mixed and largely broadleaved with a wide range of species and tree sizes. The flora is described in detail in Harron and Rushton (1986).

Portglenone Forest (grid reference C985027), Watsonian vice-county H39 (Antrim).

Portglenone Forest is divided into six main sections stretching over approximately 30ha; the altitude is 30m. The plantings date from between 1944 and 1973. Some of the broadleaved tree species result from natural regeneration dating back to the early 1950s. The beech (*Fagus sylvatica*) stand that was selected for the survey was mature and partly excluded any tree regeneration. The ground flora was confined to the edges of the plot with the exception of an outstanding colony of bluebells (*Hyacinthoides non-scripta*) which itself excluded other forms of plant life during the spring and early summer. Once the bluebells had disappeared in early summer extensive production of fungal sporocarps occurred.

Glenariff (grid reference D221216), Watsonian vice-county H39 (Antrim).

This mature woodland is situated 4km inland from the Irish sea coast at an altitude of 210m. The steep topography has preserved it from gross interference by man. The dominant species is hazel (*Corylus avellana*) though a small number of other species are present in small quantity including ash (*Fraxinus excelsior*), willows (*Salix* spp.), birch (*Betula* spp.), ivy (*Hedera helix*), hawthorn (*Crataegus monogyna*) and blackthorn (*Prunus spinosa*). There are a few sheep paths and the wood shows evidence of light grazing; many years ago, goats were present and caused much damage to the bark of the lower parts of the trees. The woodland has been coppiced though it has not been exploited since at least the Second World War and consequently there is abundant dead wood decaying on the site. The canopy allows enough light to penetrate to support a rich under-storey flora.

2. Survey methodology

Within each woodland, four transects were positioned so as to reflect, as far as possible, the variation in topography, light, tree height, tree cover, vegetation and soil moisture of the site. However, each transect was established in a homogeneous area. The transects were 52m long and a permanent quadrat (marked with wooden pegs) was established every four metres along each transect thus giving a total of 13 quadrats (52 quadrats for each woodland). The edges of the sites were avoided to prevent edge effects.

Fungal recording was carried out in quadrats 2m x 2m which were based on the positioning of the permanent quadrats along the four transects (see Fig. 1). The quadrats were positioned alternately along the sides of the transect. Fungal fruiting bodies were identified as far as possible in the field though the more difficult ones were taken back to the laboratory for investigation and identification (using Dennis *et al.* (1960), Lange and Hora (1965), Phillips (1981), Moser (1983) and Bon (1987)) and a count made of each species. In some cases, identification was only possible to the generic level and aggregate counts are presented for these records. Because of the nature of the field work the authors had to be pragmatic with regard to identification and in the case of *Micromarasmius* it was necessary to 'lump' taxa. Nomenclature follows the British Mycological Society checklist available on the Internet (British Mycological Society, 2002). Voucher specimens were not collected.

Recording took place in the same quadrats in July, August, September and October. Visiting each site at approximately monthly intervals during this period of maximum sporocarp production ensured that the same sporocarps were never counted on successive visits as the time lapse was sufficient for them to decay or dry out. On the other hand, some of the more delicate, shorter-lived fruiting bodies may have been missed because production, maturation and decay had occurred during the period between successive visits.

Vegetation recording was also carried out in 1m x 1m quadrats positioned within the 2m

× 2m quadrats where fungal recording took place. Thus for each site the ground flora was assessed in 52 quadrats. These data are not reported here.

Results

Tabulation of the data for each site enabled the following summary statistics to be calculated for each taxon:

a. the total number of sporocarps found in the 52 quadrats cumulated over the four visits;
b. an estimate (based on the data in 'a' above) of the total sporocarp production per ha in the woodland; and
c. the percentage frequency, expressed as –

$$\frac{\text{Total number of quadrats which contained the taxon} \times 100}{\text{Total number of quadrats in which recording took place (i.e. 52)}}$$

These are presented in Table 1 (which shows the consolidated data for all taxa recorded at all four sites).

Analysis of these data proceeded by calculation of a number of diversity parameters (Magurran, 1988). These included the following measures of diversity: Margalef's Index of Diversity, Menhinick's Index of Diversity, McIntosh's Index of Diversity (U), Simpson's Index of Diversity (1/D), Berger-Parker's Index of Diversity (1/D), Shannon's Index of Diversity (H) and the Q Statistic. Additionally, two measures of evenness (McIntosh's Index of Evenness and Shannon's Index of Evenness) and one measure of dominance (McIntosh's Index of Dominance) were also calculated using the cumulated total sporocarp production at each woodland site. These are presented in Table 2.

Using the cumulated total sporocarp production data obtained for each site, the differences

between the diversity (as measured by the Shannon Index of Diversity) of the sites were investigated and the results are shown in Table 3.

Finally, using two estimates of similarity appropriate to ecological data, the Jaccard and Sorenson Coefficients (Kent and Coker, 1992; Waite, 2000), the similarity between the sites was calculated. The results are given in Table 4. It was decided not to calculate the quantitative version of the Sorenson's Coefficient due to the very large differences in sporocarp counts.

The sporocarp production clearly varied between the four sites with there being a six-fold difference in the total number of sporocarps produced (Table 2, Glenariff (hazel) produced only 489 sporocarps whilst Portglenone Forest (beech) produced 3199 from the survey quadrats). The total number of taxa per site also varied widely, though not to such a great extent, with Glenariff (hazel) producing 32 different taxa and Reas Wood (mixed alder and willow) the highest total with 69 taxa (Table 2). However, examination of Table 1 highlights the individual differences between the sites. The woodland at Portglenone (beech) was dominated by a relatively small number of taxa with large numbers of individual sporocarps (*Leotia lubrica*, *Hemimycena* sp. and *Xylaria hypoxylon*, Table 1) whilst the taxa in the other woodlands were much more evenly represented. This is emphasized in the results for the McIntosh's and Shannon's Index of Evenness (Table 2). For the two measures of species evenness, Reas Wood (mixed alder and willow), Movanagher Forest (oak) and Glenariff (hazel) are very similar but the evenness is much lower (on both measures of evenness) for Portglenone Forest, the woodland dominated by beech.

In examining the diversity of sporocarp production at the sites, the approach taken has been to examine a number of different diversity indices – this is to negate the effect of bias inherent in some measures (Giavelli, Rossi and Sartore, 1986). By examining a number of different indices, it was hoped that a common pattern of diversity would emerge. Largely, this was the case. Consistently, Reas Wood (mixed alder and willow) was shown to have the most diverse sporocarp flora (out of the seven indices, it was shown to be the most diverse for four indices

and second most diverse for the other three indices; Table 2). The hazel wood in Glenariff was a less diverse woodland (with three indices it was the least diverse and second least diverse with a further three indices; Table 2). The diversity of the Portglenone Forest (beech) site was probably the lowest. On the basis of species richness (as highlighted by the number of taxa, 60 taxa), Portglenone Forest shows high diversity and this is supported by two of the diversity indices (McIntosh's Index of Diversity and the Q Statistic). However, four of the other diversity measures rank Portglenone Forest as the least diverse. Movanagher Forest, the woodland dominated by oak was the second most diverse site with one index ranking it first, three indices ranking it second and the remaining three ranking it third.

Using the data from just the Shannon Diversity Index, the differences in diversity between the sites was tested using a modified t-test (Magurran, 1988). In all cases the differences in diversity between pairs of sites were significant (Table 3) which indicated that the rank order of diversity was as follows:-

		Shannon's Diversity Index (H)
Most diverse:	Reas Wood (mixed alder and willow)	3.326
	Movanagher Forest (oak)	3.006
	Glenariff (hazel)	2.545
Least diverse:	Portglenone Forest (beech)	2.041

Thus the alder and willow mixed woodland (Reas Wood) and the oak plantation (Movanagher Forest) had the more diverse fungal flora whilst the hazel woodland (Glenariff) and the beech plantation (Portglenone Forest) had the least diverse fungal flora. Age of the woodland did not seem to be a significant factor as Glenariff was the oldest and Movanagher Forest the most recently planted.

Examination of the similarity between sites (Table 4) indicated that:-

1. The Glenariff site (hazel) was very different from the other three sites and particularly from Reas Wood (mixed alder and willow);
2. The two most similar sites were Movanagher Forest (oak) and Portglenone Forest (beech); and
3. The Movanagher Forest (oak) and Portglenone Forest (beech) sites showed the same level of similarity with the Glenariff site (hazel) and they also showed the same level of similarity with Reas Wood (mixed alder and willow).

Portglenone Forest (beech) had 24 taxa in common with Movanagher Forest (oak) whilst Glenariff (hazel) showed only eleven taxa in common with Movanagher Forest (oak), only twelve taxa in common with Portglenone Forest (beech) and only eleven in common with Reas Wood (mixed alder and willow). This is highlighted by the levels of similarity between woodlands (Table 4) which are generally low. Each woodland seemed to have its own rather characteristic fungal flora – this can be seen in Table 1 where of the 136 taxa recorded in total over all four sites:-

86 (63%) taxa were found at only one site;

31 (23%) taxa were found at only two sites;

13 (10%) taxa were found at three sites; and only

6 (4%) taxa were found at all four sites.

Of the 86 taxa found at only one site, the following numbers of taxa were unique to the sites (Table 1):-

Reas Wood (mixed alder and willow)	33 taxa out of 69 taxa (48% unique)
Glenariff (hazel)	14 taxa out of 32 taxa (44% unique)
Portglenone Forest (beech)	23 taxa out of 60 taxa (38% unique)
Movanagher Forest (oak)	16 taxa out of 50 taxa (32% unique)

At least 32% of all the fungi (as evidenced by sporocarp production) were unique to a

sampled site and, given the fact that these were all woodland sites, it suggests that many individual fungal taxa might be relatively uncommon and not widespread.

Discussion

An extensive survey by Lange (1993) produced comparable results. He was able to survey macromycete fungi in ten comparative sites. Each site had been set up by the Danish Forest and Landscape Research Institute and was divided into twelve plots each planted with a different tree species (two broadleaved species and ten conifers). Methodology was very similar to that adopted here (sampling was from July to October and by the use of transects).

Lange (1993) reported a total of 40 taxa and 53 taxa for the beech and oak plantations respectively. Our data show 60 and 50 taxa for the same tree species (Portglenone Forest and Movanagher Forest), a not very different result. They also accord with similar data produced by Tyler (1989) and Rühling and Tyler (1990). However, Lange (1993) was able to show, by recording over four years, that some species were found every year whilst some were found less frequently. Since we did not record over more than one season we cannot confirm this result; it also means that our data should be treated as a 'snap-shot' of the total fungal flora rather than a definitive list. Nevertheless, since our totals for the oak wood (50 taxa) and the beech wood (60 taxa) are about the same or exceed those of Lange (1993) we are reasonably confident that our 'snap-shot' is a very good estimate. It should be noted that the climatic conditions of Denmark are not that dissimilar from those of the north of Ireland.

Further south, however, the situation is somewhat different. For example, Perini *et al.* (1993) reported 309 species of fungi in holm oak (*Quercus ilex*) woodlands, 194 species in chestnut coppice (*Castanea sativa*) woodlands and even 83 species in juniper scrub (*Juniperus* spp.) from Mediterranean and sub-Mediterranean areas in northern Italy.

Because many of the larger, more easily recognised fungi appear to be relatively common within particular habitat types, the impression may be gained that this applies to all fungi. The

results of this investigation show that this is clearly not the case and it has been shown that a large number of taxa are restricted to one site (63% of all taxa) and 86% were restricted to either one or two sites. Perini *et al.* (1993) recorded slightly lower but still high figures for Mediterranean woodland (of 309 fungi recorded in *Quercus ilex* woodland 104 (34%) were restricted to that vegetation type). Over a number of vegetation types they found only 14% of the fungal species to be widespread and 55% were associated with only one type of vegetation community. Although the diversity of the sites in Northern Ireland differs substantially and significantly (Tables 3 and 4), even the least diverse site had an important number of unique taxa (44% of the 32 taxa recorded at Glenariff were unique to the site and in the case of Portglenone Forest it was 38% of 60 taxa).

It must therefore be concluded that diversity alone must not be used as the single criterion for the conservation of the fungal flora but that consideration should also be given to the rarity of individual taxa. The comment of Rotheroe (1993) is still relevant – he noted that when designating SSSIs or when drawing up criteria for the conservation and management of sites "little or no mycological input" was made. It is perhaps not surprising that fungi, despite being one of the largest groups of organisms in Northern Ireland, are only given limited mention in the *Biodiversity Strategy Proposals* for Northern Ireland (Anon, 1999).

Acknowledgements

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References

Anon (1986) *Nature reserves in state forests*. Forest Service, Department of Agriculture (Northern Ireland), Belfast.

Anon (1999) *Northern Ireland biodiversity strategy: proposals, June 1999*. The Stationery Office Ltd, London.

Anon (no date) *National nature reserves in Northern Ireland*. Countryside and Wildlife Branch, Department of the Environment for Northern Ireland, Belfast.

Bataille, A. and Wilson, R. N. (1992) Association of seasonal temperatures with autumnal sporocarp counts in a plantation in Northern Ireland. Unpublished manuscript.

Bon, M. (1987) *The mushrooms and toadstools of Britain and North-western Europe*. Hodder and Stoughton, St Hellier, Jersey.

British Mycological Society (2002) *The Great Britain checklist of fungi*. (Web address:http://www.ukncc.co.uk/bmspages/GBCHKLST/gbspecies.asp. Viewed December 2002.)

Dennis, R. W. G., Orton, P. D. and Hora, F. B. (1960) *New check list of British agarics and boleti*. Cambridge University Press, London.

Emmett, E. E. (1992) British *Mycena* species – 1. *The Mycologist* **6**: 72-76.

Eveling, D. W., Wilson, R. N., Gillespie, E. S. and Bataille, A. (1990) Environmental effects on sporocarp counts over fourteen years in a forest area. *Mycological Research* **94**: 998-1002.

Giavelli, G., Rossi, O. and Sartore, F. (1986) Comparative evaluation of four species diversity indices related to two specific ecological situations. *Field Studies* **6**: 429-438.

Harron, J. and Rushton, B. S. (1986) *Flora of Lough Neagh. Irish Naturalists' Journal* Committee, Belfast and the University of Ulster, Coleraine.

Kent, M. and Coker, P. (1992) *Vegetation description and analysis*. J. Wiley and Sons, Chichester.

Lange, M. (1993) Macromycetes under twelve tree species in ten plantations on various soil types in Denmark. *Opera Bot.* **120**: 1-53.

Lange, M. and Hora, F. B. (1965) *Mushrooms and toadstools*. Collins, London.

Magurran, A. E. (1988) *Ecological diversity and its measurement*. Chapman and Hall, London.

McHugh, R., Mitchel, D., Wright, M. and Anderson, R. (2001) The fungi of Irish grasslands and their value for nature conservation. *Biology and Environment* **101B**: 225-242.

Moser, M. (1983) *Keys to agarics and boleti*. Roger Phillips, London.

Phillips, R. (1981) *Mushrooms and other fungi of Great Britain and Europe*. Pan Books Ltd, London.

Perini, C., Barluzzi, C. and De Dominicis, V. (1993) Fungal communities in Mediterranean and sub-Mediterranean woodlands. pp 77-92. *In* Pegler, D. N., Boddy, L., Ing, B. and Kirk, P. (eds) *Fungi of Europe: investigation, recording and mapping*. The Royal Botanic Gardens, Kew.

Rotheroe, M. (1993) The macrofungi of British sand dunes. pp 121-137. *In* Pegler, D N., Boddy, L., Ing, B. and Kirk, P. M. (eds) *Fungi of Europe: investigation, recording and mapping*. The Royal Botanic Gardens, Kew.

Rühling, Å. and Tyler, G. (1990) Soil factors influencing the distribution of macrofungi in oak forests of southern Sweden. *Holarctic Ecol.* **13**: 11-18.

Tyler, G. (1989) Edaphic distribution patterns of macrofungal species in deciduous forests of south Sweden. *Acta Oecol. Oec.-Gen.* **10**: 309-326.

Waite, S. (2000) *Statistical ecology in practice*. Prentice Education Ltd, Harlow.

TABLE 1. The estimated production of fungal sporocarps (total number of sporocarps per ha) and their percentage frequency in four deciduous woodlands (Movanagher Forest (oak), Reas Wood (mixed alder and willow), Portglenone Forest (beech), Glenariff (hazel)) in Northern Ireland. (Note: the number of actual sporocarps produced can be determined by dividing the Estimated total number of sporocarps per ha by 48.08.)

	Estimated total number of sporocarps per ha				**Percentage frequency**			
	Movanagher Forest	**Reas Wood**	**Portglenone Forest**	**Glenariff**	**Movanagher Forest**	**Reas Wood**	**Portglenone Forest**	**Glenariff**
BOLBITIACEAE								
Hebeloma crustuliniforme				192				1.92
Hebeloma pusillum		3990				38.40		
Naucoria sp.		1346	240			19.23	1.92	
Naucoria escharoides		192	192			5.77	17.31	
Naucoria subsconspersa		1779				24.96		

BOLETACEAE								
Leccinum holopus				48				1.92
CLAVARIACEAE								
Clavaria sp.			192				5.77	
Clavaria acuta	289	48		385	1.92	1.92		3.85
Clavaria fragilis			48				1.92	
Clavulinopsis laeticolor		96				1.92		
Macrotyphula fistulosa		192	48			5.77	1.92	
CLAVULINACEAE								
Clavulina sp.		5240				17.31		
Clavulina rugosa	2308				9.61			
COPRINACEAE								
Coprinus atramentarius		288				1.92		
Coprinus micaceus		3077				5.77		
Coprinus niveus			48				1.92	
Coprinus plicatilis		48				1.92		
Psathyrella sp.	2789		144		3.85		3.85	

Psathyrella candolleana		1490	192			11.54	3.85	
Psathyrella corrugis			96				3.85	
Psathyrella microrhiza			96				3.85	
CORTINARIACEAE								
Cortinarius sp.	8269	1106	577	337	61.54	19.23	15.38	7.69
Cortinarius acutus	1202				7.59			
Cortinarius decipiens	192		144		1.92		3.85	
Cortinarius hinnuleus	433				13.46			
Cortinarius saniosus	1202				9.61			
Crepidotus sp.			144				3.85	
Crepidotus epibryus	865	2211	337		5.77	7.59	3.85	
Crepidotus variabilis	240	2740	1539		3.85	17.31	3.85	
Galerina sp.	192	1250			1.92	23.08		
Galerina hypnorium		240				1.92		
Galerina rubiginosa		481				9.61		
Inocybe sp.	48	2115	577		1.92	17.31	13.38	
Inocybe cookei			48	48			1.92	1.92
Inocybe fuscidula			96				1.92	
Inocybe geophylla	433	13606			11.54	36.58		

Inocybe geophylla var. *lilacina*		385			9.61		
Inocybe griseolilacina		192			3.85		
Inocybe maculata				96			3.85
Inocybe petiginosa		481			5.77		
Inocybe praetervisa			289			3.85	
Inocybe rimosa			385			3.85	
Tubaria sp.		385	96		9.61	1.92	
Tubaria conspersa	48			1.92			
Tubaria dispersa	337			7.69			
DACRYMYCETACEAE							
Dacrymyces stillatus			96			3.85	
DIATRYPACEAE							
Diatrype disciformis	481			1442	1.92		5.77
ENTOLOMATACEAE							
Entoloma hirtipes		385			9.61		
Entoloma nidorosum		144			1.92		
Entoloma nitidum			96			1.92	

Entoloma rhodopolium		1971				3.84		
Entoloma sericellum		96		1154		3.85		9.61
Entoloma sericeonitidum		481				3.84		
Leptonia sp.		48				1.92		
Nolanea sp.		96	337			1.92	3.85	
EXIDIACEAE								
Exidia glandulosa	96	289			1.92	1.92		
Exidia thuretiana			865				9.61	
HELIOTIACEAE								
Ascocoryne sarcoides	144		144		1.92		1.92	
Bisporella citrina		817				7.69		
HELVELLACEAE								
Helvella atra	48	2308	529		1.92	23.08	7.69	
Helvella crispa	96				3.85			
Helvella elastica	48		625		1.92		5.77	
Helvella macropus	48	3654	769		1.92	25.00	5.77	

HYDNACEAE								
Hydnum rufescens				192			3.85	
HYDNANGIACEAE								
Laccaria amethystina			2981				15.38	
Laccaria laccata	2500	5673	1731		17.31	34.61	23.04	
HYMENOCHAETACEAE								
Inonotus radiatus		2644				5.77		
LEOTIACEAE								
Leotia lubrica	48		18942		1.92		50.00	
LYCOPERDACEAE								
Lycoperdon nigrescens			529				5.77	
Lycoperdon pyriforme				48				1.92
MARASMIACEAE								
Armillaria mellea	865	1587	240	48	5.77	3.85	1.92	1.92
Marasmiellus ramealis	2740				7.69			

Marasmius sp.	817	577	48		11.54	15.38	1.92	
Marasmius epiphyllus		817				19.23		
Marasmius graminum	962	48			1.92	1.92		
Marasmius rotula			385	192			5.77	3.85
Setulipes androsaceus		48	144			1.92	1.92	
PAXILLACEAE								
Paxillus involutus		144				1.92		
PEZIZACEAE								
Peziza sp.		96	48			3.85	1.92	
Peziza badia		144				1.92		
Peziza succosa		96				3.85		
PLUTEACEAE								
Amanita excelsa				96				3.85
Amanita vaginata				673				7.69
Pluteus sp.		96	289			1.92	1.92	
Pluteus cervinus	914	48			9.61	1.92		
Pluteus nanus				48				1.92

POLYPORACEAE								
Trametes sp.		144				1.92		
PYRONEMATACEAE								
Otidea alutacea	240				1.92			
RUSSULACEAE								
Lactarius sp.	48		481	48	1.92		5.77	1.92
Lactarius blennius			240				5.77	
Lactarius decipiens			48				1.92	
Lactarius glyciosmus		48				1.92		
Lactarius obscuratus		48				1.92		
Lactarius rufus				192				1.92
Lactarius subdulcis			96	144			1.92	1.92
Lactarius tabidus			96				3.85	
Lactarius uvidus				96				3.85
Lactarius vietus				192				1.92
Russula aurata				48				1.92
Russula cyanoxantha	48		96		1.92		3.85	

Russula delica				192				1.92
Russula ochroleuca			289				5.77	
Russula puellaris	48				1.92			
Russula xerampelina	144			96	3.85			1.92
STEREACEAE								
Stereum sp.	1202				3.85			
Stereum complicatum		481		1683		1.92		5.77
Stereum rugosum		240				3.85		
STROPHARIACEAE								
Hypholoma fasciculare	433		529	481	3.85		1.92	1.92
TRICHOLOMATACEAE								
Cystoderma amianthinum		48				1.92		
Gymnopus confluens			2212				13.46	
Gymnopus dryophilus	96		144		1.92		1.92	
Gymnopus peronatus			1106				11.54	
Hemimycena sp.	48	7212	47115	2740	1.92	80.64	90.38	46.15
Hemimycena lactea		289				9.61		

Micromarasmius sp.	529	1539	4519	4375	3.85	26.88	17.31	13.46
Micromycena sp.	48				1.92			
Mycena sp.	962	5481	2452	3558	23.08	48.08	44.23	40.38
Mycena alcalina	48	481			1.92	17.31		
Mycena arcangeliana	48				1.92			
Mycena capillaris	96	2067	3606		3.85	32.69	53.85	
Mycena epipterygia	240				3.85			
Mycena filopes				481				3.85
Mycena galericulata		48		144		1.92		3.85
Mycena haematopus	48	144			1.92	5.77		
Mycena hiemalis			48				1.92	
Mycena leptocephala		289				11.54		
Mycena pelianthina		48				1.92		
Mycena polygramma	48				1.92			
Mycena vitilis		48	144	96		1.92	5.77	3.85
Mycena vulgaris			48				1.92	
Pseudoclitocybe cyathiformis			96				3.85	
Rhodocollybia butyracea	337	240	2548		3.85	1.92	30.72	

TYPHULACEAE								
Pterula gracilis		3606				9.61		
Typhula phacorrhiza		288				1.92		
XYLARIACEAE								
Xylaria hypoxylon	1971	9087	53558	3942	17.31	21.15	53.85	15.38
Xylaria longipes	289				1.92			

(We have retained the species *Mycena alcalina* which "is the name many field Mycologists allocate to collections which are found in a caespitose group on coniferous substrates and characterised by dark colours and a smell of nitric acid or dilute household bleach" (Emmett, 1992). In the field we did not attempt to differentiate this species into either *M. stipata* or *M. silvae-nigrae*. For similar reasons the taxa *Micromarasmius* spp. and *Micromycena* spp. were recorded but not differentiated in the field.)

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TABLE 2. Various measures of diversity, evenness and dominance of the sporocarp production in four deciduous woodlands (Movanagher Forest (oak), Reas Wood (mixed alder and willow), Portglenone Forest (beech), Glenariff (hazel)) in Northern Ireland.

	Movanagher Forest	**Reas Wood**	**Portglenone Forest**	**Glenariff**
Total number of sporocarps produced	741	2021	3199	489
Total number of taxa	50	69	60	32
Measures of diversity				
Margalef's Index of Diversity	7.415	8.934	7.311	5.006
Menhinick's Index of Diversity	1.837	1.535	1.061	1.447
McIntosh's Index of Diversity (U)	218.3	473.2	1545.1	164.6
Simpson's Index of Diversity (1/D)	11.69	18.40	4.29	8.97
Berger-Parker's Index of Diversity (1/D)	4.308	7.141	2.872	5.374
Shannon's Index of Diversity (H)	3.006	3.326	2.041	2.545
The Q Statistic (Q)	10.21	12.51	16.74	8.39
Measures of eveness				
McIntosh's Index of Evenness	0.8216	0.8707	0.5936	0.8059
Shannon's Index of Evenness	-0.7684	-0.7856	-0.4986	-0.7343
Measure of dominance				
McIntosh's Index of Dominance	0.7323	0.7833	0.5263	0.6949

TABLE 3. Differences between the diversity (as measured by the Shannon Index of Diversity and tested using a modified t-test) of sporocarp production at four deciduous woodland sites (Movanagher Forest (oak), Reas Wood (mixed alder and willow), Portglenone Forest (beech), Glenariff (hazel)) in Northern Ireland.

Comparison	**t-value**	**Df**	**Probability**
Movanagher Forest and Reas Wood	6.422	1224	<0.001
Movanagher Forest and Portglenone Forest	18.666	1407	<0.001
Movanagher Forest and Glenariff	7.007	1107	<0.001
Reas Wood and Portglenone Forest	34.940	5176	<0.001
Reas Wood and Glenariff	14.238	742	<0.001
Portglenone Forest and Glenariff	8.911	835	<0.001

(Df = degrees of freedom)

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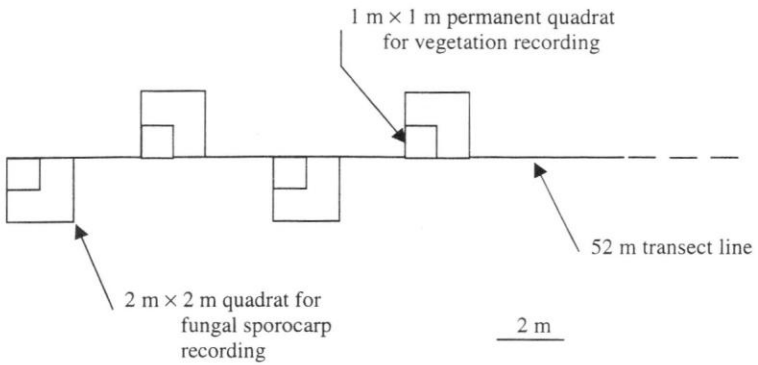
TABLE 4. Similarity (measured by two coefficients of similarity, Jaccard's coefficient and Sorenson's coefficient) between the sporocarp production at four deciduous woodland sites (Movanagher Forest (oak), Reas Wood (mixed alder and willow), Portglenone Forest (beech), Glenariff (hazel)) in Northern Ireland.

Comparison of sites	**Jaccard's Coefficient**	**Sorenson's Coefficient**
Movanagher Forest and Reas Wood	0.387	0.240
Movanagher Forest and Portglenone Forest	0.436	0.279
Movanagher Forest and Glenariff	0.268	0.155
Reas Wood and Portglenone Forest	0.388	0.240
Reas Wood and Glenariff	0.218	0.122
Portglenone Forest and Glenariff	0.261	0.150

FIGURE 1. Arrangement of quadrats used for sampling fungal sporocarps and vegetation along permanent transects in woodlands



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INSECT RECORDS FROM THE CONNEMARA (CO. GALWAY) AND MAYO (CO. MAYO) NATIONAL PARKS, WESTERN IRELAND

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Summary

Records of 304 insect species are provided for the Connemara National Park (Co. Galway, Ireland). Records of 131 insect species are provided for the Mayo National Park (Co. Mayo, Ireland). The two lists are briefly discussed. Comparison between them is confined to consideration of the Sciomyzidae and Syrphidae (Diptera), for which databased information is available. It is suggested that fewer species are recorded from the Mayo Park because of both the narrower range of habitats present and the area's recent management history. Scarcity of water bodies in both Parks is highlighted as a probable reason for the absence of many sciomyzid and syrphid species whose presence would be predicted in the habitats surveyed.

Introduction

The Connemara and Mayo National Parks are both low altitude areas covered largely by blanket bog that has been modified to various extents by human activity. Both are located in the west of Ireland and both are now being managed to maintain and enhance their floral, faunal and archaeological interest, while at the same time presenting these heritage elements to visitors. The Mayo National Park was established more recently (1998) than the Connemara National Park (1980), so its biota have had less time in which to respond to management aimed at their conservation.

Every species record from a site is a basic biogeographical datum potentially of use in various ways. In the case of a National Park, or other protected area, knowledge of the resource

to be managed is vital to the land manager and compilation of lists of the organisms present on a site is a necessary first step in that direction. But species lists are not, of themselves, interpretable. The scientific names of the species listed here for the Connemara and Mayo National Parks are just that, names. In a biogeographic context such issues as whether a list signals noticeable extensions to the known range of species, or occurrence of rarely recorded species, may be regarded as of interest. But knowing which species have such biogeographic interest can only help a land manager to orient management toward their protection if ecological data on the relevant species are also accessible.

There are scattered records of insects published for the areas now within these two National Parks, but little systematic survey data are available. To gather information on those components of the insect fauna susceptible to collection by interception traps, Malaise trap surveys were carried out in both Parks. The Connemara Park was surveyed in 1994, the Mayo Park in 1997. The present text lists some of the insects found. It does not represent a comprehensive listing of all the insects collected - the taxonomic groups covered reflect the taxonomic expertise of the author, rather than the range of material available. In the case of the Sciomyzidae and Syrphidae (Diptera), computerised autecological data are employed to identify habitats and parts of habitats that have the poorest representation of species, in comparison with the fauna expected to occur. Some consideration is then given to whether appropriate management might be expected to lead to improved representation of species.

Methods

Malaise traps were installed in pairs at various low-altitude locations within the Parks, chosen to reflect the range of habitats represented in them and to provide easy access for trap servicing. The trap locations were decided in discussion with Park personnel and the traps were installed with their long axis oriented N/S wherever possible, the south end of each trap (with its collecting bottle) being its highest point. Approximately 70% ethanol was used as

preservative in the Malaise trap sample bottles, which were replaced at approximately fortnightly intervals. In the Connemara Park, the trapping programme started 1 May and finished 7 September. In the Mayo Park trapping was from 1 June to 20 August. The habitat types observed where each Malaise trap was installed were also recorded, using the habitat categories defined in the StN database.

On removal from the Malaise traps sample bottles were capped, labelled, and stored to await sorting. Sorting was carried out in the laboratory, only those insects representative of certain taxonomic groups being sorted out and transferred to tubes containing 70% alcohol, to await determination. The rest of the collected material was retained in the sample bottles. Species belonging to the taxonomic groups selected for determination were sorted into tubes, with the exception of *Medetera* and *Thrypticus* species (Dolichopodidae: Diptera) and *Euura* and allied genera (Tenthredinidae: Hymenoptera), most of the species of which were judged too difficult to determine reliably.

Following determination, the sorted material was re-united with its parent sample, but in a small, capped, plastic tub containing 70% alcohol, that was inserted into the Malaise trap sample bottle. In this way, the determined material could be relocated, if necessary, without the need to resort the samples. The National Museum of Ireland has agreed to store the Malaise trap samples as reference data sets for the Parks.

In comparing the fauna of the two Parks, the Macrohabitats, Microhabitats and Range and Status files of the Syrph the Net (StN) database have been used (Speight *et al.*, 2003a, b; Speight and Castella, 2003). Since this database only covers European Syrphidae (Diptera) and equivalent databases are not available for other taxonomic groups, comparisons of habitat occupancy between the two Parks are thus largely confined to their syrphid faunas, although a limited investigation of the sciomyzids has also been carried out, based on databased Macrohabitat information.

Using the StN database, a first step is to associate the recorded species with the habitats

observed. This is achieved by using the Macrohabitat association data coded into the database, to produce a list of the recorded species predicted to occur with each of the habitats observed. These lists can then be compared with the lists of the species expected to occur in those habitats, basing prediction on the species available within various species pools of different geographical extent. In this instance the species in the county fauna (Co. Galway in the case of the Connemara Park, Co. Mayo in the case of the Mayo Park) expected to occur in each Park have been predicted, as have the Irish species in general and the species of the northern section of the Atlantic zone of Europe (Atlantic parts of Europe from Germany south to the River Loire). This comparison suggests whether the observed fauna of each habitat is well represented or under-represented. The fauna of a given habitat is taken to be well represented on a site if 75% or more of its expected species are observed on that site. Similarly, a fauna can be regarded as reasonably-represented if 50% or more of its expected species are present. Choice of the 75% and 50% levels is arbitrary, but provides for a standardised basis for comparison and evaluation of faunas.

A second step is to examine microhabitat occupancy levels in the habitats present, to establish whether apparently "under-performing" habitat components can be identified, through under-representation of their associated fauna. In this instance, micro-habitat occupancy levels have been examined for all habitats found in the vicinity of the sampling stations (i.e. Malaise trap emplacements), but with the habitats categorised into three broad groups: open ground, wetland and forest plus scrub. Since there are more than 80 microhabitat categories coded into the syrphid database, presentation of microhabitat occupancy levels for the Parks is confined to those micro-habitats that appear to be under-performing. In each case, a micro-habitat in a given habitat (or group of habitats) is taken to be potentially under-performing if its observed fauna represents less than 50% of the expected Galway species.

A more limited exercise has been carried out using the sciomyzids, or snail-killing flies, for which Macrohabitat association data have now been databased. Using the sciomyzid

Macrohabitat-association data with the list of habitats for the two Parks, lists of sciomyzids predicted to occur have been derived, based on the Irish and county species pools. The sciomyzids predicted to occur in association with water bodies (pools, streams, flushes) alone, within the Parks, have then been considered separately.

Results

The 353 species recorded are listed in Appendix 1. Of these, 304 are reported from the Connemara Park, but only 131 from the Mayo Park. It is possible to look more closely at these differences, firstly by considering the range of habitats observed and secondly by considering in more detail the species of syrphid associated with those habitats, using the StN database. There are 67 species of Syrphidae recorded here from the Connemara Park and 30 from the Mayo Park. Among the observed Connemara Park species, 60 would be predicted to occur there, on the basis of their known habitat associations, while 7 (i.e. 10% of the recorded species) would not. On the same basis, of the Mayo Park species, 2 (7%) would not be predicted to occur. These non-predicted species are as follows:-

Connemara National Park

Cheilosia longula, Eristalis tenax, Eupeodes corollae, Portevinia maculata, Rhingia campestris, Scaeva pyrastri, Volucella pellucens;

Mayo National Park

Eupeodes corollae, Xanthandrus comtus

The habitat categories recorded in the vicinity of the Malaise traps are listed in Appendix 2. From these lists it is clear that a wider range of habitats can be observed in the Connemara Park than in the Mayo Park. The numbers of syrphid species predicted for the two Parks, on the basis of the presence of these habitats, are shown in Tables 1 and 2. Tables 3 and 4 list microhabitats highlighted as potentially under-performing in biodiversity maintenance terms, again based on the syrphid data.

Tables 1 and 2 show that there is considerable variation between habitat categories, in the extent to which Park faunas are apparently "complete", when compared with the faunas for the same habitats in the larger geographic areas represented by county, Ireland and the northern section of the Atlantic zone. However, these Tables also show that the fauna of the Mayo Park habitats is consistently less diverse than might be expected, particularly in comparison with the fauna of the same habitats in Co. Mayo in general.

From Tables 3 and 4, it is noticeable that, in the Connemara Park, although microhabitat occupancy levels are at least reasonable, overall, there is a group of water-associated features, particularly in wetland habitats present (in this case blanket bog and cut-away blanket bog), that appear to be under-performing. In the Mayo Park (Table 4), by contrast, microhabitats in both open ground and wetland habitats are apparently generally under-performing, with most of the individual open ground microhabitats involved showing less than 25% of their expected fauna. In wetland habitats, under-performance by water-saturated sediments is highlighted.

Table 5 shows that the Mayo Park sciomyzid fauna is both predicted and observed to be less diverse than that of the Connemara Park. It also shows that, in both Parks, sciomyzids associated with water bodies make up half or more of the "missing" species, among those predicted to occur.

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TABLE 1. Numbers of species of Syrphidae (Diptera) associated with Connemara Park habitats, in species pools derived from nested areas of differing geographical extent i.e. the species list for the Connemara Park is a subset of the species list for Galway, which is itself a subset of the Irish list, which is likewise a subset of the list for the northern part of the Atlantic zone of Europe.

Abbreviations used: IRL = the island of Ireland; N Atlantic = the northern section of the Atlantic zone of Europe (i.e. Atlantic parts of Germany, Denmark, Netherlands, Belgium and France south to the River Loire, plus Britain and Ireland).

Connemara National Park	**No spp predicted for National Park based on different species pools**			
Habitat category observed	N Atlant	IRL	Galway	Nat Park list
forest and scrub habitat categories				
Betula saplings	8	8	8	4
Humid *Fagus* forest, mature	39	27	22	15
Ulex thickets	**4**	**4**	**4**	3
Alnus swamp woodland (gen.)	18	18	18	11
Salix swamp woodland (gen.)	35	29	25	16
Scattered *Salix*	**4**	**4**	**4**	4
Plantations (*Abies/Larix/Picea, Pinus*) with trackside ditches	48	38	**28**	21
open ground habitat categories				
Humid, oligotrophic, unimproved *Molinia* grassland with brooks	31	**31**	**29**	23
Moorland with brooks/rivers	26	**21**	**19**	17
wetland habitat categories				
Blanket bog with brooks/rivers and pools	**15**	**15**	**15**	10
Cutaway bog with brooks/rivers and pools	34	33	30	17

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TABLE 2. Numbers of species of Syrphidae (Diptera) associated with Mayo Park habitats, in species pools derived from nested areas of differing geographical extent (as in Table 1). Abbreviations used: as in Table 1.

Mayo National Park	**No spp predicted for National Park based on different species pools**			
Habitat category observed	N Atlant	IRL	Mayo	**Nat Pk list**
forest and scrub habitat categories				
Ulex thickets	**4**	**4**	**4**	3
Scattered *Salix*	4	4	4	2
Pinus plantation with tracks	23	21	12	6
open ground habitat categories				
Humid, oligotrophic, unimproved grassland with temporary pools	55	51	44	15
wetland habitat categories				
Blanket bog with brooks/rivers	13	13	12	7
Cutaway bog with brooks/rivers and pools	34	33	29	14

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TABLE 3. Numbers of species predicted and observed, and percent occupancy, for apparently under-performing microhabitats in Connemara Park habitats.

Connemara Park	Microhabitat occupancy level		
	predicted	observed	% occupancy
Forest microhabitats			
all	51	33	65
plant stems (hibernation)	3	1	33
Open ground microhabitats			
all	33	26	79
slow-moving water	4	1	25
Wetland microhabitats			
all	33	20	61
root-aphids (grass-root zone)	3	1	33
emergent aquatic plants	10	4	25
submerged, non-woody vegetable debris	11	5	46
oligotrophic water	15	6	40
eutrophic water	3	1	33
slow-moving water	5	2	40
standing water	16	7	44

TABLE 4. Numbers of syrphids predicted and observed, and percent occupancy, for apparently under-performing microhabitats in Mayo Park habitats.

Mayo Pk	Microhabitat occupancy level		
	predicted	observed	% occupancy
Forest microhabitats			
all	15	8	53
understorey trees	12	5	42
shrubs and bushes	13	6	46
Open ground microhabitats			
all	42	14	33
low shrubs	3	1	33
herb layer plants (in)	5	0	0
submerged sediment (inc all subcats)	18	4	22
water-saturated mud	11	1	9
water-saturated peat	11	2	18
oligotrophic water	15	4	27
mesotrophic water	17	4	24
eutrophic water	9	3	33
slow-moving water	8	1	13
standing water	19	4	21
Wetland microhabitats			
all	31	15	48
root aphids, grass-root zone	3	1	33
submerged sediment (inc all subcats)	12	4	33
water-saturated mud	6	1	17
water-saturated peat	7	2	29
oligotrophic water	14	5	36
mesotrophic water	7	3	43
slow-moving water	4	1	25
standing water	15	5	33

TABLE 5. Numbers of sciomyzid species predicted and observed, shown for all habitats and for water bodies (pools, streams, flushes) alone, in the Connemara and Mayo National Parks.

	Number of sciomyzid species		
	Irish spp	Galway spp	Observed
Connemara Nat. Pk			
Predicted for all Pk habitats	26	20	11
Predicted for Pk.water bodies	12	7	1
Mayo Nat. Pk.			
Predicted for all Pk habitats	20	15	5
Predicted for Pk.water bodies	7	6	1

Discussion

None of the species listed here are included on any list of organisms requiring protection at the international level. Most of the listed species belong to the insect Order Diptera and there are no species of Diptera named in the Habitats Directive, for example, as requiring protection at European level. Whatever their biogeographic status these organisms are, then, "second-class", in that National Agencies are under no direct obligation to protect them under the provisions of international legislation, other than through the more vague requirements of the Biodiversity Convention. This can mean that such species also become *de facto* second class organisms, since land managers, faced with meeting daunting and exacting management objectives defined by existing legislation, have little time and resources available for such "faceless" species. Further, merely knowing that a species has some particular biogeographical interest does not, in itself, help a land manager to protect that species. Yet, some of the species listed here, for these two National Parks, could be recognised as extremely localised in Ireland and others might be of international interest. Some of them were recorded for the first time in Ireland during this survey work, and have been published as such (see, for example, Speight, 1995, 1996). But there is little utility attached to highlighting the occurrence of the rare or probably threatened species, if insufficient can be said of them to provide a basis for their

protection. To provide such supporting data is, in any case, beyond the scope of the present text. The alternative is to attempt to gain an overview of the list, by considering its constituent species together. Unfortunately, this is not possible either, in any comprehensive fashion, since to carry out such an operation objectively requires the information on the species to be first databased in some way, so that they can all be subject to the same forms of scrutiny, and databased information is not available for the vast majority of the listed species. Only for the Sciomyzidae and Syrphidae can this sort of exercise be conducted at present. So consideration of biodiversity issues in this text is largely dependent upon an examination of the species belonging to these two fly families, and as such is confined to consideration of probably only 1% of the fauna of the Parks.

Some of the syrphids recorded from the Parks are not predicted to occur there, and have for that reason been excluded from consideration. Four of those species (*Eristalis tenax* (L.), *Eupeodes corollae* (Fabricius), *Scaeva pyrastri* (L.), *Xanthandrus comtus* (Harris)) are acknowledged migrants and their presence on the Park lists could well be due to their movement through the Parks from elsewhere. Another of them, *Rhingia campestris* Meigen, has larvae that develop in cow dung and is one of the most frequent and omnipresent syrphid species in the Irish landscape. Its occurrence in the Connemara Park is thus explicable in terms of its presence in farmland in the immediate vicinity of the Park. However, the two remaining, unpredicted species, *Cheilosia longula* (Zetterstedt) and *Portevinia maculata* (Fallén) may well be resident in the Connemara Park. *C. longula* would be predicted to occur in association with mature and overmature *Betula* woodland, though not with *Betula* swamp-woodland. The larvae of *P. maculata* feed in the corms of *Allium ursinum* L., a plant occurring in some abundance within the planted *Fagus* woodland within the Connemara Park, where this syrphid was observed. This fly would be expected in the vicinity of streams in acidophilous *Quercus* woodland, and its presence probably tells us something of the nature of the Connemara site

prior to installation of the beech trees there.

The greater range and number of habitats observed in the Connemara Park might be taken as adequate to explain the greater number of species recorded there than in the Mayo Park, during course of these surveys. But more detailed examination of species representation within those habitats, conducted via the StN database, suggests otherwise. In the absence of equivalent evaluation of other taxonomic groups it cannot be stated that findings derived from syrphids are "typical" for all invertebrate taxa. But, as the only analytical data available for invertebrates in this case, the results derived from interrogating the StN database deserve some attention. Essentially, the syrphid data show that the expected fauna of the habitats present in the Mayo Park is generally more poorly represented than is the fauna of the Connemara Park habitats. Further, this disparity is maximal in open ground habitats (in this area unimproved, oligotrophic, humid grassland). It might be expected that the Malaise traps in the Connemara Park would collect more species than those in the Mayo Park because they were in place for a longer period of time. But this would not explain the particular lack of grassland species. It is no secret that the area of the Mayo Park has long been subject to unregulated grazing by both cattle and sheep, a situation the Park management personnel are now making strenuous efforts to change. By contrast, grazing levels have been progressively brought under control in the Connemara Park, over the years since its establishment, such that they are now generally at sustainable levels more consistent with the National Park's conservation objectives. The difference here is that in the Connemara Park a much longer time has been available within which to tackle this problem. Could the poor fauna of the Mayo Park grassland be simply a reflection of chronic overgrazing? The total absence there of syrphids feeding on the tissues of herbaceous plants would suggest that the answer, at least in part, is yes. But can over-grazing explain the poor showing of aquatic and sub-aquatic syrphids associated with water bodies in either grassland or wetland, within the Mayo Park fauna? This may have more to do with how

you define blanket bog than with over-grazing. Botanical definitions of blanket bog (like the CORINE definition used in the StN database) incorporate no explicit mention of pools, streams, springs or flushes. Such features in this way become "optional extras" and, while much of the Mayo Park may be classified as blanket bog, permanent pools, springs and flushes were almost entirely absent from the parts of the Park surveyed. The same is true of the Connemara Park and the absence of such features has to be considered as a potentially significant contributory factor, in determining the limitations of the Park fauna. The predominance of species associated with water bodies, among the sciomyzids predicted to occur in both Parks, but unrecorded there, strengthens this interpretation.

If the present constitution of the Connemara Park syrphid fauna reflects the response of the Park grasslands to establishment of acceptable grazing levels there, a noticeable increase in representation of grassland species might be expected within the Mayo Park over the next period of years. But better representation of the expected species associated with water bodies in either Park would seem more dependent upon the creation of man-made pool systems, which would surely induce some response from the fauna. The general absence of low-altitude springs and flushes could not easily be addressed in this way and faunal elements associated only with such features would seem likely to remain poorly represented.

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References

Devillers, P., Devillers-Terschuern, J. and Ledant, J.-P. (1991) *Habitats of the European Community*. CORINE Biotopes Manual, Data specifications, Part 2. 300pp. Office for official publications of the European Communities, Luxembourg.

Fossitt, J. A. (2000) *A guide to habitats in Ireland*. 120pp. Heritage Council, Dublin.

Speight, M. C. D. (1995) *Nanna multisetosa*, *Scoliocentra confusa* and *S. dupliciseta* (Diptera: Scathophagidae, Heleomyzidae), insects new to Ireland from the Connemara National Park, Galway. *Ir. Nat. J.* **25**: 113-115.

Speight, M. C. D. (1996) *Aulogastromyia anisodactyla*, *Lyciella stylata* and *Sapromyza zetterstedti* (Diptera, Lauxaniidae), insects new to Ireland. *Ir. Nat. J.* **25**: 175-6.

Speight, M. C. D. and Castella, E. (2003) Range and Status data for European Syrphidae (Diptera), 2002. *In* Speight, M. C. D., Castella, E., Obrdlik, P. and Ball, S. (eds.) *Syrph the Net, the database of European Syrphidae*. **36.** 203pp. Syrph the Net publications, Dublin.

Speight, M. C. D., Castella, E. and Obrdlik, P. (2003a) Macrohabitat preferences of European Syrphidae (Diptera), 2002. *In* Speight, M. C. D., Castella, E., Obrdlik, P. and Ball, S. (eds) *Syrph the Net, the database of European Syrphidae*. **33**. 478pp. Syrph the Net publications, Dublin.

Speight, M. C. D., Castella, E. and Obrdlik, P. (2003b) Microsite features used by European Syrphidae (Diptera), 2002. *In* Speight, M. C. D., Castella, E., Obrdlik, P. and Ball, S. (eds) *Syrph the Net, the database of European Syrphidae*. **34**. 162pp. Syrph the Net publications, Dublin.

APPENDIX 1. Miscellaneous insect records from the Connemara and Mayo National Parks.

Species	National Park		
	Connemara	Mayo	
	L75	F80 Srahaduggaun	F9403 Glenamung
COLEOPTERA			
CANTHARIDAE			
Cantharis nigra (DeGeer, 1774)		1	
CARABIDAE			
Bembidion atrocoeruleum Stephens, 1828	1		
Bradycellus harpalinus (Audinet-Serville, 1821)	1	1	
Calathus fuscipes (Goeze, 1777)		1	
Dromius linearis (Olivier, 1795)	1		
Dromius meridionalis Dejean, 1825	1	1	
Leistus terminatus (Hellwig, 1793)	1		
Loricera pilicornis (Fabricius, 1775)	1		
Nebria salina Fairmaire & Laboulbene, 1854	1		
Notiophilus biguttatus (Fabricius, 1779)	1		
Pterostichus niger (Schaller, 1783)			1
Trechus rubens (Fabricius, 1792)	1		
CERAMBYCIDAE			
Rhagium bifasciatum Fabricius, 1775	1		1
Rhagium mordax (DeGeer, 1775)	1		
CHRYSOMELIDAE			
Galerucella tenella (L., 1761)	1		
Phratora laticollis (Suffrian, 1851)	1		
Phratora vulgatissima (L., 1758)		1	
Plateumaris discolor (Panzer, 1795)	1	1	
CICINDELLIDAE			
Cicindela campestris L., 1758			1
COCCINELLIDAE			
Adalia 2-punctata (L., 1758)	1		
Adalia 10-punctata (L., 1758)	1	1	
Anatis ocellata (L., 1758)		1	

Calvia 14-guttata (L., 1758)	1			
Coccinella 7-punctata L., 1758	1			
Halzia 16-guttata (L., 1758)	1			
CURCULIONIDAE				
Hylobius abietis (L., 1758)				1
Mesites tardii (Curtis, 1825)	1			
Otiorrhynchua sulcatus (Fabricius, 1775)	1			
DASCILLIDAE				
Dascillus cervinus (L., 1758)	1			
ELATERIDAE				
Actenicerus sjaelandicus (Muller, 1764)	1	1		
Aplotarsus incanus (Gyllenhal, 1827)	1	1	1	
Athous haemorrhoidalis (Fabricius, 1801)	1	1	1	
Ctenicera cuprea (Fabricius, 1775)	1	1		
Dalopius marginatus (L., 1758)	1	1		
Hemicrepidius hirtus (Herbst, 1784)	1			
LEIODIDAE				
Anisotoma humeralis (Fabricius, 1792)	1			
SALPINGIDAE				
Salpingus planirostris (Fabricius, 1787)	1			
Salpingus ruficollis (L., 1761)	1			
SCARABAEIDAE				
Serica brunnea (L., 1758)	1			
SILPHIDAE				
Necrodes littoralis (L., 1758)	1			
Nicrophorus humator (Gleditsch, 1767)	1			
Phosphuga atrata L., 1758	1			
DERMAPTERA				
FORFICULIDAE				
Forficula auricularia L., 1758	1			
DIPTERA				
CLUSIIDAE				
Clusia flava (Meigen, 1830)	1			
Clusiodes albimanus (Meigen, 1830)	1			
Clusiodes caledonicus (Collin, 1912)		1		
Clusiodes gentilis (Collin, 1912)	1			
Clusiodes verticalis (Collin, 1912)	1			
COELOPIDAE				

Coelopa frigida (Fabricius, 1805)		1	
CONOPIDAE			
Myopa buccata (L., 1758)	1		
DOLICHOPODIDAE			
Anepsiomyia flaviventris (Meigen, 1824)	1		1
Argyra diaphana (Fabricius, 1775)	1		
Argyra elongata (Zetterstedt, 1843)	1	1	
Argyra leucocephala (Meigen, 1824)	1		
Argyra perplexa Becker, 1918	1		
Campsicnemus alpinus (Haliday, 1833)			1
Campsicnemus compeditus Loew, 1857	1	1	
Campsicnemus curvipes (Fallen, 1823)	1		
Campsicnemus loripes (Haliday, 1832)	1	1	1
Campsicnemus scambus (Fallen, 1823)	1		1
Chrysotus gramineus (Fallen, 1823)	1	1	
Dolichopus atratus Meigen, 1824	1	1	
Dolichopus atripes Meigen, 1824			1
Dolichopus discifer Stannius, 1831			1
Dolichopus lepidus Staeger, 1842	1	1	
Dolichopus nigricornis Meigen, 1824	1	1	
Dolichopus pennatus Meigen, 1824	1		
Dolichopus phaeopus Haliday in Walker, 1851	1		
Dolichopus plumipes (Scopoli, 1763)	1	1	
Dolichopus popularis Wiedemann, 1817	1		
Dolichopus rupestris Haliday, 1833		1	
Dolichopus simplex Meigen, 1824	1	1	
Dolichopus ungulatus (L., 1758)	1		
Dolichopus urbanus Meigen, 1824	1	1	1
Dolichopus vitripennis Meigen, 1824	1	1	
Dolichopus wahlbergi Zetterstedt, 1843		1	
Hercostomus aerosus (Fallen, 1823)	1		
Hercostomus cupreus (Fallen, 1823)	1	1	
Hercostomus germanus (Wiedemann, 1817)	1		
Hercostomus nigripennis (Fallen, 1823)	1		1
Hydrophorus nebulosus Fallen, 1823	1	1	1
Hypophyllus discipes (Germar, 1817)	1		
Hypophyllus obscurellus (Fallen, 1823)	1		
Liancalus virens (Scopoli, 1763)	1		

Rhaphium crassipes (Meigen, 1824)	1		
Rhaphium fasciatum Meigen, 1824	1		
Rhaphium fascipes (Meigen, 1824)			1
Rhaphium longicorne (Fallen, 1823)	1	1	1
Rhaphium macrocerum Meigen, 1824	1		
Rhaphium riparium (Meigen, 1824)	1	1	
Rhaphium zetterstedti (Parent), 1925	1		
Sciapus platypterus (Fabricius, 1805)	1		
Sympycnus cirrhipes (Haliday in Walker, 1851)	1	1	1
Sympycnus pulicarius (Fallen, 1823)	1	1	
Syntormon pallipes (Fabricius, 1794)	1	1	
Syntormon tarsatus (Fallen, 1823)	1		
Syntormon zelleri (Loew, 1850)	1		
DROSOPHILIDAE			
Drosophila phalerata Meigen, 1830	1		
Drosophila transversa Fallen, 1823	1		
Stegana similis Lastovka & Maca, 1982	1		
DRYOMYZIDAE			
Neuroctena anilis (Fallen), 1820	1	1	
HELCOMYZIDAE			
Heterocheila buccata (Fallen, 1820)	1		
Malacomyia sciomyzina (Haliday, 1833)		1	
HELEOMYZIDAE			
Heleomyza serrata (L., 1758)		1	
Heteromyza rotundicornis (Zetterstedt, 1846)	1		
Scoliocentra confusa (Wahlgren, 1918)	1		
Scoliocentra dupliciseta (Strobl, 1894)	1		
Scoliocentra villosa (Meigen, 1830)	1		
Suillia atricornis (Meigen, 1830)	1		
Suillia bicolor (Zetterstedt, 1838)	1	1	
Suillia humilis (Meigen, 1830)	1		
Suillia mikii (Pokorny, 1886)	1		
Suillia notata (Meigen, 1830)	1		
Suillia parva (Loew, 1862)	1		
Suillia variegata (Loew, 1862)	1	1	
Tephrochlamys rufiventris (Meigen, 1830)		1	
HIPPOBOSCIDAE			
Ornithomya chloropus (Bergroth, 1901)	1	1	

LAUXANIIDAE			
Lyciella decipiens (Loew, 1847)	1		
Lyciella pallidiventris (Fallen, 1820)	1		
Lyciella platycephala (Loew, 1847)	1		
Lyciella stylata Papp, 1978	1		
Lyciella subfasciata (Zetterstedt, 1838)	1		
Lyciella vittata (Walker, 1849)	1		
Minettia lupulina (Fabricius, 1787)	1		
Peplomyza litura (Meigen, 1826)	1		
Sapromyza albiceps Fallen, 1820	1		
Sapromyza sordida Haliday, 1833	1		
Sapromyza zetterstedti Hendel, 1908	1	1	1
Tricholauxania praeusta (Fallen, 1820)	1		
LONCHAEIDAE			
Lonchaea patens Collin, 1953	1		
MICROPEZIDAE			
Calobata petronella (L., 1761)	1		
Compsobata cibaria (L., 1761)	1		
ORYGMATIDAE			
Orygma luctuosa Meigen, 1830	1		
OPETIIDAE			
Opetia nigra Meigen, 1830	1		
OPOMYZIDAE			
Geomyza balachowskyi Mesnil, 1934	1		
Geomyza majuscula (Loew, 1864)	1		
Geomyza tripunctata Fallen, 1823	1		
Opomyza germinationis (L., 1758)	1	1	
Opomyza petrei Mesnil, 1934	1		
OTITIDAE			
Herina frondescentiae (L., 1758)	1	1	
PALLOPTERIDAE			
Palloptera muliebris (Harris, 1780)	1		
Palloptera 5-maculata (Macquart, 1835)	1		
Palloptera scutellata (Macquart, 1835)	1		
Palloptera umbellatarum (Fabricius, 1775)	1		
Palloptera ustulata Fallen, 1820	1		
PIOPHILIDAE			
Liopiophila varipes (Meigen, 1830)	1		

PIPUNCULIDAE			
Dorylomorpha maculata (Walker, 1834)	1		
PSILIDAE			
Loxocera albiseta (Schrank, 1803)	1		
Loxocera aristata (Panzer, 1801)	1		1
Psila atra (Meigen, 1826)	1		
PTYCHOPTERIDAE			
Ptychoptera albimana (Fabricius, 1787)	1		
RHAGIONIDAE			
Chrysopilus auratus (Fabricius, 1805)	1		
Rhagio lineola Fabricius, 1794	1	1	
Rhagio scolopaceus (L., 1758)	1	1	
SCATHOPHAGIDAE			
Ceratinostoma ostiorum (Haliday in Curtis, 1832)		1	
Cordilura albipes (Fallen, 1819)	1		
Cordilura pubera (L., 1758)	1		
Delina nigrita (Fallen, 1819)	1		
Gymnomera tarsea (Fallen, 1819)	1	1	
Leptopa filiformis Zetterstedt, 1838	1		
Nanna fasciata (Meigen, 1826)	1		
Nanna multisetosum (Hackman, 1956)	1		
Norellia spinimana (Fallen, 1819)	1	1	
Parallelomma vittata (Meigen, 1826)	1		
Pogonota barbata (Zetterstedt, 1838)	1		
Scathophaga furcata (Say, 1823)	1	1	
Scathophaga stercoraria (L., 1758)	1	1	
Scathophaga suilla (Fabricius, 1794)	1	1	
SCIOMYZIDAE			
Hydromya dorsalis (Fabricius, 1775)	1		
Ilione albiseta (Scopoli, 1763)		1	
Limnia paludicola Elberg, 1965	1	1	
Pherbellia dubia (Fallen, 1820)	1		
Pherbellia scutellaris (von Roser, 1840)	1		
Pherbellia ventralis (Fallen, 1820)	1		
Pteromicra angustipennis (Staeger, 1845)	1		1
Pteromicra pectorosa (Hendel, 1902)	1		
Renocera pallida (Fallen, 1820)	1		
Tetanocera elata (Fabricius, 1781)			1

Tetanocera ferruginea Fallen, 1820	1		
Tetanocera fuscinervis (Zetterstedt, 1838)	1		
Tetanocera hyalipennis von Roser, 1840	1		
Trypetoptera punctulata (Scopoli, 1763)			1
STRATIOMYIIDAE			
Beris chalybata (Forster, 1771)	1		
Beris fuscipes Meigen, 1820	1		1
Beris geniculata Curtis, 1830	1		
Beris vallata (Forster, 1771)	1	1	1
Microchrysa flavicornis (Meigen, 1822)	1	1	
Sargus flavipes Meigen, 1822	1		
Sargus iridatus (Scopoli, 1763)	1		
SYRPHIDAE			
Anasimyia lineata (Fabricius, 1787)		1	
Anasimyia lunulata (Meigen, 1822)		1	
Baccha elongata (Fabricius, 1775)	1		
Brachypalpoides lentus (Meigen, 1822)	1		
Cheilosia albitarsis (Meigen, 1822)	1		
Cheilosia illustrata (Harris, 1780)	1		
Cheilosia longula (Zetterstedt, 1838)	1		
Chrysotoxum bicinctum (L., 1758)	1	1	
Criorhina berberina (Fabricius, 1805)	1		
Epistrophe eligans (Harris, 1780)	1		
Episyrphus balteatus (DeGeer, 1776)	1	1	1
Eristalis arbustorum (L., 1758)	1		
Eristalis interrupta (Poda, 1761)	1		
Eristalis intricaria (L., 1758)	1	1	
Eristalis lineata (Harris, 1776)	1		
Eristalis pertinax (Scopoli, 1763)	1		
Eristalis tenax (L., 1758)	1		
Eupeodes bucculatus (Rondani, 1857)	1		
Eupeodes corollae (Fabricius, 1794)	1	1	
Ferdinandea cuprea (Scopoli, 1763)	1		
Helophilus pendulus (L., 1758)	1	1	1
Leucozona lucorum (L., 1758)	1		
Melangyna arctica (Zetterstedt, 1838)	1		
Melangyna lasiophtalma (Zetterstedt, 1843)	1	1	1
Melanogaster hirtella (Loew, 1843)	1		

Melanostoma mellinum (L., 1758)	1	1	1
Melanostoma scalare (Fabricius, 1794)	1	1	1
Meliscaeva auricollis (Meigen, 1822)	1	1	
Meliscaeva cinctella (Zetterstedt, 1843)	1	1	1
Microdon myrmicae Schonrogge *et al*, 2002	1		
Neoascia geniculata (Meigen, 1822)	1		
Neoascia podagrica (Fabricius, 1775)	1		1
Neoascia tenur (Harris, 1780)	1	1	
Parasyrphus malinellus (Collin, 1952)	1		
Pipizella viduata (L., 1758)	1		
Platycheirus albimanus (Fabricius, 1781)	1	1	1
Platycheirus amplus Curran, 1927	1		
Platycheirus angustatus (Zetterstedt, 1843)	1	1	1
Platycheirus clypeatus (Meigen, 1822)	1	1	1
Platycheirus granditarsus (Forster, 1771)	1		
Platycheirus manicatus (Meigen, 1822)	1		
Platycheirus nielseni Vockeroth, 1990	1	1	1
Platycheirus occultus Goeldlin, Maibach & Speight, 1990	1	1	
Platycheirus peltatus (Meigen, 1822)	1		
Platycheirus podogratus (Zetterstedt, 1838)	1		
Platycheirus ramsarensis Goeldlin, Maibach & Speight, 1990	1	1	1
Platycheirus rosarum (Fabricius, 1787)	1		
Platycheirus scutatus (Meigen, 1822)	1	1	1
Portevinia maculata (Fallen, 1817)	1		
Rhingia campestris Meigen, 1822	1		
Riponnensia splendens (Meigen, 1822)	1		
Scaeva pyrastri (L., 1758)	1		
Sericomyia lappona (L., 1758)	1		1
Sericomyia silentis (Harris, 1776)	1	1	1
Sphaerophoria fatarum Goeldlin, 1989	1	1	
Sphaerophoria interrupta (Fabricius, 1805)	1		
Sphaerophoria philantha (Meigen, 1822)	1		1
Sphegina clunipes (Fallen, 1816)	1		
Sphegina elegans Schummel, 1843	1		
Syritta pipiens (L., 1758)	1		
Syrphus ribesii (L., 1758)	1		

Syrphus torvus Osten-Sacken, 1875	1	1	
Syrphus vitripennis Meigen, 1822	1		
Trichopsomyia flavitarsis (Meigen, 1822)	1	1	
Volucella bombylans (L., 1758)	1	1	1
Volucella pellucens (L., 1758)	1		
Xanthandrus comtus (Harris, 1780)		1	
Xylota jakutorum Bagatshanova, 1980	1		
Xylota segnis (L., 1758)	1	1	
Xylota sylvarum (L., 1758)	1		
TABANIDAE			
Chrysops relictus Meigen, 1820		1	
Haematopota crassicornis Wahlberg, 1848	1	1	1
Haematopota pluvialis (L., 1758)	1		1
Hybomitra montana (Meigen, 1820)	1	1	1
TEPHRITIDAE			
Xyphosia miliaria (Schrank, 1781)	1	1	
TIPULIDAE			
Dictenidea bimaculata (L., 1761)	1		
Tanyptera atrata (L., 1758)	1		
HEMIPTERA			
PENTATOMIDAE			
Pentatoma rufipes (L., 1758)	1		
HYMENOPTERA			
ARGIIDAE			
Arge gracilicornis (Klug, 1814)	1		
CIMBICIDAE			
Abia candens Konow, 1887	1		
CRABRONIDAE			
Crossocerus 4-maculatus (Fabricius, 1793)	1		
FORMICIDAE			
Myrmica rubra (L., 1758)	1		
Myrmica ruginodis Nylander, 1846	1		
Myrmica scabrinodis Nylander, 1846	1		
SPHECIDAE			
Mellinus arvensis (L., 1758)	1		1
TENTHREDINIDAE			
Aglaostigma aucupariae (Klug, 1817)	1		
Allantus calceatus (Klug, 1818)	1	1	

Ametastegia carpini (Hartig, 1837)	1		
Ametastegia equiseti (Fallen, 1808)	1		1
Ametastegia pallipes (Spinola, 1808)	1	1	
Aneugmenus temporalis (Thomson, 1871)	1		
Athalia cordata Lepeletier, 1823	1	1	
Athalia lugens (Klug, 1815)		1	
Cladius pectinicornis (Geoffroy, 1785)	1		
Claremontia confusa (Konow, 1886)	1		
Claremontia tenuicornis (Klug, 1816)	1		
Dolerus aeneus Hartig, 1837	1	1	1
Dolerus niger (L., 1767)	1	1	
Dolerus planatus, Hartig, 1837	1		
Empria excisa (Thomson, 1871)	1		
Empria klugii (Stephens, 1835)	1		
Empria tridens (Konow, 1885)	1		
Eutomostethus luteiventris (Klug, 1816)	1		
Euura mucronata (Hartig, 1840)	1		
Heptamelus ochroleucus (Stephens, 1835)	1		
Hoplocampa pectoralis Thomson, 1871		1	
Monophadnus pallescens (Gmelin in L., 1790)		1	
Monosoma pulveratum (Retzius in DeGeer, 1783)	1		
Nematus brevivalvis Thomson, 1871	1		
Nematus flavescens Stephens, 1835	1		
Nematus frenalis Thomson, 1888	1		
Nematus melanaspis Hartig, 1840	1		
Nematus oligospilus Foerster, 1854	1		
Nematus viridis Stephens, 1835	1		
Nesoselandria morio (Fabricius, 1781)			1
Pachynematus clitellatus (Lepeletier, 1823)	1	1	1
Pachynematus extensicornis (Norton, 1861)	1		
Pachynematus kirbyi (Dahlbom, 1835)	1		
Pachynematus obductus (Hartig, 1837)	1		
Pachynematus vagus (Fabricius, 1781)	1		
Pachyprotasis rapae (L., 1767)	1		
Pristiphora atlantica, Lacourt, 1987	1		
Pristiphora aphantoneura (Foerster, 1854)	1		
Pristiphora cincta Newman, 1837		1	
Pristiphora pallidiventris (Fallen, 1808)	1	1	

Pristiphora punctifrons (Thomson, 1871)	1		
Rhogogaster viridis (L., 1758)	1		
Strombocerina delicatula (Fallen, 1808)	1		
Tenthredo atra L., 1758	1		
Tenthredo livida L., 1758	1		
Tenthredopsis coquebertii (Klug, 1817)	1	1	
Tenthredopsis nassata (L., 1767)	1	1	
NEUROPTERA			
CHRYSOPIDAE			
Chrysoperla carnea (Stephens, 1836)	1		
Cinctochrysa albolineata (Killington, 1935)	1		
Nineta flava (Scopoli, 1763)	1		
Nineta vittata (Wesmael, 1841)	1		
HEMEROBIIDAE			
Hemerobius humulinus L., 1761	1		
Hemerobius lutescens Fabricius, 1793	1		
Hemerobius marginatus Stephens, 1836	1		
Hemerobius nitidulus Fabricius, 1777	1		
Hemerobius simulans Walker, 1853	1		
Hemerobius stigma Stephens, 1836	1		1
Micromus variegatus (Fabricius, 1793)	1		
Nesomicromus paganus (L., 1767)		1	
Wesmaelius betulinus Strom, 1788	1		
Wesmaelius subnebulosus (Stephens, 1836)	1		
SIALIDAE			
Sialis lutaria (L., 1758)		1	
ODONATA			
COENAGRIIDAE			
Pyrrhosoma nymphula (Sulzer, 1776)	1	1	
LESTIDAE			
Lestes sponsa (Hansemann, 1823)		1	
ORTHOPTERA			
ACRIDIDAE			
Myrmelleotettix maculatus (Thunberg, 1815)		1	
Omocestus viridulus (L., 1758)			1

APPENDIX 2. Habitats recorded at the Malaise trap installations.

The habitat definitions used below are from Speight *et al.* (2003a), which follows, where possible, the CORINE system (Devillers *et al.*, 1991). Corresponding categories in Fossitt (2000), where these exist, are given in brackets following the definitions.

Connemara National Park

Forest and scrub habitat categories

Betula saplings: CORINE 41.B: BIRCH WOODS; Formations dominated by *Betula pendula*, *B. pubescens*, or their allies, on non-marshy terrain (WN1: oak/birch/holly woodland; WS2: immature woodland).

Humid *Fagus* forest, mature: CORINE 41.11, 41.12, 41.13, 41.15, except 41.122: Forests dominated by *Fagus sylvatica* (WD1: mixed broadleaved woodland).

Ulex thickets: CORINE 31.85: GORSE THICKETS; *Ulex europaeus* thickets of the Atlantic domain (WS1: scrub).

Alnus swamp woodland (gen.): CORINE 44.91: ALDER SWAMP WOODS; *Carici elongatae-Alnetum* (*Irido-Alnenion*); mesotrophic and meso-eutrophic *Alnus glutinosa* swamp woods of marshy depressions (WN6: wet willow-alder-ash woodland).

Salix swamp woodland (gen.): small-willow (*Salix* spp.) dominated wet woodlands of lake edges and seepages/springs on river or brook floodplains (WN5: riparian woodland; WN6: wet willow-ash-alder woodland)).

Scattered *Salix*: individual mature or overmature trees of *Salix* spp, isolated from one another, or occurring only in scattered clumps or lines, or as occasional outstanding trees in hedgerows (WD5: scattered trees and parkland).

Plantations (*Abies/Larix/Picea*, *Pinus*) with trackside ditches: CORINE 83.3111: EUROPEAN FIR, SPRUCE, LARCH PLANTATIONS; CORINE83.3112: EUROPEAN PINE PLANTATIONS *plus* tracksides carrying a grassy herb layer vegetation which cannot survive under closed canopy conditions, with or without some shrub vegetation (e.g. *Rubus fruticosus*, *Prunus spinosus, Corylus*) and often with patches of bare ground *plus* intermittently-flooded, man-made drainage channels (WD4: conifer plantations).

Open ground habitat categories

Humid, oligotrophic, unimproved *Molinia* grassland with brooks: CORINE 51.2: nutrient-poor purple moorgrass (*Molinia coerulea*) grassland, developed on peat *plus* small, permanently running, freshwater bodies with a channel sufficiently narrow that the marginal bushes or herb layer vegetation can form a closed canopy above the water (both natural brooks and permanently flowing drainage ditches are included).

Moorland with brooks/rivers: wet heathland: CORINE 31.1, 31.211, 31.212, 31.45 *plus* small, permanently running, freshwater bodies with a channel sufficiently narrow that the marginal bushes or herb layer vegetation can form a closed canopy above the water (both natural brooks and permanently flowing drainage ditches are included) (HH3: wet heath/HH4: montane heath).

Wetland habitat categories

Blanket bog with brooks/rivers and pools: CORINE 52.1:lowland blanket bogs *plus* rivers and

small, permanently running, freshwater bodies with a channel sufficiently narrow that the marginal bushes or herb layer vegetation can form a closed canopy above the water (both natural brooks and permanently flowing drainage ditches are included) *plus* small, permanently-flooded, standing-water bodies (PB3: lowland blanket bog *plus* FW1: eroding/upland rivers).

Cutaway bog with brooks/rivers and pools: areas of blanket bog which have been exploited for peat-cutting in the past, leaving an uneven and lowered land surface incorporating pools, regenerating bog and (usually) patches of birch/willow (*Betula/Salix*) scrub *plus* rivers and small, permanently running, freshwater bodies with a channel sufficiently narrow that the marginal bushes or herb layer vegetation can form a closed canopy above the water (both natural brooks and permanently flowing drainage ditches are included) *plus* small, permanently-flooded, standing-water bodies.

Mayo National Park

Forest and scrub habitat categories

Ulex thickets: CORINE 31.85: GORSE THICKETS; *Ulex europaeus* thickets of the Atlantic domain (WS1: scrub).

Scattered *Salix*: individual mature or overmature trees of *Salix* spp, isolated from one another, or occurring only in scattered clumps or lines, or as occasional outstanding trees in hedgerows (WD5: scattered trees and parkland).

Pinus plantation with tracks: CORINE83.3112: EUROPEAN PINE PLANTATIONS *plus* tracksides carrying a grassy herb layer vegetation which cannot survive under closed canopy conditions, with or without some shrub vegetation (e.g. *Rubus fruticosus*, *Prunus spinosus*,

Corylus) and often with patches of bare ground (WD4: conifer plantations).

Open ground habitat categories

Humid, oligotrophic, unimproved grassland with temporary pools: CORINE 37.22, 37.32: humid/flooded, unimproved grassland: oligotrophic, seasonally-flooded, grassland with Cyperaceae and/or Juncaceae *plus* small, temporary water bodies of natural origin and their basins, flooded by river overflow, fluctuation in ground-water level, and/or rain or snow melt, considered both when containing water and when not (G54: wet grassland).

Wetland habitat categories

Blanket bog with brooks/rivers: CORINE 52.1:lowland blanket bogs *plus* rivers and small, permanently running, freshwater bodies with a channel sufficiently narrow that the marginal bushes or herb layer vegetation can form a closed canopy above the water (both natural brooks and permanently flowing drainage ditches are included).

Cutaway bog with brooks/rivers and pools: areas of blanket bog which have been exploited for peat-cutting in the past, leaving an uneven and lowered land surface incorporating pools, regenerating bog and (usually) patches of birch/willow (*Betula/Salix*) scrub *plus* rivers and small, permanently running, freshwater bodies with a channel sufficiently narrow that the marginal bushes or herb layer vegetation can form a closed canopy above the water (both natural brooks and permanently flowing drainage ditches are included) *plus* small, permanently-flooded, standing-water bodies.

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KALIOFENUSA PUSILLA (SERVILLE, 1823) (HYMENOPTERA: TENTHREDINIDAE), SPECIES OF LEAF-MINING SAWFLY NEW TO IRELAND

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Whilst on a visit to Dublin, I collected four females of a fenusine sawfly off a Wych Elm (*Ulmus glabra* Hudson) sapling next to the south side boundary fence of St Stephen's Green, near the city centre (O1633). Two individuals were collected in the afternoon of 26 April 2004 in sunny weather. These insects were active on the upper surface of the young leaves, with which they were making contact with their cerci and apices of their abdomens. Two more specimens were collected resting in the middle of the upper surface of very new leaves early the next morning.

Benson (1952) treated the genus *Kaliofenusa* Viereck as a single species *Fenusa ulmi* Sundevall. This was subsequently split into three European species under *Kaliofenusa* by Liston (1993). Two of these, *Kaliofenusa ulmi* (Sundevall) and *K. carpinifoliae* Liston, currently considered to be junior synonyms of *K. pusilla* (Serville) (Sheppard, in prep.), are known from England and Scotland. However, no representative of the genus has been previously recorded from Ireland (O'Connor *et al.,* 1997; Liston, 1995).

All of the four Dublin specimens key out to *Kaliofenusa ulmi* (Sundevall) in Liston (1993), although a number of characters typical of *K. carpinifoliae* are also apparent. These include:- less extensive surface sculpture on the face and front lobes of the mesonotum, a more rounded sawsheath in lateral view, and brown colouration of the middle and hind tibiae and tarsi. These discrepancies are perhaps unsurprising, and are consistent with the recent synonymy of these species under *K. pusilla.*

Benson (*op. cit.*) describes *Fenusa ulmi* as common in Britain, but this was before the decline of *Ulmus* due to Dutch elm disease. This decline is noted as a probable cause of the extinction of *K. ulmi* in many lowland areas of Europe (Liston, 1993). It is possible that the Dublin population could well originate from an accidental introduction. O'Connor *et al.* (*op. cit.*) states that *Ulmus* may have been re-introduced to Ireland following its extinction in historic times, and for this reason perhaps neither this, or the two other *Ulmus* feeding species of sawfly *Priophorus rufipes* Lepeletier and *Trichiocampus ulmi* (L.) known from Ireland should be considered truly native.

Two ♀♀ are deposited in the collection of the National Museum of Ireland and two ♀♀ in the collection of the Liverpool Museum.

Acknowledgement

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References

Benson, R. B. (1952) Hymenoptera 2. Symphyta. Section (b). *Handbk Ident. Br. Insects* **(2b).**

Liston, A. D. (1993) Taxonomy and host associations of west Palaearctic *Kaliofenusa* Viereck: leaf-mining sawflies on *Ulmus* (Hymenoptera: Tenthredinidae). *Entomologist's Gaz.* **44**: 45-54.

Liston, A. D. (1995) *Compendium of European sawflies. List of species, modern nomenclature, distribution, foodplants, identification literature*. Chalastos Forestry, Daibersdorf.

O'Connor, J. P., Liston, A. D. and Speight, M. C. D. (1997) A review of the Irish sawflies (Hymenoptera: Symphyta) including a checklist of species. *Bull. Ir. biogeog. Soc.* **20**: 2-99.

Sheppard, D. (in prep.) Introduction to the sawlies. Unpublished manuscript.

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MANAGEMENT OF IRISH OCEANIC BLANKET BOG AND ITS EFFECT ON GROUND BEETLES: IMPLICATIONS FOR THE CONSERVATION OF THE THREATENED *CARABUS CLATHRATUS* L. (COLEOPTERA: CARABIDAE)

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Abstract

Irish oceanic blanket bog is a habitat of both European and global conservation importance. Widescale destruction of this habitat due to erosion, peat harvesting, forestry and drainage for

agriculture has resulted in considerable declines in the distribution and quality of this ecosystem over the last century. This study looks at how ground beetles (Coleoptera: Carabidae) of blanket bogs on the Beara Peninsula, West-Cork, respond to the management practices of traditional peat cutting by hand and grazing by cattle. The effects of the floral communities of the bogs are also considered, in particular the importance of vegetation structure. The effects of these management practices are considered in detail for the threatened wetland ground beetle *Carabus clathratus*. Overall abundance of ground beetles was negatively correlated with the depth to which the peat was cut. The study determined that traditional peat cutting and cattle grazing, the percentage cover of two grass species and the architectural complexity of the vegetation were found to influence ground beetle community structure. The abundance of *C. clathratus* was positively correlated with plant species richness and was also affected by several other floral components. No impact of peat cutting or grazing was found to influence the abundance of *C. clathratus*. The results suggest that unique communities have developed in response to the management practices seen in these bogs.

Introduction

Pristine oceanic blanket bog (also referred to as Atlantic blanket bogs) is a habitat of considerable conservation importance on both a European and global scale (Gosselink and Maltby, 1990) and as such blanket bogs have been considered to be a priority habitat under the EU Habitats directive ANNEX I. Oceanic blanket bogs occur in areas of high annual rainfall, where greater than 1250mm and at least 200 days of rain occurs every year. Oceanic blanket bogs occur below 200m above sea level and can be found primarily on the lowlands of the western counties of Ireland. Blanket bogs that remain undrained have a high water content at around 93%, an acidic pH of between 3.5-4.2 and are variable in their depth ranging from 1.5-7m depending on the underlying topography (The Heritage Council, 2000; IPCC, 2002a). The bogs themselves can originate from 4000 years BP and develop extremely slowly, depositing as

little as 2mm of peat per year (Gosselink and Maltby, 1990).

In spite of this conservation significance, between 1946 to 1984 over 80,000ha of peat bogs of all types have been lost in Ireland (Van Eck *et al.*, 1984). The extent of this loss was such that in 1983 a European parliamentary report warned that Irish peat bogs would be lost unless preventative measures were implemented (Baldock, 1984). Ireland has failed to live up to the European Commission's requirements of its Environmental Impact Assessment Directive intended in part to provide some protection for bogs and this has resulted in multiple fines over recent years (EU Commission, 2002). The main causes of bog habitat destruction in Ireland are erosion, hand and mechanized peat cutting, forestry and drainage for agriculture (Anderson *et al.*, 2000; Cruickshank and Tomlinson, 1990). Bogs are also likely to be sensitive to deposition of aerial pollution, in particular nutrients such as nitrogen, and may also be susceptible to future effects of global warming (Moore, 2002). In recent years surface milling is one of the most widespread forms of peat exploitation (Anderson *et al.*, 2000; Money, 1995). The process uses repeated mechanized removal of thin layers of peat which leave large areas of flat peat fields stripped of vegetation (Money, 1995). The uses for this industrially harvested peat are variable, although horticultural consumption is a major component. Sources of horticultural supply have spurned several campaigns in recent years to try and promote ecologically sound alternatives to peat, the success of which has been variable (IPCC, 2002b).

As large areas of lowland bogs in Ireland have been modified in some way, either as a result of peat cutting or reversion to agricultural land, it is vital that there exists an understanding of the ecology of these habitats so that successful restoration may be attempted (Money, 1995; Rawes, 1983). Where research into the effects of habitat degeneration in blanket bogs have occurred it has primarily focused on the plant communities. This unfortunately has left researchers with a poor understanding of the ecology of other components of blanket bogs, for example the invertebrates. This study focuses on how ground beetles (Coleoptera: Carabidae) of oceanic blanket bogs on the Bera Peninsula, West-Cork respond to the effects of traditional peat

cutting, cattle grazing and aspects of the floral communites. Ground beetles were chosen as they have been used extensively in ecological monitoring programs, respond well to environmental change, and have well documented natural histories (Lövei and Sunderland, 1996; Thiele, 1977). The ground beetle *Carabus clathratus* L. is given particular consideration in this study, as it is declining in abundance in Ireland and is a potential indicator of peat bog / wetland quality (Anderson *et al.*, 2000; Hyman and Parsons, 1992; McFerran *et al.*, 1995). The overall focus of this study is not on general trends in the ground beetle communities, such as total beetle abundance and species diversity. Instead this study considers how the species specific structure of these communities responds to management practices that are a common cause of oceanic blanket bog habitat degradation.

Methods

At Kilmacowen on the Beara Peninsula, West-Cork (Ordnance Survey grid reference V6950), five experimental sites of oceanic western blanket bog were sampled for ground beetles using pitfall traps. Each of the five experimental sites was chosen so to be divided into two adjoining areas of uncut and traditionally cut peat at a depth of between 0.5 to 1.8m. Harvesting of the peat had occurred at least 2 years prior to sampling, and vegetation had re-established itself on the cut peat. In both the cut and uncut areas at each site three pitfall-trapping stations were established, each station is represented by three pitfall traps in a triangle, separated by 2m. Each trapping station was randomly positioned with the cut and uncut areas, although they were separated by at least 25m. Pitfall traps were made of 7.5 x 9.5cm polythene cups, filled with a 100% solution of ethylene glycol and a small quantity of detergent. Traps were covered with chicken wire (hole diameter 2.5cm) to prevent the accidental capture of small vertebrates and a plywood rain guard (15 x 15cm) was placed at a height of 10cm above each trap. Traps were set on 16 July 2002 and the contents were collected every five days for a

period of 45 sampling days until 05 September 2002. In addition to the Carabidae, the abundance of the ant species *Myrmica ruginodis* (Nylander) (Hymenoptera: Formicidae) was also recorded from the pitfall traps and included as a covariable in the analysis. The catch of each sampling station of three pitfall traps over the 45-day period was summed for both the Carabidae and ants. Carabidae nomenclature follows Luff and Duff (2001).

At each of the pitfall trapping stations, environmental and management parameters were recorded. At each trapping station the depth to which the peat has been cut relative to that half of the site that remains uncut is recorded. Cattle grazing pressure around the immediate area of each trapping station was assessed by counting the number of cowpats present within each quadrat at 0, 25 and 45-day intervals during the Carabidae sampling. On each occasion cowpats present within the quadrat are removed. For each trapping station the counts of cowpats are summed over the three sampling dates. Sheep grazing was not considered in this study. Plant percentage cover was determined by counting the presence or absence of plant contacts on 15 randomly positioned sampling pins within a 5 x 5m quadrat. The percentage cover produced from this point quadrat data was used to produce values of plant species richness and Shannon Weiner diversity. Percentage cover of *Juncus articulatus, J. effusus, Carex panicea, Molinia caerulea, Holcus lanatus, Agrostis stolonifera, Potentilla erecta and Sphagnum* spp. were included as separate covariables in the statistical analysis. Plant nomenclature follows Clapham *et al.* (1993). Within the above quadrat vegetation height was measured at five randomly positioned points and average vegetation height was calculated. Vegetation structure was assessed using a drop disc. This method used a circular wooden disk (30cm diameter and 100g) with a free moving ruler running through it. The disk is then dropped onto the vegetation at five randomly positioned points in the quadrat. An average quadrat value is obtained of the heights to which the vegetation in compacted to by the disk. This measure provides an indication of vegetation structure, which is a function of sward height and density. Soil water content was determined by collecting approximately 200g of soil below the height of the vegetation at a

randomly positioned point within each quadrat. Soil weight was recorded and it was then dried to a constant mass to provide a percentage volume of water in the peat. This measure was made on a single day during which it did not rain.

Statistical analysis

The response of beetle abundance, species richness and Shannon-Weiner diversity in the plots to the environmental parameters and management conditions defined above were tested using generalized linear mixed models (GLIMIX) with site as a random factor. This statistical technique allows the model to compensate for differences in variation between the five study sites. The analysis was also repeated for the abundance of *Carabus clathratus* (Carabidae). Model simplification was by deletion of the least significant factors from a maximal model containing all 16 parameters. All statistical significances were judged based on a Type III analysis. All models had a Poisson error distribution and Log link, with the exception of beetle diversity, which was normally distributed with the Identity link. This analysis was performed on SAS 8.00 (SAS Institute, 1999). Analysis of the Carabidae at the community level was performed using the ordination technique redundancy analysis (RDA) in CANOCO 4.0 (Ter Braak and Šmilauer, 1997). This technique allows the determination of linear relationships between species composition and environmental variables and management practices as described above. All species were included in the analysis. The significance of the relationships between the environmental and management parameters and the ordination axis were determined using Monte-Carlo permutation tests (1000 iterations). The permutations of each test were restricted within each of the five sites. Choice of significant parameters included in the model was determined by manual selection (Ter Braak and Šmilauer, 1998).

Results

During the 45 day trapping period 879 Carabidae from 25 species were collected. The most abundant species was *Pterostichus diligens* (Strum) with 166 individuals. *Carabus clathratus* was unexpectedly abundant and was represented by 111 individuals, and was the 4th most abundant species after *P. diligens, P. niger* (Schaller) and *P. nigrita* (Paykull) *sensu stricto*. There was almost no difference in terms of overall abundance between those sites that had been traditionally cut for peat and those uncut, with 439 and 440 individuals respectively (Table 1). Grazing occurred significantly more frequently in areas not cut for peat ($F_{1,28}$=6.18, p=0.02).

Total Carabidae abundance was negatively correlated with the depth to which the peat had been removed during peat harvesting ($F_{1,26.9}$ = 4.55, p = 0.04), although the strength of this relationship is weak. A weak positive relationship was also found between Carabidae abundance and the percentage cover of *J. articulatus* ($F_{1,27.0}$ = 5.01, p = 0.03). Carabidae species richness was not significantly influenced by any of the management and environmental factors considered (Table 2). Carabidae diversity showed a weak negative correlation with plant species richness ($F_{1,28}$ = 3.04, p = 0.07), percentage cover of *J. effusus* ($F_{1,26}$ = 5.22, p = 0.03) and *A. stolonifera* ($F_{1,26}$ = 6.37, p = 0.02) (Table 2). The abundance of *Carabus clathratus* was positively correlated with the percentage cover of *J. effusus* ($F_{1,17.4}$ = 17.4, p < 0.001), *M. caerulea* (F1,17.4 = 17.4, p < 0.001), *C. panicea* ($F_{1,16.4}$ = 6.80, p = 0.02), *H. lanatus* ($F_{1,17.3}$ = 22.5, p < 0.001), *P. erecta* ($F_{1,16.3}$ = 31.8, p < 0.001), *Sphagnum* spp. ($F_{1,16.2}$ = 13.5, p < 0.01) and overall plant species richness ($F_{1,18.2}$ = 22.3, p < 0.01). The abundance of *C. clathratus* was also negatively correlated with soil water content ($F_{1,16.3}$ = 9.03, p < 0.01) and the abundance of the ant *M. ruginodis* ($F_{1,16.3}$ = 9.03, p < 0.01) (Table 3).

The redundancy analysis was based on all 25 species of Carabidae collected over the sampling period. The carabid community was significantly correlated with the environment (sum of all canonical eigenvalues = 0.416; Monte Carlo permutation test p = 0.001). The first two axes of the ordination explained 35.3 % of the variance in the species data, with the entire

model explaining 42.4 % of the overall variance. The first and second axis explained respectively 50.5 % and 29.1 % of the species environment relationship (Table 4; Fig. 1). Both management practices and three of the environmental variables were found to explain a significant proportion of the data's variance. The depth to which traditional peat cutting occurred ($F = 2.81$, $p < 0.01$), the intensity of cattle grazing ($F = 2.09$, $p < 0.01$), the development of the structure of the vegetation ($F = 5.29$, $p < 0.001$) and the percentage cover of *M. caerulea* ($F = 2.14$, $p = 0.05$) and *A. stolonifera* ($F = 3.58$, $p = 0.02$) (Tables 5 and 6). The variance the model can be explained by the components of vegetation structure = 37.1 %, *A. stolonifera* = 22.8 %, depth of peat cutting = 16.7 %, *M. stolonifera* = 12.0 % and grazing intensity = 11.4 %. No multicolinearity was detected between the significant environmental variables of the model.

Discussion

As oceanic blanket peat bogs are sites of conservation importance at a European scale, it is important that research into how the floral and faunal communities present in these sites respond to frequent management practices. Without such research restoration of sites affected by these management practices would not be possible as recommendations could only be based on guess work, not experimental evidence. While the blanket bogs considered in this study were not pristine, the results provide an important insight into how the structure of ground beetle communities are determined by traditional peat cutting and cattle grazing, and has implications for how sites should be managed to promote regeneration of this natural ecotype.

One of the major outcomes of the study is the absence or weak response of the ground beetle communities at the level of abundance, species richness and diversity to both the management practices and the floral communities. This is to the extent that overall there was almost no difference between the catches of ground beetles on either the cut and un-cut experimental sites. While the cutting of peat and plant species richness was seen to have a negative effect on overall beetle abundance and diversity, the strength of these responses was weak and

ecologically meaningful conclusions from them are hard to make. The lack of clear responses in overall measures of community structure to the management practices may in part this may be due to the variable time periods since peat cutting last occurred. This is in agreement with Heery (2002) who showed that re-colonization of characteristic plant, bird and invertebrate species in previously industrially harvested raised peat bogs can occur within relatively short time periods (under 10 years). Foster and Procter (1995) did find increases in Coleoptera species richness, evenness and diversity where cutting of fens had occurred, however, the cutting had been extremely recent. This suggests that the recovery rate of bogs, at least for invertebrates, is often extremely fast in terms of overall patterns of community structure like abundance, species richness and diversity. It is at the level of individual species where the structuring of communities in response to management is likely to differ most.

The wetlands associated species *C. clatratus* has been considered as a potential indicator of pristine bogs, however, this study suggests if is not affected by what would be expected to be detrimental management practices. Neither cutting for peat nor grazing influenced the distribution of this species and instead it was a series of vegetation characteristics, including a positive relationship with plant species richness, which determined its occurrence in the bog. However, it is unclear if the distribution patterns of the adults are helpful in determining habitat preferences. Adult females are known to show preferences for soil substrate during oviposition (Huk and Kühne, 1999), and as such it is possible that while preferences for uncut/cut peat may exist, they were missed as this study did not consider sex of the beetles and the trapping period may not have coincided with oviposition.

The distribution of the beetles in relation to the abundances of various plant species may reflect foraging advantages that those plants provide in terms of prey species that utilize them or structural benefits they have in terms of both refuges and mobility (Lawton, 1983; Melbourne, 1999). The negative correlation with soil moisture, something that goes against known preferences (Huk and Kühne, 1999), may also be related to the distribution of potential prey

that may prefer drier soil conditions. The negative correlation of *C. clathratus* with the ant *M. ruginodis* probably reflect avoidance on the part of the beetle due, either to direct negative interspecific interactions or indirect affects such as competition through shared prey resources (Thiele, 1977).

Carabus clatratus would seem to be more liberal than previously thought in terms of its habitat requirements. While the species is specific to wetlands, its dependence on this habitat being pristine may not be so crucial. Indeed in other studies *C. clatratus* has been found to be one of the first species to re-colonize previously industrially harvested blanket bogs, suggesting that the species is tolerant of degraded bog habitats (Heery, 2002). However, as with all habitat specialist species, the total loss of their required habitat type, rather than simply its degradation, will result in the extinction of local populations and will endanger other populations as the remaining suitable habitat becomes more fragmented (De Vries and Den Boer, 1990; Dempster, 1991; Kotze and O'Hara, 2003). This is likely to be a major contributing factor to their decline since the 1900's (Anderson *et al.*, 2000; Johnson and Halbert, 1902).

The redundancy analysis allowed a rigorous statistical approach to the analysis of how the ground beetle communities changed at a species-specific level. The significance of both traditional peat cutting and cattle grazing as key determinants of beetle community structure suggests the impact that these management practices would have on pristine oceanic blanket bog. This is seen particularly in terms of the separation in the communities of beetles caught on cut and un-cut parts of the bog, where the occurrence of this key management practice fundamentally changed the structure of the beetle communities. An increase in the general development of vegetation structure influenced the structure of the beetle communities in the blanket bogs. In particular, an increase in vegetation structure was associated with areas that had been cut for peat. It is thought that this occurred because these areas were less accessible to the cattle and so were grazed less frequently than un-cut parts of the bog. This reduced intensity of grazing in the areas cut for peat is thought to have contributed to the increased percentage

coverage of *Molinia caerulea,* which was also found to influence beetle community structure. *M. caerulea* is a tussock-forming grass that would have contributed to the overall development of vegetation structure in the areas that were not cut for peat, as well as providing an important refuge for invertebrates within the tussock itself (Dennis *et al.*, 1998; Luff, 1966). *Agrostis stolonifera* also influenced beetle community structure, although its effect was more evident in those areas that had not been cut for peat, and so were under slightly higher grazing pressure. *A. stolonifera* does not share the same tendency of *M. caerulea* to form tussocks, and so would provide a fine scale structure that differed considerably from the vegetation found in the areas cut for peat. Modification of plant architecture, either in general or in terms key plant species with an important structural component, is likely to be one of the major determinants of beetle community structure (Lawton, 1983; McDonnell *et al.*, 2002; Woodcock, 2003) outside of the main management treatments of peat cutting and grazing.

One of the failings of the study is the relatively short trapping period of only 45 days. The quantitative nature of pitfall trap data is reduced over short sampling periods (Adis, 1979; Baars, 1979; Den Boer, 1979) and so it is unlikely that the catches from the pitfall traps in this study reflect true relative abundances of the ground beetles in the bogs. They are, however, likely to retain the relative orders of abundance of those species that occur in the blanket bogs and so are suitable for investigating changes in community structure (Niemelä *et al.*, 1986; Niemelä *et al.*, 1990). It must also be remembered that the catches of the pitfall traps represent not true abundance, but an interaction between the activity of each species and its abundance (Heydemann, 1957; Thiele, 1977). As the method of pitfall trapping has been kept constant throughout the study, community responses to the different management types will be reflected in what is collected in the traps, although it may be a distorted image of how the beetle communities are actually responding (Maelfait and Desender, 1990).

Conclusion

This study has provided evidence for the development of distinct communities of ground beetles on oceanic blanket peat bogs in response to the management practices of traditional cutting of peat by hand and cattle grazing. The formation of these distinct communities in this degraded bog is a clear indication of the need to avoid further anthropogenic disturbance if these sites are to eventually progress to a community comparable to that of pristine oceanic blanket bogs. Where management has occurred it has formed distinct sub-communities characteristic of the disturbed habitat type, which are likely to be un-representative of those in pristine blanket bogs. Unless the existing management of peat cutting and grazing are stopped the ground beetle communities would be unlikely to ever revert to the desired target of those found in pristine bogs.

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References

Adis, J. (1979) Problems of interpreting arthropod sampling with pitfall traps. *Zool. Anz. Jena* **202**: 177-184.

Anderson, R., McFerran, D. and Cameron, A. (2000) *The ground beetles of Northern Ireland (Coleoptera-Carabidae).* Ulster Museum, Belfast.

Baars, M. A. (1979) Catches in pitfall traps in relation to mean densities of carabid beetles. *Oecologia* **41**: 25-46.

Baldock, D. (1984). *Wetland drainage in Europe: the effects of agricultural policy in four EEC countries*. Institute for European Environmental Policy/International Institute for

Environment and Development, London.

Clapham, A. R., Tutin, T. G. and Warburg, E. F. (1993) *Excursion flora of the British Isles. Third Edition*. Cambridge University Press, Cambridge.

Cruickshank, M. M. and Tomlinson, R. W. (1990) Peatland in Northern Ireland: inventory and prospects. *Irish Geography* **23**: 17-30.

De Vries, H. H. and Den Boer, P. J. (1990) Survival of populations of *Agonum ericeti* Panz. (Col., Carabidae) in relation to fragmentation of habitats. *Neth. J. Zool.* **40**: 484-498.

Dempster, J. (1991). Fragmentation, isolation and mobility of insect populations. pp. 143-153. *In* Collins, N. and Thomas, J. (eds) *The conservation of insects and their habitats*. Academic Press, London.

Den Boer, P.J. (1979) The individual behaviour and population dynamics of some carabid. beetles in Forests. Miscellaneous Papers L. H. Wageningen **18**: 157-166.

Dennis, P., Young, M. R. and Gordon, I. J. (1998) Distribution and abundance of small insects and arachnids in relation to structural heterogeneity of grazed, indigenous grasslands. *Ecol. Ent.* **23**: 253-264.

EU Commission (2002) *Commission proposes daily fines on Ireland to ensure adequate protection of sensitive peatlands from peat extraction.* Internet: http://www.euirelan.ie/news/environment/1202/irelandfined.html.

Foster, A. P. and Procter, D. A. (1995). The occurrence of some scarce East Anglican fen invertebrates in relation to vegetation management. pp. 223-240. *In* Wheeler, B. D., Shaw, S. C., Fojt, W. J. and Robertson, R. A. (eds). *Restoration of temperate wetlands*. John Wiley and Sons, Chichester.

Gosselink, J. G. and Maltby, E. (1990). Wetland losses and gains. pp. 298-322. *In* Williams, M. (ed.) *Wetlands: a threatened landscape*. Blackwell, Oxford.

Heery, S. (2002) IPPC information factsheets. *The conservation value of cut-away bog Lough Boora parklands - a case study.* Internet: http://www.ipcc.ie/infoboorafs.html.

Heydemann, B. (1957) Die biotopstruktur als raumweiderstand und raumfulle fur die tierwelt. *Verhandlungen der Deutschen Zoologischen Gesellschaft* **56**: 332-347.

Huk, T. and Kühne, B. (1999) Substrate selection by *Carabus clatratus* (Coleoptera, Carabidae) and its consequences for offspring development. *Oecologia* **121**: 348-354.

Hyman, P. S. and Parsons, M. S. (1992) *A review of the scarce and threatened Coleoptera of Great Britain.* Part 1. JNCC Publications, Peterborough.

IPCC (2002a) Blanket bogs information sheet. Internet: http://www.ipcc.ie /infoblanketbogfs.htm.

IPCC (2002b) *Press release: peat-free gardening campaign report 2002 launched.* Internet: http://www.ipcc.ie/prmosspeat09-2002.html.

Johnson, W. F. and Halbert, J. N. (1902) A list of the beetles of Ireland. *Proc. R. Ir. Acad.* **6**: 535-827.

Kotze, D. J. and O'Hara, R. B. (2003) Species decline - but why? Explanations of carabid beetle (Coleoptera, Carabidae) declines in Europe. *Oecologia* **135**: 138-148.

Lawton, J. (1983) Plant architecture and the diversity of phytophagous insects. *Annu. Rev. Entomol.* **28**: 23-39.

Lövei, G. L. and Sunderland, K. D. (1996) Ecology and behaviour of ground beetles (Coleoptera: Carabidae). *Annu. Rev. Entomol.* **41**: 231-256.

Luff, M. L. (1966) The abundance and diversity of the beetle fauna of grass tussocks. *J. Anim. Ecol.* **35**: 189-208.

Luff, M. L. and Duff, A. (2001) *Checklist of the Carabidae of the British Isles.* Internet: http://www.coleopterist.org.uk/carabidae-refs.htm.

Maelfait, J.-P. and Desender, K. (1990). *Possibilities of short-term carabid sampling for site assessment studies.* pp. 217-225. *In* Stork, N. E. (ed.) *The role of ground beetles in environmental and ecological studies.* Intercept Ltd., Hampshire.

McDonnell, R. J., Fahy, O. L. and Gormally, M. J. (2002) Ground beetle (Coleoptera:

Carabidae) and plant communities of Atlantic blanket bog in Connemara, Ireland. *Bull. Ir. biogeog. Soc.* **26**: 83-105.

McFerran, D., Cameron, A. and Anderson, R. (1995) The distribution and status of *Carabus clathratus* L. (Coleoptera: Carabidae) in the West Fermanagh and Erne Lakeland environmentally sensitive area. *Ir. Nat. J.* **25**: 67-91.

Melbourne, B. A. (1999) Bias in the effects of habitat structure on pitfall traps: an experimental evaluation. *Aust. J. Ecol.* **24**: 228-239.

Money, R. P. (1995). Re-establishment of a *Sphagnum*-dominated flora on cut-over lowland raised bogs. pp. 405-422. *In* Wheeler, B. D., Shaw, S. C., Fojt, W. J. and Robertson, R. A. (eds) *Restoration of temperate wetlands*. John Wiley and Sons, Chichester.

Moore, P. D. (2002) The future of cool temperate bogs. *Environ. Conserv.* **29**: 3-20.

Niemelä, J., Halme, E. and Haila, Y. (1990) Balancing sampling effort in pitfall trapping of carabid beetles. *Entomol. Fen.* **1**: 233-238.

Niemelä, J., Halme, E., Pajunen, T. and Haila, Y. (1986) Sampling spiders and carabid beetles with pitfall traps: the effects of increased sampling effort. *Annales Entomologici Fennici* **52**: 109-111.

Rawes, M. (1983) Changes in two high altitude blanket bogs after the cessation of sheep grazing. *J. Ecol.* **71**: 219-235.

SAS Institute (1999) *SAS release 8.00 for Windows*. SAS Institute Inc., Cary, USA.

Ter Braak, C. J. F. and Šmilauer, P. (1997) *CANOCO for Windows version 4.0*. Centre for Biometry Wageningen, Wageningen.

Ter Braak, C. J. F. and Šmilauer, P. (1998) *CANOCO reference manual and user's guide to Canoco for Windows*. Centre for Biometry Wageningen, Wageningen.

The Heritage Council (2000) Peatland. Internet: http://www.heritagecouncil.ie/publications/habitats/7.html

Thiele, H.-U. (1977) *Carabid beetles in their environment. A study on habitat selection by*

adaptation in physiology and behaviour. Springer-Verlag, New York.

Van Eck, H., Gowers, A., Lamaire, A. and Schanee, J. (1984) *Irish bogs, a case for planning*. Catholic University, Nijmegen.

Woodcock, B. A., Leather, S. R. and Watt, A. D. (2003). Changing management in Scottish birch woodlands: a potential threat to local invertebrate biodiversity. *Bull. Ent. Res.* **93**: 159-168.

TABLE 1. Mean abundance (± SE) of Carabidae in the pitfall trap clusters of uncut and cut oceanic blanket peat bogs with total abundance of each species collected during the experiment. Nomenclature follows Luff and Duff (2001).

	Cut peat		**Uncut peat**		**Total**
	Mean	SE	Mean	SE	**abundance**
Carabus clathratus L.	4	0.57	3.4	0.95	111
C. granulatus L.	1.47	0.34	1.6	0.58	46
Leistus ferrugineus (L.)	0	0	0.07	0.07	1
Nebria brevicollis (Fabricius)	0.2	0.2	1.53	0.77	26
Notiophilus aquaticus (L.)	0.07	0.07	0.13	0.09	3
Notiophilus palustris (Duftschmid)	0	0	0.07	0.07	1
Loricera pilicornis (Fabricius)	0.73	0.3	1.47	0.52	33
Elaphrus cupreus Duftschmid	0.33	0.16	0	0	5
Dyschirius glabosus (Herbst)	0.07	0.07	0.13	0.09	3
Bembidion lampros (Herbst)	0.07	0.07	2.33	0.93	36
B. mannerheimii Sahlberg	0.07	0.07	0.07	0.07	2
Poecilus versicolor (Strum)	0.07	0.07	1.2	0.34	19
Pterosticus diligens (Sturm)	3.2	0.86	7.87	1.51	166
P. niger (Schaller)	5.67	0.89	3.33	0.87	135
P. nigrita (Paykull) *sensu stricto*	5.6	1.21	2.4	0.55	120
P. vernalis (Panzer)	0.13	0.13	1.53	0.58	25
Abax parallelepidus (P.and M.)	0	0	0.2	0.2	3
Paranchus albipes (Fabricius)	0	0	0.07	0.07	1
Agonum fuliginosum (Panzer)	4.67	1.17	1.13	0.47	87
A. gracile Sturm	2.4	0.94	0.27	0.15	40
A. viduum (Panzer)	0.33	0.13	0.07	0.07	6
A. mulleri (Herbst)	0.07	0.07	0.33	0.19	6
A. thoreyi Dejean	0.07	0.07	0	0	1
Oxypselaphus obscurus (Herbst) Dejean	0.07	0.07	0	0	1
Amara plebja (Gyllenhal)	0	0	0.13	0.09	2

TABLE 2. Response of Carabidae abundance, species richness and Shannon Weiner diversity to the management practices of traditional peat cutting and cattle grazing, environmental conditions and vegetation characteristics in oceanic blanket peat bogs. * Indicates significant effects at $p < 0.05$.

Parameter	Abundance	Species richness	Diversity
M. ruginodis abundance	$F_{1,20.3} = 0.55$, $p = 0.46$	$F_{1,26} = 1.18$, $p = 0.28$	$F_{1,26} = 3.33$, $p = 0.08$
Soil water content	$F_{1,21.7} = 1.04$, $p = 0.31$	$F_{1,22} = 0.72$, $p = 0.40$	$F_{1,17} = 0.40$, $p = 0.53$
Grazing intensity	$F_{1,25.5} = 3.67$, $p = 0.06$	$F_{1,27} = 1.67$, $p = 0.21$	$F_{1,19} = 0.85$, $p = 0.36$
Depth of peat cutting	$F_{1,26.9} = 4.55$, $p = 0.04$*	$F_{1,18} = 0.81$, $p = 0.48$	$F_{1,16} = 0.39$, $p = 0.54$
Juncus articulatus	$F_{1,27.0} = 5.01$, $p = 0.03$*	$F_{1,24} = 0.36$, $p = 0.32$	$F_{1,23} = 0.62$, $p = 0.43$
J. effusus	$F_{1,15.6} = 0.02$, $p = 0.89$	$F_{1,20} = 0.99$, $p = 0.33$	$F_{1,26} = 5.22$, $p = 0.03$*
Molinia caerulea	$F_{1,13.4} = 0.11$, $p = 0.74$	$F_{1,8.2} = 0.30$, $p = 0.60$	$F_{1,18} = 0.75$, $p = 0.39$
Carex panicea	$F_{1,16.4} = 1.83$, $p = 0.18$	$F_{1,8.6} = 0.22$, $p = 0.65$	$F_{1,14} = 0.00$, $p = 0.97$
Holchus lanatus	$F_{1,14.7} = 0.08$, $p = 0.78$	$F_{1,23} = 1.00$, $p = 0.32$	$F_{1,22} = 0.80$, $p = 0.38$
Agrostis stolonifera	$F_{1,19.7} = 0.60$, $p = 0.44$	$F_{1,17} = 0.37$, $p = 0.54$	$F_{1,26} = 6.37$, $p = 0.02$*
Potentilla erecta	$F_{1,12.6} < 0.01$, $p = 0.94$	$F_{1,12.8} = 0.06$, $p = 0.81$	$F_{1,13} = 0.05$, $p = 0.82$
Sphagnum spp.	$F_{1,18.8} = 0.63$, $p = 0.43$	$F_{1,21} = 1.16$, $p = 0.29$	$F_{1,15} = 0.13$, $p = 0.72$
Plant species richness	$F_{1,18} = 0.37$, $p = 0.54$	$F_{1,28} = 3.04$, $p = 0.07$	$F_{1,26} = 12.5$, $p < 0.001$*
Plant diversity	$F_{1,13.1} = 0.08$, $p = 0.44$	$F_{1,19} = 0.84$, $p = 0.34$	$F_{1,21} = 0.51$, $p = 0.48$
Sward height	$F_{1,21.8} = 1.50$, $p = 0.23$	$F_{1,12.5} = 0.08$, $p = 0.78$	$F_{1,20} = 0.62$, $p = 0.44$
Vegetation density	$F_{1,15.9} = 0.21$, $p = 0.65$	$F_{1,25} = 0.76$, $p = 0.39$	$F_{1,24} = 0.68$, $p = 0.41$

TABLE 3. Response of the threatened *Carabus clathratus* to the management practices of traditional peat cutting and cattle grazing, environmental conditions and vegetation characteristics in oceanic blanket peat bogs. * Indicates significant effects at $p < 0.05$.

Parameter	Significance
M. ruginodis	$F_{1,16.3} = 9.03$, $p < 0.01$*
Soil water content	$F_{1,16.9} = 24.1$, $p < 0.001$*
Grazing intensity	$F_{1,15.4} = 1.05$, $p = 0.32$
Depth of peat cutting	$F_{1,11.5} = 0.52$, $p = 0.48$
Juncus articulatus	$F_{1,10.2} = 0.01$, $p = 0.94$
J. effusus	$F_{1,17.4} = 17.4$, $p < 0.001$*
Molinia caerulea	$F_{1,16.6} = 23.1$, $p < 0.001$*
Carex panicea	$F_{1,16.4} = 6.80$, $p = 0.02$*
Holcus lanatus	$F_{1,17.3} = 22.5$, $p < 0.001$*
Agrostis stolonifera	$F_{1,14.1} = 0.72$, $p = 0.72$
Potentilla erecta	$F_{1,16.3} = 31.8$, $p < 0.001$*
Sphagnum spp.	$F_{1,16.2} = 13.5$, $p < 0.01$*
Plant species richness	$F_{1,18.2} = 22.3$, $p < 0.01$*
Plant diversity	$F_{1,9.98} = 0.08$, $p = 0.78$
Sward height	$F_{1,12.9} = 0.62$, $p = 0.44$
Vegetation density	$F_{1,15.9} = 3.88$, $p = 0.07$

TABLE 4. Redundancy analysis results of the Carabidae community in managed Irish oceanic blanket bog. Bracketed values indicate cumulative explained variance with each ordination axes added.

	I	II	III	IV
Eigenvalues	0.21	0.12	0.05	0.02
Species-environment correlations	0.88	0.80	0.71	0.57
Percentage variance of species data	22.4	12.9	6.1	2.5
		(35.3)	(41.4)	(43.6)
Percentage variance of species-environment	50.5	29.1	13.7	4.9
		(79.6)	(93.3)	(98.2)
Sum of all canonical eigenvalues				1.00
Sum of all canonical eigenvalues				0.42

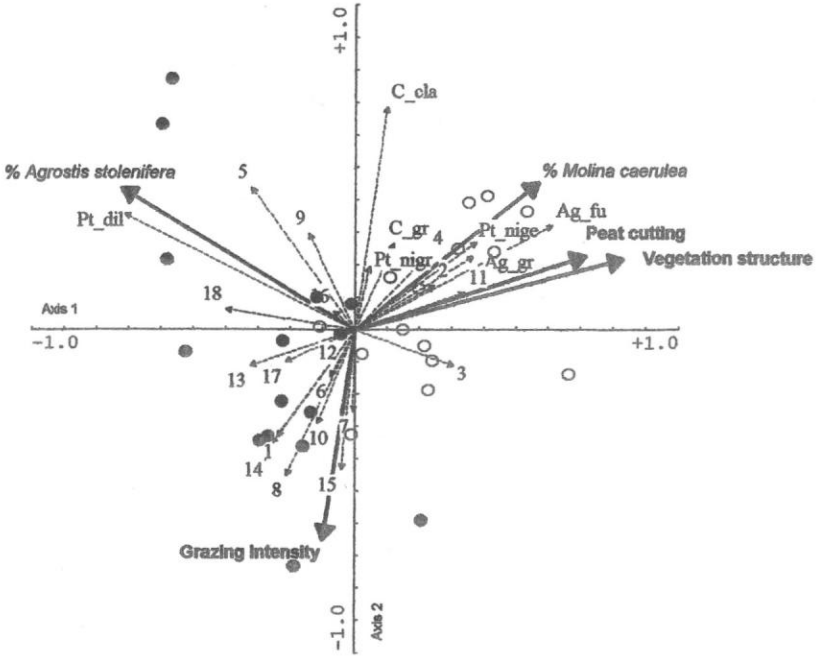
TABLE 5. Redundancy analysis results showing the significance of the effect of management and environmental conditions on the structure of Carabidae communities in oceanic blanket bog. * Indicates where an environmental variable is significantly influences Carabidae community structure at the $p < 0.05$ level.

Parameter	Significance
M. ruginodis	F=0.40, p=0.84
Soil water content	F=0.50, p=0.83
Grazing intensity	F=2.09, p<0.01
Depth of peat cutting	F=2.81, p<0.01
Juncus articulatus	F=0.52, p=0.79
J. effusus	F=0.61, p=0.69
Molinia caerulea	F=2.14, p=0.05
Carex panicea	F=0.82, p=0.34
Holcus lanatus	F=0.87, p=0.58
Agrostis stolonifera	F=3.58, p=0.02*
Potentilla erecta	F=1.10, p=0.40
Sphagnum spp.	F=0.99, p=0.32
Plant species richness	F=1.33, p=0.26
Plant diversity	F=1.65, p=1.38
Sward height	F=1.01, p=0.44
Vegetation structure	F=5.29, p<0.001*

TABLE 6. Correlation coefficients for environmental variables found to significantly influence Carabidae community structure. * Indicates where an environmental variable is significantly correlated with one of the four-ordination axis at $p < 0.05$.

	I	II	III	IV
Grazing intensity	-0.10*	-0.67*	-0.27	0.49*
Depth of peat cutting	0.72	0.23	0.64*	-0.01
Percentage cover of *Molinia*	0.59*	0.47*	-0.06*	-0.24
Percentage cover of *Agrostis*	-0.74	0.44*	-0.32	0.37*
Vegetation structure	0.83*	0.21	-0.07*	-0.04

FIGURE 1. Redundancy analysis triplot for the first and second axis of the Carabidae of oceanic blanket peat bog, showing how communities respond to management and environmental conditions. Ungrazed plots are indicated by '•', cattle grazed by '○'. Environmental variables are shown as solid line vectors, species associated with the direction of the arrows show an ecological preference for the environmental conditions indicated. Carabidae species vectors are indicated by dashed lines: C_cla = *Carabus clathratus*, C_gr = *C. granulatus,* Ag_gr = *Agonum gracile*, Ag_fu = *A. fuliginosum*, , Pt_nigr = *Pterostichus nigrita*, Pt_nige = *P. niger*, Pt_dil = *P. diligens,* 1 = *Agonum mulleri*, 2 = *A. thoreyi*, 3 = *A. viduum*, 4 = *Oxypselaphus obscurus*, 5 = *Paranchus alipes*, 6 = *Abax parallelepidus*, 7 = *Amara plebja*, 8 = *Bembidion lampros*, 9 = *B. mannerheimii*, 10 = *Dyschirius glabosus*, 11 = *Elaphrus cupreus*, 12 = *Leistus ferrugineus*, 13 = *Loricera pilicornis*, 14 = *Nebria brevicollis*, 15 = *Notiophilus aquaticus*, 16 = *Notiophilus palustris*, 17 = *Pterostichus vernalis*, 18 = *Poecilus versicolor*.



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TERRESTRIAL COLEOPTERA RECORDED IN IRELAND, MAY 2003

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Summary

A meeting of coleopterists was convened at Portumna over a weekend at the end of May 2003. Over 1500 records of terrestrial Coleoptera of 490 species in 40 families were recorded, mainly from Clare, Galway and North Tipperary. A total of eight additions to the Irish List were reported: 4 Staphylinidae; 1 Cryptophagidae; 1 Coccinellidae; 1 Chrysomelidae, 1 Curculionidae. The staphylinid additions were all riparian wetland species.

Introduction and methods

A meeting of coleopterists was arranged in May 2003 to investigate a somewhat neglected region of Ireland to the east of the Burren and around the callows along the River Shannon, adjacent karstic areas as well as some of the larger midland bogs. The group was based at Portumna from which visits were made to east and central Clare, the Shannon Callows between Portumna and Lough Derg, some of the larger raised mires east of the River Shannon and several semi-natural woodland sites including the demesne at Charleville outside Tullamore, Co. Offaly. The group was mainly active from 23-25 May 2003, although some contributors arrived early and ranged wider afield. Weather during the period of recording was relatively cool and windy, but with little rain.

Recording in wetland sites was by sweeping and beating, or by trampling and sieving vegetation in standing water. In woodland, bark and other fungi were examined for mycetophilous species, bark on trees and dead wood for saproxiles, and shrub/herb vegetation was swept for phytophagous species. Pasture and other open habitats were examined by sweeping, herbivore dung by sieving and pootering, and moss and other detachable debris by sieving. Those interested in aquatic fauna, which is dealt with in a separate publication, also collected water margin species included in the present account.

The following contributed terrestrial records: Roy Anderson, Dave Boyce, Garth Foster, Jervis Good, Peter Langton, Derek Lott, Stephen McCormack, Ferdia Marnell, James Moran, Glenda Orledge, Áine O'Connor, Eugenie Regan, Matt Smith, Paul Smith, Mark Telfer and Colin Welch.

Results

Over 1500 records of terrestrial Coleoptera were obtained for the following vice-counties: Clare, South East Galway, North East Galway, North Tipperary, Offaly, Roscommon, East Mayo and Leitrim. However, the majority of records received were for Clare, South East Galway and North Tipperary i.e. within a twenty mile radius of the base at Portumna. Eight species previously unknown for Ireland were recorded: *Bledius occidentalis* Bondroit; *Carpelimus similis* (Smetana); *Stenus solutus* Erichson; *Lathrobium rufipenne* Gyllenhal [Staphylinidae]; *Cryptophagus pseudodentatus* Bruce [Cryptophagidae]; *Grammoptera ustulata* (Schaller) [Cerambycidae]; *Scymnus auritus* Thunberg [Coccinellidae]; *Bruchus rufimanus* Boheman [Chrysomelidae]. A number of rare or noteworthy species were also seen, including a formerly doubtful Irish species, *Stenus aceris* Stephens (Staphylinidae). These included the RDB1 carabids *Panagaeus cruxmajor* (L.) and *Badister meridionalis* Puel as well as *Pelophila*

borealis (Paykull) and *Agonum lugens* (Duftschmid), two species almost restricted in the British Isles to Ireland.

A full list of species recorded by participants is given in Table 2. The sites from which species were recorded are indicated in Table 1 by abbreviations. Site abbreviations are keyed to site name, grid reference and a brief habitat description in Table 1. The status of each species is indicated as follows: new to Ireland; rare; notable in GB; red data species in GB, and so forth.

Notes on selected species

Carabidae

Acupalpus parvulus (Sturm)

This is a rare species in Ireland. A single specimen was recorded by Derek Lott from Cloghan Lake (N105194), Offaly (26.v.2003).

There are scattered records from across south and west Ireland north to Armagh but only one recent published record, for Lough Caragh, North Kerry (Owen, 1997).

Agonum lugens (Duftschmid) [Fig. 1, Map 1]

Published records for this species show a range limited to the catchment of the River Fergus in Co. Clare (Anderson, 1985, 1996). It is unknown in Britain. Owen (1997) added Lough Gash in the southern part of the Fergus drainage. Good (2004) has recorded it from Lough Loum, Lough Skeardeen and Lough Bunny in the same geographical area. One of us (ER) has pitfall records for: Lough Gealain (R3194), Knockaunroe (R3194) and Poulroe (R3795) in Clare; and Frenchpark (M4114), Cuildooish (M4115) and Ballinduff (M4608) in South-East Galway. Fuller details of which are in press. In addition, it was found by hand searching at three sites during the present survey: Lough Gealain (R312946; M. Telfer); Knockaunroe Turlough (R312941; M. Telfer, E. Regan); and Roo West (M385022; M. Telfer, J. Moran). Several of

The recorded sites are now outside the Fergus drainage so it is obviously not restricted in that way, although the territory occupied is compact (Fig. 1, Map 1).

***Badister meridionalis* Puel**

This rare species has RDB1 status in Britain and is restricted to one or two sites in the south midlands. In Ireland it has heretofore been recorded exclusively from the turlough system in the vicinity of Lough Coole (M40) in South East Galway by one of the authors (ER) and by Speight (1976).

Three recorders collected specimens in a second locality not far from Coole Lough, in poached, marly fen at Roo West (M385022), South East Galway. The site is probably hydrologically connected to the Lough Coole system as the drainage runs north and appears to be separate from the Fergus system which runs south.

***Badister peltatus* (Panzer) and *B. dilatatus* Chaudoir**

These species have similar ranges in south and west Ireland and probably occur together in many parts of the Fergus and Shannon catchments. Each was recorded from two sites.

Badister dilatatus: Dromore Forest (R3586) Clare (Dave Boyce; 23.v.2003); Pickford's Lough (R474964) South East Galway (Stephen McCormack, 25.v.2003); and Portumna Forest Park (M841032) South East Galway (Mark Telfer, 26.v.2003). *Badister peltatus*: Portumna Forest Park (Mark Telfer, James Moran, 26.v.2003); and Portland Park callows (M883064), North Tipperary (Eugenie Regan, 23.v.2003).

Badister dilatatus is N_b and *B. peltatus* N_a in Britain.

***Carabus clatratus* L.**

Elsewhere in Europe this species is considered stenotopic for water-logged peatlands but in Ireland, due probably to prevailing soil conditions with widely impeded drainage and high

organic carbon content, occupies a wider range of habitats. These include hay meadows and lakeshore pasture around Lough Erne in Co. Fermanagh (McFerran, Cameron and Anderson, 1995). A single adult was recorded at Kilmacduagh (M401006; Mark Telfer, 25.v.2003), in a marly fen.

***Panagaeus cruxmajor* (L.)** [Fig. 1, Map 2]

This highly distinctive and rare species was recorded from two sites: Portumna Forest Park (M842032) by Dave Boyce (26.v.2003); and Kilmacduagh (M401006) Clare by Stephen McCormack (25.v.2003). At Kilmacduagh a pair were captured by hand after dark on a rock under moss in a marly fen.

According to Fowles (1994), Tywyn Burrows in Wales is the only extant locality in Britain. In Ireland, it has been found recently in seven wetland (lakeshore, turlough) sites in Galway, Clare and Mayo (Anderson *et al.*, 2000; Moran *et al.*, 2003). This includes a Good (2004) record for Lough Loum, Clare, which is adjacent to the Kilmacduagh site described here. The preferred habitat appears to be muddy turlough shores or a particular kind of marly, shallow-water fen with some water movement. Regular seasonal flooding and associated areas of relatively open muddy ground in spring and summer are characteristic, and probably of importance to this species.

Staphylinidae

***Bledius occidentalis* Bondroit New to Ireland**

A single specimen was taken by Derek Lott on bare peat at the margin of an artificial pond created from peat workings on a margin of Coreenbeg Bog (M895263), Roscommon. This is a large raised mire bordering the River Suck and formerly exploited by Bord na Mona for power generation to the national grid. The locality is very disturbed and it is presumed that the

captured specimen was casual from another location.

This is a pRDBK species in Britain, found mainly in the south-east but occurring as far north as the Humber, in coastal localities, on firm sand or clay. It appears to be in decline and recorded recently from only three vice-counties (Hyman and Parsons, 1994).

***Carpelimus similis* (Smetana) New to Ireland**

A male specimen was swept beside the Ardsollus River, Blackweir Bridge (R389715), Newmarket-on-Fergus, Clare by Colin Welch (26.v.2003). A notable (N_b) species in Britain, very local on stream and ditch banks north to Norfolk and Cardiganshire in Wales (Hyman and Parsons, 1994). This is a first Irish record. Barclay (2003) records the infestation by this species of a hotel in south Devon, suggesting synsnthropic proclivities.

***Stenus aceris* Stephens**

An unaccountably rare species in Ireland. A single female was swept by Colin Welch under oak in Charleville Woods (N320227), Offaly (24.v.2003). Anderson *et al.* (1997) mis-reported Moore (1981) in recording the species from Sherkin Island, Cork. Otherwise known only from unconfirmed nineteenth-century sources (Anderson, 1984).

***Stenus palustris* Erichson** [Fig. 1, Map 3]

First reported for Ireland by Good (1989), from Finlough near Clonmacnoise, Offaly, then by Good (1999) from mine spoil at Shallee near Silvermines, North Tipperary (collected 1991). Finally, Owen (1997) recorded it from Scragh Bog, Westmeath.

Six site and three new vice-county records are added here: Knocklahard Lake (M192664), East Mayo (D. Lott; 22.v.2003); Charleville Wood (N315226), Offaly (R. Anderson, 24.v.2003, D. Lott, 26.v.2003); Murragh Island callows (M942134), River Shannon, Offaly (D. Lott, 23.v.2003); Pollremon (M575698), North East Galway (D. Lott, 21.v.2003); Cloghballymore

Lough (M393136), South East Galway (D. Lott; 22.v.2003); Lough Avalla (M503036), South East Galway (D. Lott, 24.v.2003). Although some of these have been visited within the recent past this species was not seen. It may be commoner now than formerly and seems fairlywidespread in central Ireland in its preferred habitat (Fig. 1, Map 3). At Charleville Woods it was present in *Carex paniculata* tussocks under scrub willow and on tall fen vegetation over shallow open water. This profile tallies with descriptions of its preferences in Britain and Europe (Hyman and Parsons, 1994; Koch, 1989).

***Stenus solutus* Erichson New to Ireland**

A single specimen was collected by Derek Lott from the callows at Portland Park (M883064), North Tipperary, on the Shannon (23.v.2003). This record is a first for Ireland. The locality comprises a shallow riverine fen with complex micro-topography and scattered wet hollows in what would have been wet summer grazing. It is now enclosed.

Stenus solutus is a local species in Britain and almost confined to the southern half of England.

***Lathrobium rufipenne* Gyllenhal New to Ireland**

Two specimens were taken by Derek Lott on 22 May in swampy margins of Knocklahard Lake (M191665), East Mayo. A full account of this and recent British records is given elsewhere (Lott, 2003).

This is a rare fen species in Britain with RDB2 status, and is currently known from only two sites, in Norfolk and Cheshire, respectively. It inhabits reed litter and sphagnum in fens and transitional mires (Hyman and Parsons, 1994). Its discovery in Ireland is highly significant.

***Quedius auricomus* Kiesenwetter**

A single specimen was recorded in moss on the top of a large oak log in Charleville Wood

(N319226), Offaly (R. Anderson, 24.v.2003). Normally found in waterfall moss, this is a somewhat unusual habitat for the species.

Notable (N_b) in Britain, and rare in Ireland. Lott (*in litt.*) has taken the species recently at Glenahoo, North Kerry.

***Hygropora cunctans* (Erich.)** [Fig. 1, Map 4]

This species is associated with transition mires and is rare (pRDBK) in Britain. It was added to the Irish List by Lott and Bilton (1991) from Mullygollan Turlough, Roscommon. Since 1990 it has been found at several other wetland and turlough sites (Fig. 1, Map 4). Recorded here from: Kilmacduagh (M399002) and Roo West (M385022), Clare; Bullock Island, River Shannon (N026181), North Tipperary; Annaghmore Lake (M906839), Roscommon; and Knocklahard Lake (M191665), East Mayo (all by D. Lott, 20-26.v.2003). Evidently not as rare as in Britain.

***Philhygra terminalis* (Gravenhorst) and *Schistoglossa aubei* (Brisout)**

Philhygra terminalis was added to the Irish List by Bullock (1930), from flood refuse on the River Flesk near Killarney, but there are no subsequent records. One record is given here: a single specimen at Lough Avalla (M503036), South East Galway (D. Lott, 24.v.2003). This and the following species are pRDBK in Britain i.e. insufficiently known, although Lott (2002) reports recent captures of *P. terminalis* in Surrey and Leicestershire. In these latter sites, it appeared characteristic of undisturbed wetlands in an advanced stage of ecological succession.

Schistoglossa aubei is known from Derryleckagh Bog in Down (Lott and Bilton, 1991). A single record here: margins of the River Shannon at Lackagh (M996965), Co Leitrim (D. Lott, 20.v.2003).

***Parameotica difficilis* (Brisout)**

Good and Butler (2001) added this species to the Irish List from a wooded turlough at Garryland, near Gort, South East Galway, and Good (2004) found a second site at Lough

Loum near Kilmacduagh, Clare. It is N_b in Britain and found mainly in the south-east, in litter of marshes (Hyman and Parsons, 1994).

It was taken at two separate localities: in a shallow-water marl substrate (fen) at Roo West (M385022), Clare (D. Lott; 24.v.2003) and in riverine pasture at the Boleyneendorrish River (M526060), North East Galway (D. Lott; 24.v.2003).

Cryptophagidae

***Cryptophagus pseudodentatus* Bruce New to Ireland**

This is a common species in Britain and therefore probably overlooked in Ireland. Colin Welch took three specimens sieving hay on a barn floor at Cragroe Castle near Roscoe Lough (R449696), Clare (26.v.2003), a first Irish record.

Cerambycidae

***Grammoptera ustulata* (Schaller) New to Ireland**

A specimen of this rare and (in Britain) declining old wood species was swept under beech in Charleville Wood (N320227) by Colin Welch (24.v.2003) and is a first record for Ireland.

It has RDB3 status in Britain and is given Grade 1 status as an indicator of ancient woodland fauna (Harding and Rose, 1986). It is recorded mainly from the south of England (Windsor, Wye Forest, New Forest). Its discovery in Charleville Woods therefore confirms this site as one of national importance.

Chrysomelidae

***Bruchus rufimanus* Boheman New to Ireland**

Four were swept from roadside herbage at Lough Bunny by Colin Welch (R377965; 25.v.2003). This species is widespread on leguminosae in Britain and can be a pest of commercial broad beans, but has not hitherto been recorded in Ireland.

Curculionidae

***Bagous limosus* (Gyllenhal)**

This is associated with *Potamogeton* in water-margin habitats but is relatively rare and has N_b status in Britain. It is confined to England.

A single specimen was captured by Mark Telfer in marly fen at Roo West (M386022), Clare (24.v.2003).

***Bagous lutulentus* (Gyllenhal)**

Another uncommon water-margin weevil, N_b in Britain and restricted to southern England and Wales where it is associated with *Equisetum fluviatile* (Hyman and Parsons, 1992).

A single specimen was beaten off vegetation in the Shannon callows at Portland Park (M883064), North Tipperary by Roy Anderson (23.v.2003).

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TABLE 1. Sites visited

Site	Grid Ref	VC	Description	Abbrev.
All Saints Bog	N028113	H18	Lowland raised bog with birch	***ALL***
Annaghmore Lough	M906839	H25	Lakeshore	***ANN***
Atorick, Lough	R637964	H9	Peaty lake margin with floating bog	***ATO***
Avalla, Lough	M503036	H15	Small lake	***AVA***
Avullig, Lough	R615750	H15	Acid mountain loughan	***AVU***
Ballinduff Turlough	M457079	H15	Turlough margins	***BALI***
Ballydonaghan L.	R606802	H15	Small lake; mossy edges	***BALN***
Ballydoogan Bog	M668181	H15	Small raised bog with fen transition	***BALD***
Ballyline Lough	R3886	H9		***BALL***
Ballyvaughan, pools	R5699	H9	Saltmarsh flats	***BALV***
Blackweir Bridge, Newmarket-on-Fergus	R389715	H9	Marl stream estuary	***BLA***
Boleyneendorrish River	M526060	H17	Riverbank pasture	***BOL***
Boora, Lough, Parklands	N173235	H18	Cutaway (raised) bog and regenerating fen complex	***BOO***
Bullock Island	N026181	H18	Shannon callows	***BUL***
Bunny, Lough	R379965	H9	Limestone pavement/lakeshore	***BUN***
Carter's Lough, Derryulk	R559839	H9	Eutrophic pond	***CAR***
Charleville Wood	N315226	H18	Mature oak wood on limestone; shallow mesotrophic fen	***CHA***
Cloghan Lake	N105194	H18	Cutaway (raised) bog with lake	***CLOA***
Cloghballymore Lough	M393136	H15	Turlough margins	***CLOB***
Coole Park	M430042	H15	Wooded turlough	***COO***
Corlis	M717829	H25	Riverbank pasture	***CORL***
Corofin, Clifden House	R265890	H9	Lakeshore	***CORO***

TABLE 1. (continued)

Correenbeg	M899264	H25	Lowland stream bank; excavations on raised bog	***CORE***
Cragroe Castle	R449696	H9	Lakeshore	***CRAG***
Cutra, Lough	R483986	H9	Flooded limestone lake	***CUT***
Derg, L. nr Woodford	R793964	H15	Lakeshore	***DERG***
Derrycrag wood	R738994	H15	Mixed wood.	***DERR***
Dromore Lough (Forest0	R3586	H9	Fenny lakeshore	***DROM***
Drumsna, R. Shannon	M994969	H29	Fenny riverbank	***DRUS***
Dungory Castle	M380105	H15	Grassland	***DUN***
N of Fanore, Black Head	M149105	H9	Limestone pavement	***FAN***
Finn Lough, Carrowmeer	R435703	H18	Calcareous lake margin	***FIN***
Gealain, Lough	R312946	H9	Turlough with limestone pavement	***GEA***
Graney, Lough	R559949	H9	Limestone lakeshore with fen vegetation	***GRA***
Hollymount	R453934	H9	Small lake	***HOL***
Island Lake	M481819	H26	Riverbank pasture	***ISL***
Kilmacduagh	M399002	H9	Marly fen	***KIL***
Kinvarra, pools	M337107	H9	Coastal saline pools	***KINV***
Knockaunroe	R312941	H9	Limestone pavement/turlough	***KNOA***
Knocklahard Lake	M191665	H26	Lakeshore	***KNOL***
Loughrea	M625154	H15	Limestone lakeshore	***LOU***
Mocorrha Lough	M232547	H26	Lakeshore with fluctuating water table	***MOC***
Mullaghmore	R312915	H9	Limestone pavement	***MUL***
Murragh Island	M941133	H15	Shannon callows	***MUR***
Pickford's Lough	R474964	H15	Old peat cuttings with birch woodland	***PIC***
Pollaharan Bridge	R596958	H9	Scrub	***POLH***

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TABLE 1. (continued)

Pollnaknockaun Wood	M740014	H15	Mature oak wood, marshy in places	***POLN***
Pollremon	M575698	H17	Wet grassland	***POLR***
Portland Park	M883064	H10	Shannon callows	***PORT***
Portumna Bay, The Quay, Park etc.	M841032	H15	Lakeshore with shallow fen and small turloughs	***PORQ***
Poulaloughan	R601751	H15	Acid mounain lochan	***POUL***
Roo West	M385022	H9	Poached marly fen/turlough	***ROO***
Ross Lake	M200363	H9	Calcareous lake margins	***ROS***
Terryglass, Lough Derg	M862009	H10	Lakeshore	***TER***

TABLE 2. Species listed by sites and by vice-county.

Praeger VC	*Clare*	*N Tipp-erary*	*S E Galway*	*N E Galway*	*Offaly*	*Ros-common*	*E Mayo*	*Leitrim*	*Status (+ GB)*
Hydrophilidae									
Cercyon analis (Paykull)			PORQ						
Cercyon haemorrhoidalis (Fab.)	BLA CAR CRAG								
Cercyon impressus (Sturm)	MUL ROO								
Cercyon lateralis (Marsham)	ROO								
Cercyon marinus Thomson	MUL ROO								
Cercyon melanocephalus (L.)	MUL ROO					CORE			
Cercyon pygmaeus (Illiger)	MUL								
Cercyon sternalis Sharp		PORT	PORQ		CHA				
Cercyon ustulatus (Preyssler)					FIN				
Cryptopleurum minutum (Fab.)	CRAG CUT MUL								
Sphaeridium bipustulatum Fab.			PORQ						
Sphaeridium lunatum Fab.	MUL								
Sphaeridium scarabaeoides (L.)	MUL								
Histeridae									
Hister bissexstriatus Fab.	ROO								
Onthophilus striatus (Forster)	MUL ROO								
Paralister carbonarius (Hoffmann)	MUL ROO								

Leiodidae				
Anisotoma humeralis (Fab.)			CHA	Local
Leiodes calcarata (Erichson)	ROO			
Ptiliidae				
Acrotrichis atomaria (Degeer)			FIN	
Acrotrichis cognata (Matthews)			FIN	Natural ised (N_b)
Acrotrichis dispar (Matthews)	MUL			
Acrotrichis fascicularis (Herbst)	ROO			
Acrotrichis grandicollis (Mann.)	CRAG MUL		FIN	
Acrotrichis sericans (Heer)	MUL			
Acrotrichis sitkaensis (Motsch.)	BUN	PORQ		
Ptenidium nitidum (Heer)			CHA	
Ptenidium pusillum (Heer)			CHA FIN	
Ptiliola kunzei (Heer)	MUL			
Ptiliolum fuscum (Erichson)	MUL			
Silphidae				
Silpha atata L.	FAN KIL	COO PORQ		
Thanatophilus dispar (Herbst)	ROO			Local (pRDB1)
Scydmaenidae				
Euconnus hirticollis (Ill.)		PORQ	CHA	Local

Neuraphes elongatulus (Müll. and Kun.)					CHA				Local
Scydmaenus tarsatus Müll. and Kun.					FIN				Local
Carabidae									
Abax parallelepipedus (Pill. and Mitt.)	DROM		PIC		FIN				
Acupalpus parvulus					CLOA				Rare (local)
Agonum afrum (Duft.)	BALL DROM GRA KIL KNOA ROO	BUL			FIN	CORE			
Agonum fuliginosum (Panz.)	BALL CRAG	PORT	PORQ	POLR	CHA MUR	CORL	KNOL		
Agonum gracile Sturm	ATO CUT DROM GRA KIL	BUL PORT TER	AVA PORQ POUL		CHA CLOA MUR		KNOL	DRUS	
Agonum lugens (Duft.)	GRA KNOA								Burren (Ireland only)
Agonum marginatum (L.)	DROM GRA KIL ROO		COO			CORE			
Agonum micans Nicolai		BUL							Rare (local)

Agonum muelleri (Herbst)	CAR CORO DROM GRA KIL ROO		COO PORQ						
Agonum piceum (L.)	DROM KIL KNOA	BUL PORT	PIC PORQ			CORE	KNOL	DRUS	
Agonum thoreyi Dejean	ATO CUT DROM KIL ROO	BUL TER	AVA CLOB PORQ	POLR	CHA CLOA FIN MUR	ANN CORL	KNOL MOC		
Agonum viduum (Panzer)	BALL DROM GRA KIL	TER							
Amara aenea (Degeer)	CORO ROO								
Amara communis (Panzer)	ROO								
Amara lunicollis Schiødte					FIN				
Amara ovata (Fab.)	ROO								
Amara plebeja (Gyll.)	ROO								
Amara similata (Gyll.)	BALV								
Anchomenus dorsalis (Pont.)	BALV CORO FAN		DERG						
Anthracus consputus (Duft.)	KINV ROO								Rare (N_b)
Badister bullatus (Schrank)	FAN								
Badister dilatatus Chaud.	DROM		PIC PORQ						Local (N_b)
Badister meridionalis Puel	ROO								Rare (RDBI)

Badister peltatus (Panz.)		PORT	PORQ*						Local (N_a, BAP2)
Bembidion aeneum Germar	GEA ROO		COO						
Bembidion assimile Gyll.	GEA KIL KNOA ROO	BUL	COO PORQ	POLR		CORE	ISL MOC		
Bembidion bipunctatum (L.)	BALL		PORQ						Local (N_b)
Bembidion bruxellense Wesmael						CORE			
Bembidion clarki Dawson	DROM KNOA MUL ROO	BUL	COO PORQ						Rare (N_b)
Bembidion deletum Audinet-Serville								DRUS	Local
Bembidion dentellum (Thun.)	ROO	BUL	COO			CORE			
Bembidion doris (Panzer)	GRA KNOA ROO	PORT	PORQ		CLOA	CORE	ISL KNOL MOC	DRUS	
Bembidion genei Küster	GRA		PORQ						Very rare
Bembidion guttula (Fab.)	ROO	BUL	COO PORQ			CORE			
Bembidion mannerheimi Sahlberg	BUN GRA KNOA MUL		COO		CHA POLN	CORE			
Bembidion tetracolum Say	BALL KIL	TER	COO	BOL					
Blethisa multipunctata (L.)	BALL GEA GRA KIL ROO		PORQ			CORE	KNOl	DRUS	Wide spread (N_b)

Bradycellus ruficollis (Stephens)					ALL			
Carabus clatratus L.	KIL							Local (N_a)
Carabus granulatus L.	DROM GRA KIL				CHA	CORE		
Chlaenius nigricornis (Fab.)	BALL GRA							Local (N_b)
Clivina fossor (L.)	BALL GRA KIL MUL ROO	BUL	PORQ		FIN	CORE		
Cychrus caraboides (L.)	BALL							
Demetrias atricapillus (L.)			PORQ		CHA			
Dromius linearis (Olivier)	ROS							
Dromius melanocephalus Dejean	GRA							
Dromius meridionalis Dejean	ROS							
Dromius notatus Stephens	KIL							
Dyschirius globosus (Herbst)	BUN DROM GEA KIL ROO		COO			CORE		
Elaphrus cupreus Duft.	DROM GEA KNOA KIL ROO	BUL	CLOB POLN PORQ	POLR	CHA FIN		DRUS	
Elaphrus riparius (L.)	ROO							
Harpalus latus (L.)	BUN GEA							
Loricera pilicornis (Fab.)	BALL CORO GEA KNOA ROO	BUL	POLN PORQ		FIN			

Nebria brevicollis (Fab.)	BALL BLA KIL	BUL	DERG		MUR			
Ocys harpaloides (Serville)			DERG	BOL	CHA			
Panagaeus cruxmajor (L.)	KIL		PORQ					Rare (pRDB1, BAP1)
Pelophila borealis (Paykull)	ROO		COO					Local (pRDB3)
Platynus albipes (Fab.)	BALL DROM GEA KIL KNNOA	BUL TER	COO PORQ	BOL	FIN	CORE		
Platynus assimilis (Paykull)		BUL	COO					
Platynus obscurus (Herbst)		PORT	COO PORQ		CHA FIN			
Poecilus versicolor (Sturm)	ROO		PORQ					
Pterostichus anthracinus (Panzer)			COO				DRUS	Local (N_b)
Pterostichus crenatus (Duft.)	KIL	BUL			FIN			
Pterostichus diligens (Sturm)	GEA KIL MUL ROO	PORT	BALD PORQ POUL	POLR	ALL			
Pterostichus gracilis (Dejean)	KIL KNOA				CHA		KNOL	Local (N_b)
Pterostichus madidus (Fab.)			POLN PORQ			CORE		
Pterostichus melanarius (Ill.)	FAN	PORT	COO POLN					

Pterostichus minor (Gyll.)	BUN DROM GEA KIL KNOA	BUL	PORQ			KNOL		
Pterostichus niger (Schaller)			PORQ					
Pterostichus nigrita (Paykull)	BUN GRA KIL ROO	BUL TER	COO PORQ	BOL	CHA FIN MUR	CORE		
Pterostichus rhaeticus Heer			BALD PORQ					
Pterostichus strenuus (Panzer)	BUN CRAG FAN ROO	TER	COO PORQ	POLR	FIN		DRUS	
Stenolophus mixtus (Herbst)	MUL		COO		CLOA			Local
Trechus obtusus Erichson						MOC		
Trichocellus placidus (Gyll.)	BUN DROM							
Staphylinidae								
Omaliinae								
Eusphalerum minutum (Fab.)	BUN MUL							
Lesteva hanseni Lohse				BOL				Rare (N_b)
Lesteva punctata Erichson		PORT			MUR			
Lesteva sicula heeri Fauvel	BUN KNOA	PORT TER	BALD POLN PORQ	BOL POLR	CHA CLOA MUR	CORL	ISL MOC	
Olophrum piceum (Gyll.)							MOC	
Olophrum fuscum (Grav.)			AVA		MUR			Local
Philorinum sordidum (Steph.)	ROO							

Phyllodrepa devillei (Bernhauer)				CHA			?natural ised
Phyllodrepa ioptera (Stephens)				CHA			
Proteininae							
Megarthrus denticollis (Beck)	CRAG MUL			CHA			
Megarthrus depressus (Paykull)	MUL						
Micropeplinae							
Micropeplus porcatus (Paykull)	ROO		PORQ	MUR			
Pselaphinae							
Brachygluta fossulata (Reich.)			POLN				
Bryaxis bulbifer (Reich.)	MUL			CHA			
Pselaphaulax dresdensis Herbst					KNOL		Rare (N_b)
Reichenbachia juncorum (Leach)			PORQ POLN				
Rybaxis longicornis (Leach)				CHA			
Trissemus impressus (Panzer)			PORQ	CHA CLOA MUR	KNOL		Local
Tachyporinae							
Sepedophilus nigripennis (Steph.)	MUL						
Sepedophilus pedicularius (Grav.)	DROM			CHA		DRUS	Rare (N_b)
Tachinus laticollis Grav.	BUN ROO	TER					
Tachinus marginellus (Fab.)	MUL ROO ROS		PORQ				

Tachinus signatus Grav.	MUL ROO	PORT	BALD LOU POLN		FIN	CORE	DRUS	
Tachyporus chrysomelinus (L.)	ROO							
Tachyporus dispar (Payk.)	BUN MUL ROO			POLR	CHA			
Tachyporus obtusus var. *nitidicollis* Steph.	BLA				CHA			
Tachyporus pallidus Sharp	DROM		AVA		CHA			Local
Habrocerinae								
Habrocerus capillariformis (Gr.)			POLN					Local
Aleocharinae								
Acrotona aterrima (Grav.)	CRAG				FIN		DRUS	
Acrotona muscorum (Bris.)			PORQ					
Acrotona parvula (Mann.)	MUL							
Acrotona pygmaea (Grav.)	ROO		CLOB		FIN			
Alaobia pallidicornis (Thom.)					CHA			Local
Alaobia trinotata (Kraatz)					CHA			
Aleochara lanuginosa Grav.	MUL					MOC		
Aleochara intricata Mann.	MUL							
Alianta incana (Erich.)	MUL	PORT			MUR			Local
Aloconota gregaria (Erich.)	ROO		PORQ					
Aloconota insecta (Thom.)	BALL							
Aloconota sulcifrons (Steph.)				BOL				
Amischa analis (Grav.)					CLOA			

Amischa decipiens (Sharp)	ROO				CLOA				Local
Atheta basicornis (Muls. and Rey)		BUL							Rare (N_b)
Atheta crassicornis (Fab.)					CHA				
Atheta graminicola (Grav.)	BALL DROM KIL ROO	BUL PORT TER	AVA CLOB PORQ		CHA CLOA FIN MUR	ANN CORE CORL	MOC	DRUS	
Atheta nigricornis (Thom.)	CRAG								
Autalia rivularis (Grav.)	MUL								
Bolitochara obliqua Erich.	MUL				CHA				
Boreophilia eremita (Rye)				POLR				DRUS	
Calodera nigrita Mann.	ROO								Local (N_b)
Chaetida longicornis (Grav.)	CRAG				FIN				
Cordalia obscura (Grav.)						CORE			
Datomicra celata (Erich.)					FIN				
Datomicra sordidula (Erich.)	MUL								
Dilacra luteipes (Erich.)	ROO				MUR		MOC		Local
Dimetrota atramentaria (Gyll.)	CRAG MUL	BUl							
Dimetrota ischnocera (Thom.)	MUL								
Dimetrota nigripes (Thom.)	MUL				CHA				
Dimetrota setigera (Sharp)	MUL								
Dinaraea aequata (Erich.)					CHA				Local
Dochmonota clancula (Erich.)	ROO		CLOB		CHA				Local (N_b)

Geostiba circellaris Grav.)			POLN					
Gymnusa brevicollis (Payk.)				POLR			KNOL	
Gnypeta carbonaria (Mann.)	ROO							
Hygronoma dimidiata (Grav.)		PORT	AVA PORQ	POLR	CHA		ISL KNOL MOC	
Hygropora cunctans (Erich.)	KIL ROO	BUL				ANN	KNOL	?Rare (pRDBK)
Ischnopoda atra (Grav.)	BALL DROM KIL ROO	BUL TER	AVA PORQ		FIN MUR CHA	ANN CORL	MOC KNOL	DRUS
Leptusa fumida Kraatz								
Meotica exilis (Grav.)	ROO							
Microdota amicula (Steph.)					FIN			
Microdota atricolor (Sharp)	MUL							
Mniusa incrassata (Muls. and Rey)					CHA			
Mocyta fungi (Grav.)	BUN DROM		PORQ		CHA			
Mocyta fungi agg.	ROO	BUL			CHA CLOA MUR	ANN CORE	MOC	DRUS
Mocyta orbata (Erich.)	ROO				FIN			Local
Myllaena brevicornis (Matthews)			POLN					
Myllaena dubia (Grav.)			PORQ	POLR	CHA CLOA MUR		KNOL	

Myllaena intermedia Erichson			BALD POLN	POLR					
Myllaena minuta (Grav.)	BUN		AVA CLOB		CHA FIN		KNOL		
Ocyusa maura (Erich.)	KIL	PORT	AVA CLOB POLN		CHA CLOA		KNOL		?Local
Ocyusa picina (Aubé)	KIL	PORT	AVA CLOB POLN	POLR	CLOA FIN MUR	CORE	ISL		?Local
Oligota parva Kraatz	CRAG								Local
Oxypoda elongatula Aubé	KIL	PORT TER	AVA POLN PORQ	BOL	CHA CLOA MUR	CORE CORL			
Pachnida nigella (Erich.)		PORT			MUR				Local
Parameotica difficilis (Brisout)	ROO			BOL					Rare (N_b)
Parocyusa longitarsis (Erich.)					CHA				
Philhygra debilis (erich.)					CHA				Local
Philhygra elongatula (Grav.)	MUL ROO						MOC		
Philhygra hygrobia (Thom.)	ROO		CLOB		FIN				
Philhygra hygrotopora (Kraatz)	BALL ROO			BOL					
Philhygra malleus (Joy)	KIL ROO	BUL TER			CHA MUR			DRUS	
Philhygra melanocera (Thom.)	KIL ROO	BUL TER	PORQ		FIN MUR		MOC	DRUS	

Philhygra palustris (Kiesen.)	MUL	BUL		FIN				Local
Philhygra terminalis (Grav.)			AVA					Rare (pRDBK)
Philhygra volans (Scriba)	ROO	TER		MUR				
Schistoglossa aubei (Brisout)						KNOL	DRUS	Rare (pRDBK)
Schistoglossa gemina (Erich.)				MUR				Rare (N_b)
Tinotus morion (Grav.)	MUL							
Oxytelinae								
Anotylus rugosus (Fab.)	CRAG MUL KNOA ROO ROS	BUL TER		CHA	ANN CORE			
Anotylus tetracarinatus (Block)	MUL							
Bledius occidentalis Bondroit					CORE			New to Ireland (pRDBK)
Carpelimus corticinus (Grav.)	ROO	BUL	COO	CHA MUR	ANN CORL CORE	ISL KNOL	DRUS	
Carpelimus elongatulus (Erich.)			AVA POLN	FIN				
Carpelimus rivularis (Mots.)		TER			CORL CORE	ISL	DRUS	
Carpelimus similis (Smetana)	BLA							New to Ireland (N_b)

Deleaster dichrous (Grav.)				BOL					(N_b)
Ochthephilus aureus (Fauvel)				BOL					Local
Oxytelus laquaetus (Marsham)	MUL	BUL							
Platystethus arenarius (Fourc.)	BLA								
Platystethus nodifrons Mann.	ROO		COO						Rare (N_b)
Thinodromus arcuatus (Steph.)		TER							Local
Steninae									
Stenus aceris Stephens					CHA				Very rare (common)
Stenus bifoveolatus Gyll.	ATO GRA KIL	PORT	AVA POLN POUL	POLR	CHA CLOA FIN MUR	ANN CORL	KNOL MOC	DRUS	
Stenus bimaculatus Gyll.		PORT	POLN PORQ		CHA MUR	CORE			
Stenus binotatus Ljungh	KIL					CORL			
Stenus boops Ljungh	KIL KNOA ROO	BUL TER	AVA		CLOA FIN	ANN CORE	ISL MOC KNOL	DRUS	
Stenus brunnipes Stephens	MUL		PORQ		FIN MUR		MOC		
Stenus canaliculatus Gyll.							MOC		
Stenus carbonarius Gyll.	DROM	BUL				ANN			Local (N_b)
Stenus clavicornis (Scop.)					FIN	CORE		DRUS	

Stenus cicindeloides (Schall.)	BLA KIL	PORT	POLN	POLR	CHA CLOA FIN MUR		KNOL	DRUS	
Stenus crassus/formicetorum					MUR				
Stenus europaeus Puthz	KIL KNOA				CHA			DRUS	Local (N_b)
Stenus exiguus Erich.			POLN						Rare (N_b)
Stenus flavipes Stephens				POLR	CHA	ANN CORE			
Stenus formicetorum Mann.					FIN				
Stenus fornicatus Stephens							KNOL		Rare (N_b)
Stenus fuscipes Grav.	ROO				FIN		ISL MOC		Local
Stenus guttula Müller						CORE			
Stenus guynemeri Jacq. du Val				BOL					Local
Stenus impressus Germar			POLN		CHA		ISL		
Stenus juno (Payk.)	ATO CUT DROM ROO	BUL PORT TER	AVA BALN CLOB POLN PORQ	POLR	CHA CLOA FIN	ANN CORL CORE	ISL MOC	DRUS	

Stenus latifrons Erich.	ATO GRA KIL ROO	BUL PORT	AVA BALN BALD CLOB PIC PORQ	POLR	CHA CLOA FIN MUR	ANN	ISL KNOL MOC	DRUS	
Stenus lustrator Erich.	BUN	PORT	AVA				KNOL		Local
Stenus melanarius Stephens					CLOA				Rare
Stenus melanopus (Marsh.)							MOC		Local
Stenus nanus Stephens	ROO					ANN		DRUS	
Stenus nitens Stephens	DROM GRA KIL	PORT	AVA BALD CLOB PORQ		CHA	ANN	MOC KNOL	DRUS	Local
Stenus nitidiusculus Stephens	CAR GRA KIL	PORT	AVA AVU BALD BALN PIC POLN PORQ POUL	POLR	CHA CLOA MUR	ANN CORL	ISL MOC		
Stenus pallitarsis Stephens	ATO GRA KIL	BUL PORT	AVA BALD COO DERG		CHA CLOA FIN MUR	ANN CORL CORE		DRUS	
Stenus palustris Erich.			AVA	POLR	CHA MUR		KNOL		?Rare (N_b)

Stenus picipennis Erich.		PORT			CLOA MUR		MOC		
Stenus picipes Stephens	BLA				CHA FIN				
Stenus pubescens Stephens	KIL		PORQ		CLOA			DRUS	
Stenus similis (Herbst)	DROM	BUL		BOL	CHA				
Stenus solutus Erich.		PORT							New to Ireland (local)
Stenus tarsalis Lungh	DROM	BUL PORT	BALD COO		CHA MUR	ANN CORE	KNOL MOC	DRUS	
Stenus umbratilis Casey	ATO CUT				CLOA	ANN		DRUS	Local
Euasthetinae									
Euasthetus laeviusculus Mann.			POLN		CHA				Local
Euasthetus ruficapillus Lacord.			CLOB		CHA FIN		KNOL		Local
Paederinae									
Lathrobium brunnipes (Fab.)		BUL	BALD POLN PORQ	POLR	FIN		KNOL		
Lathrobium elongatum (L.)					CHA	ANN		DRUS	Local
Lathrobium fulvipenne (Grav.)	BLA								
Lathrobium geminum Kraatz	BALL					CORE			
Lathrobium impressum Heer	BALL						KNOL		
Lathrobium multipunctum Grav.				BOL					Rare

Lathrobium quadratum (Payk.)	DROM ROO	BUL			FIN	ANN			Local
Lathrobium rufipenne Gyll.							KNOL		New to Ireland (RDB2)
Lathrobium terminatum Grav.	BUN KNOA	PORT TER	BALD CLOB PORQ	PORT	MUR		KNOL		
Paederus fuscipes Curtis	KIL	PORT							Local (N_b)
Paederus riparius (L.)	DROM	TER	POLN PORQ	POLR	CHA FIN	ANN	KNOL	DRUS	
Rugilus erichsoni (Fauvel)	MUl								
Staphylininae									
Bisnius fimetarius (Grav.)	CRAG MUL				FIN				
Bisnius puella (Nordm.)	MUL								Local
Erichsonius cinerascens (Grav.)	BUN		BALD CLOB		CHA CLOA	ANN	KNOL		
Gabrius breviventer (Sperk)	ROO		PORQ		FIN				
Gabrius nigritulus (Grav.)	CRAG					CORE			
Gabrius piliger Muls. and Rey	MUL								
Gabrius trossulus (Nordm.)					CHA	CORE			Local
Gyrohypnus angustatus Stephens					FIN				
Gyrohypnus fracticornis (Müller)	MUL		PORQ						
Leptacinus pusillus (Steph.)					FIN				
Neobisnius villosulus (Steph.)						CORE			Local
Ochthephilum fracticorne (Payk.)			BALD	POLR					Local

Philonthus albipes (Grav.)	MUL							
Philonthus carbonarius (Grav.)					CORE			
Philonthus cognatus Steph.	ROO							
Philonthus corvinus Erich.						KNOL		Rare (N_a)
Philonthus fumarius (Grav.)	DROM ROO	TER	CLOB PORQ	CHA MUR	ANN			Local (N_b)
Philonthus furcifer Renk.	ROO		PORQ					Local (Ireland only)
Philonthus micans (Grav.)	ROO		CLOB	FIN				
Philonthus micans/micantoides			BALI					
Philonthus micantoides Ben. and Lohse	DROM	BUL						Rare
Philonthus nigrita (Grav.)	ROO		BALD CLOB	MUR	ANN CORL CORE	KNOL		
Philonthus quisquiliaris (Gyll.)		TER					DRUS	
Philonthus rotundicollis (Mén.)					CORE			
Philonthus sanguinolentus (Grav.)	MUL							
Philonthus splendens (Fab.)	CRAG MUL							
Philonthus umbratilis (Grav.)		TER		CHA				
Philonthus varians (Payk.)	CRAG MUL	BUL	PORQ	FIN	CORE			
Quedius auricomus Kies.				CHA				Rare (N_b)

Quedius curtipennis Bernh.			BALD				?Natural ised
Quedius fuliginosus (Grav.)			BALD POLN	POLR		CORL	
Quedius fumatus (Steph.)					CHA		
Quedius maurorufus (Grav.)		TER	PORQ	POLR	CLOA MUR	CORL	
Quedius picipes (Mann.)	MUL						Local
Stap[hylinus dimidiaticornis Gem.	ROO						
Staphylinus erythropterus L.	DROM		BALD PORQ			CORL	
Xantholinus elegans (Oliv.)	MUL						Rare (local)
Xantholinus linearis (Oliv.)					FIN		
Xantholinus longiventris Heer			PORQ				
Geotrupidae							
Geotrupes stercorarius (L.)		BUL					
Scarabaeidae							
Aphodius ater (DeGeer)	ROO						
Aphodius constans Dufts.	FAN MUL						Local
Aphodius depressus (Kugel.)	FAN MUL ROO		PORQ				
Aphodius erraticus (L.)	GEA MUL ROO						

Aphodius fimetarius (L.)	FAN MUL ROO		
Aphodius fossor (L.)	ROO		
Aphodius luridus (Fab.)	ROO		
Aphodius prodromus (Brahm)	FAN MUL ROO		
Aphodius pusillus (Herbst)	ROO		Local
Aphodius rufus Moll	BLA		
Aphodius sphacelatus (Panz.)	MUL		
Aphodius sticticus (Panz.)	MUL	PORQ	
Cetonia aurata (L.)	GEA MUL		Local
Melolontha melolontha (L.)		PORQ	
Onthophagus similis (Scriba)	MUL		Rare (local)
Phyllopertha horticola (L.)		PORQ	
Dascillidae			
Dascillus cervinus (L.)	FAN		
Byrrhidae			
Cytilus sericeus (Forster)	ROO		
Elateridae			
Agriotes lineatus (L.)		DUN	
Aplotarsus incanus (Gyll.)	BLA	COO PORQ	

	BLA BUN		CLOB			
Athous haemorrhoidalis (Fab.)	CUT FAN		POLN	CLOA		
	MUL ROS		PORQ			
Ctenicera cuprea (Fab.)	BUN KINV		PORQ			
Dalopius marginatus (L.)	CUT		POLN	ALL		
			PORQ	CHA		
Melanotus villosus (Geoff.)				CHA		
Cantharidae						
Cantharis cryptica Ashe	CRAG					
Cantharis figurata Mann.	BLA					
Cantharis pallida Goeze				CLOA		
Cantharis rufa L.				CLOA		
Malthodes marginatus (Latr.)				CHA		
Rhagonycha lignosa (Müll.)			DERG			
Rhagonycha limbata Thom.			POLN			
Cleridae						
Necrobia violacea (L.)	GRA					
Brachypteridae						
Brachypterus glaber (Stephens)	ROS	BUL	LOU			
Brachypterus urticae (Fab.)	BLA ROO			CHA		
Kateretes pusillus Thunb.					CORE	Rare (local)
Kateretes rufilabris (Latr.)	GRA	BUL				
Nitidulidae						
Cychramus luteus (Fab.)				CHA		

Epuraea aestiva (L.)	BLA ROO				
Epuraea melanocephala (Marsh.)				CHA CLOA	
Epuraea thoracica Tourn.			POLN		
Meligethes aeneus (Fab.)	FAN			CHA CLOA	
Meligethes atratus (Oliv.)	MUL ROO				
Meligethes carinulatus Förster	BUN MUL				
Meligethes exilis Sturm	MUL				Rare (N_b)
Meligethes nigrescens Stephens	MUL ROO				
Meligethes obscurus Erich.	BUN MUL				Local
Meligethes viridescens (Fab.)		BUL			
Monotomidae					
Monotoma picipes Herbst	CRAG		PORQ		
Rhizophagidae					
Rhizophagus dispar (Payk.)				CHA	
Cryptophagidae					
Atomaria lewisi Reitter				FIN	
Atomaria nitidula (Marsh.)	MUL				
Atomaria rubella Heer				CHA	
Atomaria testacea Stephens	MUL			FIN	
Cryptophagus pseudodentatus Br.	CRAG				New to Ireland (common)

Cryptophagus setulosus Sturm	CRAG					
Ephistemus globulus (Payk.)	CRAG					
Micrambe vini (Panz.)	ROO			CHA CLOA		
Telmatophilus caricis (Oliv.)		PORT		FIN		Local
Telmatophilus typhae (Fallén)		PORT				
Byturidae						
Byturus ochraceus (Scriba)	BLA					Local
Byturus tomentosus (DeGeer)				CHA		
Silvanidae						
Psammoecus bipunctatus (Fab.)		PORT	PORQ	CHA MUR		Local
Cerylonidae						
Cerylon fagi Brisout			COO	CHA		Local (N_b)
Endomychidae						
Mycetaea hirta (Marsh.)	CRAG					Local
Coccinellidae						
Adalia decempunctata (L.)	CAR ROO			CHA FIN		
Calvia quattuordecimguttata (L.)	BLA KNOA MUL			CHA		
Coccidula rufa (Herbst)		PORT	PORQ		CORE	
Coccinella septempunctata L.		BUL			CORE	

Propylea quattuordecimguttata (L.)	BUN	BALI	CHA FIN	
Scymnus auritus Thunb.			CHA	New to Ireland (local)
Thea 22-punctata (L.)	ROS			
Corylophidae				
Orthoperus nigrescens Stephens			CHA	Rare (N_b)
Latridiidae				
Cartodere nodifer (Westw.)	CRAG		CHA FIN	
Cortinicara gibbosa (Herbst)	ROO		CHA FIN	
Dienerella filum (Aubé)	CRAG			?Naturalised
Enicmus transversus (Oliv.)			FIN	
Lathridius anthracinus Mann.	CRAG			Local
Mycetophagidae				
Typhaea stercorea (L.)	CRAG			
Ciidae				
Cis bidentatus (Oliv.)		POLN PORQ	CHA	
Cis boleti (Scop.)	POLH	COO PORQ	ALL CHA	

Cis fagi Waltl				CHA	Local
Cis festivus (Panz.)			COO POLN PORQ	CHA	Local (N_b)
Cis nitidus (Fab.)	GRA		DERR	CHA	Local
Octotemnus glabriculus (Gyll.)			COO PORQ	CHA	
Salpingidae					
Salpingus planirostris (Fab.)				CHA	
Salpingus ruficollis (L.)	BLA				
Scraptiidae					
Anaspis frontalis (L.)				CHA	
Anaspis garneysi Fowler		BUL			
Anaspis maculata Geoff.	BUN CRAG MUL	BUL	PORQ	CHA	
Anaspis regimbarti Schilsky	BUN			CHA	
Anaspis rufilabris (Gyll.)	BLA			CHA	
Cerambycidae					
Ampedus pomorum (Herbst)			PORQ		
Grammoptera ruficornis (Fab.)	BLA BUN CRAG	BUL	BALI PORQ	CHA	
Grammoptera ustulata (Schall.)				CHA	New to Ireland (RDB3)

Rhagium bifasciatum Fab.			PORQ			
Rhagium mordax (DeGeer)			PORQ	CHA		
Chrysomeliidae						
Aphthona lutescens (Gyll.)	DROM MUL ROO	BUL		FIN		
Aphthona nonstriata (Goeze)	CRAG	BUL	PORQ	CHA FIN		
Altica oleracea (l.)		BUL				
Batophila rubi (Payk.)	BUN					Rare (local)
Bruchidius ater (Marsh.)				CLOA		Local
Bruchus rufimanus Boheman	BUN					New to Ireland (local)
Cassida viridis L.	HOL				CORE	
Chrysolina polita (L.)		PORT		CHA		
Crepidodera aurea (Geoff.)		BUL		CLOA		
Crepidodera fulvicornis (Fab.)			POLN	CLOA		
Galerucella calmariensis (L.)	BUN		POLN	FIN		
Galerucella lineola (Fab.)	BLA	BUL	POLN	FIN		
Galerucella nymphaeae (L.)				FIN		
Galerucella sagittariae (Gyll.)	BUN CUT ROS	BUL			CORE	Local
Galerucella tenella (L.)				CLOA FIN		

Gastrophysa viridula (DeGeer)	BLA GRA	BUL	COO		CORE	
Hydrothassa marginella (L.)		BUL			CORE	
Lema cyanella (L.)				CHA FIN		
Lochmaea caprea (L.)	DROM		CLOA	POLN		
Lochmaea crataegi (Förster)	ROO					
Lochmaea suturalis (Thom.)		BUL		CLOA		
Longitarsus luridus (Scop.)	MUL					
Longitarsus pratensis (Panz.)	MUL					
Oulema melanopus (L.)	ATO		DERG			
Oulema septentrionis Weise	ROO		COO			Occasional (Ireland only)
Phaedon armoraciae (L.)	GRA	BUL				
Phaedon cochleariae (Fab.)	GRA	PORT		CHA FIN MUR	CORE	
Phratora vulgatissima (L.)	ROO	BUL PORT	POLN	CHA CLOA MUR		
Phyllotreta exclamationis (Thun.)		PORT				Local
Phyllotreta flexuosa (Ill.)			PORQ			
Prasocuris junci (Brahm)					CORE	

Prasocuris phellandrii (L.)	BLA GRA HOL ROO	BUL		CHA FIN MUR	CORE	
Rhynchitidae						
Deporaus betulae (L.)			POLN	CLOA		Rare (common)
Brentidae						
Apion apricans Herbst	BUN MUL					
Apion carduorum Kirby				CHA		
Apion curtirostre Germar		BUL		CHA		
Apion ervi Kirby	BUN					
Apion fulvipes (Geoff.)	ROO			FIN		
Apion hydrolapathi (Marsh.)				FIN		
Apion loti Kirby	BUN					
Apion ulicis (Förster)	ROO			CLOA		
Apion viciae (Payk.)	BUN					
Curculionidae						
Anthonomus rubi (Herbst)				CLOA		
Archarias pyrrhoceras (Marsh.)			POLN	CHA		
Bagous limosus (Gyll.)	ROO					Rare (N_b)
Bagous lutulentus (Gyll.)		PORT				Rare (N_b)
Barypeithes araneiformis (Sch.)				CHA		
Barypeithes pellucidus (Bohem.)				CHA		
Ceutorhynchus minutus (Reich)				CHA		

Ceutorhynchus pallidactylis (Marsh.)				CLOA		
Ceutorhynchus typhae (Herbst)				CHA		
Coeliodinus rubicundus (Herbst)	BUN			ALL		Local
Dorytomus rufatus (Bedel)		PORT		CHA		
Erirhinus acridulus (L.)					CORE	
Euophryum confine (Broun)				CHA		
Gymnetron villosulum Gyll.				CHA		Rare (N_b)
Hylastinus obscurus (Marsh.)				CLOA		Local
Hylobius abietis (L.)	GRA					
Hypera rumicis (L.)				FIN		
Leiosoma deflexum (Panz.)				CHA		
Limnobaris dolorosa (Goeze)		BUL				
Mecinus labile (Herbst)	MUL					Local
Mecinus pyraster (Herbst)		BUL				Local
Miarus campanulae (L.)	MUL					Local
Micrelus ericae (Gyll.)	MUL			CLOA		
				CHA		
Nedyus quadrimaculatus (L.)	ROO			CLOA		
				FIN		
Orchestes fagi (L.)	BLA ROO ROS		LOU	CHA		
Phyllobius argentatus (L.)	CAR			CHA		
Phyllobius calcaratus (Fab.)	ROS					

Phyllobius pyri (L.)	MUL	POLN	CHA CLOA	
Phyllobius roboretanus Gredler	BUN ROO ROS		CLOA	
Polydrusus pterygomalis Bohem.			CHA	
Polydrusus tereticollis (DeGeer)		POLN		
Rhampus pulicarius (Herbst)	BUN			
Rhinoncus pericarpius (L.)			CLOA	
Rhynchaenus calceatus Germ.			ALL	
Sciaphilus asperatus (Bonsd.)			CHA	
Sitona ambiguus Gyll.			FIN	
Sitona regensteinensis (Herbst)	ROO		CLOA	
Tanysphyrus lemnae (Payk.)			FIN	Local

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FIGURE 1. Species maps.

Map 1. *Agonum lugens*

Map 2. *Panagaeus cruxmajor*
(light circles = pre 1970 records)

Map 3. *Stenus palustris*

Map 4. *Hygropora cunctans*

References

Anderson, R. (1984) Staphylinidae (Coleoptera) in Ireland - 3: Steninae. *Ir. Nat. J.* **21**: 242-251.

Anderson, R. (1985) *Agonum lugens* (Duftschmid) new to the British Isles (Col., Carabidae). *Entomologists' mon. Mag.* **121**: 133-135.

Anderson, R. (1996) Late summer emergence of *Agonum lugens* (Duft.) in the Burren, Ireland. *Coleopterist* **4**: 26.

Anderson, R., McFerran, D. M. and Cameron, A. (2000) *Atlas of the ground-beetles (Coleoptera: Carabidae) of Northern Ireland.* Ulster Museum, Belfast. 246 pp.

Anderson, R., Nash, R. and O'Connor, J. P. (1997) A revised and annotated list of Irish Coleoptera. *Ir. Nat. J. Special Ent. Suppl. 1997:* 1-81.

Barclay, M. V. L. (2003) *Carpelimus similis* Smetana (Staphylinidae) and *Carpophilus marginellus* Motschulsky (Nitidulidae) infesting a hotel in South Devon. *Coleopterist* **12**: 124.

Bullock, E. (1930) Coleoptera from the Killarney district of County Kerry, Ireland. *Entomologist's mon. Mag.* **64**: 102-104.

Fowles, A. (1994) *Invertebrates of Wales: a review of important sites and species.* JNCC, Peterborough.

Good, J. A. (1989) *Stenus palustris* Erichson (Coleoptera: Staphylinidae): a reed marsh beetle new to Ireland. *Ir. Nat. J.* **23**: 32.

Good, J. A. (1999) Recolonisation by Staphylinidae (Coleoptera) of lead mine tailings at Silvermines, Co. Tipperary, Ireland. *Bull. Ir. biogeog. Soc.* **23**: 128-140.

Good, J. A. (2004) Lake-shore fens and reedbeds as a habitat for Staphylinidae and Carabidae (Coleoptera) in the east Burren area of Co. Clare, Ireland. *Bull. Ir. biogeog. Soc.* **28**: 163-188.

Good, J. A. and Butler, F. T. (2001) Turlough pastures as a habitat for Staphylinidae and Carabidae (Coleoptera) in south-east Galway and north Clare, Ireland. *Bull. Ir. biogeog.*

Soc. **25**: 74-94.

Harding, P. T. and Rose, F. (1986) *Pasture-woodlands in lowland Britain.* Institute of Terrestrial Ecology, Monks Wood.

Hyman, P. S. and Parsons, M. S. (1992) *A review of the scarce and threatened Coleoptera of Great Britain. Part 1. UK Nature Conservation No. 3.* JNCC, Peterborough.

Hyman, P. S. and Parsons, M. S. (1994) *A review of the scarce and threatened Coleoptera of Great Britain. Part 2. UK Nature Conservation No. 12.* JNCC, Peterborough.

Koch, K. (1989) *Die Käfer Mitteleuropas. Ökologie. 1.* Goecke and Evers, Krefeld.

Lott, D. A. (2002) *Philhygra terminalis* (Gravenhorst) (Col. Staphylinidae) in Surrey and Leicestershire. *Coleopterist* **11**: 74.

Lott, D. A. (2003) Recent records of *Lathrobium rufipenne* Gyllenhal (Staphylinidae) in Britain and Ireland. *Coleopterist* **12**: 101-103.

Lott, D. A. and Bilton, D. T. (1991) Records of Coleoptera from Irish wetland sites, 1989. *Bull. Ir. biogeog. Soc.* **14**: 16-72.

McFerran, D. M., Cameron, A. and Anderson, R. (1995) The distribution and status of *Carabus clatratus* L. (Coleoptera:Carabidae) in the West Fermanagh and Erne Lakeland Environmentally Sensitive Area. *Ir. Nat. J.* **25**: 67-71.

Moore, R. (1981) A list of the beetles from Sherkin Island taken in autumn 1980, including some new records for Cork and Munster. *Journal of Sherkin Island* **1**: 86-99.

Moran, J., Gormally, M. J. and Sheehy Skeffington, M. (2003) Records of *Panagaeus crux-major* (L.) and *Pterostichus aterrimus* (Herbst) recorded on turloughs, in Cos Clare and Mayo. *Ir. Nat. J.* **27**: 309-311.

Owen, J. A. (1997) Beetles (Coleoptera) recorded from various Irish sites in 1993, 1994 and 1996. *Bull. Ir. biogeog. Soc.* **20**: 136-154.

Speight, M. C. D. (1976) *Badister meridionalis, Megasyrphus annulipes* and *Westmaelius quadrifasciatus:* insects new to Ireland. *Ir. Nat. J.* **18**: 303-304.

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OBSERVATIONS ON THE TRICHOPTERA OF THE RIVERS FLESK AND LAUNE, KILLARNEY, CO. KERRY, IRELAND

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Introduction

Situated in south-west Ireland, the Killarney Valley is world renown for its scenic beauty and is one of the most important tourist areas on the island. In 1967, concern was expressed at the discharge of untreated sewage from Killarney town into Lough Leane (Lower Lake). As a result, a study of the Killarney Valley system was carried out by University College Dublin from 1971 to 1975 (Bracken *et al.*, 1977). The overall objective was to assess the extent of cultural eutrophication in the area. However, in the past, the valley had received little attention from limnologists and the opportunity was taken to investigate the poorly known aquatic fauna of the lakes and rivers. Concomitantly, a major survey had commenced on the Irish caddisfly fauna by O'Connor. The rich and interesting trichopteran fauna of the Killarney Lakes was described by O'Connor and Wise (1984) based on data from both surveys. The Ephemeroptera and Plecoptera of the lakes and rivers were also described in Wise and O'Connor (1997). The present paper provides similar detailed base-line information on the Trichoptera of the Rivers Flesk and Laune. The River Flesk is the largest affluent river in the catchment area while the whole system is drained by the River Laune.

The study area

The climatic conditions of the Killarney Valley region are characterized by heavy rainfall (annual average 1263-3000mm), warm temperatures (seasonal means 6.5-15.2 °C) and prevailing south-west winds. The three main lakes are all centrally located in the River Laune catchment which has an area of 829km. The Laune flows from the Lough Leane into the sea at the upper end of Dingle Bay. The Flesk is the largest sub-catchment of Lough Leane. Devonian Old Red Sandstone and Lower Carboniferous strata (mainly limestone) comprise the main underlying bedrock in the area. The landscape is rugged, with many small water bodies of glacial origin.

Material and methods

Material was obtained in two separate surveys. The first survey, by Wise, was undertaken during eutrophication investigations in the Killarney Valley when larvae and pupae were collected from October 1971 to September 1972 from the Rivers Flesk and Laune. The sampling technique was similar to that of Macan (1957) and Hynes (1961). A twelve meshes per cm square-framed net with 25cm sides was used. Organisms, disturbed by excavating the substrate with a rake, were swept by the current into the net positioned immediately downstream. Large stones were removed by hand in order to dislodge attached organisms and "sweep" samples were taken in *Ranunculus* beds etc. A collection was made at each site once a month and took a ten minute period to complete. Data collected in this manner provided a basis for relative comparisons. The five larval sampling stations are shown (Fig.1). Wide fluctuations in water levels (mean annual range <2m) are a feature of all stations.

River Flesk

Station I (Irish grid ref. W036876): elevation 61m a.s.l. A shallow area characterized by a lush growth of macrophytic vegetation (dominant *Ranunculus pseudofluitans* Baker and Fogg) which tends to impede flow. The current velocity has a mean flow-rate of 53cms/sec. The substrate between the weed beds is typical of that normally associated with rapidly flowing

water. **Station II** (V987904): elevation 30m a.s. l. A shallow, stony "riffle" area with a sparse growth of *Ranunculus*. The flow rate is fast (mean 67cms/sec.) and the substrate is stable. **Station III** (V967895): elevation <30m a. s. l. An extensive shallow "riffle" with a predominatly stony substrate of cobbles and pebbles. The current is fast flowing (mean 77cms/sec.). Angiosperms are dominated by beds of *Ranunculus* and the bryophytes are represented mainly by growths of *Fontinalis*.

River Laune

Station I (V893911): elevation <30m a. s. l. A deep, slow-flowing (mean 34cms/sec.) region below Lough Leane. The substrate consists of pebbles with patches of gravel and silt deposits. There are extensive beds of *Ranunculus* and some *Potamogeton.* **Station II**: (V893911), elevation <30m. A broad shallow "riffle" characterized by fast current velocities (mean 81cms/sec.). The substrate consists of cobbles typical of rapidly eroding areas. *Ranunculus pseudofluitans* is the only angiosperm but bryophytes (mainly *Fontinalis*) are well represented.

Second survey

During a study of the Irish Trichoptera, imagines, pupae and larvae were collected by O'Connor on both rivers and in running water elsewhere in the area from 1972 to 1995. Adults were caught in Heath portable light-traps and by sweeping vegetation etc. with a hand-net. Larvae and pupae were searched for by hand and net. Only data from the two rivers are included here.

Results and discussion

The combined results of the two surveys are given in Table 1. A total of 55 species is now on record from the Rivers Flesk and Laune, with 50 taken from the former and 24 from the latter. Of the species only found in the Flesk, *Odontocerum albicorne* (Scopoli) was the most abundant and widely distributed. *Plectrocnemia geniculata* McLachlan, *Philopotamus montanus* (Donovan) and *Diplectrona felix* McLachlan were only present at Station 1. The last-

named species may be considered as a vagrant from upper valley tributaries as it found mainly in shaded habitats which do not become warm in the summer such as springs and small woodland streams (Brindle, 1956; Edington, 1965; Edington and Hildrew, 1995; Mosely, 1939; Wallace, 1991).

Hydropsyche siltalai Döhler was the dominant species belonging to the "Flesk Community". The larvae of *Eurycnemus* crassipes (Panzer) (Diptera: Chironomidae) were discovered to be obligate ectoparasites on the prepupae/pupae of *H. siltalai* in this river (Ashe, O'Connor and Murray, 2000). Cheumatopsyche *lepida* (Pictet), *Agapetus* spp., *Rhyacophila dorsalis* (Curtis) and *Glossosoma boltoni* Curtis had similar distributions being most abundant in the lower Flesk at Station III. *Polycentropus flavomaculatus* (Pictet) reached its greatest density at Station II. *Lepidostoma hirtum* (Fabr.) and *Agraylea multipunctata* Curtis, on the other hand, were more abundant in the Flesk at Station I where there was a good growth of *Ranunculus.*

Species which reached maximum densities in the River Laune but which were also present in the Flesk include *Hydropsyche pellucidula* (Curtis), *Chimarra marginata* (L.), *Sericostoma personatum* (Spence in Kirby and Spence), *Rhyacophila munda* McLachlan and *Potamophylax latipennis* (Curtis)/*P. cingulatus* (Stephens). Of those species only found in the Laune, *Neureclipsis bimaculata* (L.) is the most notable. Although occurring in fairly slowly flowing lowland rivers such as the River Shannon, it is usually found in streams and rivers at the exits of large ponds and lakes. The large population at Station I is directly attributable to the close proximity of the outflow from Lough Leane. Other species which are associated with the slow flowing conditions at this station are *Limnephilus lunatus* Curtis and *L. marmoratus* Curtis. The larvae of *Wormaldia* spp., taken in the Laune, are undoubtedly vagrants from a tributary stream as the genus typically occurs where water runs vertically down through piles of boulders (Edington and Hildrew, 1995). The larvae of *Mesophylax impunctatus* McLachlan were probably washed into the Laune from Lough Leane as the species normally occurs under stones on gravel on exposed lake shores (O'Connor and Wise, 1984; Wallace, Wallace and Philipson,

2003).

The remaining species were generally scarce and appeared to be randomly distributed. There is insufficient evidence to place them in specific associations and little can be said about their distribution patterns.

While no data were available on the Trichoptera of the Laune prior to the present investigations, some previous work had been carried out on the Flesk. King and Halbert (1910) recorded twelve species from the river based on adults. Beirne (1939) reported another two species from imaginal material. Fahy (1972) gave a grid reference (V9791) which may also refer to the Flesk, adding a further four species.

Since the two rivers are similar in altitudinal and physio-chemical characteristics, the major factor determining the faunal differences is the influence exerted by the eutrophic Lough Leane on the River Laune.

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References

Ashe, P., O'Connor, J. P. and Murray, D. A. (1998) A checklist of Irish aquatic insects. *Occasional Publication of the Irish Biogeographical Society* **No. 3**.

Ashe, P., O'Connor, J. P. and Murray, D. A. (2000) Larvae of *Eurycnemus crassipes* (Panzer) (Diptera: Chironomidae) ectoparasitic on prepupae/pupae of *Hydropsyche*

siltalai Döhler (Trichoptera: Hydropsychidae) with a summary of known chironomid /trichopteran associations. *Spixiana* **23**: 267-274.

Beirne, B. P. (1939) Irish Trichoptera records. *Journal of the Society for British Entomology* **2**: 8.

Brindle, A. (1956) The ecology of North-East Lancashire Trichoptera (with special reference to the use of light as a collecting method). *Entomologist's Gazette* **7**: 179-184.

Bracken, J. J., Horkan, J. P. K., Kane, P. O. and Wise, E. J. (1977) The trophic status of Lough Leane. pp 50-64. *In* Downey, W. K. and Ni Uid, G. (eds) *Lake pollution prevention by eutrophication control.* Stationery Office, Dublin.

Edington, J. M. (1965) The effect of water flow on populations of net-spinning Trichoptera. *Internationale Vereinigung für Theoretische und Angewandte Limnologie* **13**: 40-48.

Edington, J. M. and Hildrew, A. G. (1995) *A revised key to the caseless caddis larvae of the British Isles with notes on their ecology.* Freshwater Biological Association Scientific Publication **No.** 53.

Fahy, E. (1972) Some records of Trichoptera from Ireland. *Irish Naturalists' Journal* **17**: 199-203.

Hynes, H. B. N. (1961) The invertebrate fauna of a Welsh mountain stream. *Archives für Hydrobiologia* **57**: 344-388.

King, J. J. F. X. and Halbert, J. N. (1910) A list of the Neuroptera of Ireland. *Proceedings of the Royal Irish Academy* **28**B: 29-112.

Macan, T. T. (1957) The Ephemeroptera of a stony stream. *Journal of Animal Ecology* **26**: 317-342.

Mosely, M. E. (1939) *The British caddis-flies (Trichoptera).* Routledge, London.

O'Connor, J. P. and Wise, E. J. (1984) Observations on the Trichoptera of the Killarney Lakes, Co. Kerry, Ireland. *Irish Fisheries Investigations.* Series A. **No. 24.**

Wallace, I. D. (1991) *A review of the Trichoptera of Great Britain.* Research and survey in

Nature conservation. **No.** 32. Nature Conservancy Council, Peterborough.

Wallace, I. D., Wallace, B. and Philipson, G. N. (2003) *Keys to the case-bearing caddis larvae of Britain and Ireland.* Freshwater Biological Association Scientific Publication **No**. 61.

Wise, E. J. and O'Connor, J. P. (1997) Observations on the distribution and relative abundance of the Ephemeroptera and Plecoptera in the Killarney Valley, Co. Kerry, Ireland. pp 175-179. *In* Landolt, P. and Sartori, M. (eds) *Ephemeoptera and Plecoptera. Biology - Ecology -Systematics*. MTL, Fribourg.

TABLE 1. The Trichoptera of the Rivers Flesk and Laune. Summary of combined data from all known sources. L indicates larval material, A indicates imaginal and/or pupal material and KH denotes species only reported by King and Halbert (1910). The numbers represent the annual totals of individuals collected at monthly intervals between October 1971 and September 1972. Nomenclature follows Ashe, O'Connor and Murray (1998) .

	River Flesk					River Laune			
	Combined records		Larval Abundance			Combined records		Larval Abundance	
Stations			I	II	III			I	II
Rhyacophila dorsalis	L	A	15	26	91	L	A		53
R. munda	L	A	13	3	22	L			58
Glossosoma boltoni	L	A	13	53	52	L	A		8
Agapetus fuscipes		A							
Agapetus ochripes		A					A		
A. fuscipes/ochripes	L		24	77	126	L			24
Philopotamus montanus	L		2						
Wormaldia subnigra		A							
Wormaldia sp.						L			2
Chimarra marginata	L	A	1	47	137	L			179
Neureclipsis bimaculata						L	A	875	11
Plectrocnemia geniculata	L		3						
Polycentropus flavomaculatus	L	A	3	35	25	L			2
P. irroratus		A				L		1	1
Cyrnus trimaculatus		A							
Tinodes waeneri		A							
T. maclachlani	KH								
Lype phaeopa		A							
L. reducta		A							
L. phaeopa/reducta	L		3		1				
Psychomyia pusilla	L	A		4	2	L		1	
Hydropsyche pellucidula	L	A	36	46	116	L		75	517
H. contubernalis	L		2	9	3	L	A		2
H. siltalai	L	A	75	262	907	L			6
Cheumatopsyche lepida	L	A	1	58	622	L	A	4	269
Diplectrona felix	L		2						
Agraylea multipunctata	L	A	8		1	L		1	
Hydroptila sparsa		A							
H. angulata		A							

Stations	River Flesk					River Laune			
	Combined records		Larval Abundance I	II	III	Combined records		Larval Abundance I	II
H. tineoides		A							
H. forcipata		A							
Ithytrichia lamellaris		A							
Oxyethira frici		A							
Phryganea grandis		A							
Apatania auricula							A		
Limnephilus flavicornis	KH								
L. marmoratus						L	A	7	1
L. lunatus		A				L		30	1
L. centralis		A							
Anabolia nervosa		A							
Potamophylax latipennis		A							
P. cingulatus		A							
P. latipennis/cingulatus	L		3	6	6	L		18	12
Halesus radiatus							A		
H. digitatus		A							
H. radiatus/digitatus	L		6	7	3	L		3	8
Mesophylax impunctatus						L		4	
Odontocerum albicorne	L	A	8	16	20				
Athripsodes albifrons	L	A	1	3		L	A	3	
A. cinereus	L	A	1	3		L	A	3	
A. commutatus		A							
Ceraclea annulicornis	L				1	L		1	
Mystacides azurea		A							
Adicella reducta		A							
Oecetis testacea		A							
Goera pilosa	L	A	3	1	1	L		11	
Silo pallipes		A							
S. nigricornis	L	A		1					
Lepidostoma hirtum	L	A	285	103	143	L		109	56
Lasiocephala basalis		A							
Sericostoma personatum	L	A	23	8	16	L		2	41

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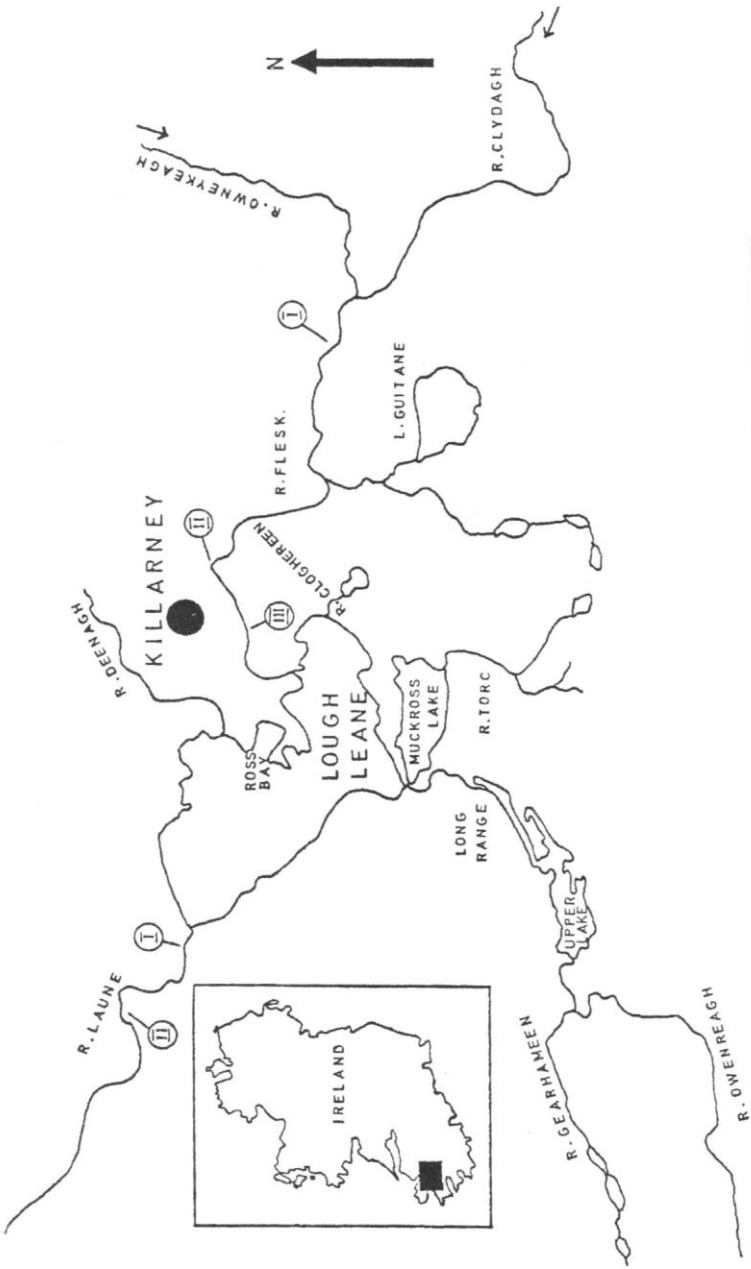
FIGURE 1. Location map showing the larval sampling stations.



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NEW VICE-COUNTY RECORDS FOR LACEWINGS (NEUROPTERA) FROM NORTHERN IRELAND

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Introduction

Barnard *et al.* (1991) provide distributional data for the Neuroptera in Ireland. Records from the north are particularly scarce and the present note brings together a miscellany of records obtained over a period of ten years. Most records constitute new vice-county records and these are indicated by an asterisk. Identification and nomenclature are from Plant (1997) and habitat associations are taken from Plant (1994). All records are my own, although the Hemerobiidae have been identified for me by Colin Plant.

CHRYSOPIDAE

***Chrysoperla carnea* (Stephens)**

***DOWN (H38)**: Murlough Dunes, J410350, 21.v.1992, off sycamore *Acer pseudoplatanus* L.

Widespread in Ireland; most often found amongst the foliage of broad-leaved trees and shrubs.

***Cunctochrysa albolineata* (Killington)**

***ANTRIM (H39):** Craigagh Wood, D227323, 17.vi.1992, swept in mature oak *Quercus* woodland.

***ARMAGH (H37)**: Derrymore, J059277, 6.vii.1992, beaten from oak foliage.

*** DOWN (H38)**: Rostrevor Oakwood, J186177, 28.vi.1992, in oak woodland.

***FERMANAGH (H33)**: Reilly Wood, Crom, H338257, 28.v.1992, swept in alder *Alnus* carr;

Florence Court Park, H171341, 3.vi.1992, beaten from birch *Betula*.

Widespread; amongst the foliage of broad-leaved trees and shrubs.

***Nineta vittata* (Wesmael)**

***DERRY (H40)**: Springhill, H869826, 25.vi.1992, beaten from ash *Fraxinus excelsior* L. foliage along edge of shelterbelt.

Very few Irish records, but these are very widely scattered (Plant, 1994); found amongst the foliage of broad-leaved trees and shrubs.

HEMEROBIIDAE

***Hemerobius humulinus* L.**

***ANTRIM (H39)**: Manor House Wood, Rathlin Island, D145511, 27.viii.1998, swept beneath alders; Murlough Bay, D190420, 20.v.2000, male and female swept in open birch woodland.

Widespread in Ireland; amongst the foliage of trees and shrubs.

***Hemerobius lutescens* F.**

***ANTRIM (H39)**: White Park Bay, D023440, 20.v.2000, beaten from hawthorn *Crataegus*.

***ARMAGH (H37)**: Derrymore, J056280, 6.vii.1992, off foliage of parkland oak.

***DERRY (H40)**: Port Vantage, Downhill, C761359, 9.vi.1992, swept in open sycamore woodland.

***FERMANAGH (H33)**: Reilly Wood, Crom, H338257, 28.v.1992.

Widespread; amongst the foliage of trees and shrubs.

***Hemerobius micans* Olivier**

DOWN (H38): Skillins Wood, Grey Abbey, J573677, 18.viii.1998, swept along upper saltmarsh edge to oak wood; Island Reagh, Strangford Lough, J525644, 21.viii.1998, beaten from hazel *Corylus avellana* L. foliage under mature oaks.

***FERMANAGH (H33)**: Florence Court Park, H169343, 3.vi.1992, off oak foliage.

Widespread on oak trees.

***Hemerobius stigma* Stephens**

***FERMANAGH (H33)**: Florence Court Park, H171345, 3.vi.1992, swept beneath mature oak trees.

Status unclear but probably fairly widespread; reputedly confined to pine trees.

***Micromus paganus* (L.)**

***ANTRIM (H39)**: Breen Wood, D125335, 7.vi.1992, one swept in woodland glade.

Status unclear but probably fairly widespread; associated with field layer vegetation in open situations.

***Micromus variegatus* (Fabr.)**

***ANTRIM (H39)**: Port na Tober, Giants Causeway, C960456, 9.vi.1992, one swept from a patch of woodrush *Luzula* behind storm beach; White Park Bay, D023440, 20.v.2000, swept from scrubby grassland.

***DERRY (H40)**: Bar Mouth, C791353, 10.vi.1992, swept from marshy coastal grassland by mouth of River Bann.

***DOWN (H38)**: Murlough Dunes, J410350, 20.v.1992; Skillins Wood, Grey Abbey, J573677, 18.viii.1998, swept along upper saltmarsh edge to oak wood; Mid Isle, Ballyurnanellan, J567671, 18.viii.1998, swept from tall dense grassland of upper saltmarsh; Sea Plantation, Mount Stewart, J550695, 18.viii.1998.

***FERMANAGH (H33):** Gortgonnell, Castle Coole, H256424, 2.vi.1992, swept from fen pasture.

Probably widespread; associated with field layer vegetation in open situations.

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References

Barnard, P. C., O'Connor, J. P. and Speight, M. C. D. (1991) A review of published distributional data for Irish Neuroptera (Insecta), together with additional records and a check-list of the Irish species. *Bull. Ir. biogeog. Soc.* **14**: 109-122.

Plant, C. W. (1994) *Provisional atlas of the lacewings and allied insects (Neuroptera, Megaloptera, Raphidioptera and Mecoptera) of Britain and Ireland.* Biological Records Centre, Huntingdon.

Plant, C. W. (1997) A key to the adults of British lacewings and their allies. *Field Studies* **9**: 179-269.

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CALCAREOUS GRASSLAND AS A HABITAT FOR STAPHYLINIDAE (COLEOPTERA) IN THE BURREN NATIONAL PARK, CO. CLARE, IRELAND

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Glinny, Riverstick, Co. Cork, Ireland.

Dedicated to Prof. David W. Jeffrey on the occasion of his retirement, in recognition of his great contribution to grassland ecology in Ireland.

Abstract

Three calcareous grassland sites, in the Burren Carboniferous limestone uplands in the west of Ireland, were sampled for Staphylinidae using a suction sampler, and (at one site) pitfall traps. In total, 26 species were recorded, including species typical of Irish calcareous grasslands (*Drusilla canaliculata* (Fabr.), *Falagrioma thoracica* (Stephens), *Metopsia clypeata* (Müller) and *Micropeplus staphylinoides* (Marsham)). Most of the 23 species recorded from grassland on shallow loess-derived soil on Mullagh Mór (altitude *circa* 160m) were typical of wet rather than dry grassland. Three species (*Cypha tarsalis* (Luze), *Philonthus mannerheimi* Fauvel and *Rugilus similis* (Erichson)) were considered indicators of ecologically well-developed habitat, but two of these are restricted to wetland or moist woodland habitat, and not dry grassland habitat. It is hypothesised that a limestone pavement/calcareous grassland ecotone exists, with grikes (limestone rock fissures) acting as a refuge for hygrophilous species when the shallow grassland soils dry out seasonally.

Introduction

In addition to their unique flora (Nelson and Walsh, 1991), the Carboniferous limestone uplands of the Burren also have a notable phytophagous and aquatic invertebrate fauna

(O'Connor and O'Connor, 1982; O'Connor *et al.*, 1988; D'Arcy and Hayward, 1992; Speight, 1999). Relatively little, however, is known about the calcareous grassland soil fauna of the Burren. As part of grassland staphylinid surveys, a number of samples were taken from three locations in the Burren National Park uplands (one on Mullagh Mór and two near Carron), and the results are reported here.

Methods

Three locations in the Burren were sampled, as follows:-

(1) Mullagh Mór, Co. Clare (R329955; circa 160m altitude; see photograph and map in O'Donovan (2001)), six plastic cup pitfall traps with undiluted ethylene glycol (commercial antifreeze) as preservative (20 June - 1 July 1985), and three D-vac suction samples (00.30 - 01.00h GMT, 20 June 1985) covering a total area of *circa* $3m^2$. (The D-vac was a 2-stroke engine-driven apparatus mounted on the operator's back (Dietrick, 1961); the manual haulage of this contraption up the terrace cliffs of Mullagh Mór, and the more lunatic nocturnal descent by torchlight, was made possible by the kind and able assistance of Dr Paddy Sleeman. Nocturnal sampling was considered preferable at the time because of the probability of greater numbers of staphylinids climbing up from the soil and litter into the grass and herb canopy at night). The area sampled was located on the upper terrace on the eastern side of Mullagh Mór, in calcareous grasslands on loess-derived soils (see Jeffrey, 1995; Moles *et al.*, 1995). The vegetation of this area has been described by O'Donovan and Jeffrey (1990) and O'Donovan (2001).

(2) Tullycommon (near Carron), Co. Clare (R285976), eight D-vac suction samples (16.00-19.00h GMT, 20 May 1988), covering a total area of *circa* $8m^2$, four samples in the deeper soils at the base of a limestone cliff, and four on the rendzina soils of the cliff ledges and scree base. The *Sesleria albicans* Kit. ex Schultes-dominated grassland vegetation at the base of the limestone cliff included *Anthoxanthum odoratum* L., *Carex flacca* Schreber, *Geranium sanguineum* L., *Lathyrus montanus* Bernh., *Listera ovata* (L.) R. Br., *Lotus corniculatus* L.,

Orchis mascula (L.) L., *Potentilla erecta* (L.) Räuscel and *Primula vulgaris* Hudson. The *Sesleria*-dominated vegetation of the rock cliff ledges was poorer in plant species, probably because it was shallower and drier, and would be unlikely to have had any historical patches of dung-enrichment due to grazing animals.

(3) Sheshodonnell East (near Carron), Co. Clare (R268970), six D-vac suction samples (20.00-21.00 GMT, 21 June 1992), covering an area of *circa* 6m^2, three in limestone rubble/gravel spoil of a small 19th century lead mine (Castletown Mine), and three in the original soil nearby. The former had a sparser cover of grasses, whereas the latter had a complete calcareous vegetation cover with *Dactylis glomerata* L., *Geranium sanguineum*, etc.

Species were selected as indicators of well-developed habitat if:- (1) they have a restricted habitat preference; (2) they have not been recorded from non-calcareous Irish grasslands; and (3) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems. 'Well-developed habitat' is defined as an ecosystem which is sufficiently undisturbed by human activity to allow it to retain many local or rare characteristic species.

The male *Cypha tarsalis* was determined using the aedeagal illustrations in Palm (1966) and Welch (1995), as well as the descriptions of elytral microsculpture from Lohse (1974). The female *Rugilus similis* was determined using the keys and illustrations in Lohse (1964), Szujecki (1965) and Fowler (1888). Nomenclature follows Lott and Duff (2003), with the exception of the genus concept of *Atheta*, where Anderson *et al.* (1997) is followed. Plant nomenclature follows Stace (1997). Voucher specimens of the potential indicator species have been retained in the author's collection.

Results

Of the 26 species of staphylinid recorded from three locations in the Burren uplands (Tables 1 and 2), three potential (i.e. not confirmed) grassland indicator species were recorded on

Mullagh Mór. It is not possible to definitively state that these three species were breeding in the calcareous grassland, because each species was represented by a single individual only, and they must be treated as unconfirmed indicator species until the hypothesis explaining their presence (see discussion) is tested. The habitat and distribution of each species is described below.

Cypha tarsalis was only recently recorded from Ireland, from a male specimen found on the River Shannon callows near Clonmacnoise (Good, in press). It was also only discovered recently in Great Britain, based on three male specimens collected from the Scilly Isles in 1897 (Welch, 1995). Palm (1966) provides a map of its Scandanavian distribution showing it to be distinctly coastal, and describes its habitat as follows (in translation): "Not uncommon and sometimes in large numbers by evening sweep netting in its habitat: in moist wood and meadow soils under leaves, moss and rotting vegetable matter and also under detritus at especially lake and fen margins." Horion (1967) states (in translation) that it occurs "In woodland and meadow soils under leaves, moss, rotting plant matter: in detritus of shores and marshes; seemingly it is especially a sea-shore species in the northern regions (Palm, 1935). In Bohemia in bog soils from birch leaves and in humus (without *Sphagnum*) (Smetana, 1964)". A single male was recorded from a D-vac sample from Mullagh Mór (Table 1).

Philonthus mannerheimi has been recorded from counties Armagh, Cavan, Donegal, Down and Fermanagh (Last, 1974; Anderson, 1997). It is local in Great Britain (Last, 1974; Hyman and Parsons, 1994), and uncommon, local or rare in continental Europe, and is unknown outside Europe (Horion, 1965). Its habitat in north-west and central Europe is restricted to wetlands: wet and marshy woods, alder *Alnus* carr, lake and pond shores, fens and river banks (Horion, 1965; Last, 1974; Koch, 1989; Hyman and Parsons, 1994; Anderson, 1997), although single individuals have been captured in other habitats (Anderson, 1997). The microhabitats from which it has been recorded include moss, leaves and flood refuse. However, and of particular interest in the context of the Burren, Horion (1965) also records it from alpine

pasturage under dung, manure and other decomposing material. At Mullagh Mór (Table 1), it was represented by a single male from a pitfall trap.

Rugilus similis was recorded as a single female from a pitfall trap on Mullagh Mór (Table 1). The species is known in Ireland from plant litter on lake-shores and river banks (Anderson, 1997), and from reedbeds in Great Britain (Hyman and Parsons, 1994). However, it is also recorded by Hyman and Parsons (1994) from dry or chalky grassland. In Central Europe it is known from open woodland and woodland margins, decomposing hay and weeds in fields and meadows, as well as the margins of drainage ditches and ponds (Horion, 1965). The species is local in Ireland and Great Britain (Anderson, 1997; Hyman and Parsons, 1994), and in continental Europe it is also local or rare except for southern Germany, the Austrian alpine foreland, the (former) Czechoslovakia and Poland (Horion, 1965).

Because of the dominance of *Stenus impressus* Germar in the south-facing cliff samples (Table 2), and its similarity to *S. aceris* Luff (Luff, 1966; Reid, 1985), all male specimens were dissected to determine if *S. aceris* was present. There is only one doubtful Irish record of *S. aceris*, from Waterford in the 19th century (Power, 1878) (see Anderson, 1984). It is a grassland associated species restricted to southern England which might possibly occur in the Burren. However, all specimens dissected proved to be *S. impressus*.

Of the remaining 22 species recorded (Tables 1 and 2), most of them occur frequently in mesic non-calcareous grassland samples (Good and Giller, 1990; Good and Butler, 1996; Good and Wistow, 1997; Good, 1999). The exceptions are *Drusilla canaliculata* and *Falagrioma* (= *Falagria*) *thoracica*, which are associated with south-facing dry slopes (Good and Wistow, 1997), and *Metopsia clypeata* (= *retusa* (Stephens)) and *Micropeplus staphylinoides*, which have only been consistently recorded from limestone meadows and pastures in Ireland (Good, 1995; Good and Wistow, 1997; 12 *M. retusa* were recorded in 3 D-vac samples from rough grassland on limestone till-derived soils near Navan, Co. Meath (J. A. Good, unpublished)).

Discussion

There is a great contrast between the species-poor staphylinid fauna of south-facing limestone cliffs (Table 2), and the unexpectedly species-rich fauna of an east-facing terrace of Mullagh Mór (Table 1, Fig. 1). Only two species (*Stenus impressus* and *S. brunnipes* Stephens) were recorded in numbers greater than one from the south-facing cliff grassland near Carron (Table 2). It is therefore unlikely that grassland soil and litter in such an environment will contain a diverse staphylinid assemblage indicating potential conservation value of this habitat. This is not unexpected, since the poor representation of species in the Irish dry grassland non-phytophagous fauna has been demonstrated for the Asilidae (Diptera), for instance (Speight, 1986). However, there may be myrmecobiont species (obligate ant nest associates, e.g. *Claviger testaceus* Preyssler) in these dry habitats, and further investigation of ants' nests, as well as species associated with dung, carrion and small mammal burrows in calcareous grassland, would be worthwhile.

The shallow loess-derived soils of the east-facing terraces of Mullagh Mór are less prone to drought than the south-facing rendzina soils. Nevertheless, drought is also a critical factor for the vegetation of these terrace soils (O'Donovan and Jeffrey, 1990; Prof. D.W. Jeffrey, pers. comm.), so the occurrence of a species-rich staphylinid assemblage with many mesic grassland species, and especially two indicator species with habitat preferences for wetland, moist woodland or wet grassland habitats, is apparently anomalous. (The third indicator species, *Rugilus similis*, is also only known in Ireland from wetland habitats, although it is recorded from dry grassland in Great Britain). Three hypotheses can be advanced to explain the presence of the two indicator species (*Cypha tarsalis* and *Philonthus mannerheimi*).

First, both species are widely recorded from wetland habitats, and they may have been carried up from the wetlands at the eastern foot of Mullagh Mór by updrafting air currents. Evidence of concentration of dispersing staphylinids is provided by Good and Dorman (1992), who reported on the concentration of *Philonthus cognatus* Stephens (closely related to *P.*

mannerheimi), by air currents during their dispersal from and to overwintering habitats in spring and autumn. Both individuals from Mullagh Mór were male, and there appears to be a tendancy for males of some species to disperse more than females. For instance, male predatory staphylinines appear to disperse widely in spring, not unlike male mammals (see Sleeman, 1988). Pitfall trap data from a large cereal field near Heilbronn in southern Germany (J. Bosch and J. A. Good, unpublished) include spring records of 22 *Ocypus similis* (a relatively large staphylinine), all of them male, a woodland species clearly dispersing out from farm woodlots.

However, this hypothesis fails on two points. First, if these two species are representative of a dispersing wetland fauna blown up from the east Burren wetlands, why are the more abundant wetland species (see Good, 2004) not represented in the Mullagh Mór sample? Furthermore, none of the two Mullagh Mór species were recorded from 19 fen and turlough sites examined in the east Burren / south-east Galway area, despite over 100 species of staphylinid being recorded (Good and Butler, 2001; Good, 2004; Good and Butler, unpublished). It seems very unlikely that only two apparently rare species should all turn up in a few square metres of upland grassland without any other wetland species. The second point against this hypothesis is that any wind dispersal event will not carry just wetland species, but especially, given their greater dispersal habits, species of pasture and dung such as *Philonthus cognatus, Platystethus arenarius* (Geoffroy), *Tachyporus hypnorum* (Fabr.), etc. (cf. Good and Dorman, 1992). Yet, only a single individual each of two species in this group were recorded (*Philonthus carbonarius* and *Tachyporus hypnorum*).

A second hypothesis is that the two species in question were dispersed by wind, not from the wetlands, but from the organic-rich soils with *Calluna, Dryas* and *Empetrum nigrum* L. communities occurring on the terraces to the north of Mullagh Mór (see Keane and Sheehy Skeffington, 1995). Even though these soils are equally shallow compared to the terrace soils of Mullagh Mór (Keane and Sheehy Skeffington, 1995), patches with seepages may occur (Jeffrey, 1995). However, it is not just the two unusual wetland-associated species that must be

explained as vagrants, but also the relatively large number of typical mesic 'old field' and eurytopic grassland species present in the sample (Table 1). The fauna present has many species in common with, and a similar species richness to, a Centaureo-Cynosuretum grassland in Killarney National Park (Fig. 1; Good and Giller, 1990), despite much lower productivity of the habitat (O'Donovan and Jeffrey, 1990; O'Donovan, 2001).

The third hypothesis is that, during dry weather, the species requiring a moist environment retreat into the limestone pavement grikes which occur within the patches of calcareous grassland. Grikes provide a stable microclimate, similar to that of moist woodland (Heslop-Harrison, 1960; Dickinson *et al.*, 1964), and also have extensive bryophyte cover like that of woodland on limestone pavement (Kelly and Kirby, 1982). This explains the presence of both the wet grassland fauna as a whole, and the two unusual potential indicator species, both of which can occur in moist or wet woodland. If this hypothesis is correct, then it is not just a grassland habitat that is present, but a three-dimensional ecotonal habitat of limestone pavement and calcareous grassland. This hypothesis is easily testable by sampling the grassland and the associated grike soil during dry weather and when dew and mist have little effect on soil surface moisture. More challenging is to determine whether there is a noctural:diurnal movement from grikes to grassland and back, as opposed to a wet:dry seasonal movement only, because this entails more nocturnal suction sampling.

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References

Anderson, R. (1984) Staphylinidae (Coleoptera) in Ireland - 3: Steninae. *Ir. Nat. J.* **21**: 242-251.

Anderson, R. (1997) Species inventory for Northern Ireland: rove beetles (Coleoptera: Staphylinidae). *Environment and Heritage Service Research and Development Series* No. 97/11: 1-78.

Anderson, R., Nash, R. and O'Connor, J. P. (1997) Irish Coleoptera. A revised and annotated list. *Ir. Nat. J. Spec. Ent. Suppl. 1997*: 1-81.

D-Arcy, G. and Hayward, J. (1992) *The natural history of the Burren.* Immel Publishing, London.

Dickinson, C. H., Pearson, M. C. and Webb, D. A. (1964) Some micro-habitats of the Burren, their micro-environments and vegetation. *Proc. R. Ir. Acad.* **63B**: 291-302.

Dietrick, E. J. (1961) An improved back pack motor fan for suction sampling of insect populations. *J. econ. Ent.* **54**: 394-395.

Fowler, W. W. (1888) *The Coleoptera of the British Islands.* **2.** *Staphylinidae.* Reeve, London.

Good, J. A. (1995) Faunal indicators of environmentally sensitive grassland management. pp. 194-203. *In* Jeffrey, D. W., Jones, M. B. and McAdam, J. H. (eds) *Irish grasslands: their biology and management.* Royal Irish Academy, Dublin.

Good, J. A. (1999) Recolonisation by Staphylinidae (Coleoptera) of old metalliferous tailings and mine soils in Ireland. *Biol. Environ. Proc. R. Ir. Acad.* **99B**: 27-35.

Good, J. A. (2004) Lake-shore fens and reedbeds as a habitat for Staphylinidae and Carabidae (Coleoptera) in the east Burren area of Co. Clare, Ireland. *Bull. Ir. biogeog. Soc.* **28**:

163-188.

Good, J. A. (in press) *Cypha tarsalis* (Luze) (Staphylinidae) new to Ireland. *Coleopterist.*

Good, J. A. and Butler, F. T. (1996) Ancient pasture as a habitat for Staphylinidae (Coleoptera) at the Curragh, Co. Kildare, Ireland. *Bull. Ir. biogeog. Soc.* **19**: 151-158.

Good, J. A. and Butler, F. T. (2001) Turlough pastures as a habitat for Staphylinidae and Carabidae (Coleoptera) in south-east Galway and north Clare, Ireland. *Bull. Ir. biogeog. Soc.* **25**: 74-94.

Good, J. A. and Dorman, J. A. (1992) Dispersal of *Philonthus cognatus* Stephens (Coleoptera: Staphylinidae) and its occurrence in garfish guts (*Belone belone* (L.)). *Ir. Nat. J.* **24**: 171.

Good, J. A. and Giller, P. S. (1990) Staphylinid beetles from cereal and grass fields in south-west Ireland. *Bull. Ir. biogeog. Soc.* **13**: 2-22.

Good, J. A. and Wistow, S. (1997) Recolonisation by Staphylinidae (Coleoptera) of restored meadows on rehabilitated cement kiln mounds near Drogheda, Co. Louth, Ireland. *Bull. Ir. biogeog. Soc.* **20**: 127-134.

Heslop-Harrison, J. (1960) A note on temperature and vapour pressure deficit under drought conditions in some microhabitats of the Burren limestone, Co. Clare. *Proc. R. Ir. Acad.* **61B**: 109-114.

Horion, A. (1965) *Faunistik der Mitteleuropäischen Käfer*. **X**. *Staphylinidae: Paederinae bis Staphylininae*. Feyel, Überlingen-Bodensee.

Horion, A. (1967) *Faunistik der Mitteleuropäischen Käfer*. **XI**. *Staphylinidae: Habrocerinae bis Aleocharinae (Ohne Subtribus Athetae)*. Feyel, Überlingen-Bodensee.

Hyman, P. S. and Parsons, M. S. (1994) *A review of the scarce and threatened Coleoptera of Great Britain.* Part 2. UK Nature Conservation Series No. 12, Joint Committee for Nature Conservation, Peterborough.

Jeffrey, D. W. (1995) The management of Burren grasslands. pp. 267-275. *In* Jeffrey, D. W., Jones, M. B. and McAdam, J. H. (eds) *Irish grasslands - their biology and management.*

Royal Irish Academy, Dublin.

Keane, S. and Sheehy Skeffington, M. (1995) Vegetation in the east Burren uplands in relation to land use and conservation. pp. 253-266. *In* Jeffrey, D. W., Jones, M. B. and McAdam, J. H. (eds) *Irish grasslands - their biology and management*. Royal Irish Academy, Dublin.

Kelly, D. and Kirby, E. N. (1982) Irish native woodlands over limestone. *J. Life Sci. R. Dubl. Soc.* **3**: 181-198.

Koch, K. (1989) *Die Käfer Mitteleuropas. Ökologie*. **1**. Goecke and Evers, Krefeld.

Last, H. (1974) *Philonthus mannerheimi* Fauvel (Col., Staphylinidae) and related species. *Entomologist's mon. Mag.* **109**: 85-88.

Lohse, G. A. (1964) *In Die Käfer Mitteleuropas*. **5**. *Staphylinidae I (Micropeplinae bis Tachyporinae)*. Goecke and Evers, Krefeld.

Lohse, G. A. (1974) Hypocyphtinae. pp. 7-11. *In* Freude, H., Harde, K. W. and Lohse, G. A. (eds) *Die Käfer Mitteleuropas*. **5**. *Staphylinidae II (Hypocyphtinae und Aleocharinae), Pselaphidae*. Goecke and Evers, Krefeld.

Lott, D. and Duff, A. (2003) *Checklist of beetles of the British Isles. Staphylinidae*. www.coleopterist.org.uk. Revised 28 January 2003.

Luff, M. L. (1966) The separation of *Stenus impressus* Germar and *S. aceris* Stephens (Col., Staphylinidae). *Entomologist's mon. Mag.* **102**: 49-52.

Moles, N., Moles, R. and O'Donovan, G. (1995) Evidence for the presence of Quaternary loess-derived soils in the Burren karstic area, western Ireland. *Ir. Geog.* **28**: 48-63.

Nelson, E. C. and Walsh, W. (1991) *The Burren: a companion to the wildflowers of an Irish limestone wilderness*. Boethius Press, Kilkenny and The Conservancy of the Burren, Ballyvaghan.

O'Connor, J. P. and O'Connor, M. A. (1982) *Tinodes unicolor* (Pictet) and *Metalype fragilis* (Pictet) (Trichoptera: Psychomyiidae) discovered in the Burren, Co. Clare. *Entomologist's*

Gaz. **33**: 192-194.

O'Connor, J. P., O'Connor, M. A. and de Coucy Williams, M. (1988) Notes on *Berytinus montivagus* (Meyer) and *Metatropis rufescens* (Herrich-Schäffer) (Hemiptera) in Ireland. *Entomologist's Rec.* **100**: 81-84.

O'Donovan, G. (2001) Productivity, grazing pressure and phenology of a limestone grassland in the Burren National Park, Co. Clare. *Tearmann: Ir. J. agri-environ. Res.* **1**: 35-54.

O'Donovan, G. and Jeffrey, D. W. (1990) Above- and below-ground productivity and nitrogen flux in a *Sesleria albicans* (Kit.) dominated grassland in the Burren, Co. Clare, Ireland. pp. 74-78. *In* Hillier, S. H., Walton, D. W. H. and Wells, D. A. (eds) *Calcareous grasslands - ecology and management.* Bluntisham Books, Huntingdon.

Palm, T. (1966) Skalbaggar, Coleoptera. Kortvingar: Staphylinidae. Underfam. Habrocerinae, Trichophyinae, Tachyporinae. *Svensk Insektfauna* **no. 50**: 1-94.

Power, J. A. (1878) A contribution to the entomology of Ireland. *Entomologist* **11**: 2-8.

Reid, C. (1985) External characters for the separation of *Stenus aceris* Stephens and *S. impressus* Germar (Col., Staphylinidae). *Entomologist's mon. Mag.* **121**: 71-72.

Sleeman, D. P. (1988) Irish stoat road casualities. *Ir. Nat. J.* **12**: 527-529.

Speight, M. C. D. (1986) The Irish asilid fauna. *Bull. Ir. biogeog. Soc.* **10**: 56-71.

Speight, M. C. D. (1999) Bush crickets and the Burren, with first records of *Pholidoptera griseoaptera* (De Geer) (Orth., Tettigoniidae). *Entomologist's Rec. J. Var.* **111**: 139-141.

Stace, C. (1997) *New flora of the British Isles.* Second edition. Cambridge University Press, Cambridge.

Szujecki, A. (1965) Kusakowate - Staphylinidae. Kiepurki - Euaesthetinae i żarlinki – Paederinae. *Klucze Oznacz. Owad. Pol.* **19** (24c): 1-74.

Welch, R. C. (1995) *Cypha tarsalis* Luze (Col.: Staphylinidae) new to Britain. *Entomologist's Rec. J. Var.* **107**: 185-187.

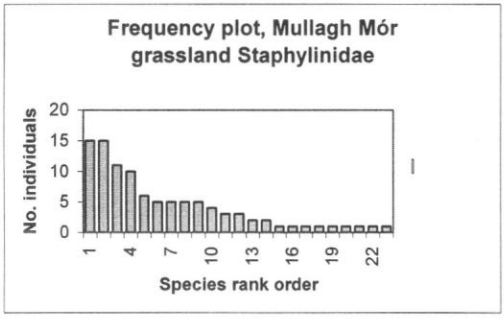
TABLE 1. Staphylinidae recorded from pitfall traps and suction samples from calcareous grassland on Mullagh Mór, Co. Clare (June, 1985), classified according to the type of grassland of which they are characteristic (based on data from Good, 1995; 1999; Good and Giller, 1990; Good and Butler, 1996; Good and Wistow, 1997; J. A. Good, unpublished). Potential indicator species are marked with an asterisk.

Species	No.
?-characteristic species of Burren limestone pavement/grassland ecotone	
Cypha tarsalis (Luze) *	1
Philonthus mannerheimi Fauvel *	1
Rugilus similis (Erichson) *	1
Characteristic species of limestone grasslands	
Drusilla canaliculata (Fabricius)	15
Metopsia clypeata (Müller)	1
Micropeplus staphylinoides (Marsham)	4
Characteristic species of 'old field' grasslands	
Sepedophilus nigripennis (Stephens)	3
Stenus brunnipes Stephens	2
Stenus cicindeloides (Schaller)	1
Stenus fulvicornis Stephens	5
Stenus impressus Germar	3
Tachyporus dispar (Paykull)	5
Eurytopic grassland species	
Amischa analis (Gravenhorst)	11
Atheta amplicollis (Mulsant & Rey)	15
Atheta fungi (Gravenhorst)	1
Stenus clavicornis (Scopoli)	5
Stenus ossium Stephens	6
Tachinus signatus Gravenhorst	5
Tachyporus nitidulus (Fabricius)	2
Xantholinus linearis (Olivier)	1
Xantholinus longiventris Heer	10
Characteristic species of external nutrient-input grasslands	
Philonthus carbonarius (Gravenhorst)	1
Tachyporus hypnorum (Fabricius)	1

TABLE 2. Staphylinidae recorded from D-vac suction samples from *Sesleria albicans* grassland at limestone cliffs near Carron, Co. Clare (May 1988), and from a dry, shallow soil and deeper soil (with *Dactylis glomerata*) on limestone pavement near Castletown, Co. Clare (June, 1992). Potential indicator species are marked with an asterisk.

Species	**Cliffs**	**Grassland at base of cliffs**	**Castletown Dry**	**Castletown with *Dactylis***
Stenus brunnipes	2	9	5	-
Stenus impressus	25	36	2	8
Amisha decipiens	-	1	-	-
Drusilla canaliculata	-	1	-	-
Falagrioma thoracica	-	1	-	-
Tachyporus dispar	-	1	1	3
Stenus picipes	-	-	1	-
Sepedophilus nigripennis	-	-	-	3
Stenus clavicornis	-	-	-	2
Stenus fulvicornis	-	-	-	4

FIGURE 1. Frequency charts of species in rank order from the Mullagh Mór sample (D-vac and pitfall traps combined), compared to a similar sample from mesotrophic grassland in Muckross, Killarney National Park (data from Good and Giller, 1990), showing nearly identical species richness but much reduced dominance in the Burren sample.



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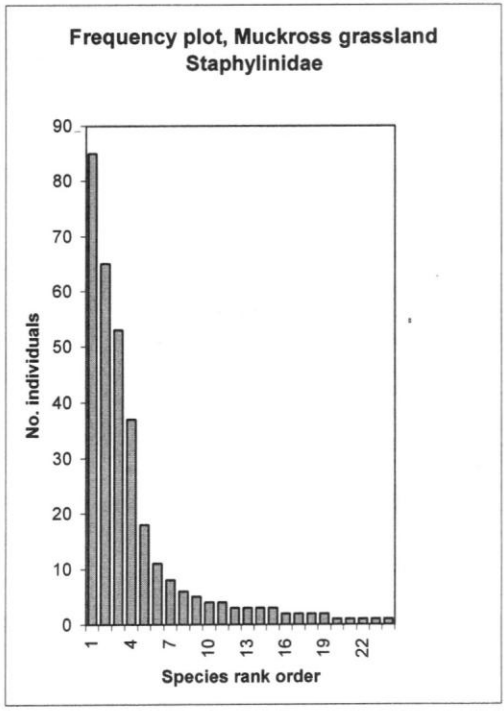

Bull. Ir. biogeog. Soc. No. 28 (2004)

LAKE-SHORE FENS AND REEDBEDS AS A HABITAT FOR STAPHYLINIDAE AND CARABIDAE (COLEOPTERA) IN THE EAST BURREN AREA OF CO. CLARE, IRELAND

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Abstract

A total of 76 species of Staphylinidae, and 35 species of Carabidae, were recorded from ten lake-shore fens and reedbeds in the east Burren area of Co. Clare during 1996 and 1999. A relatively large proportion of these species (22 or 20%) were considered indicators of ecologically well-developed habitat, and indicate the high conservation value of the small lake ecotones for the characteristic soil fauna of flooded ecosystems. For both lake-shore fens and reedbeds, and also turlough pastures (Good and Butler, 2001), the sites with the greatest number of indicator species were ecotones between ecologically well-developed terrestrial habitats (woodland, scrub, limestone pavement, fen) and aquatic habitats of relatively small expanse (turloughs, small lakes). It is hypothesized that ecotones with a well-developed semi-natural terrestrial habitat plus a large ecotonal area will support a relatively high level of wetland soil biodiversity, unless spring/summer water fluctuations are very large, or unless there is excessive wave disturbance of the shore.

Introduction

The region north of Ennis, south-west of Gort, and immediately east of the Burren uplands, contains a complex of wetlands, forming the upper part of the River Fergus catchment (flowing south), and part of an underground karst drainage system which surfaces briefly as the Cloonteen River (flowing north) (Drew, 1990; D'Arcy and Hayward, 1992; Johnston and

Peach, 1998). Many of the wetland soils in this region are calcareous fen peats (Finch *et al.*, 1971), with areas of *Cladium mariscus*-dominated fen, calcareous fens, and reed and tall sedge swamps, in contrast to the predominantly mineral soils of most of the turloughs characteristic of this karst area. A number of rare Coleoptera have been recorded in these wetlands (Speight *et al.*, 1982; Anderson, 1985; 1997a; Lott and Bilton, 1991), but these records are mostly from turloughs. Relatively little is known of the soil invertebrate fauna of the lake-shore calcareous fen wetlands. As part of the Gort-Ardrahan Flooding Study commissioned by the Office of Public Works (Jennings O'Donovan and Partners/Southern Water Global, 1999), a fen peat site near Kilmacduagh (the margin of Lough Loum in Co. Clare) was sampled in 1996 for staphylinid and carabid beetles. The sample proved to contain an exceptional suite of species, and in 1999 a further investigation was carried out in other fen sites in the region. The results of both the Lough Loum sample and the 1999 study are reported here.

Methods

Thirty sites were visited to record lake-shore habitats in 1999. Site names were taken from O.S. 1:50,000 maps (1995-1998). The term 'site' is used here to mean a recognisably separate waterbody or fen (and not 'site' in the meaning of the European Communities (Natural Habitats) Regulations, 1997 (S.I. no 94 of 1997) (i.e. Special Areas of Conservation)). Predominant types of shore habitats (see results) were recorded at those parts of each site examined. From these, ten lake-shore calcareous fens and reedbeds were selected for sampling, all associated with relatively small lakes or isolated arms of lakes. Large open lakes (e.g. Lough Cullaun (R3190), Muckanagh Lough (R3792)) were not sampled because of the exposure of the shore to wave action due to the long fetch.

Details of sites and sampling are summarized in Table 1. Three sampling methods were used: (1) A set of four plastic cup pitfall traps with undiluted ethylene glycol (commercial antifreeze) as preservative (six traps were set at each site, and four selected); (2) Suction sampling using a

Stihl® BR 400 suction apparatus, mounted on the operator's back. This machine (referred to as an 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58mm diameter (0.0026m^2 surface area). Six subsamples of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (*circa* 2m^2) was effectively sampled; (3) Sieving of reed or sedge leaf-litter, taking 16 subsamples of *circa* 0.07m^2 each (total *circa* 1.1m^2), using a coarse-meshed metal sieve.

It was not possible to use all three methods (pitfall traps, suction sampling, sieve sampling) at each site because of access difficulties, flooding at the time of sampling, or unsuitability of the vegetation to sampling by one of these methods. Results have thus been separated into a standard set of pitfall trap + suction samples (Tables 2 and 3) and pitfall traps (± sieve samples) only (Tables 4 and 5).

Species were selected as indicators of well-developed habitat if: (1) they have a restricted preference to the types of flooded soil habitat associated with fens and lake shores; and (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems. 'Well-developed habitat' means that the ecosystem is sufficiently undisturbed by human activity to allow it to retain many local or rare characteristic species. The presence of two or more indicator species, likely to breed in the habitats sampled, is considered an indication of habitat quality, given the sampling effort involved.

Nomenclature of Staphylinidae follows Lott and Duff (2003), with the exception of the genus concept of *Atheta*, where Anderson *et al.* (1997) is followed, and Anderson *et al.* (2000) for Carabidae. Plant nomenclature follows Stace (1997). Voucher specimens of a number of indicator species will be deposited in the National Museum of Ireland, and specimens of other species are retained in the author's collection.

Results

Habitats

Six types of habitat were recognised at the 30 lake-shore sites visited, and are described below. The term *ecotone* is defined as 'a habitat created by the juxtaposition of distinctly different habitats' (Ricklefs, 1979).

(1) Cut-away peat-cliff lake shores

In this case, lake margin fen peat has been historically cut, typically leaving a dry peat surface with *Schoenus nigricans* and *Myrica gale* directly above a small vertical peat cliff by permanent standing water usually with dense *Cladium mariscus* beds. This habitat is well represented at Ballyogan Lough (R3791), Shandangan Lough (R3090), Poulroe (R3896), Turkenagh Lough (R3392), and on the east side of Coolreash Lough (R3294). These abrupt interfaces were not sampled, since it was assumed, *a priori*, that the soil under *Schoenus* on relatively dry peat would be unsuitable for terrestrial-ecotonal fen species, and that flooded *Cladium* was an aquatic environment, equally unsuitable for such species. A brief examination of this habitat (including both *Schoenus* and recently dewatered *Cladium* beds) at Coolreash Lough resulted in few species for the collecting effort entailed, supporting the above assumption.

(2) *Schoenus/Cladium* fen gradients

Extensive *Cladium* beds are a characteristic habitat of the east Burren wetlands, often occurring as a virtual macrophyte monoculture of *Cladium mariscus*. In most cases the plants are emergent and permanently in standing water, thus providing an aquatic habitat rather than a terrestrial-ecotonal habitat. Brief sampling of this type of habitat gave a very poor diversity of staphylinids and carabids, and it was not sampled further.

However, the *Cladium* fen habitat type is defined (European Commission, 1999) as including a gradient from calcareous fen to *Cladium* beds. This is frequently represented by a *Schoenus nigricans*-dominated vegetation grading into beds of *Cladium mariscus*, and this gradient was

widespread at the sites visited. This naturally gradual gradient must be distinguished from the cut-away peat-cliff habitat, referred to above, which also often supported a *Schoenus/Cladium* interface. Two sites with this gradual gradient were sampled, at Ballard (lough) and at Lough Duff, the areas sampled being mostly in the *Schoenus*-dominated zone.

(3) Lake-shore turlough fens

Lakes which extend their shores seasonally with a seasonally-exposed shore vegetation similar to completely dewatered turloughs, occur more typically on mineral rather than peat soils, and are better represented in south-east Galway and in the 'high' Burren (e.g. Carron turlough (R2898), Lough Gealáin (R3194), Coolreash Lough (R3294), and the Castle Lough turlough (R3497)). However, there are some recognised turloughs which possess extensive areas of fen peat, a good example being Knockaunroe turlough. In other cases it is somewhat arbitrary to distinguish turlough sites from fen sites, since they contain both vegetation types as complexes (e.g. Lough Bunny), and seasonal flooding is also a feature of many of the east Burren fens.

For the purposes of this study, two lake-shore turloughs with fen peat were identified and sampled, namely, Knockaunroe turlough and Lough Skaghard (both in the Burren National Park).

(4) *Phragmites* reedbeds

These occurred frequently in small lakes, especially with mesotrophic water and soil conditions. Where they were associated with woodland/scrub to lake ecotones, and where summer dewatering of the shore occurs, they may provide a temporary extension of suitable wet woodland microclimate due to canopy cover. Two examples were sampled: Lough Garr and Templebannagh Lough (Lower). A further site (Tool's Lough) where *Carex* swamp and intensive *Lolium perenne*-dominated pasture occurred up-gradient from *Phragmites* beds, was also sampled and included in this category.

(5) Springs and flushes

These occur throughout the karst area of the Burren (Drew, 1990), and two were sampled which were characterised by a *Juncus/Carex* vegetation on fen peat: at Lough Loum and Lough Bunny, and a further site with *Eleocharis/Agrostis* vegetation grading into *Carex acutiformis* or *riparia*, at Lough Skeardeen. It is likely that not just the flush *per se*, but the macrohabitat within which the flush exists (e.g. flush in fen, flush in woodland), defines the species assemblage occurring there (see Speight *et al.*, 2003).

(6) Shallow peat cuttings infilled with peat sediment

This was surmised only at Lough Loum, and may exist at other ecotonal sites without having been recognised. The uncompacted nature of the surface may indicate that peat cuttings had been completely infilled by peat/marl sediment carried by water overflowing from the lake margin, or from flushes. Whether this feature is actually important to ecotonal flora and fauna to such an extent that it actually defines a significant habitat is not clear, but many of the indicator species of staphylinids and carabids were found near the putative infilled cuttings, with open vegetation with mosses, *Chara* spp., algae and cyanobacteria, at the margin of Lough Loum.

Species

In total, 76 species of staphylinid and 35 species of carabid were recorded from ten lake-shore fen and reedbed sites (Tables 2-5). Of these, 14 species of staphylinid (18%) and 8 species of carabid (23%) are considered indicators of well-developed habitat, and a number of species have not been previously recorded from the Clare/south-east Galway region. Species found at each site are given in Tables 2-5, where they are separated into sets of species associated with different sites, to faciltate visual comparison of species occurrence at each site.

Summaries of the habitat and distributions of the following indicator species are given in Good and Butler (2001), and are not repeated here: *Carpelimus subtilicornis* (recorded from L. Loum and L. Bunny), *Parameotica* (=*Atheta*) *difficilis* (L. Loum), *Hygropora cunctans* (L.

Loum), *Philhygra gyllenhalii* (L. Garr), *Philonthus furcifer* (L. Loum and Knockaunroe), *Pelophila borealis* (L. Loum), *Platynus livens* (Knockaunroe) and *Stenus carbonarius* (Knockaunroe, Tool's L., Ballard).

Lough Bunny, Knockaunroe Turlough, Lough Gash and Dromore Forest (Co. Clare) are the only sites in Ireland and Great Britain from which there are published records of *Agonum lugens* (Anderson, 1985; Anderson, 1996; Owen, 1997), although there are more recent unpublished records from the east Burren area. It is a stenotopic species restricted to marshy and muddy shores of streams, rivers and lakes (Koch, 1989). Anderson (1985) recorded it from open *Scirpus lacustris* and *Juncus* with *Cladium* vegetation on muddy substrates. It was recorded from three sites during this survey (Table 3).

Atheta aquatilis is known from two coastal lagoon sites in Co. Antrim and Co. Donegal (Lott and Bilton, 1991; Anderson *et al.*, 1997; Good and Butler, 2000). It is local in Great Britain (Hyman and Parsons, 1994), and uncommon in Central Europe and Scandanavia (Palm, 1970; Benick and Lohse, 1974). It is a stenotopic species restricted to moss and litter in flooded shaded habitats, springs, flushes and wet woodland (Palm, 1970; Koch, 1989; Hyman and Parsons, 1994). A single female was recorded from a pitfall trap in a *Phragmites* bed at Lough Garr.

There are published records of *Atheta strandiella* from six sites in Ireland (Good, 1992; Nelson and Anderson, 1999), and it is local in Great Britain (Hyman and Parsons, 1994). It is particularly associated with carrion in wetlands (Palm, 1970; Good, 1992; Hyman and Parsons, 1994), especially moss-rich fens (Nelson and Anderson, 1999). It was recorded from a dead shrew (*Sorex minutus* L.) in a pitfall trap at Lough Duff during this survey.

Carabus clatratus is a stenotopic species occurring in dense vegetation on peat or, uniquely in Ireland, poorly drained interdrumlin gley soils, at bogs and lake shores, and locally wet meadows and salt-meadows (Anderson *et al.*, 2000; Koch, 1989; Hyman and Parsons, 1992; Luff, 1998). It occurs across the Palaearctic (McFerran *et al.*, 1995), but is very local in Great

Britain, where it is only recently recorded from north-west Scotland (Luff, 1998), and is local in Ireland (McFerran *et al.*, 1995; Owen, 1997; Good and Butler, 1998). It was only recorded from Lough Duff during this survey.

There are old records of *Chlaenius tristis* from Kerry, Clare and Kildare, and more recently from Lough Ree (Westmeath) (Speight *et al.*, 1982). It was recently rediscovered in Great Britain where it was thought to have been extinct (Hodge, 1997). It is rare and declining in many European countries, according to Fowles (1994). Hyman and Parsons (1992) describe the habitat of this species as "lush vegetation on soft soil or mud at the margin of standing water", and Hodge (1997) emphasises the importance of bare muddy ground, as a likely component of its habitat. This combination of habitats corresponds to where it was recorded at Lough Loum. Fourteen specimens were taken by pitfall trapping, and a further specimen by treading moss, in an open area, possibly an infilled peat cutting, close to tall sedge and rush vegetation. Both techniques were used during the natural draw-down of water levels during June 1996. The area was flooded during 1999, so pitfall trap sampling of the same area was not feasible.

Dochmonota clancula is only known in Ireland from Lough Gash (Lott and Bilton, 1991; Anderson, 1997b; Owen, 1997), and is local in England and unknown in Scotland (Hyman and Parsons, 1994). In Great Britain, it has been recorded from bogs, fens and pond shores (Hyman and Parsons, 1994), and in Central Europe it is considered stenotopic, restricted to marshy shores of ponds in woods and marshy river banks (Koch, 1989). It was recorded only from Lough Garr (Dromore) during this survey.

Panageus crux-major is a local and distinctive carabid, only recorded in Ireland from six lake-shore or turlough sites in counties Galway, Clare and Mayo (Anderson *et al.*, 2000), and extremely local in Great Britain, having declined due to drainage of fens (Hyman and Parsons, 1992). Fowles (1994) describes Tywyn Burrows in south Wales as the only existing British locality for this species. Its described habitat is similar to that of *Chlaenius tristis* (Hyman and Parsons, 1992), but also includes muddy turlough shores (Anderson *et al.*, 2000); in Central

Europe it has been chiefly recorded from marshes and marshy shores (Koch, 1989).

Philhygra hygrobia is restricted to marshy water margins, wet woodland and willow carr (Koch, 1989; Hyman and Parsons, 1994). There is at least one record from Ireland (Bullock, 1935) and the species is local in Great Britain (Hyman and Parsons, 1994).

Philonthus fumarius has been recorded relatively frequently at ecologically well-developed wetland sites in Ireland (Johnson and Halbert, 1902; Lott and Bilton, 1991; Owen, 1997; Good and Butler, 1998), although it is still likely to be a local species (given the number of sites sampled by these authors), as it is in Great Britain (Hyman and Parsons, 1994). It is not rare in Central Europe, but apparently rare elsewhere in its range (Horion, 1965). The species occurs in marshes including muddy and marshy freshwater shores (Horion, 1965; Koch, 1989), and especially on coastal marshes. It was recorded from Lough Garr and Lough Skeardeen during this survey.

Philonthus corvinus is known from four localities (in Fermanagh, Louth, Monaghan and North Tipperary) in Ireland (Lott and Foster, 1990), and is local in Great Britain (Hyman and Parsons, 1994). It is local or rare throughout its range in Northern and Central Europe (Horion, 1965). It occurs especially in *Sphagnum* and reed litter, and frequently in small lakes or ponds being overgrown by peat, or being silted up (Horion, 1965; Koch, 1989; Hyman and Parsons, 1994). It was recorded only from Skaghard Lough (Burren National Park) during this survey.

Anderson *et al.* (2000) describe *Pterostichus aterrimus* as local and rather rare in Ireland, but in Britain it is listed as endangered, where it has not been recorded since 1973 (Hyman and Parsons, 1992; Luff, 1998). It occurs in wet intact fens in Ireland (Nelson and Anderson, 1999), and elsewhere at water margins on muddy or peaty soils and in dense vegetation and reedbeds and in oligotrophic bogs (Koch, 1989; Hyman and Parsons, 1992; Anderson *et al.*, 2000). It was recorded only at Lough Loum.

Pterostichus gracilis is local in Ireland and Britain (Speight *et al.*, 1982; Luff, 1998; Anderson *et al.*, 2000), and in Central Europe except for northern and eastern regions (Freude,

1976). It is restricted to riparian habitats, fens and wet grassland in rich vegetation on fine textured soils (Hyman and Parsons, 1992; Anderson *et al.*, 2000). *P. gracilis* was recorded from Lough Loum and Lough Garr.

There are only three old records of *Quedius humeralis* from Ireland (Co. Cavan and Killarney) (Anderson, 1997b). Although originally listed as notable in Britain by Hyman (1986), it was removed from the list by Hyman and Parsons (1994). It was common in montane regions of Europe, but local in lowland areas (Horion, 1965). The species is associated with flooded habitats in woods, such as springs and moss trickles, as well as *Sphagnum* in bogs (Horion, 1965). It was recorded from Lough Duff.

Stenus europaeus is a very local species in Ireland and Britain (Anderson, 1984; 1997b; Hyman and Parsons, 1994). It appears to be local in western Europe, becoming more frequent to the north and east of Europe (Horion, 1963). In Ireland and Britain, it has a distinct habitat preference for wooded eutrophic, or wooded calcareous, fens on lake-shores, although it is also known from marshes and bogs (Anderson, 1997b; Hyman and Parsons, 1994). Anderson (1997b) considers that the species is in decline. It was recorded from Ballard and Lough Bunny.

Sites

Of the six sites sampled with two techniques (Table 1), the sample from Lough Loum (Kilmacduagh Fen) was exceptional, including 52 species of staphylinid and carabid of which 13 (25%) were indicator species (Tables 2-3). Of the four sites sampled with one technique only (Table 1), the sample from Lough Garr (Dromore), a woodland/lake reedbed ecotone on mestrophic soil, contained six indicator species (13%). However, given the season of sampling, and the often inefficient operation of the traps, the lack of high numbers of indicator species from other sites does not necessarily mean that they all possessed few indicator species.

Discussion

The above results indicate that the East Burren wetlands have a high soil biodiversity value for lake-shore fens and reedbeds. The thirteen indicator species recorded at Lough Loum were a mixture of turlough and lake-shore fen species (see Table 6), suggesting that a combination of turlough and fen characteristics occur at Lough Loum. However, this only partly explains the exceptional diversity of indicator species recorded, and Lough Loum may have a unique combination of environmental characteristics, namely:-

(1) It is a small lake, and therefore not excessively impacted by wave erosion of its shores.

(2) Seasonal water level fluctuations are relatively small (estimated <0.4 m), as a result of :

  (2a) Hydrological isolation from flooding associated with much of the east Burren wetlands (including the Cloonteen River);

  (2b) The small local catchment of the lake;

  (2c) The Kilmacduagh Fen site, of which it forms part, has an unconstricted surface outflow, which prevents the whole site behaving like a riverine turlough with high inflows of water causing flooding due to the constriction of outflow.

(3) There is a flush associated with the lake margin, as well as several local springs.

(4) The soil is fen peat on a gley subsoil (Finch *et al.*, 1971), with summer water-holding capacity.

(5) There is a large ecotonal surface area, with an overall gentle gradient from fen to open water with emergents at the margin of the lake (i.e. without abrupt peat 'cliff' ecotones from *Schoenus* to emergent *Cladium*).

(6) Proximity to scrub and limestone pavement (overwintering habitat) on the west (sheltered) side of Lough Loum.

(7) Connectance to a large area of fen and other wetlands.

(8) Calcareous wetland soils supporting a diverse vegetation structure of tall sedge swards with open areas with mosses, *Chara* spp. and *Utricularia* sp., and a diverse water cover

from shallow water to drier fen.

(9) Open areas of saturated algae-rich peaty (or possibly sapropelic) soils, possibly as a result of naturally infilled peat cuttings.

However, Lough Loum was sampled in 1996, during natural water draw-down in June and July. In the same period in 1999, when the other sites were sampled, many of the sites were flooded, resulting in inefficient trapping and requiring some sampling to be postponed until later in the year (see Table 1). Thus, sampling inefficiency and seasonal bias may explain the relatively low numbers of indicator species recorded at some sites, but, for the purpose of this discussion, it is assumed that this is not the whole explanation.

The wetland sites (lake-shore fens and reedbeds; turloughs (Good and Butler, 2001)) which have large numbers (n>5) of indicator species recorded from standardized samples (Lough Loum, Lough Garr, Garryland turlough, Lough Coy, Newtown turlough, Roo West turlough) have one characteristic in common. They can all be described as ecotones between well-developed terrestrial habitats (woodland, scrub, limestone pavement) and aquatic habitats (turloughs, small limestone or mesotrophic lakes), and with a relatively large ecotonal surface area (with the exception of Lough Garr). The habitats are perhaps better defined, not as a lake-shore fen, lake-shore reedbed, nor turlough, but as an ecotone of woodland-turlough (Garryland), woodland-small lake (Lough Garr), scrub-turlough (Lough Coy), limestone pavement-turlough (Newtown, Roo West), or complex ecotone (limestone pavement/scrub/fen/flush/small lake at Lough Loum).

Lough Duff, for example, is a complex ecotone (limestone pavement/scrub/fen/small lake), but has a relatively small ecotonal surface area. Similarly, Lough Skeardeen is a limestone pavement/small lake ecotone, but also has a relatively small surface ecotonal area. Tool's Lough and Templebannagh Lough (Lower) do not have well-developed semi-natural terrestrial components to their ecotone, and both also have relatively small ecotonal surface areas. At two other sites (Lough Skaghard and Lough Bunny (south-west arm)) there may have been an

insufficient dewatered soil exposure period for favourable breeding habitat conditions to develop for a large number of carabid or staphylinid species.

The initial categorization of habitats (see results) was an attempt to define habitats which were more relevant to soil invertebrates than habitats defined by vegetation types. Compared to the type of hypothesis described above, based on ecotone, flooding regime, etc., such a classification may be misleading. Three species, for instance, only occurred in reedbeds: *Atheta aquatilis, Dochmonota clancula* and *Philhygra gyllenhalii*. However, as can be seen from the habitat summaries for these species, none are restricted to reedbeds, and their occurrence in this habitat is better understood by defining it as a woodland-small lake ecotone. In this type of ecotone, reedbeds would be expected to occur, and will act as an extension of the shaded flooded woodland environment.

Each sampled site has its own characteristics, potentially positive (e.g. low amplitude water fluctuation at Lough Loum) or potentially negative (e.g. short dewatered exposure period at Lough Skaghard), which may confound any attempt to create an all-embracing generalization. Also, the unpredictability of flooding at any one site probably increases the biodiversity of the whole wetland system, or, in the words of Pinay *et al.* (1990): "subsystem instability maintains the metastability of the whole riparian ecotone". Nevertheless, it can be hypothesised that sites with a well-developed semi-natural terrestrial habitat plus a large ecotonal area will support a higher level of wetland soil biodiversity than those that do not, unless spring/summer water fluctuations are very large, or unless there is excessive wave disturbance of the shore. This hypothesis may be more predictive of soil biodiversity than one based on the classification of *Cladium* fens, turloughs, limestone pavements, alkaline fens, limestone/marl lakes, mesotrophic lakes, reedbeds and pedunculate oak-ash woodland as discrete entities.

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References

Anderson, R. (1984) Staphylinidae (Coleoptera) in Ireland - 3: Steninae. *Ir. Nat. J.* **21**: 242-251.

Anderson, R. (1985) *Agonum lugens* (Duftschmid) new to the British Isles (Col., Carabidae). *Entomologist's mon. Mag.* **121**: 133-135.

Anderson, R. (1996) Late summer emergence of *Agonum lugens* (Duftschmid) (Carabidae) in the Burren, Ireland. *Coleopterist* **4**: 87.

Anderson, R. (1997a) A second Irish locality for *Agonum livens* (Gyllenhal) (Carabidae). *Coleopterist* **5**: 76.

Anderson, R. (1997b) Species inventory for Northern Ireland: Rove beetles (Coleoptera: Staphylinidae). *Environment and Heritage Service Research and Development Series* **No. 97/11**: 1-78.

Anderson, R., McFerran, D. and Cameron, A. (eds) (2000) *The ground beetles of Northern Ireland (Coleoptera - Carabidae).* Ulster Museum, Belfast.

Anderson, R., Nash, R. and O'Connor, J. P. (1997) Irish Coleoptera. A revised and annotated list. *Ir. Nat. J. Spec. Ent. Suppl. 1997*: 1-81.

Benick, G. and Lohse, G. A. (1974) Staphylinidae II (Aleocharinae, Callicerini). *In* Freude, H., Harde, K. W. and Lohse, G. A. (eds) *Die Käfer Mitteleuropas*. **5**. Goecke and Evers,

Krefeld.

Bullock, E. (1935) Coleoptera new to Ireland from Co. Kerry. *Entomologist's mon. Mag.* **71**: 130-131.

D'Arcy, G. and Hayward, J. (1992) *The natural history of the Burren*. Immel Publishing, London.

Drew, D. (1990) The hydrology of the Burren, County Clare. *Ir. Geog.* **23**: 69-89.

European Commission (1999) *Interpretation manual of European Union Habitats*. Eur 15/2. European Commission DG Environment, Brussels.

Finch, T. F., Culleton, E. and Diamond, S. (1971) *Soils of County Clare*. Soil Survey Bulletin no. 23. An Foras Talúntais, Dublin.

Fowles, A. (1994) *Invertebrates of Wales: a review of important sites and species*. Joint Nature Conservation Committee, Peterborough.

Freude, H. (1976) Fam. Carabidae. *In* Freude, H., Harde, K. W., and Lohse, G. A. (eds) *Die Käfer Mitteleuropas*. **2**. Goecke & Evers, Krefeld.

Good, J. A. (1992) *Atheta strandiella* Brundin (Coleoptera: Staphylinidae), a necrophilous beetle new to Ireland. *Ir. Nat. J.* **24**: 79.

Good, J. A. and Butler, F. T. (1998) Coastal lagoon shores as a habitat for Staphylinidae and Carabidae (Coleoptera) in Ireland. *Bull. Ir. biogeog. Soc.* **21**: 22-65.

Good, J. A. and Butler, F. T. (2000) Coastal lagoon and saline lake shores as a habitat for Staphylinidae, Carabidae and Pselaphidae (Coleoptera) in Ireland. *Bull. Ir. biogeog. Soc.* **24**: 111-141.

Good, J. A. and Butler, F. T. (2001) Turlough pastures as a habitat for Staphylinidae and Carabidae (Coleoptera) in south-east Galway and north Clare, Ireland. *Bull. Ir. biogeog. Soc.* **25**: 74-94.

Hodge, P. J. (1997) *Chlaenius tristis* (Schaller) (Carabidae): a thriving colony in North Wales. *Coleopterist* **6**: 106-107.

Horion, A. (1963) *Faunistik der Mitteleuropäischen Käfer*. **IX**. *Staphylinidae: Micropeplinae bis Euaesthetinae*. Feyel, Überlingen-Bodensee.

Horion, A. (1965) *Faunistik der Mitteleuropäischen Käfer*. **X**. *Staphylinidae: Paederinae bis Staphylininae*. Feyel, Überlingen-Bodensee.

Hyman, P. S. (1986) *A national review of British Coleoptera.* 1a. *A review of the statuses of British Coleoptera (in taxonomic order).* Unpublished report, cited in Hyman and Parsons (1994).

Hyman, P. S. and Parsons, M. S. (1992) *A review of the scarce and threatened Coleoptera of Great Britain.* Part 1. UK Nature Conservation Series No. 3, Joint Committee for Nature Conservation, Peterborough.

Hyman, P. S. and Parsons, M. S. (1994) *A review of the scarce and threatened Coleoptera of Great Britain.* Part 2. UK Nature Conservation Series No. 12, Joint Committee for Nature Conservation, Peterborough.

Jennings O'Donovan and Partners/Southern Water Global (1998) *An investigation of the flooding problems in the Gort-Ardrahan area of south Galway*. Unpublished report to Office of Public Works, Dublin.

Johnson, W. F. and Halbert, J. N. (1902) A list of the beetles of Ireland. *Proc. R. Ir. Acad.* (3) **6**: 535-827.

Johnston, P. and Peach, D. (1998) Hydrological modelling of the flows in the karst limestones of the Gort lowlands. *In* Jennings O'Donovan and Partners/Southern Water Global. *An investigation of the flooding problems in the Gort-Ardrahan area of south Galway*. Report to the Office of Public Works, Dublin.

Koch, K. (1989) *Die Käfer Mitteleuropas. Ökologie*. **1**. Goecke and Evers, Krefeld.

Lott, D. A. and Bilton, D. T. (1991) Records of Coleoptera from Irish wetland sites in 1989. *Bull. Ir. biogeog. Soc.* **14**: 60-72.

Lott, D. and Duff, A. (2003) *Checklist of beetles of the British Isles. Staphylinidae.*

www.coleopterist.org.uk. Revised 28 January 2003.

Lott, D. A. and Foster, G. N. (1990) Records of terrestrial Coleoptera from wetland sites in 1987, including *Stenus glabellus* Thomson (Staphylinidae) new to the British Isles. *Ir. Nat. J.* **23**: 280-282.

Luff, M. L. (1998) *Provisional atlas of the ground beetles (Coleoptera, Carabidae) of Britain.* Biological Records Centre, Huntingdon.

McFerran, D., Cameron, A. and Anderson, R. (1995) The distribution and status of *Carabus clatratus* L. (Coleoptera: Carabidae) in the West Fermanagh and Erne Lakeland Environmentally Sensitive Area. *Ir. Nat. J.* **25**: 67-71.

Nelson, B. and Anderson, R. (1999) Records of uncommon wetland beetles from N. Ireland, with particular reference to Biodiversity and RBD list species. *Coleopterist* **8**: 11-16.

Owen, J. A. (1997) Beetles (Coleoptera) recorded from various Irish sites in 1993, 1994 and 1996. *Bull. Ir. biogeog. Soc.* **20**: 136-154.

Palm, T. (1970) Skalbaggar, Coleoptera. Kortvingar, Staphylinidae. Underfam. Aleocharinae (*Atheta*). *Svensk Insektfauna* no. 52: 117-296.

Pinay, G., Décamps, H., Chauvet, E. and Pustec, E. (1990) Functions of ecotones in fluvial systems. pp. 141-169. *In* Naiman, R. J. and Décamps, H. (eds) *The ecology and management of aquatic-terrestrial ecotones*. UNESCO/Parthenon, Paris.

Ricklefs, R.E. (1979) *Ecology*. Second edition. Thomas Nelson, Sunbury-on-Thames, UK.

Speight, M. C. D., Anderson, R. and Luff, M. L. (1982) An annotated list of the Irish ground beetles (Col., Carabidae + Cicindelidae). *Bull. Ir. biogeog. Soc.* **6**: 25-53.

Speight, M. C. D., Castella, E. and Obrdlik, P. (2003) Macrohabitat preferences of European Syrphidae (Diptera), 2002. *In* Speight, M. C. D., Castella, E., Obrdlik, P. and Ball, S. (eds) *Syrph the Net, the database of European Syrphidae*. **33**. Syrph the Net publications, Dublin.

Stace, C. (1997) *New flora of the British Isles*. Second edition.Cambridge University Press, Cambridge.

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TABLE 1. Details of sites and sampling of east Burren lake-shore fens and reedbeds, Co. Clare. Locality names are those used in O.S. 1: 50,000 maps (1995-1998).

Site (grid ref.)	Dominant plant species	Sampling techniques & dates
Ballard (lough) R329922	Small lake: *Schoenus nigricans* - *Cladium mariscus*	Pitfall traps: 25 September – 13 October 1999 Suction sampler : 2 Sept. 1999
Lough Bunny (south-west arm) R365961	Isolated part of lake: *Juncus* spp, *Carex* spp, *S. nigricans, Cladium mariscus, Phragmites communis*	Pitfall traps: 4 - 25 September 1999 Suction sampler: 4 September 1999
Lough Duff R396992	Small lake: *Schoenus nigricans* - *Cladium mariscus*	Pitfall traps: 30 June - 23 July1999 Suction sampler: 28 July 1999
Lough Loum M397007	Small lake: *S. nigricans, Juncus* spp, *Carex* spp - *C. mariscus*	Pitfall traps: 23 June - 4 August 1996 Suction sampler: 23 June 1996
Lough Skeardeen R388992	Isolated part of lake: *Carex acutiformis* or *riparia, Agrostis stolonifera*, *Eleocharis* sp., *Carex* spp.	Pitfall traps: 17 June - 7 July 1999 Suction sampler: 4 September 1999
Templebannagh Lough (Lower) R390951	Small lake: *Myrica gale* - *Phragmites communis*	Pitfall traps: 1 July - 23 July 1999 Sieve samples: 14 October 1999
Knockaunroe Turlough R312937	Turlough lake: *Cladium mariscus Schoenoplectus lacustris*	Pitfall traps: 9 June - 8 July 1999
Lough Garr (Dromore) R346863	Small lake: *Agrostis stolonifera, Phragmites communis, Cladium mariscus*	Pitfall traps: 16 June - 8 July 1999
Skaghard Lough R353975	Turlough lake: *Carex* spp. - *Cladium mariscus*	Pitfall traps: 9 July - 23 July 1999
Tool's Lough R313897	Small lake: *Carex* spp - *Phragmites communis*	Suction sampler: 29 July 1999

TABLE 2. Staphylinidae recorded from pitfall traps + suction samples from five lake-shore fens in Co. Clare (Lough Loum, Lough Duff, Lough Skeardeen, Lough Bunnny (south-west arm), Ballard lough). Indicator species are marked with an asterisk.

Species	***L. Loum***	***L. Duff***	***L. Skeard.***	***L. Bunny***	***Ballard lough***
Acrotona aterrima (Gravenhorst)	1	-	-	-	-
Aleochara bipustulata (Linnaeus)	1	-	-	-	-
Amischa analis (Gravenhorst)	2	-	-	-	-
Anotylus rugosus (Fabricius)	3	-	-	-	-
Carpelimus rivularis (Motschulsky)	1	-	-	-	-
Carpelimus subtilicornis (Roubal) *	1	-	-	1	-
Euaesthetus ruficapillus Lacordaire	1	-	1	-	-
Gabrius breviventer (Sperk)	2	-	-	-	-
Hygropora cunctans (Erichson) *	11	-	-	-	-
Ischnopoda atra (Gravenhorst)	4	-	1	2	-
Lathrobium quadratum (Paykull)	2	-	1	-	-
Paederus riparius (Linnaeus)	3	1	1	1	-
Parameotica difficilis (Brisout) *	1	-	-	-	-
Philhygra elongatula (Gravenhorst)	2	-	-	-	-
Philhygra hygrobia (Thomson) *	1	-	-	-	-
Philhygra malleus (Joy)	3	-	-	-	-
Philonthus ebeninus (Gravenhorst)	1	-	-	-	-
Philonthus fumarius (Gravenhorst) *	1	-	1	-	-
Philonthus furcifer Renkonen *	1	-	-	-	-
Philonthus micans (Gravenhorst)	6	-	-	-	-
Philonthus punctus (Gravenhorst)	1	-	-	-	-
Philonthus quisquiliarius (Gyllenhal)	3	-	-	-	-
Philonthus varians (Paykull)	1	-	-	-	-
Stenus boops Ljungh	11	-	12	-	-
Stenus cicindeloides (Schaller)	6	-	82	44	-
Stenus fuscipes Gravenhorst	4	-	-	3	-
Stenus juno (Paykull)	1	-	4	3	-
Stenus latifrons Erichson	22	-	7	44	2
Stenus melanopus (Marsham)	1	-	-	-	-
Stenus nitens Stephens	1	1	1	1	6
Tachyporus obtusus (Linnaeus)	1	-	-	-	-

TABLE 2 (continued)

Species	***L. Loum***	***L. Duff***	***L. Skeard.***	***L. Bunny***	***Ballard lough***
Atheta fungi (Gravenhorst)	-	1	-	-	-
Atheta strandiella Brundin *	-	6	-	-	-
Drusilla canaliculata (Fabricius)	-	1	-	-	1
Ocypus olens (Müller)	-	7	-	-	7
Quedius humeralis Stephens *	-	1	-	-	-
Stenus brunnipes Stephens	-	3	-	-	-
Stenus impressus Germar	-	9	-	-	-
Stenus nitidiusculus Stephens	-	4	2	-	-
Aleochara brevipennis Gravenhorst	-	-	2	-	-
Atheta graminicola (Gravenhorst)	-	-	2	-	-
Lathrobium terminatum Gravenhorst	-	-	1	-	-
Rybaxis longicornis (Leach)	-	-	2	-	-
Stenus bifoveolatus Gyllenhal	-	-	34	4	-
Stenus binotatus Ljungh	-	-	2	-	-
Stenus fulvicornis Stephens	-	-	2	2	-
Stenus pallitarsis Stephens	-	-	1	1	-
Stenus picipes Stephens	-	-	1	-	-
Stenus tarsalis Ljungh	-	-	2	-	-
Philhygra melanocera (Thomson)	-	-	-	1	-
Stenus europaeus Puthz *	-	-	-	1	1
Stenus picipennis Erichson	-	-	-	1	-
Stenus umbratilis Casey	-	-	-	2	-
Atheta amplicollis (Mulsant & Rey)	-	-	-	1	-
Ocypus aeneocephalus (De Geer)	-	-	-	-	1
Olophrum piceum (Gyllenhal)	-	-	-	-	1
Quedius semiobscurus (Marsham)	-	-	-	-	1
Stenus carbonarius Gyllenhal *	-	-	-	-	1
Total no. species	31	10	21	16	9
Total no. indicator species	6	2	1	2	2

TABLE 3. Carabidae recorded from pitfall traps + suction samples from five lake-shore fens in Co. Clare (Lough Loum, Lough Duff, Lough Skeardeen, Lough Bunnny (south-west arm), Ballard lough). Indicator species are marked with an asterisk.

Species	***L. Loum***	***L. Duff***	***L. Skeard.***	***L. Bunny***	***Ballard lough***
Agonum afrum (Duftschmid)	4	-	6	-	-
Agonum gracile (Sturm)	2	-	-	-	-
Agonum lugens (Duftschmid) *	1	-	3	1	-
Agonum marginatum (Linnaeus)	1	-	1	-	-
Agonum thoreyi (Dejean)	9	-	-	-	-
Agonum viduum (Panzer)	2	-	-	-	-
Bembidion assimile Gyllenhal	3	-	-	-	-
Bembidion doris (Panzer)	6	-	1	-	-
Blethisa multipunctata (Linnaeus)	2	-	12	-	1
Carabus clatratus Linnaeus *	12	2	-	-	-
Carabus granulatus Linnaeus	1	-	3	-	3
Chlaenius nigricornis (Fabricius)	10	-	7	-	-
Chlaenius tristis (Schaller) *	15	-	-	-	-
Dyschirius globosus (Herbst)	2	-	-	-	-
Elaphrus cupreus Duftschmid	18	-	2	-	-
Panageus crux-major (Linnaeus) *	2	-	-	-	-
Pelophila borealis (Paykull)	3	-	-	-	-
Pterostichus anthracinus (Illiger)	1	-	1	-	-
Pterostichus aterrimus (Herbst) *	3	-	-	-	-
Pterostichus gracilis (Dejean) *	1	-	-	-	-
Pterostichus nigrita (Paykull)	16	-	8	-	-
Demetrias atricapillus (Linnaeus)	-	1	1	-	-
Nebria brevicollis (Fabricius)	-	3	-	-	-
Pterostichus madidus (Fabricius)	-	1	-	-	-
Synuchus vivalis (Illiger)	-	1	-	-	-
Agonum piceum (Linnaeus)	-	-	4	1	-
Bradycellus verbasci (Duftschmid)	-	-	1	-	-
Loricera pilicornis (Fabricius)	-	-	9	-	-
Bembidion mannerheimii Sahlberg	-	-	-	-	1
Pterostichus diligens (Sturm)	-	-	-	-	1
Total no. species	21	5	14	2	4
Total no. indicator species	6	1	1	1	0

TABLE 4. Staphylinidae recorded from pitfall traps (Knockaunroe Turlough, Lough Skaghard, Lough Garr (Dromore)), sieve samples + pitfall traps (Templebannagh Lough (Lower)), or from suction samples (Tool's Lough), from five lake-shore fens or reedbeds in Co. Clare. Indicator species are marked with an asterisk.

Species	***Knock-aunroe***	***L. Skagh.***	***L. Garr***	***Templeb. L. Lr.***	***Tool's L.***
Philhygra melanocera (Thomson)	1	-	1	-	3
Philonthus furcifer Renkonen *	1	-	-	-	-
Stenus boops Ljungh	4	-	2	-	4
Stenus carbonarius Gyllenhal *	1	-	-	-	7
Carpelimus corticinus (Gravenhorst)	-	1	-	-	-
Philonthus corvinus Erichson *	-	1	-	-	-
Anotylus rugosus (Fabricius)	-	-	5	1	-
Atheta aquatilis (Thomson) *	-	-	1	-	-
Atheta graminicola (Gravenhorst)	-	-	4	1	26
Bryaxis bulbifer (Reichenbach)	-	-	1	1	-
Carpelimus subtilicornis (Roubal) *	-	-	1	-	-
Dochmonota clancula (Erichson) *	-	-	7	-	-
Ocyusa maura (Erichson)	-	-	1	-	-
Paederus riparius (Linnaeus)	-	-	1	1	-
Philhygra gyllenhalii (Thomson) *	-	-	1	-	-
Philhygra malleus (Joy)	-	-	4	-	2
Philonthus fumarius (Gravenhorst) *	-	-	2	-	-
Tachinus signatus Gravenhorst	-	-	1	-	-
Stenus bimaculatus Gyllenhal	-	-	1	2	-
Stenus juno (Paykull)	-	-	1	-	1
Xantholinus linearis (Olivier)	-	-	1	-	-
Atheta fungi (Gravenhorst)	-	-	-	1	2
Lesteva sicula Erichson	-	-	-	7	-
Myllaena infuscata Kraatz	-	-	-	4	-
Myllaena minuta (Gravenhorst)	-	-	-	2	-
Ochthephilum fracticorne (Paykull)	-	-	-	2	-
Ocyusa picina (Aubé)	-	-	-	2	-

TABLE 4 (continued)

Species	***Knock-aunroe***	***L. Skagh.***	***L. Garr***	***Templeb. L. Lr.***	***Tool's L.***
Olophrum piceum (Gyllenhal)	-	-	-	2	-
Philonthus splendens (Fabricius)	-	-	-	1	-
Stenus flavipes Stephens	-	-	-	1	-
Stenus nitens Stephens	-	-	-	5	-
Stenus nitidiusculus Stephens	-	-	-	5	-
Stenus pusillus Stephens	-	-	-	6	-
Acrotona aterrima (Gravenhorst)	-	-	-	-	1
Ischnopoda atra (Gravenhorst)	-	-	-	-	6
Lathrobium terminatum Gravenhorst	-	-	-	-	1
Rybaxis longicornis (Leach)	-	-	-	-	1
Stenus cicindeloides (Schaller)	-	-	-	-	2
Stenus pallitarsis Stephens	-	-	-	-	14
Stenus picipes Stephens	-	-	-	-	2
Stenus tarsalis Ljungh	-	-	-	-	11
Total no. species	4	2	17	17	15
Total no. indicator species	2	1	5	0	1

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TABLE 5. Carabidae recorded from pitfall traps (Knockaunroe Turlough, Lough Skaghard, Lough Garr (Dromore)), sieve samples + pitfall traps (Templebannagh Lough (Lower)), or from suction samples (Tool's Lough), from five lake-shore fens or reedbeds in Co. Clare. Indicator species are marked with an asterisk.

Species	***Knock-aunroe***	***L. Skagh.***	***L. Garr***	***Templeb. L. Lr.***	***Tool's L.***
Agonum lugens (Duftschmid) *	2	-	-	-	-
Agonum piceum (Linnaeus)	1	-	1	-	1
Bembidion doris (Panzer)	1	-	1	-	-
Blethisa multipunctata (Linnaeus)	3	2	5	-	-
Loricera pilicornis (Fabricius)	6	-	2	-	-
Platynus livens (Gyllenhal) *	1	-	-	-	-
Pterostichus anthracinus (Illiger)	4	-	-	-	-
Pterostichus minor (Gyllenhal)	1	-	20	-	-
Bembidion assimile Gyllenhal	-	-	10	-	-
Dyschirius globosus (Herbst)	-	-	13	-	-
Platynus obscurum (Herbst)	-	-	1	-	-
Pterostichus gracilis (Dejean) *	-	-	3	-	-
Pterostichus madidus (Fabricius)	-	-	2	-	-
Agonum afrum (Duftschmid)	-	3	33	-	-
Agonum viduum (Panzer)	-	8	1	-	-
Carabus granulatus Linnaeus	-	7	66	-	-
Chlaenius nigricornis (Fabricius)	-	18	-	-	-
Elaphrus cupreus Duftschmid	-	2	3	-	-
Pterostichus niger (Schaller)	-	1	-	-	-
Agonum thoreyi Dejean	-	-	-	4	-
Pterostichus nigrita (Paykull)	-	-	-	-	1
Total no. species	8	7	14	1	2
Total no. indicator species	2	0	1	0	0

TABLE 6. Indicator species recorded at Lough Loum (Kilmacduagh Fen), compared to their recorded occurrence (+) from turloughs (Good and Butler, 2001) and other lake-shore fen and reedbed sites (Tables 2-5).

Species	**Turloughs**	**Lake-shore fen/reedbeds**
Carpelimus subtilicornis	+	+
Philonthus furcifer	+	+
Hygropora cunctans	+	-
Parameotica difficilis	+	-
Pelophila borealis	+	-
Philonthus punctus	+	-
Agonum lugens	-	+
Carabus clatratus	-	+
Philonthus fumarius	-	+
Pterostichus gracilis	-	+
Chlaenius tristis	-	-
Panagaeus crux-major	-	-
Pterostichus aterrimus	-	-

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NON-MARINE MOLLUSCA: NEW AND NOTABLE RECORDS FOR IRELAND

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In 1976, the first atlas of non-marine Mollusca was published for Great Britain and Ireland (Kerney, 1976). An updated atlas was then published in 1999 (Kerney, 1999). This paper gives a list of notable non-marine molluscan records for Ireland found by the author since the publication of the last atlas. Notable records were considered to be new vice-county records, new ten kilometre square records or updates of very old records of rare species. New vice-county records are marked with an asterisk. The list includes many records from the Grand and Royal Canals which are derived from a survey with Ian J. Killeen, undertaken in 2003 with Heritage Council funding, (Moorkens and Killeen, 2003). A paper giving the results of the survey is in preparation and therefore the list below includes only a selection of the records (e.g. a single record for each county, eastern and western limits).

This lists includes 26 vice-county records new to the Republic of Ireland database. Many of these are for species which are clearly spreading (e.g. *Arion flagellus* Collinge), or for species not segregated during periods of intensive recording during the 1970s (e.g. *Arion distinctus* Mabille). Others are for aliens and other relatively recent arrivals in Ireland (e.g. *Physella acuta* (Draparnaud), *Lehmannia valentiana* (Férussac)). However, it also includes new vice-county locations for the Annex II species *Vertigo moulinsiana* (Dupuy) and *V. angustior* Jeffreys. There is also a new record for the rarest *Vertigo* snail in Ireland, *Vertigo pusilla* Müller, in North Kerry, only the sixth record for this species since 1965. Pearl mussel (*Margaritifera margaritifera* (L.)) records are considered too sensitive to include in this paper due to the danger to this species from pearl fishing.

Shells from specimens of shelled species collected as new vice-county records have been lodged at the National Museum of Ireland in Dublin.

Any non-marine molluscan records would be much appreciated, and can be added to the Republic of Ireland database by sending to the above address. The nomenclature follows Moorkens and Speight (2001).

***Bithynia tentaculata* (L., 1758)**

West Mayo: Moher Lough, L977773, April 2004, small lake.

***Aplexa hypnorum* (L., 1758)**

Clare: Doughmore, Q996692, February 2000, dune slack; Cragmurria Lough, R544806, July 2003, small lake.

North Kerry: Castlegregory, Q6115, April 2003, pond in dune system.

***Physella acuta* (Draparnaud, 1805)**

***Mid-Cork**: Riverstick, W6759, May 2004, in artificial wetland.

***Kildare**: Grand Canal, Ponsonby Bridge, N937267, and Henry Bridge, Ardclogh, N956282, both March 2003.

A spreading alien species, native to North America. See Anderson (2003).

***Radix auricularia* (L., 1758)**

Offaly: Derry Bridge, N151227, Grand Canal, March 2003.

***Myxas glutinosa* (Müller, 1774)**

Kildare: Bonynge Bridge, N814252, Grand Canal, November 2002; Dewey Bridge, N980369, Royal Canal, April 2003.

Dublin: Herbert Place, O171331, Grand Canal, October 2003; Collins Bridge, O028368, Royal Canal, April 2003.

***Anisus vortex* (L., 1758)**

Clare: Lough Bunny, R384976, May 2004.

Longford: Draper's Bridge, N214591, Royal Canal, May 2003.

South-east Galway: Ballinahistil, M7020, April 2002, pond.

***Gyraulus laevis* (Alder, 1838)**

North Kerry: Castlegregory, Q6115, dune pond, April 2003.

Gyraulus crista

Offaly: L'estrange Bridge, N059206, Grand Canal, March 2003.

Kildare: Bonynge Bridge, N814252, Grand Canal, November 2002; Dewey Bridge, N980369, Royal Canal, April 2003.

Dublin: Clondalkin, O067322, Grand Canal, March 2003; Westmanstown, O039382, Royal Canal, April 2003.

Westmeath: Shanonagh Bridge, N369528, Royal Canal, May 2003.

***Hippeutis complanatus* (L., 1758)**

Mid Cork: Riverstick, W6759, May 2004, farm pond.

Clare: Doughmore, Q996692, February 2000, dune slack.

South-east Galway: Ballinahistil, M7020, April 2002, pond.

***Planorbarius corneus* (L., 1758)**

Offaly: L'estrange Bridge, N059206, Grand Canal, March 2003; Dangean, N447276, Grand Canal, March 2003.

***Acroloxus lacustris* (L., 1758)**

Offaly: Dangean, N447276, Grand Canal, March 2003.

Kildare: East of Sallins, N896228, Grand Canal, March 2003.

Dublin: Herbert Place, O171331, Grand Canal, October 2003.

Longford: Lynoen Bridge, N099677, Royal Canal, May 2003.

***Columella edentula* (Draparnaud, 1805)**

East Cork: Ballyannan Woods, W8772, June 2003, mixed woodland.

Clare: Cragmurria Lough, R544806, fen by small lake, July 2003.

***Vertigo pusilla* Müller, 1774**

***North Kerry**: Beal Point, Q898484, August 2003, dune grassland.

***Vertigo antivertigo* (Draparnaud, 1801)**

Clare: Cragmurria Lough, R544806, July 2003, fen by small lake; Doughmore, Q9969, February 2000, marsh.

Westmeath: Scragh Bog, N424590, April 2004, swamp; Ballynafid Lake, N411607 April 2004, fen by lake; Slevin's Lough, N450563, April 2004, fen by lake; Kildallan Bridge, N345564, marsh adjacent to Royal Canal.

***Vertigo substriata* (Jeffreys, 1833)**

Dublin: Ballyman Glen, O2218, June 2002, in leaf litter.

***Vertigo moulinsiana* (Dupuy, 1849)**

Offaly: Tullamore, N355256, November 2002, margin of Grand Canal.

***Westmeath**: Loch Owel (Royal Canal feeder), N422563, April 2004; Kildallan Bridge, N345564, May 2003, marsh adjacent to Royal Canal.

Longford: Savage Bridge, Kilashee, N082708, May 2003, dried-up section of Royal Canal.

***Vertigo lilljeborgi* (Westerlund, 1871)**

South Kerry: Lough Caragh, V715903, August 2002, marginal fen.

West Donegal: Procklis Lough, B936257, June 2003, marginal fen.

***Vertigo geyeri* Lindholm, 1925**

West Mayo: Dooaghtry, L744693, August 2000, fen by lake.

***Vertigo angustior* Jeffreys, 1830**

North Kerry: Castlegregory, Q6115, April 2003, dune grassland.

***West Donegal**: Glen Bay, G5285, October 2000, dune grassland.

***Vallonia pulchella* (Müller, 1774)**

Clare: Doughmore, Q9969, February 2000, marsh.

***Ena obscura* (Montagu, 1803)**

Offaly: Kildangan, north-west of Tullamore, N3122, November 2002, on ivy-covered wall.

***Arion flagellus* Collinge, 1893**

***Mid Cork**: Riverstick, W6759, May 2004, farm.

***East Cork**: Ballyannan Woods, W8772, June 2003, mixed woodland.

***Waterford**: Colligan River Estuary, Dungarvan, X283937, garden.

Clare: Doughmore, Q9969, May 2004, in dune slack.

***Offaly**: Charleville Woods, south-west of Tullamore, N3122, November 2002, under logs.

***Dublin**: Rathfarnham, 01328, April 2004, suburban garden.

***Westmeath**: near Loch Owel (Royal Canal feeder), N422563, April 2004, under logs.

***West Mayo**: Bundorragha, L841633, April 2004, under planks at base of wall.

***Arion distinctus* Mabille, 1868**

North Kerry: Castlegregory, Q6115, April 2003, grassland.

Clare: Doughmore, Q9969, May 2004, in dune slack.

Galway: North of Galway, M301296, October 2000, limestone grassland.

Offaly: Charleville Woods, south-west of Tullamore, N3122, November 2002, under logs.

***West Mayo**: Bundorragha, L841633, April 2004, under planks at base of wall.

***Arion fasciatus* (Nilsson, 1823)**

***Offaly**: Charleville Woods, south-west of Tullamore, N3122, November 2002, under logs.

***Zonitoides excavatus* (Alder, 1830)**

Mid Cork: Riverstick, W6759, May 2004, farm.

East Cork: Ballyannan Woods, W8772, June 2003, mixed woodland.

***Westmeath**: Castlewatty, Lough Derravaragh, N4066, April, 2004, woodland near lake.

***Zonitoides arboreus* (Say, 1816)**

***Dublin**: Rathfarnham, 01328, April 2004, garden centre.

A species native to North America, now widely spread by man to other parts of the world. In

western Europe it is most frequently recorded from greenhouses and garden centres, and only occasionally in 'open' habitats. There are no prior published records for this species in Ireland.

***Boettgerilla pallens* Simroth, 1912**

Mid Cork: Riverstick, W6759, May 2004, near farm buildings.

Dublin: Rathfarnham, 01328, April 2004, suburban garden.

***Lehmannia valentiana* (Férussac, 1821)**

***Kildare**: Newbridge, N808152, August 2002, walls of hotel garden.

Dublin: Rathfarnham, 01328, April 2004, suburban garden.

An introduced species, native to the Iberian peninsula. Now known from a number of sites around Cork and in Rathgar, Dublin (see Moorkens, 2003). This species is likely to continue to spread.

***Cochlodina laminata* (Montagu, 1803)**

Offaly: Charleville Woods, south-west of Tullamore, N3122, November 2002, on trees.

Wicklow: Knocksink Wood, Enniskerry, O218179, September 2000, on trees.

***Cernuella virgata* (da Costa, 1778)**

***West Donegal**: Lunnaigh, B812714, August 2000, dune grassland.

***Ashfordia granulata* (Alder, 1830)**

Galway: North of Galway, M301296, October 2000, limestone grassland.

***Perforatella subrufescens* (Miller, 1822)**

East Cork: Ballyannan Woods, W8772, June 2003, mixed woodland.

Clare: Caher River valley, M1706, July 2000, on trees.

Offaly: Charleville Woods, SW of Tullamore, N3122, November 2002, on trees.

***Theba pisana* (Müller, 1774)**

***North Kerry**: Castlegregory, Q6115, April 2003, dune grassland.

Theba pisana has been relatively slow to spread in Ireland, unlike the case in south-west Britain. Although a population has been known from County Dublin for nearly 200 years, there

were no further records until it was found in two separate locations in County Cork in the late 1990s. This newly discovered population on the sand dune system of the Maharees peninsula near Castlegregory is extensive. I have carried out several surveys in the area in recent years but not noticed *Theba*, suggesting that it may have arrived relatively recently. Given this distributional jump from Cork to Kerry, *Theba* might well be expected to spread to the dune systems to the north in County Clare and beyond.

***Cepaea hortensis* (Müller, 1774)**

***East Cork**: Ballyannan Woods, W8772, June 2003, mixed woodland.

***Anodonta anatina* (L., 1758)**

Offaly: Shannon Harbour, N039192, Grand Canal, March 2003.

***Kildare**: Celbridge Abbey, N989338, River Liffey, September 2000; East of Leixlip, O018369, Royal Canal, April 2003; west of Aughpaudeen, N857243, Grand Canal, May 2003.

***Meath**: West of Enfield, N765410, Royal Canal, April 2003.

Westmeath: Kilmore Bridge, N732415, Royal Canal, April 2003.

***Musculium lacustre* (Müller, 1774)**

Offaly: Dangean, N447276, Grand Canal, March 2003.

Kildare: Bonynge Bridge, N814252, Grand Canal, November 2002; Dewey Bridge, N980369, Royal Canal, April 2003.

Dublin: Drimnagh, O127331, Grand Canal, November 2003; Westmanstown, O039382, Royal Canal, April 2003.

***Westmeath**: East of Mullingar, N448519, Royal Canal, May 2003.

***Longford**: Cloondara, N062756, Royal Canal, May 2003.

***Pisidium amnicum* (Müller, 1774)**

Offaly: Shannon Harbour, N039192, Grand Canal, March 2003.

Kildare: East of Sallins, N896229, Grand Canal, March 2003: Dewey Bridge, N980369, Royal Canal, April 2003.

Dublin: Hazelhatch, N985305, Grand Canal, March 2003.

Westmeath: Kildallan Dridge, west of Mullingar, N345564, Royal Canal, May 2003.

The Atlas shows a large number of pre-1967 ten kilometre square records for this and other *Pisidium* species, but Kerney (1999) suggests that this is a result of the detailed work carried out in the early 20th century by pioneers such as A. W. Stelfox, R. A. Phillips and Chas Oldham, and has no general significance with regard to evidence of species decline.

***Pisidium pseudosphaerium* Schlesch, 1947**

***Dublin**: Herbert Place, O171331, Grand Canal, October 2003; Confey, O008370, Royal Canal, May 2003.

Westmeath: Scragh Bog, N424590, April 2004; Ballynafid Lake, N411607, April 2004.

Longford: Molly Ward's Bridge, N189593, Royal Canal, May 2003.

***Pisidium henslowanum* (Sheppard, 1823)**

Offaly: South-east of Ballynacarrigy, N315584, Grand Canal, May 2003.

Kildare: Aghpaudeen, N867240, Grand Canal, April 2003; East of Leixlip, O018369, Royal Canal, April 2003.

Meath: West of Enfield, N765410, Royal Canal, April 2003.

Westmeath: Kilpatrick Bridge, N407513, Royal Canal, May 2003.

***Pisidium lilljeborgii* Clessin, 1886**

West Mayo: Moher Lough, L977773, April 2004; Creggan Lough, L998822, April 2004.

West Donegal: Lough Craghy, B793121, June 2003.

***Pisidium hibernicum* Westerlund, 1894**

West Mayo: Moher Lough, L977773, April 2004; Creggan Lough, L998822, April 2004.

West Donegal: Sallagh, B813134, Lough Craghy, B793121, Lough Auva, G537814, all June 2003.

Offaly: near Pollagh, N210263, Grand Canal, March 2003.

Kildare: Kilpatrick, N715294, Grand Canal, March 2003.

Dublin: Donore Avenue Bridge, O144325, Grand Canal, November 2003.

***Pisidium pulchellum* Jenyns, 1832**

Dublin: West of Clondalkin, O033323, Grand Canal, March 2003; Herbert Place, O170331, Grand Canal, November 2003.

Westmeath: Loch Owel (Royal Canal feeder), N422563, April 2004.

Longford: Cloondara, N062756, Royal Canal, May 2003.

***Pisidium moitessierianum* Paladilhe, 1866**

***Offaly**: Cartland Bridge, N598323, Grand Canal, March 2003.

***Westmeath**: Kilmore Bridge, N732415, Royal Canal, April 2003.

See Killeen and Moorkens (2003), and Moorkens and Killeen (2003).

***Dreissena polymorpha* (Pallas, 1771)**

Offaly: Grand Canal: continuous distribution from Banagher to Edenderry.

Westmeath: Lough Derravarragh, N468632, April 2004.

Longford: Cloondara, N062756, Royal Canal, May 2003.

The presence of this species was first noted in Ireland in 1997, but it was established in the Limerick docks in 1994 or before (Minchin *et al.*, 2002). Its distribution to date includes parts of the Shannon Boyle Navigation, the Suck Navigation, The Shannon-Erne Waterway, Lough Erne, Loughs Gill and Bo in Co. Sligo, and the Grand Canal (Minchin *op. cit.*).

References

Anderson, R. (2003) *Physella* (*Costatella*) *acuta* Draparnaud in Britain and Ireland – its taxonomy, origins and relationship to other introduced Physidae. *Journal of Conchology* **38**: 7-22.

Kerney, M. P. (1976) *Atlas of the non-marine Mollusca of the British Isles*. Institute of Terrestrial Ecology, Cambridge.

Kerney, M. P. (1999) *Atlas of the land and freshwater molluscs of Britain and Ireland*. Harley

Books, Colchester. 264pp.

Killeen, I. J. and Moorkens, E. A. (2003) *Pisidium moitessierianum* Paladilhe, 1866, rediscovered in Ireland. *Journal of Conchology* **38**: 94.

Minchin, D., Lucy, F. and Sullivan, M. (2002) Monitoring of zebra mussels in the Shannon-Boyle navigation, other navigable regions and principal Irish lakes, 2000 and 2001. *Marine Environment and Health Series.* **No. 5**. (2000). 17pp.

Moorkens, E. A and Killeen, I. J. (2003) A survey of the aquatic Mollusca of the Grand and Royal Canals. Unpublished report to the Heritage Council.

Moorkens, E. A. (2003) News from Ireland. *Mollusc World* **1**: 6.

Moorkens, E. A. and Speight, M. C. D. (2001) The CLECOM project list of Irish non-marine mollusca. *Bulletin of the Irish biogeographical Society* **25**: 95-104.

Bull. Ir. biogeog. Soc. No. 28 (2004)

NEW IRISH SITES FOR THE EXOTIC TERRESTRIAL AMPHIPOD *ARCITALITRUS DORRIENI* (HUNT, 1925) (CRUSTACEA: AMPHIPODA)

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26 St Patrick's Terrace, Sligo, Ireland.

Introduction

The exotic terrestrial amphipod *Arcitalitrus dorrieni* (Hunt) was first recorded in Ireland from the Kylemore area of Co. Galway (Rawlinson, 1937). It now occurs over a substantial area in that part of Co. Galway and in an adjacent part of Co. Mayo, and has been found in a small number of additional coastal sites, which are mapped by O'Hanlon and Bolger (1994). More recently, it has been discovered in parts of Galway City (McCarthy and Mac Loughlin, 2002). The ecology of Irish populations has been investigated by O'Hanlon and Bolger (e.g. 1997, 1999). The following information extends the known range to counties Cork and Waterford, and strongly suggests that this invertebrate is presently undergoing a significant expansion in range. New vice-county records are denoted by an asterisk (*). The present known distribution of *A. dorrieni* in Ireland is shown on Fig. 1.

NORTH KERRY: *Killarney National Park, V9685, 2 December 1999. Numerous animals under logs and in leaf litter in Muckross House Arboretum. Not, as yet, present in adjacent parts of the national park. This site had been searched unsuccessfully for *Arcitalitrus* in March 1992 (O'Hanlon and Bolger, 1994); Tralee, Q839147, 7 April 2002, a few specimens under Japanese Knotweed *Reynoutria japonica* Houtt. on the banks of a narrow canal/stream; Oakpark, Tralee, Q8416, 22 April 2002, frequent in a small, disturbed, planted woodland on the outskirts of Tralee. Clearly well established in Tralee, especially given that Prof. Tom Bolger tells me that he has additional records

from the town.

MID CORK: *Crosshaven, W7761, 30 December 1995, numerous specimens in leaf litter in *Quercus-Fagus* woodland. Subsequently noted on many occasions in the Carrigaline-Crosshaven area. Present as far west as Helay's Bridge, W714615, where *Arcitalitrus* is abundant in disturbed mixed woodland, and as far east as Crosshaven village, W801615. A few animals present on a small waste area in Carrigaline village, on a waste area in Crosshaven, and on grassy road verges between these two villages, suggesting that *Arcitalitrus* can do reasonably well away from woodlands in this area, which is among the mildest in Ireland. All large populations located however were in woodlands or hedgerows. On 11 January 1999, following a number of very cold nights, animals were found to be quite active under leaf litter which bore a heavy covering of frost; Kerry Pike, W6073, 28 February 2000. A small population of *Arcitalitrus* present at this sites, under plant pots on gravel in a commercial garden centre.

EAST CORK: *Tivoli, Cork City, W702722, 24 April 2000. Well established on a shrubby area adjacent to gardens, under stones and in leaf litter beneath Japanese Knotweed, *Reynoutria japonica* Houtt. Various other alien invertebrates present, including the exotic land planarian *Kontikia ventrolineata* (Dendy) which also occurs with *A. dorrieni* at the Waterford sites listed below. Much of this site destroyed by roadwork operations in 2001-2002.

WATERFORD: Mountcongreve, S534101, 24 March 1999. Abundant in leaf litter in *Rhododendron* gardens. This population was briefly alluded to by Cawley and Jones (2002). On subsequent visits noted as being common under stones and pieces of wood along roadverges just outside the gardens at Knockanagh, S535098. Frequent also in an adjacent shrubby area, in leaf litter under cherry laurel *Prunus laurocerasus* L., with a few specimens under moss on dead tree trunks.

WEST GALWAY: Barna Wood, M2423, 21 August 2002. A small number of adults,

and numerous small immatures sieved from a bag of leaf litter collected in disturbed *Quercus-Fagus* woodland.

Discussion

The above records, coupled with those listed by O'Hanlon and Bolger (1994) suggest that *Arcitalitrus* now occurs widely if very locally in south Munster and south Leinster. It is significant that three of the above sites, at Oakpark, Tivoli, and Barna had been visited by the author in 1996 without locating *Arcitalitrus*. It appears unlikely that it would have been missed at each of these had it been present, bearing in mind that I have been familiar with this invertebrate since late 1995. Most likely it is either only a recent arrival at these sites, or populations have become more abundant since 1996. The presence of this amphipod at a garden centre at Kerry Pike, and the fact that some of the above new sites are near gardens seems unlikely to be coincidental. Searches at a small number of garden centres in Cork and Waterford have however failed to turn up any additional colonies.

Acknowledgements

Thanks to Prof. T. Bolger for help in obtaining literature and correspondence. J. M. C. Holmes very kindly confirmed the identities of a number of specimens, and these have been deposited in the collections of the National Museum of Ireland. The distribution map was generated using DMAP provided by Alan J. Morton.

References

Cawley, M. and Jones, H. D. (2002) *Kontikia ventrolineata* (Dendy, 1892), an alien land planarian (Tricladida: Terricola: Geoplanidae) new to Ireland. *Ir. Nat. J.* **26** (2001): 424-425.

McCarthy, T. K. and MacLoughlin, E. (2002) The landhopper *Arcitalitrus dorrieni* (Amphipoda: Talitridae) in Galway City. *Ir. Nat. J.* **27**: 33-36.

O'Hanlon, R. P. and Bolger, T. (1994) The current status of *Arcitalitrus dorrieni* (Crustacea : Amphipoda: Talitridae) in Ireland. *Ir. Nat. J.* **24**: 440-444.

O'Hanlon, R. P. and Bolger, T. (1997) Aspects of the life history and reproductive biology of the introduced terrestrial amphipod *Arcitalitrus dorriei* (Hunt) at two sites in Co Galway, Ireland. *J. nat. Hist.* **31**: 1175-1202.

O'Hanlon, R. P. and Bolger, T. (1999) The importance of *Arcitalitrus dorrieni* (Hunt) (Crustacea: Amphipoda: Talitridae) in coniferous litter breakdown. *Appl. soil Ecol.* **11**: 29-33.

Rawlinson, R. (1937) The occurrence of the amphipod *Talitroides dorrieni* (Hunt) in Co Galway, Ireland. *Ann. Mag. nat. Hist.* (10) **20**: 589-592.

FIGURE 1. Distribution map for *Arcitalitrus dorrieni* in Ireland.

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FIRST IRISH RECORD OF *MEIONETA MOSSICA* SCHIKORA, 1993 (ARANEAE, LINYPHIIDAE)

Myles Nolan

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Stephen McCormack

13 Rivendell, Highfield Park, Galway, Ireland.

Introduction

The first Irish record of *Meioneta mossica* Schikora, 1993 was identified by MN from specimens caught in pitfall traps by SMcC on a mountain summit in Co. Sligo. This spider is very closely related to the widespread *M. saxatilis* (Blackwall, 1844). Schikora (1993, 1995) were used to identify *M. mossica* and to distinguish it from *M. saxatilis*. Comparative material of the latter species from the Natural History Museum, Dublin (NMINH) was examined. The following abbreviations are used:- MN = Myles Nolan, SMcC = Stephen McCormack.

Meioneta mossica Schikora, 1993

Two males of *M. mossica* were determined from spiders caught in pitfall traps on the summit of Truskmore, Co. Sligo G760473. The traps were set by SMcC as part of a larger scale project sampling beetles from montane sites in Connaught and Ulster. All the spider material was passed on to MN and a full account of it will be presented in time. The males of *M. mossica* are distinguishable from those of *M. saxatilis* by four characteristics. The most obvious is the presence of one tooth (rather than two) on the posterior pocket of the paracymbium. In addition, the lamella characteristica points nearly towards the posterior tegular apophysis, the chelicerae taper strongly and there are three or fewer visible teeth on the fang groove of the chelicerae in facial view.

The comparative material of *M. saxatilis* (three males) was from the Gibson collection (Gibson, 1982; Nolan, 2001) in the Natural History Museum, Dublin (NMINH : 1987.16) and it confirms that *M. saxatilis* is also found in Ireland. These specimens conform to Schikora's descriptions and display the range of characteristics that distinguish the species from *M. mossica*. It is more difficult to separate the females .

The summit of Truskmore (altitude 647 metres, 2100 feet) is highly exposed with a relatively thin peat layer through which the underlying rock occasionally obtrudes. The low vegetative sward consisted of *Calluna*, *Juncus squarrosus* L. and *Rhacomitrium* mosses. Some 115 adult spiders were identified from the ten pitfalls that were laid at this station. The fact that two specimens of *M. mossica* were captured would suggest that it is relatively common in the locality. *M. saxatilis* has been recorded from at least eleven Irish counties and some of these could possibly refer to *M. mossica*. MN intends to make a fuller examination of specimens held in the NMINH collection to see if this is possibly the case.

Data suggest that the spider has an essentially Scandinavian and north-european distribution and is associated with varied bog habitats (Schikora, 1995). In the Swedish type habitat, it was found most commonly in the hollows and hummocks of an ombrotrophic area of bog. It has been recorded at eleven sites in Britain, ranging from the south of England to the Shetland Islands and from a number of other European countries. Some of these finds sustain its association with bog habitats (Kupryjanowicz *et al.*, 1997; Harvey *et al.*, 2002). Platnick (2004) indicates that it occurs as far west as Russia.

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References

Gibson, Lesley R. (1982) *Carnsore spiders and their possible use in indicating site quality.* Unpublished PhD Thesis. Department of Zoology, Trinity College Dublin.

Harvey, P. R., Nellist, D. R. and Telfer, M. G. (eds) (2002) *Provisional atlas of British spiders (Arachnida, Araneae).* **1** and **2**. Biological Records Centre, Huntingdon.

Kupryjanowicz, J., Hajdamowicz, I., Stankiewicz, A., and Starega, W. (1997) Spiders of some raised peat bogs in Poland. *In*: Selden, P. A. (ed.). *Proceedings of the 17th European Colloquium of Arachnology, Edinburgh 1997*, 267-72. British Arachnological Society, Burnham Beeches, Bucks.

Nolan, M. (2000) A provisional list of spiders (Araneae) from Lesley Gibson's survey (1979-1982) of Carnsore Point, Co. Wexford, including one species new to Ireland *Maro minutus* (O.P.-Cambridge, 1906) (Linyphiidae). *Bull. Ir. biogeog. Soc.* **24**: 159-67.

Platnick, N. I. (2004) The world spiders catalog, version 4.5. American Museum of Natural History, online at http://research.amnh.org /entomology/spiders/catalog/index.html.

Schikora, H.-B. (1993) *Meioneta mossica* sp.n., a new spider close to *M. saxatilis* (Blackwall) from northern and central Europe (Araneae: Linyphiidae). *Bull. Br. arachnol. Soc.* **9**: 157-163.

Schikora, H.-B. (1995) Intraspecific variation in taxonomic characters, and notes on distribution and habitats of *Meioneta mossica* Schikora and *M. saxatilis* (Blackwall), two closely related spiders from northern and central Europe (Araneae: Linyphiidae). *Bull. Br. Arachnol. Soc.* **10**: 65-74.

Bull. Ir. biogeog. Soc. No. 28 (2004)

SOME FURTHER RECORDS FOR UNCOMMON SPIDERS (ARANEAE), INCLUDING FOUR SPECIES NEW TO IRELAND

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Introduction

The following article comprises distribution records for uncommon and under-recorded Irish spiders. As on a previous occasion (Cawley, 2001), species are generally included on the bases that they have been reported from four or fewer Irish counties. However, I have also included a few more widespread species which, based on the information contained in Harvey *et al.* (2002), would appear worthy of mention. Also on this occasion, I have included a full list of spiders for some of the more interesting sites, resulting in a large number of new county records. These are denoted by an asterisk (*). Three of the species involved, *Enoplognatha latimana* Hippa and Oksala, *Entelecara flavipes* (Blackwall) and *Tegenaria silvestris* L. Koch have not previously been reported from Ireland, and details are also included for a first confirmed record of *Simitidion simile* (C. L. Koch). Taking this article into account, and if one follows strictly the approach of Merrett and Murphy (2000), based on van Helsdingen (1996a) and subsequent publications, including Nolan (2004), the Irish spider list now stands at 400 species. The more conservative, and in my opinion rather compelling, taxonomic approach of Roberts (1987) gives a figure of 397 species. The taxa of disputed validity are *Dicymbium brevisetosum* Locket 1962, *Pelecopsis nemoralioides* (O. P.-Cambridge, 1884) and *Pardosa agrestis* (Westring, 1861). In addition, one would query van Helsdingen's (1996a) inclusion of the alien *Tegenaria pagana* C. L. Koch, 1840 on the list, this species being regarded as a casual and not established in Great Britain. For convenience and ease of comparison, nomenclature and sequence in this account strictly follows

Merrett and Murphy (2000). Unless otherwise stated spiders were identified using Roberts (1985-1987, 1993).

***Euryopis flavomaculata* (C. L. Koch, 1836)**

LEITRIM: *Cornagillagh, Roosky, N0687, 30 August 2003. Single female sieved from *Sphagnum* on lowland blanket bog. This distinctive theridiid would appear to be quite widespread if uncommon in Ireland. Other spiders collected were: **Peponocranium ludicrum* (O. P. - Cambridge) (2♀♀), **Poeciloneta variegata* (Blackwall) (1♂), **Stemonyphantes lineatus* (L.) (1♀), *Linyphia triangularis* (Clerck) (2♀♀), **Araneus quadratus* Clerck (1♀), *Larinioides cornutus* (Clerck) (2♀♀), **Agalenatea redii* (Scopoli) (1 subadult ♀), **Pirata uliginosus* (Thorell) (1♀), **Dolomedes fimbriatus* (Clerck) (numerous ♀♀ on vegetation in a drain, with immatures present on *Calluna*), **Antistea elegans* (Blackwall) (1♀), **Dictyna arundinacea* (L.) (numerous near adults), **Scotina gracilipes* (Blackwall) (1♂, 1♀), **Clubiona trivialis* C. L. Koch (13♂♂, 8♀♀), **Tibellus oblongus* (Walckenaer) (1♀) and **Neon reticulatus* (Blackwall) (1♀). A visit on 1 October 2001 had turned up the following spiders: *Ceratinella brevipes* (Westring) (2♂♂), **Walckenaeria antica* (Wider) (1♀), **Maso sundevalli* (Westring) (1♀), *Bathyphantes gracilis* (Blackwall) (1♂), *C. trivialis* (1♂) and *Xysticus cristatus* (Clerck) (1♀). These were collected by sieving mosses. **Ero cambridgei* Kulczyński (1♀) and **Episinus angulatus* (Blackwall) (1 immature) were among the few spiders beaten from heather *Calluna*. The following spiders were collected at the site on 22 June 2002: **Neottiura bimaculata* (L.) (2♂♂, 1♀), *P. ludicrum* (1♂, 6♀♀), *S. lineatus* (2 subadult ♀♀), **Microlinyphia pusilla* (Sundevall) (1♀), *Tetragnatha extensa* (L.) (2♀♀), **P. pullata* (1♂), *D. fimbriatus* (1 subadult ♀), *D. arundinacea* (3♀♀), *C. trivialis* (1♂, 1♀), **Zora spinimana* (Sundevall) (1 subadult), **Philodromus cespitum* (Walckenaer) (6♀♀) and *N.*

reticulatus (1♂). The following spiders were sieved from mosses *etc* on 16 April 2004: *E. flavomaculata* (1 subadult ♂), **Robertus arundineti* (O. P. - Cambridge) (2♀♀), *P. ludicrum* (1♀), **Gongylidiellum vivum* (O. P. - Cambridge) (1♂, 1♀), **Savignia frontata* Blackwall (1♂, 1♀), **Araeoncus crassiceps* (Westring) (1♂), **Erigone atra* Blackwall (1♂), **Jacksonella falconeri* (Jackson) (1♂), **Centromerus dilutus* (O. P. -Cambridge) (1♀), **Centromerita concinna* (Thorell) (1♀), *Lepthyphantes ericaeus* (Blackwall) (1♂), **Lepthyphantes angulatus* (O. P. - Cambridge) (1♀), **Haplodrassus signifer* (C. L. Koch) (1 subadult ♂, raised to maturity), **Ozyptila trux* (Blackwall) (1♀) and *N. reticulatus* (2♂♂, 2♀♀).

The site comprises part of a large area of blanket bog which straddles the Leitrim-Longford border, and is transversed by the Sligo-Dublin railway line. It clearly supports an interesting spider fauna, which includes quite a number of uncommon species. The site has long been known to be of botanical interest, supporting midland plants which are otherwise rare in Co. Leitrim, notably the bog rosemary *Andromeda polifolia* L. Many of the non-linyphiids were collected over a relatively small area where heather *Calluna vulgaris* (L.) was well developed. *J. falconeri* is otherwise known in Ireland only from Clara Bog, Co. Offaly (Higgins, 1990), however it is minuscule, even by linyphiid standards, and could easily be overlooked. *P. cespitum*, and especially *A. redii* are generally southern spiders, rarely encountered in the north-west. *A. quadratus* was widely recorded in the past however there are few modern records. There is a suggestion that this distinctive orb web spider may be declining in Great Britain.

***Steatoda grossa* (C. L. Koch, 1838)**

KERRY: *Tralee, Q8415, 11 August 2002. Mature male on the inside wall of a house. **WATERFORD**: *Dungarvan, X2593, 16 September 2003. Female on the inside wall of a shop.

While uncommon this synanthrophic spider would appear to be distinctly more

frequent in Ireland than *Steatoda bipunctata* (L.). This is the reverse of the situation which pertains in Great Britain.

***Achaearanea lunata* (Clerck, 1757)**

LAOIS: *Durrow, S410787, 18 April 2003. Single subadult female beaten from ivy *Hedera* on a tree trunk in open mixed woodland. Raised to maturity on 10 May 2003.

The only other Irish record for *A. lunata* is from Borris, Co. Carlow (Pack-Beresford, 1920). Widespread in southern Britain, and possibly under-recorded in southern parts of Ireland.

***Simitidion simile* (C. L. Koch, 1836) New to Ireland**

KILKENNY: Newrath, on the outskirts of Waterford City, S598133, 1 June 2004. Single female beaten from vegetation on a south facing rock exposure, mostly covered by gorse *Ulex europaeus* L. Identified by reference to the epigyne and carapace colouration. The abdominal pattern was completely different to that illustrated by Roberts (1985), resembling instead those illustrated for *Theridion mystaceum* L. Koch and *Theridion varians* Hahn.

An old Co. Antrim record for *S. simile* has been treated as unreliable by various authors, including van Helsdingen (1996).

Other spiders of note collected at the site, mostly beaten from *Ulex*, were **Theridion tinctum* (Walckenaer) (1♀) and **Nigma puella* (Simon) (1♂, 3♀♀), as well as **Anelosimus vittatus* (C. L. Koch) (3♀♀), *Theridion sisyphium* (Clerck) (6♀♀), **T. mystaceum* (2♀♀), **N. bimaculata* (1♀), **Rugathodes instabilis* (O. P. - Cambridge) (1♀), *Enoplognatha ovata* (Clerck) (6♂♂, 1♀), *Walckenaeria unicornis* O. P. - Cambridge (1♀), **Entelecara erythropus* (Westring) (1♀), *Dismodicus bifrons* (Blackwall) (1♀), *P. ludicrum* (2♀♀), **Typhochrestus digitatus* (O. P. - Cambridge) (1♀), *E. atra* (1♀), **P. variegata* (5♂♂, 4♀♀), **Lepthyphantes obscurus* (Blackwall) (1♀), *Lepthyphantes tenuis* (Blackwall) (1♂, 2♀♀), *Tetragnatha montana* Simon (1♂),

**Metellina mengei* (Blackwall) (4♂♂, 1♀), *Araneus diadematus* Clerck (2 subadults), **Araniella cucurbitina* (Clerck) (3♂♂, 4♀♀), **Pardosa pullata* (Clerck) (1♀), *Pisaura mirabilis* (Clerck) (1 juvenile), *Agelena labyrinthica* (Clerck) (subadult), **Dictyna latens* (Fabricius) (1♂, 2♀♀), **Clubiona reclusa* O. P. - Cambridge (1♂, 1♀), *Clubiona terrestris* Westring (1♂), **Clubiona comta* C. L. Koch (3♀♀), **Drassodes cupreus* (Blackwall) (1♀), *Philodromus aureolus* (Clerck) (5♂♂, 3♀♀), **Philodromus cespitum* (Walckenaer) (1♂, 3♀♀), *Misumena vatia* (Clerck) (1 juvenile), *Salticus scenicus* (Clerck) (1♀) and **Euophrys frontalis* (Walckenaer) (1♀).

A recent record of *T. tinctum* from Waterford City listed by O'Meara (2002) is erroneous, for it is based on a photographs which the author has recently seen and which refers to *Meta* sp..

***Enoplognatha latimana* Hippa and Oksala, 1982 New to Ireland**

CORK: Ballyphehane, Cork City, W678697, 20 July 2003. *E. latimana* (6♂♂, 4♀♀) beaten from rank grasses, thistles *Cirsium* and gorse *Ulex europaeus* L., on an area of waste ground at a derelict brick factory. Present in close association with *E. ovata* (3♂♂, 14♀♀). The only other spiders beaten from vegetation at the site were *T. sisyphium* (2♀♀), *P. mirabilis* (1 juvenile), *Clubiona terrestris* Westring (1♀) and *X. cristatus* (1♀).

WATERFORD: Dungarvan, X258931, 30 July 2003. Two females beaten from rank vegetation on waste ground. Present in association with *E. ovata* (4♀♀) and *L. ericaeus* (1♀).

This relatively recently described theridiid is identical in overall appearance to the ubiquitous *E. ovata*. However, the palp and epigyne allow for reasonably straightforward identification. Widespread if local in southern Britain (Harvey *et al.*, 2002), and apparently increasing its range. The author had anticipated the presence in Ireland of this spider and had checked numerous *E. ovata*, especially the more easily identified males, before finding

the above specimens. One would suspect that it will prove widespread, at least in the south, where it might be anticipated especially from rank grasslands.

***Theridiosoma gemmosum* (L. Koch, 1877)**

FERMANAGH: *Lough Macnean Lower, H0937, 23 March 2004. Subadult male sieved from debris collected in narrow band of lakeshore *Salix/Alnus* carr.

LAOIS: *Durrow, S418775, 18 April 2003. Two males and two near adult males at the base of vegetation in a small marsh adjacent to woodland.

***Walckenaeria dysderoides* (Wider, 1834)**

SLIGO: *Carns, G7034, 12 November 2002. Single female sieved from beech *Fagus* leaf litter in mixed woodland. Also present were *Walckenaeria acuminata* Blackwall (1♀), *Microneta viaria* (Blackwall) (2♂♂, 6♀♀), *C. dilutus* (2♂♂, 2♀♀), *Saaristoa abnormis* (Blackwall) (1♀), **Drapetisca socialis* (Sundevall) (1♂), and **Hahnia helveola* Simon (1♂). *Tapinocyba pallens* (O. P. - Cambridge) and *Tapinocyba insecta* (L. Koch) have been reported from beech *Fagus sylvatica* L. leaf litter at this site by Cawley (2001), and another uncommon linyphiid present is **Asthenargus paganus* (Simon), collected in October 2001 (2♂♂, 3♀♀) and April 2003 (3♀♀). *W. dysderoides* has recently been added to the Irish list by Fahy and Gormally (2003).

Site comprises a narrow deciduous fringe to a conifer plantation. Mostly comprised of *Fagus* but with a few mature oak *Quercus*. Although disturbed, the site supports a good range of woodland invertebrates, especially molluscs, and essentially represents the south west extremity of the Lough Gill woodlands.

***Entelecara flavipes* (Blackwall, 1834) New to Ireland**

CORK: Ballyvolane, Cork City, W679735, 15 June 2003. 13♂♂ and 6♀♀ beaten from bramble *Rubus* L., gorse *Ulex europaeus* L., elder *Sambucus ebulus* L. and red valerian *Centranthus ruber* (L.) DC. Site comprises an area of waste ground on the outskirts of Cork City, mostly covered by rank grassland, but with some bare ground and much

shrub invasion.

E. flavipes is very local in Britain where it is almost confined to southern England (Harvey *et al.*, 2002). Also beaten from vegetation at this site were **A. vittatus* (2♀♀), *T. sisyphium* (9♀♀), *T. varians* (1♀), *E. ovata* (9♂♂, 1♀), *W. unicornis* (1♀), **Hylyphantes graminicola* (Sundevall) (3♀♀), *D. bifrons* (2♀♀), *P. variegata* (1♀), *L. tenuis* (1♀), *T. montana* (7♂♂, 3♀♀), *M. mengei* (1♂, 1♀), *P. mirabilis* (1 juvenile), *C. reclusa* (1♂, 2♀♀), *C. terrestris* (1♀), **P. aureolus* (1♀), *P. cespitum* (1♀), *M. vatia* (1 immature ♀), and *X. cristatus* (1♂). The following spiders were collected on the ground layer, under stones *etc*: **Diplostyla concolor* (Wider) (1♀), *Pardosa palustris* (L.) (1♀), *P. pullata* (3♀♀), *Pardosa amentata* (Clerck) (4♀♀), *Tegenaria agrestis* (Walckenaer) (1 subadult ♀), and *S. scenicus* (1♂). *T. agrestis* has previously been reported from this its only known Irish site by Cawley (2001).

Although van Helsdingen (1995) treated the occurrence of *Entelecara media* Kulczyński, 1887 in Ireland as questionable, he subsequently (1996a) retained the species on the Irish list. This record is based on a male collected in Co. Cork by Mackie (1972). However, it is clear from information contained in Locket *et al.* (1974), that this record is likely to refer to *Entelecara errata* O. P.- Cambridge, 1913, the true *media* being unknown in the British Isles. Dr Dimitri Logunov has very kindly searched the Mackie collection at the Manchester Museum, and reports the absence of any specimen of *E. media*. It seems best at this stage that *E. media* should be deleted from the Irish list.

***Pelecopsis nemoralioides* (O. P. - Cambridge, 1884)**

WATERFORD: *Skehacrine, Dungarvan, X278938, 14 January 2003. Single male and a number of females sieved from moss collected on a small patch of sand dune. Other adult spiders present in this moss, and in moss on an adjacent border wall, were **Pholcomma gibbum* (Westring) (1♀), **W. antica* (2♂♂, 1♀), **Cnephalocotes obscurus*

(Blackwall) (1♂), *Tiso vagans* (Blackwall) (3♂♂, 5♀♀), **Troxochrus scabriculus* (Westring, 1851) (not form *cirrifrons*, 1 subadult ♂, raised to maturity), **Tapinocyba praecox* (O. P. - Cambridge) (3♂♂, 1♀), **G. vivum* (1♂), *E. atra* (1♀), *Pachygnatha degeeri* Sundevall (1♀), **Micaria pulicaria* (Sundevall) (1♀) and **E. frontalis* (1♀).

P. nemoralioides was identified using Locket *et al.* (1974). A controversial taxon of disputed validity. Locket *et al* (1974) recognised three very similar species, *P. nemoralis* (Blackwall, 1841), *P. mediocris* (Kulczyński, 1899) and *P. locketi* Cooke, 1967. However, Wunderlich (1985) treated *mediocris* and *locketi* as synomyms of *P. nemoralioides* (O. P. - Cambridge, 1884), with *nemoralis* a distinct species. All of these taxa were treated as part of a single variable species *Pelecopsis nemoralis* (Blackwall, 1841) by Roberts (1987, 1993). However *nemoralioides* was retained as a species distinct from *nemoralis* by Merrett and Murphy (2000) and Harvey *et al.* (2002). The southern sand dune habitat is typical of *nemoralioides*, whereas *nemoralis* usually occurs in woodlands, and is more frequent in the north.

***Silometopus ambiguus* (O. P. - Cambridge, 1905)**

CORK: *Redbarn, Youghal, X0874, 14 September 2000. Single male collected on sandy foreshore.

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

CORK: *Loughbeg, W7863, 8 October 2003, 4♂♂ and 3♀♀ sieved from debris collected from an old dungheap in a field. Also present were *Araeoncus humilis* (Blackwall) (5♂♂, 6♀♀) and *Ostearius melanopygius* (O. P. - Cambridge) (9♂♂, 8♀♀ and numerous immatures).

WATERFORD: *Ringcrehy, Dungarvan, X2591, 24 June 2004. Single male sieved from debris collected on a dungheap, with *A. humilis* (16♂♂, 22♀♀) and *O. melanopygius* (1♂, 1♀) again present.

Previous Irish records for this spider, which shows strong synanthrophic tendencies,

have been confined to the east of the country. However the above new records show that it is present in the south also. It could yet prove widespread in Irish dungheaps, no doubt often in association with *A. humilis* and *O. melanopygius*.

***Ceratinopsis stativa* (Simon, 1881)**

CORK: *Glanaprehane, W1887, 8 August 2003, single female collected on mountain summit at *circa* 650m. Other spiders collected at this site, sieved in the field from mosses, and from debris collected at the base of grass/heather *Calluna vulgaris* (L.) clumps were *Robertus lividus* (Blackwall) (1♀), **Theonoe minutissima* (O. P. - Cambridge) (1♀), **C. brevipes* (1♀), **Dicymbium tibiale* (Blackwall) (1♂, 1♀), **Gonatium rubens* (Blackwall) (1♀), **Mecynargus morulus* (O. P. - Cambridge) (2♂♂, 5♀♀), **Hilaira frigida* (Thorell) (2♀♀), **Centromerus prudens* (O. P. - Cambridge) (1♀), **C. concinna* (1 subadult ♂, raised to maturity), **Saaristoa firma* (O. P. - Cambridge) (1♀), *P. variegata* (2♀), *Lepthyphantes alacris* (Blackwall) (1♀), *Lepthyphantes zimmermanni* Bertkau (1♂, 4♀♀), and *L. ericaeus* (1♂). The site was revisited on 17 February 2004 and the following spiders collected: *R. lividus* (2♀♀), *C. brevipes* (1♂, 1♀), *W. antica* (5♂♂, 10♀♀), *Walckenaeria nudipalpis* (Westring) (1♀), *D. tibiale* (3♂♂, 4♀♀), *G. rubens* (2♀♀), *C. stativa* (2♀♀), *E. atra* (2♂♂), *M. morulus* (12♂♂, 21♀♀), *H. frigida* (2♂♂, 1♀), *C. concinna* (7♀♀), *B. gracilis* (1♀), *L. ericaeus* (1♀) and *Clubiona diversa* O. P. - Cambridge (1♀).

C. stativa is a rare spider, associated with *Sphagnum* and grasslands, and listed by van Helsdingen (1996a) from counties Carlow and Clare. The miniscule *T. minutussima* would appear to be widespread in Ireland. Although there are few records for *M. morulus* and *H. frigida*, they also would appear to be widespread on Irish mountains. There are few Irish records also for the generally northern *S. firma*, and these include recent finds from Antrim and Armagh (Johnston and Cameron, 2002).

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

CORK: *Mullaghamish, W2080, 3 July 2002. A single male of this myrmecophile collected from the nest of *Formica lemani* Bondroit, on a heathy hillside at *circa* 430m. A generally northern spider, however there is a recent record from Co. Kerry (Nolan, 2002).

***Troxochrus scabriculus* f. *cirrifrons* (O. P. – Cambridge, 1871)**

CORK: *White Strand, W6043, 27 June 2002. At the base of vegetation on a small patch of disturbed sand dunes.

KERRY: Derrymore Island, Q7412, 25 August 2002, narrow fringe of sand dunes.

***Tapinocyba pallens* (O. P. – Cambridge, 1872)**

CORK: *Glenbower Wood, W9977, 16 May 2004. Two females collected from leaf litter in mixed woodland.

LEITRIM: *Glenfarne Wood, H3108, 26 November 2002. Single female sieved from beech *Fagus* leaf litter, deciduous fringe to conifer plantation.

***Microctenonyx subitaneus* (O. P. Cambridge, 1875)**

CORK: Macroom, W3272, 15 August 2002, single ♂ and a number of subadults, sieved from material collected in a cowshed.

FERMANAGH: *Mullaghbane, H0937, 6 May 2004. Male sieved from debris collected in a cowshed.

KILKENNY: *Ballykeefe, S410498, 23 November 2001, 1♂ and 3♀♀ sieved from debris collected in a cowshed.

LAOIS: *Durrow, S409774, 18 April 2003, 1♀ sieved from debris collected in an old stable. **Harpactea hombergi* (Scopoli) (immatures) also present.

SLIGO: *Killanly, G2625, 2 September 1994. Male sieved from debris collected in a stable. Determined in 2003.

WATERFORD: *Tournore, Dungarvan, X2794, 30 January 2003, 1♂ and 5♀♀ sieved

from debris collected in a cowshed. Also present were *H. hombergi* (immatures), **Oonops pulcher* Templeton (1♀), *Thyreosthenius parasiticus* (Westring) (1♀) and **O. melanopygius* (subadult ♀).

Although only a recent addition to the list (Cawley, 2001), *M. subitaneus* would seem to be widespread in Ireland, possibly more so than in Great Britain. Two other cowshed associated invertebrates, the woodlouse *Porcellio dilatatus* Brandt and the false-scorpion *Dinocheirus panzeri* (C. L. Koch) also appear to be more frequent here, and in fact both species were present at each of the above six sites. Possibly the traditionally less intensive farming scene in Ireland accounts for this state of affairs.

***Satilatlas britteni* (Jackson, 1913)**

WATERFORD: *Skehacrine, Dungarvan, X278938, 12 March 2003. Two subadult females, and a subadult male, under a piece of wood in saltmarsh. Male matured and was identified on 19 March.

***Gongylidiellum murcidum* Simon, 1884**

CORK: Recorded at the following three Co. Cork sites: Lough Aderry, W934735, 1 February 2003: **G. murcidum* (1♂) sieved from wet moss and from debris collected from under alder *Alnus*. Site comprises an area of damp rough grassland with scattered *Alnus* in a field which is otherwise moderately grazed pasture. Other spiders collected were **W. nudipalpis* (1♀), *Gnathonarium dentatum* (Wider) (2♀♀), **Erigonella ignobilis* (O. P. - Cambridge) (6♂♂, 8♀♀), *S. frontata* (1♂, 1♀), *E. atra* (1♂, 1♀), *Porrhomma pygmaeum* (Blackwall) (1♂, 1♀), *Tallusia experta* (O. P. - Cambridge) (2♂♂), *C. concinna* (1♀), *L. tenuis* (1♀), *Neriene clathrata* (Sundevall) (1♀), *O. trux* (1♀) and **Ozyptila brevipes* (Hahn) (1♀). A second visit to the site on 17 March 2003 revealed *E. cambridgei* (1♀), **Walckenaeria nodosa* O. P. - Cambridge (3♀♀), *G. dentatum* (2♂♂, 2♀♀), *Lophomma punctatum* (Blackwall) (1♀), *G. murcidum* (1♂), *E. ignobilis* (5♂♂, 5♀♀), *Diplocephalus permixtus* (O. P. - Cambridge) (1♀), *Taranucnus setosus* (O. P. –

Cambridge) (1♂), *P. degeeri* (1♂) and **A. elegans* (immature ♀). Halfway, W584609, 4 February 2003: *G. murcidum* (1♀) sieved from moss collected in rush *Juncus* dominated damp grassland with scattered alder *Alnus*. Also collected were *G. dentatum* (8♂♂, 2♀♀), *Oedothorax fuscus* (Blackwall) (1♂), **C. obscurus* (1♂), *T. vagans* (1♂, 1♀), *Monocephalus fuscipes* (Blackwall) (1♀), *L. punctatum* (3♂♂, 1♀), *E. ignobilis* (3♂♂, 2♀♀), *S. frontata* (1♂, 1♀), *E. atra* (2♀♀), *P. pygmaeum* (1♀), *T. experta* (1♂), *B. gracilis* (1♀) and *Pachygnatha clercki* Sundevall (1♂). Tooreen, W569597, 22 May 2004: *G. murcidum* (2♂♂) sieved from debris collected in an extensive horsetail *Equisetum* dominated marsh, with some *Alnus / Salix* invasion, on the south side of the Owenboy River. Other spiders collected were *T. gemmosum* (1♂, 2♀♀) and *E. ignobilis* (3♂♂, 7♀♀), as well as *R. instabilis* (1♂), *P. gibbum* (1♂, 5♀♀), *C. brevipes* (3♂♂, 1♀), *W. unicornis* (6♀♀), *H. graminicola* (1♂), *G. dentatum* (6♂♂, 19♀♀), *Gongylidium rufipes* (L.) (1♀), *Hypomma bituberculatum* (Wider) (1♂, 5♀♀), *M. sundevalli* (3♀♀), **Pocadicnemis pumila* (Blackwall) (5♀♀), *O. fuscus* (1♀), **Silometopus elegans* (O. P. - Cambridge) (9♂♂, 9♀♀), *S. frontata* (1♂), *D. permixtus* (3♀♀), *A. crassiceps* (1♂, 12♀♀), *P. pygmaeum* (2♂♂, 2♀♀), **Agyneta conigera* (O. P. - Cambridge) (1♀), *Bathyphantes parvulus* (Westring) (3♂♂, 1♀), *Kaestneria dorsalis* (Wider) (1♀), *P. variegata* (1♂), *T. setosus* (2♀♀), *L. zimmermanni* (1♂), *L. ericaeus* (4♂♂), *N. clathrata* (1♂, 4♀♀), **Microlinyphia impigra* (O. P. - Cambridge) (1♂), *T. montana* (2♂♂, 1♀), *P. clercki* (1♂, 1♀), *P. degeeri* (1♀), *Metellina merianae* (Scopoli) (1♀), *A. redii* (1♀), *P. pullata* (1♀), *P. amentata* (8♀♀), *Pardosa nigriceps* (Thorell) (1♂, 1♀), *A. labyrinthica* (juveniles), *D. arundinacea* (1♂, 1♀), *Clubiona stagnatilis* Kulczyński (1♀), *Clubiona phragmitis* C. L. Koch (1♂, 3♀♀), *Clubiona lutescens* Westring (2♂♂, 2♀♀), *Tibellus maritimus* (Menge) (1♀), and *O. trux* (Blackwall) (2♂♂, 2♀♀)

ROSCOMMON: Derryonogh, N051875, 8 May 2004. **G. murcidum* (15♂, 5♀♀)

sieved from damp leaf litter under willow *Salix* on the banks of the River Shannon. Other uncommon spiders present, under *Salix* and in adjacent *Juncus* dominated damp grassland included **T. gemmosum* (2 subadult ♀), **W. nodosa* (3♀♀), **Hypomma fulvum* (Bösenberg) (6♂♂, 4♀♀) and **E. ignobilis* (1♂), as well as **G. dentatum* (2♂♂, 2♀♀), *G. rufipes* (1♂, 1♀), *H. bituberculatum* (9♂♂, 18♀♀), **Baryphyma trifrons* (O. P. - Cambridge) (1♂, 1♀), **M. sundevalli* (1 subadult ♀), *P. pumila* (1♂, 2♀♀), **Oedothorax gibbosus* (Blackwall) (7♂♂, of which 4 were referrable to form *tuberosus*, 1♀), **G. vivum* (1♂), **S. frontata* (2♂♂, 2♀♀), **D. permixtus* (3♀♀), *Diplocephalus picinus* (Blackwall) (2♂♂, 1♀♀), *E. atra* (2♀♀), **P. pygmaeum* (7♂♂, 22♀♀), *Bathyphantes approximatus* (O. P. - Cambridge) (2♀♀), *B. gracilis* (1♂, 1♀), *K. dorsalis* (1♂, 1♀), **Kaestneria pullata* (O. P. - Cambridge) (1♀), **S. lineatus* (2♀♀), *L. tenuis* (1♂, 2♀), **L. ericaeus* (1♀), **M. impigra* (3♂♂), *T. extensa* (1♀), *P. clercki* (1♀), *L. cornutus* (1♀), *P. palustris* (1♂, 1♀), *P. amentata* (6♀), and *C. phragmitis* (2♂♂, 1♀♀).

The only other published Irish record for *G. murcidum* is from Co. Clare (Locket *et al.*, 1974). Until recently *W. nodosa* was known in Ireland only from Co. Monaghan (Pack-Beresford, 1929), however there are a number of recent records as listed below. Both of these species, as well as *E. ignobilis* are scarce in Britain.

***Mecynargus morulus* (O. P. - Cambridge, 1873)**

WATERFORD: *Farbreaga, S2803, 14 September 2003. Sieved from mosses *etc* collected on mountain summit at *circa* 550m (9♂♂, 10♀♀). Other spiders collected on the mountain summit were **R. lividus* (1♀), *C. brevipes* (2♂♂, 4♀♀), *W. acuminata* (1♂), *W. antica* (1♀), **D. tibiale* (1♂, 1♀), **Entelecara erythropus* (Westring) (1♀), *G. rubens* (2♂♂, 1♀), **C. concinna* (1♂, 1♀), *L. zimmermanni* (1♂, 1♀), **P. nigriceps* (1♀), *Pirata piraticus* (Clerck) (1♀), **C. trivialis* (2♂♂) and **H. signifer* (1 subadult ♂).

The female *E. erythropus* was initially mis-identified as the very similar montane and generally northern *Entelecara errata* O. P. - Cambridge. However, a visit on 23 May 2004 revealed the presence of *erythropus* (4♂♂, 2♀♀) under stones at a cairn on the mountain summit.

***Donacochara speciosa* (Thorell, 1875)**

WATERFORD: *Bawnacarrigaun, X240904, 20 May 2003. Single female in folded reed *Phragmites* leaves, and a second female sieved from debris collected at the base of reeds.

The only other Irish records for this relatively large and distinctive linyphiid are from Co. Limerick (Pack-Beresford, 1929), and the Co. Leitrim site listed below. Site comprises a reed *Phragmites* stand on the banks of a tidal part of the River Brickey, with scattered willow *Salix*, and a few clumps of *Carex paniculata* L.. Other uncommon spiders present were **T. gemmosum* (1♀) and **H. fulvum* (1♀) and as well as **Nesticus cellulanus* (Clerck) (1 subadult ♂), **R. instabilis* (2♀♀), *P. gibbum* (1♀), **W. unicornis* (1♀), *G. dentatum* (7♂♂, 17♀♀), *G. rufipes* (1♀), *H. bituberculatum* (5♀♀), **O. gibbosus* (11♂♂ of which 6 were referrable to form *tuberosus*, 19♀♀), *G. vivum* (2♀♀), **T. experta* (1♀), **B. parvulus* (1♂, 1♀), **T. setosus* (2♀♀), *L. zimmermanni* (1♂), *Neriene montana* (Clerck) (1♀), *N. clathrata* (1♀), *M. merianae* (1♂), **P. piraticus* (1♂, 1♀), **A. elegans* (2 immatures), **C. phragmitis* (2♂♂, 8♀♀) and **C. lutescens* (5♂♂, 7♀♀). A few wolf spiders were collected on rough grassland bordering the *Phragmites*. These turned out to be **Pardosa prativaga* (L. Koch) (3♀♀) and *P. amentata* (3♀♀). A brief visit on 16 December 2003 revealed the following spiders: **E. cambridgei* (1♀), *W. unicornis* (4♂♂, 1♀), *G. dentatum* (12♂♂, 20♀♀), **G. rubens* (1♀), **L. punctatum* (3♀♀), *D. permixtus* (1♂, 2♀♀), *D. speciosa* (1 subadult ♀), *T. experta* (5♂♂, 5♀♀), *B. approximatus* (1♂, 2♀♀), *B. gracilis* (6♂♂, 5♀♀), *T. setosus* (1♂), **L. alacris* (Blackwall) (1♀), **L. tenuis* (1♀), *L. zimmermanni* (1♀), *N. clathrata*

(1♂, 1♀), *P. clercki* (1♀), *C. phragmitis* (single intersex ♂, with an abnormally developed epigyne) and *O. brevipes* (3♀♀).

***Carorita paludosa* Duffey, 1971**

LEITRIM: Carrick on Shannon, M944993, 8 April 2004. **C. paludosa* sieved from debris under *Phragmites* (1♂) and shaken from sedge clumps (3♂♂, 1♀). Other uncommon spiders collected were **H. fulvum* (20♂♂, 2♀♀ and numerous near-adults), **Maro sublestus* Falconer (1♀), and **D. speciosa* (1♂, 1♀), as well as *C. brevipes* (1♀), **G. dentatum* (7♂♂, 9♀♀), **O. gibbosus* (1♀ and abundant near adults), *S. frontata* (1♀), *D. permixtus* (1♂), **P. pygmaeum* (7♂♂, 3♀♀), **T. experta* (1♂), **B. approximatus* (1♂), *B. gracilis* (6♂♂, 2♀♀), **T. setosus* (1♀), *P. clercki* (1♂), and *A. elegans* (1 juvenile). The site comprises a *Phragmites* stand and adjacent patch of open *Carex* dominated marsh on the banks of the River Shannon. Debris collected from adjacent willow *Salix*/alder *Alnus* carr yielded the following spiders: **T. gemmosum* (subadults), **W. nodosa* (1♀), **Walckenaeria vigilax* (Blackwall) (1♂), *G. dentatum* (1♂, 1♀), *S. frontata* (1♂), *D. permixtus* (1♂), *P. pygmaeum* (3♂♂, 5♀♀), *B. approximatus* (1♂, 1♀), *B. gracilis* (1♂) and *P. clercki* (1♀).

SLIGO: Cleaveragh, G713343, 11 April 2004. **C. paludosa* (4♂♂, 12♀♀), sieved from ground layer debris. An interesting mixed site on the south bank of the Garavogue River, and adjacent to a large area of mixed wet woodland. Comprises wet and dry patches, the latter invaded by bog myrtle *Myrica gale* L. Other uncommon spiders present were **Baryphyma gowerense* (Locket) (2 subadult ♂, 2♀♀), **Pocadicnemis juncea* Locket and Millidge (16♂♂, 3♀♀), and **Pelecopsis mengei* (Simon) (9♀♀), as well as **C. brevipes* (3♂♂, 4♀♀), **Dicymbium nigrum* (Blackwall) (1♀), **G. dentatum* (5♂♂, 13♀♀), *H. bituberculatum* (7♂♂, 10♀♀), **B. trifrons* (1♀), **S. elegans* (1♂), **L. punctatum* (1♂, 1♀), **G. vivum* (4♀♀), **Micrargus subaequalis* (Westring) (1♀), *D. permixtus* (4♂, 6♀), **D. picinus* (1♂), *Aphileta misera* (O. P. - Cambridge) (1♂), *P.*

pygmaeum (2♂♂), **Agyneta decora* (O. P. - Cambridge) (1♂), **B. approximatus* (1♀), **B. gracilis* (1♂), **T. setosus* (1 subadult ♀), **L. ericaeus* (1♀), *L. angulatus* (1♂), *N. clathrata* (1♀), **C. stagnatilis* (1♂), **T. oblongus* (1♀), and **O. trux* (1♀). The site was revisited on 12 June 2004 and the following spiders collected by sieving ground layer debris and beating *Myrica*: **T. sisyphium* (8♀♀), *Theridion impressum* L. Koch (4♂♂, 2♀♀), **R. instabilis* (1♀), *E. ovata* (2♂♂), *C. brevipes* (1♂, 3♀♀), **W. unicornis* (1♀), *G. dentatum* (3♀♀), *H. bituberculatum* (8♀♀), *B. trifrons* (3♀♀), *P. juncea* (1♀), **O. gibbosus* (3♀♀), *P. mengei* (1♂, 4♀♀), *L. punctatum* (1♀), *G. vivum* (4♀♀), *D. permixtus* (11♀♀), *C. paludosa* (2♂♂, 6♀♀), *B. approximatus* (1♀), *B. gracilis* (2♂♂), *L. tenuis* (1♂), *Lepthyphantes mengei* Kulczyński (1♂), **M. impigra* (1♀), **Tetragnatha nigrita* Lendl (1♂), *A. quadratus* (1 subadult ♀), **A. cucurbitina* (1♂), *P. amentata* (4♀♀), *P. piraticus* (3♀♀) and *C. stagnatilis* (5♂♂, 2♀♀).

C. paludosa and *M. sublestus* are internationally rare spiders, known in Ireland from single sites in Clare (Locket *et al.*, 1974) and Offaly (van Helsdingen, 1996b) respectively. *D. speciosa* is also a rare species, which with *W. nodosa* was until recently known from single Irish sites. One would suspect that the winter maturing *W. nodosa* is greatly under-recorded in Ireland.

***Asthenargus paganus* (Simon, 1884)**

CORK: *Glenbower Wood, W9977, 7 January 2003. Single female sieved from moss, beneath conifers in mixed woodland.

***Porrhomma pallidum* Jackson, 1913**

FERMANAGH: *Templenaffrin, H092390, 6 May 2004. Single ♀ sieved from leaf litter in mainly hazel *Corylus* woodland. Also present in the leaf litter were *Lepthyphantes tenebricola* (Wider) (3♂♂, 2♀♀).

***Maro minutus* O. P. - Cambridge, 1906**

SLIGO: *Doonweelin Lake, G6440, 31 August 2003, 1♀ in moss on heath covered

hillock. Carrowdough, G6034, 10 April 2004, 1♂ and 2♀♀ sieved from mosses collected in sand dunes, with **W. nodosa* (1♀) present in nearby damp slack.

***Floronia bucculenta* (Clerck, 1757)**

CORK: *Castlemartyr, W9573, 15 August 1999. Female beaten from gorse *Ulex*, on path through felled conifer plantation.

***Lepthyphantes angulatus* (O. P. - Cambridge, 1881)**

SLIGO: Slish Wood, G7432, 21 January 2002. Single female sieved from oak *Quercus* leaf litter in lakeshore woodland. Added to the Irish list by McFerran and Cameron (1995), based on specimens collected at three sites in Co. Fermanagh, including one woodland site. The only other Irish records are those from Sligo and Leitrim listed above.

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

LEITRIM: *Roosky, N0586, 8 May 2004. Female in a telephone box on the banks of the River Shannon.

***Neoscona adianta* (Walckenaer, 1802)**

WATERFORD: Tramore Burrow, S6100, 6 June 2004. Subadults swept from vegetation in sand dunes. Added to the Irish list when specimens were collected by J. N. Halbert at this site in July 1901 (Pack-Beresford, 1909).

CORK: The Long Strand, Rosscarbery, W3234, 17 June 2004. Subadults frequent on low vegetation in sand dunes.

So far all Irish records for this spider have come from the Cork/ Waterford coast, along which it would appear to be widespread but distinctly local.

***Tegenaria silvestris* L. Koch, 1872 New to Ireland**

CORK: Ballintemple, Cork City, W703710, 26 October 2003. Single female under a stone in a long disused limestone quarry. Most of the floor of the quarry comprises rank grassland, with much *Salix*, *Buddleja* and *Rubus* invasion. A male collected in a small

cave here on 18 December 2003.

This spider is relatively small compared to other *Tegenaria*, and atypical in that as with *T. agrestis*, it is not associated with buildings. Instead it usually turns up in damp parts of woodlands, however it occasionally turns up in other habitats, including waste ground and caves. Mapped by Harvey *et al.* (2002) as quite widespread in central and southern England and Wales, and with a few Scottish records.

***Nigma puella* (Simon, 1870)**

CORK: *Belvelly, W795705, 13 August 2003. Single female beaten from rank vegetation bordering saltmarsh.

WATERFORD: *Bawnacarrigaun, X238907, 24 June 2004. Female beaten from gorse *Ulex*, rough marshy ground dominated by rushes *Juncus*, on the bank of the River Brickey.

***Scotina celans* (Blackwall, 1841)**

SLIGO: *Killerry, G7533, 21 January 2001. Subadult sieved from *Sphagnum* in lakeshore heath.

***Zelotes electus* (C. L. Koch, 1839)**

WEXFORD: The Raven, T1126, 23 June 2003. Two females, active in the sunshine, in disturbed sand dunes.

***Zelotes apricorum* (L. Koch, 1876)**

KERRY: *Derrymore Island, Q7513, 25 August 2002. Single female under a stone on coastal shingle. Increasing evidence, including some from Ireland suggests that this species, and the equally uncommon *Zelotes subterraneus* (C. L. Koch) may be referrable to a single variable species.

***Ozyptila sanctuaria* (O. P. - Cambridge, 1871)**

CORK: *Ballintemple, Cork City, W703710, 18 December 2003. Single female sieved from moss collected on a bank in disused limestone quarry.

Now recorded in Ireland from single sites in Waterford, Kilkenny and Cork and clearly widespread in the south if seemingly very local.

***Marpissa nivoyi* (Lucas, 1846)**

KERRY: Derrymore Island, Q7412, 25 August 2002, male in disturbed sand dune verge.

***Pseudeuophrys lanigera* (Simon, 1871)**

CORK: Youghal Refuse Tip, X0979, 5 October 2003. Subadult female, under a stone on a large boulder. Usually confined to the immediate vicinity of houses.

Discussion

Much remains to be discovered about the Irish spiders. Comparisons with some invertebrate groups led Cawley (2002) to estimate that 25-50 species remain to be added to the Irish spider list. This seems like a reasonable figure given that eight species have been added since that study was published. Some overall patterns are beginning to emerge. A number of species appear to be much more widespread in Ireland than on the island of Great Britain. This is particularly true of a suite of wetland spiders, including *R. instabilis*, *T. gemmosum*, *H. fulvum*, *G. murcidum* and possibly, at least in the north west, *C. paludicola*. It may be that Ireland will eventually be shown to hold wetland spider communities of international importance. Surprisingly, the southern *N. puella* would appear also to be rather more frequent in Ireland than in Britain. A small number of species appear to be less frequently recorded by modern workers than might be anticipated (e.g. *Gibbaranea gibbosa* (Walkenaer)). Although under-recorded the woodland, sand dune and upland faunas would appear at this stage to be relatively poor.

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References

Cawley, M. (2001) Distribution records for uncommon spiders (Araneae) including five species new to Ireland. *Bull. Ir. biogeog. Soc.* **25**: 135-143.

Cawley, M. (2002) A review of the Irish harvestmen (Arachnida: Opiliones). *Bull. Ir. biogeog. Soc.* **26**: 106-137.

Fahy, O. L., and Gormally, M. J. (2003) Two additions to the Irish spider fauna (Araneae, Linyphiidae): *Walckenaeria dysderoides* (Wider, 1834) and *Agyneta ramosa* Jackson, 1912. *Ir. Nat. J.* **27**: 318-319.

Johnston, R. J. and Cameron, A. (2002) *Sintula cornigera* (Blackwall, 1856) (Araneae, Linyphiidae) new to Ireland and other new county records of spiders in Northern Ireland. *Ir. Nat. J.* **27**: 77-80.

Harvey, P. R., Nellist, D. R. and Telfer, M. G. (eds.) (2002) *Provisional atlas of British spiders (Arachnida, Araneae).* **1** and **2**. Biological Records Centre, Huntingdon.

Helsdingen, P. J. van (1995) The spider fauna of Ireland. Pp 89-92. *In*: Růžička (ed.) *Proceedings of the 15th European Colloquium of Arachnology.* Institute of Entomology, Ĉeské Budéjovice.

Helsdingen, P. J. van (1996a) The county distribution of Irish spiders, incorporating a revised catalogue of the species. *Ir. Nat. J. Spec. Zool. Suppl.* 1996.

Helsdingen, P. J. van (1996b) The spider fauna of some Irish floodplains. *Ir. Nat. J.* **25**: 285-293.

Higgins, D. G. (1990) Four additions to the Irish spider (Araneae) fauna. *Ir. Nat. J.* **23**: 279-280.

Locket, G. H., Millidge, A. F. and Merrett, P. (1974) British spiders. **3**. Ray Society, London.

Mackie, D. W. (1972) The distribution of some Irish spiders and harvestmen. *Ir. Nat. J.* **17**: 234-237.

McFerran, D. M. and Cameron, A. (1995) *Lepthyphantes angulatus* (O. P.–Cambridge, 1881) (Araneae, Linyphiidae), new to Ireland. *Ir. Nat. J.* **25**: 79-80.

Merrett, P. and Murphy, J. A. (2000) A revised check list of British spiders. *Bull. Br. arachnol. Soc.* 11: 345-358.

Nolan, M. (2000) A provisional list of spiders (Araneae) from Lesley Gibson's survey (1979-1982) of Carnsore Point, Co. Wexford, including one species new to Ireland, *Maro minutus* (O. P. – Cambridge, 1906) (Linyphiidae). *Bull. Ir. biogeog. Soc.* **24**: 159-167.

Nolan, M. (2002) Uncommonly recorded spiders (Araneae) from Ireland, including one species new to the country. *Bull. Ir. biogeog. Soc.* **26**: 154-160.

Nolan, M. (2004) Early records of Irish spiders: two species deleted, two clarifications and type material of *Erigone welchi* Jackson, 1911 (Araneae). *Bull. Ir. biogeog. Soc.* **28**: 233-243.

O'Meara, M. (2002) *The spiders of Co Waterford. A catalogue of the spiders of County Waterford at the start of the twenty-first century*. Fauna of Waterford Series, **No. 5**. Waterford Wildlife, Waterford.

Pack-Beresford, D. R. (1909) A supplementary list of the spiders of Ireland. *Proc. R. Ir. Acad.* **27B**: 87-118.

Pack-Beresford, D. R. (1920) Some new and rare Irish spiders. *Ir. Nat.* **29**: 29-33.

Pack-Beresford, D.R. (1929) Report on recent additions to the Irish fauna and flora. Araneida. A revision of the Irish spider list. *Proc. R. Ir. Acad.* **39B**: 41-52.

Roberts, M. J. (1985-1987) *The spiders of Great Britain and Ireland.* **1-3**. Harley Books, Colchester.

Roberts, M. J. (1993) *Appendix to The spiders of Great Britain and Ireland.* Harley Books, Colchester.

Wunderlich, J. (1985) Zur Synonymie einiger europaischer Arten der Gattung *Pelecopsis* Simon 1864 (Arachnida: Araneae: Linyphiidae). *Senckenberg. biol.* **66**: 111-114.

Bull. Ir. biogeog. Soc. No. 28 (2004)

NEOBISIUM CARPENTERI (KEW) (ARACHNIDA: PSEUDOSCORPIONES) – A FALSE SCORPION UNIQUE TO COUNTY CORK, IRELAND

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Introduction

In his note describing new distribution records for false scorpions, Cawley (2002) appears unaware that the County Cork populations of *Neobisium carpenteri* (Kew) represent a unique false scorpion. Although similar false scorpions have been found in Carmarthenshire (south-west Wales) and Essex (eastern England), it is clear that these are actually different species - albeit as yet not described as such (R. E. Jones, pers. comm.). *N. carpenteri* had long been believed to be confined to the immediate surrounds of Glengarriff (Legg and O'Connor, 1997) but Cawley (2002) reported on its occurrence more widely through West and Mid Cork, and I can report two further localities within this range. It has also become apparent that the species has unusual arboreal habits.

The three different populations in Britain and Ireland

The three populations which presently share the name *N. carpenteri* appear to be quite different ecologically:-

- County Cork material mostly comes from sites with concentrations of trees and shrubs, and from either leaf litter or tree canopy; there are also a few records from other moist situations such as open acid wetland and sea cliff vegetation;
- At Colne Point in Essex it has been found in salt marsh debris and litter amongst coastal shingle (Legg and Jones, 1988);
- In Carmarthenshire, south Wales, "specimens resembling *N. carpenteri* have been found

in a quarry but these do not have such a high rounded galea as the Irish and Essex specimens" (Legg and Jones, 1988).

Legg and Jones (1988) also note that Beier (1963) has drawn attention to the similarity between *N. carpenteri* and *N. ischyrum* (Navas), a species found in Spain and Portugal, suggesting that the Irish population may be another example of the relict Lusitanian fauna that is well known in south-west Ireland. The taxonomy of these populations is unclear at present but would present an interesting study.

Two new localities

During a short visit to West Cork in June 1996, single specimens of a pseudoscorpion were found amongst material knocked from tree foliage into a beating tray at two localities close to Skibbereen. The presence of pseudoscorpions in tree canopy is very unusual and this point was raised with R. E. Jones who suggested they may be *N. carpenteri*, and an inspection of my material confirmed that they were indeed this very rare species.

The two localities are as follows:- (1) Lough Ine, W0928, 2 June 1996, beaten from foliage of scrub oak *Quercus* along western lough-side; (2) Lissangle, W1040, 4 June 1996, beaten from hawthorn *Crataegus* blossom, along lane-side lined by ash *Fraxinus* and hawthorn.

Similar sampling took place widely in the Skibbereen area through the period 2-15 of June and also during a visit to the Glengarriff area on 13 June, but no further specimens were found. Both new localities are effectively linear stands of scrubby woodland, rather than true woodland, and have well-structured canopy. Sampling in the area at other times of year in previous visits had not revealed the species at all.

The unusual arboreal habit

Most pseudoscorpions are to be found in vegetable debris of a wide variety of sorts and in a

similar variety of situations, the key criteria for presence appearing to be humidity and prey. In this, *N. carpenteri* appears to be no exception. It has been found within the humid environment of woodlands and in moist situations outside of woods. It is, however, unique in Ireland in its arboreal habits. Of the Irish false scorpions, six other species have been found above ground level in decaying wood but none of these have been reported right out in the tree canopy where *N. carpenteri* has been found. *Neobisium carcinoides* Hermann (=*muscorum* (Leach)), *Roncus lubricus* L. Koch and *Dinocheirus panzeri* (C. L. Koch) on occasion have been found under tree bark (Legg and Jones, 1988), presumably on dead stems and branches, although this is not stated. *Lamprochernes nodosus* (Schrank), *Pselaphochernes dubius* (O. P.-Cambridge) and *P. scorpioides* (Hermann) have been found in decaying wood (Legg and Jones, *op. cit.*). While none of these appear to be exclusively arboreal, *N. carpenteri* appears to be much the most adventurous of species in its use of trees.

The earliest records include an aerial arboreal encounter:- 1909-1910, junction of Glengarriff and Canrooska Rivers, Glengarriff, V95, on a rocky wooded hill-side under the flaking outer-bark of strawberry-trees *Arbutus*, in rock crevices and among dead leaves, H. W. Kew (1910a, b, 1911, 1916). The 1910 specimens were collected in June (O'Connor, pers.comm.).

Cawley (2002) also reports aerial records:- Inishannon, W5357, 12 September 1999, in moss on tree branches in deciduous woodland along the east bank of the Bandon River; Inchanadreen, W1954, 14 December 2000, in moss on tree branches, small deciduous fringe to conifer plantation.

Interestingly, the tree canopy records are concentrated in either the late spring/ early summer period (early June), when deciduous trees are coming into leaf or are freshly in leaf, or autumn and early winter, when the false scorpions were found in moss on the branches. This pattern may merely reflect the limited number of records, but may equally indicate something else about the habits of this intriguing species. Does it explore the tree canopy in high summer? And, if not, why not? The canopy would be relatively dry and therefore more hostile to such a

moisture-demanding species, and the abundance of prey would also be much lower at that season than in the spring.

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References

Beier, M. (1963) *Ordnung Pseudoscorpionidea (Afterskorpione). Bestimmungsbucher Bedenfauna Europas* **1**: 1-313. Akad. Verlag, Berlin.

Cawley, M. (2002) Distribution records for false-scorpions (Arachnida: Pseudoscorpiones), including *Neobisium carpenteri* (Kew) and *Pselaphochernes scorpioides* (Hermann). *Bull. Ir. biogeog. Soc.* **26**: 211-219.

Kew, H. W. (1910a) A holiday in south-western Ireland. Notes on some false-scorpions and other animals observed in the counties of Kerry and Cork. *Ir. Nat.* **19**: 64-73.

Kew, H. W. (1910b) On the Irish species of *Obisium*; with special reference to one from Glengariff new to the Britannic fauna. *Ir. Nat.* **19**: 108-112.

Kew, H. W. (1911) A synopsis of the false-scorpions of Britain and Ireland. *Proc. R. Ir. Acad.* **29B**: 38-64.

Kew, H. W. (1916) A synopsis of the false-scorpions of Britain and Ireland; supplement. *Proc. R. Ir. Acad.* **33B**: 71-85.

Legg, G. and Jones, R. E. (1988) Pseudoscorpions (Arthropoda; Arachnida). Keys and notes for the identification of the species. *Synopses Br. Fauna* (New Series) **No. 40.**

Legg, G. and O'Connor, J. P. (1997) A review of the Irish Pseudoscorpions (Arachnida:Pseudoscorpiones). *Bull. Ir. biogeog. Soc.* **20**: 105-126.

Bull. Ir. biogeog. Soc. No. 28 (2004)

EARLY RECORDS OF IRISH SPIDERS: TWO SPECIES DELETED, TWO CLARIFICATIONS AND TYPE MATERIAL OF *ERIGONE WELCHI* JACKSON, 1911 (ARANEAE)

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Abstract

It is proposed that *Zelotes longipes* (L. Koch, 1866) and *Hypsosinga sanguinea* (C. L. Koch, 1844) be deleted from the Irish list. The specimen of the latter is of a closely related species. Early records of two uncommon species, *Dipoena inornata* (O. P.-Cambridge, 1861) and *Theridion tinctum* (Walckenaer, 1802), are deleted. Existing type material of *Erigone welchi* Jackson, 1911, is noted. Jackson did not designate any specimen from the type series as a holotype so a specimen of good diagnostic quality from the National Museum of Ireland, Dublin, is designated as the lectotype. The remainder of the specimens from the type series are paralectotypes.

Introduction

The following notes are made on the basis of an examination of material held in the collection of the Natural History Division of the National Museum of Ireland, Dublin (NMINH). While engaged during 2003 on a contract with the museum to report on their spider collection, the author undertook to examine specimens of rare or uncommon species. It was found that a small number of species had been either misidentified or identified on the basis of inadequate characteristics.

On the basis of the examined specimens, it is proposed that two spider species *Zelotes longipes* (L. Koch, 1866) and *Hypsosinga sanguinea* (C. L. Koch, 1844) be deleted from the

Irish list. Specimens attributed to the former are immature or of a different species. Early records of *Dipoena inornata* (O. P.-Cambridge, 1861) and *Theridion tinctum* (Walckenaer, 1802) are clarified and deleted. The former was misidentified and the latter is represented by immature specimens that are difficult to attribute to species. Both of these species have been subsequently recorded in Ireland. Type material of *Erigone welchi* Jackson, 1911, was located and is briefly described. It seems to be the only spider named to date whose original description was based solely on Irish specimens. A male from the collection is designated as the lectotype for the species. Inconsistencies between data labels, register information and published notes pertaining to these specimens of *E. welchi* are examined and resolved.

Identifications were made using Locket and Millidge (1951, 1953), Locket *et al.* (1974) and Roberts (1993). Nomenclature is based on Merrett and Murphy (2000). Information on Irish records is primarily from van Helsdingen (1996). No records of the deleted species have been found in publications on Irish spiders subsequent to van Helsdingen (*op. cit.*). Distribution information is taken from Harvey *et al.* (2002) and Platnick (2004).

Species to be deleted

***Zelotes longipes* (L. Koch, 1866) (GNAPHOSIDAE)**

The first Irish specimens attributed to this species were identified from material collected on Inishmore, Galway Bay and at Ballyvaughan, Co. Clare in July 1895. George Carpenter (1895) initially named them as *Prosthesima petiverii* Scopoli (now *Zelotes apricorum* (L. Koch)) but in a later publication (1898), he reassigned them to *Prosthesima longipes* (L. Koch) although offering no grounds for this transfer. He also noted that the specimens were immature. *Z. longipes* cannot be distinguished from some of its congeners without an examination of the mature genitalia. Superficial characteristics such as colouration and eye disposition are inadequate to separate it from at least three other species (Locket and Millidge, 1951; Roberts, 1993).

Two specimens were located in the NMINH collection – each in a separate tube – in a jar with the name *Prosthesima longipes* written on its external label. The single label within one tube reads:– Inishmore Aran 146: 1895. Under the registration number (NMINH : 1895.146), the register records the donation of a collection of insects and spiders by the Roya[1] Irish Academy. It was collected in Cos Galway and Clare by Carpenter and J. N. Halbert for the Flora and Fauna Committee. An account of this field trip (Praeger, 1895) states that Inishmore was visited on 15 July (16 July in this account is an error). The specimen is a submature female and while her genital structures are faintly visible through the integument of the epigyne's ventral surface, they are not sufficiently developed to allow her to be assigned definitely to species.

The label in the second tube reads:– *Prosthesima longipes* Ballyvaughan Clare. The specimen was taken on 13 July. This is another submature female but the visibly well-developed genitalia allow it to be placed in either *Z. apricorum* or (less likely) *Z. subterraneus* (C. L. Koch).

Neither of these specimens should be assigned to *Z. longipes* and this species should thus be deleted from the Irish list.

Z. longipes has a Palaearctic distribution and occurs in Britain, rarely in a few southern areas, being common only on Dorset heathland. The species may yet be found in Ireland.

***Hypsosinga sanguinea* (C. L. Koch, 1844) (ARANEIDAE)**

This species was added to the Irish list by Carpenter when he examined a collection of spiders taken by R. F. Scharff and J. N. Halbert at Clonbrock (some six miles from Ballinasloe), Co. Galway between 16 and 22 June 1896 during a field trip by the Dublin Naturalists' Field Club (Carpenter, 1896; McWeeney and Praeger, 1896). Carpenter (1898) stated that the single female specimen was taken by Halbert and noted that this was a valuable addition to the Irish list, being rare in England and confined to the southern counties there.

A jar was found in the Museum's collection bearing the name *Singa sanguinea* on an external

label with a single tube containing one specimen. The data label reads:– *Singa sanguinea* Clonbrock Galway J.N.H.. The museum's register (NMINH : 1896.70) records the donation of a collection of insects and spiders taken by J.N. Halbert at Clonbrock.

The specimen was determined by the present author to be a female of *Hypsosinga pygmaea* (Sundevall) rather than *H. sanguinea* (C. L. Koch). The genitalia of the specimen are less dissimilar to its congener than the illustrations in Roberts (1993) suggest but it certainly belongs to *H. pygmaea*. *H. sanguinea* has not been subsequently recorded from Ireland and should be deleted from the Irish list.

While the species has a Palaearctic distribution, it is deemed Nationally Scarce (notable B) in Britain where it is found in the southern English counties. Its preferred habitat seems to be heathland.

Two early records clarified

***Dipoena inornata* (O. P. -Cambridge, 1861) (THERIDIIDAE)**

Carpenter (1898) notes that this species (*Laseola inornata* (O. P. -Cambridge.)) was recorded only once in Ireland and that the specimen in the museum's collection came from a batch of spiders donated by Dr Robert Templeton. According to an entry for 12 September 1868 in the register, Templeton deposited "45 small bottles of spiders preserved in spirits". The above specimen probably belonged to this batch. Carpenter suggested that the spider was probably collected in Leinster on the basis of locality information accompanying some of Templeton's other specimens and van Helsdingen (1996) puts a question mark against this rather broad and uncertain assignation.

A jar was found containing a single tiny specimen. The four labels therein read:– *Lasaeola inornata*; Fam: Theridiidae; Male; Templ Coll *Las. inornata* Cb ♂. The specimen is a mature male and though very badly bleached, an examination of the palp indicates that the specimen does not belong to the *Dipoena* genus. When viewed in a position similar to Roberts' (1993)

illustration, a long curved backward-C form embolus can be clearly seen. It is recognisable as a theridiid palp similar to *Paidiscura pallens* (Blackwall) or *Pholcomma gibbum* (Westring). Some of the other palpal structures cannot be clearly seen but the distance between the palpal tibia and the most proximal curve of the embolus confirms that the spider is a specimen of *P. pallens*.

D. inornata was subsequently collected in Co. Clare (Mackie and Millidge, 1970). The species has a European distribution and has Nationally scarce (Notable B) status in Britain where it occurs primarily in southern England. It can be locally abundant on heathland and on sandy banks.

***Theridion tinctum* (Walckenaer, 1802) (THERIDIIDAE)**

Carpenter (1898) notes that this species was first recorded in Ireland in June 1897 at Mote Park in Co. Roscommon. He states that both specimens were "not quite mature". This raises a doubt since the *Theridion* genus is large and many of the species are superficially similar. The two specimens in the NMINH collection are in a tube accompanied by a single data label:– Mote Park June 1897. 95. The jar has an external label:– Theridion tinctum Wck. The entry in the register (NMINH : 1897.95) records the presentation of a collection of insects and spiders, collected by Halbert at Mote Park.

As stated by Carpenter, both specimens are immature: one a submature male, the other either a submature or immature female. The specimens are certainly theridiid like on the basis of the relative length of the tarsi and metatarsi of the first pair of legs and the annulations of varying size visible on the legs of both spiders. The sternum of the male has a dark border that is especially broad posteriorly but this feature is shared by a number of *Theridion* species. The carapace of both specimens bears darkish lines that extend back from either side of the ocular area to slightly beyond the foveal point making a quadrangular area (pale within) on the carapace. However a broadly similar pattern is to be found on the carapace of quite a few members of *Theridion* in the British Isles.

Since these specimens are immature, they were presumably diagnosed on the basis of superficial markings and colouration. This may be possible with *Theridion tinctum* (Walckenaer) which seems to be fairly distinctive (in the adult form at least) but most authorities agree that markings are highly variable even within the species. As a result the above specimens cannot be assigned to a definite species.

According to O'Meara (2002), *T. tinctum* was photographed in Waterford city in September 2001 and identified using this image. In addition, it is noted in a paper in the present volume (Cawley, 2004).

T. tinctum has a Holarctic distribution and is widespread in the southern half of England.

Type specimens of *Erigone welchi* Jackson, 1911 (LINYPHIIDAE)

Erigone welchi Jackson, 1911 was first described on the basis of a number of spiders collected by Robert Welch in Co. Donegal. It is the only valid species of spider whose original description was based solely on Irish specimens, some of which are in NMINH. The data on the label accompanying the specimens are inconsistent with information from other sources. Jackson (1911) states that the first specimens of *E. welchi* were collected by Robert Welch in September 1908, probably on the Carrickfin peninsula (B7020) near Bunbeg, Co. Donegal. The northern half of the Carrickfin peninsula lies west of Bunbeg, separated from the mainland by the long inlet of the river Gweedore. Pack-Beresford (1911) states that he received the specimens from Welch in the summer of 1910. Jackson received the specimens from Pack-Beresford in the autumn of 1910 but prior to describing the species he referred them to the Rev. Octavius Pickard-Cambridge and Wladislaw Kulczynski both of whom agreed that they were an unknown species.

Welch collected the specimens on a mollusc hunting expedition described by Stelfox (1909). He was with the group from 5 to 9 September 1908 collecting first at Horn Head and moving to Bunbeg on 7 September. There is no suggestion that collecting was carried out in Bunbeg itself.

The whole of 8 September however was spent on Carrickfin peninsula where a variety of sites were sampled. Taken with information from data accompanying the specimens, this strongly suggests that Carrickfin peninsula is the type locality and 8 September the date of capture.

The museum specimens were found in a jar bearing an external label:– *Erigone welchi* [Jackson]. A tube contains a label:– *Erigone welchi* Jackson, on one side and:– Bunbeg Co. Donegal Carrickfin peninsula RW 9.09 305-1910, on the reverse. The entry in the register for the registration number does not agree with the information on the label. By contrast, the entry for NMINH: 1910.355 (made on 12 July) has the following information:– Collection of invertebrates given by R. Welch, Horn Head district, collected September 1908. This is the only entry for the period from September 1908 (earliest suggested date of collection of specimens) to February 1911 (date of publication of Jackson's description) that can in any way be correlated with the register number on the label. The collection date on the label (September 1909) is also inconsistent with the register's entry (September, 1908) and is considered another error. Pack-Beresford (1911) gives no date but in a later paper (1929) gives the same date.

Another male specimen was located in the Natural History Museum, London (BMNH: 1972.606) and the accompanying labels confirm the details outlined above. This specimen was obtained by the museum with the Jackson collection. The main label reads:– 1972.606 Erigone welchi Jackson ♂ Co-type ?Carrickfin peninsula Bunbeg, Co. Donegal. Sept. 1908. R. Welch (c.) Irish Nat. 1911 p.28 figs Jackson Coll. Two smaller labels read:– E. welchii/Bunbeg, and:– E welchii palpus/Bunbeg.

Jackson (1911) based his description of *E. welchi* on three male and two female specimens. Pack-Beresford (1911) says that there were three of each sex and this comment is considered an error.

The NMINH material consists of two partial males, two whole females, a female abdomen and a female cephalothorax. An internal examination of the epigyne on the loose abdomen shows that it is indeed a female of *E. welchi.* On the loose female cephalothorax the carapace

shows the dentate margins characteristic of the genus and this cephalothorax is taken (for the present) to belong to the aforementioned abdomen.

The two whole females are specimens of *Erigone dentipalpis* (Wider). Jackson (1911) expressed reservations about the ease with which females in this genus could be distinguished but these reservations were probably based on the external structure of the scape since this is what he illustrated in his description of *E. welchi*. There are however very clear differences between these two species in respect of the form of the scape and it seems unlikely that Jackson would have confused them. These specimens may have been collected with the specimens of *E. welchi* and simply never separated out. Alternatively, it could be suggested that they were used for comparative purposes. It is also possible that the specimens were accidentally amalgamated at some stage. It is very common to find in the NMINH spider collection, a jar that contains two, three or more species from a single genus. The suggestion that they are the second and third female mentioned by Pack-Beresford (1911) may be made but is unlikely.

Of the two male specimens, only one has the diagnostic structures intact. This specimen has both palps intact and their form and the form of the patellar apophyses undoubtedly place it in *E. welchi*. This specimen lacks an abdomen. The palps of the other specimen are absent. However, the chelicerae, the palpal femora and the femora of leg I lack the strong dentition characteristic of *E. welchi* and it certainly does not represent this species. Thus we are left with a situation where one whole specimen of each sex is unaccounted for. These could have been retained by Pickard-Cambridge who described and illustrated the species for British arachnologists (1911) and may exist in un-curated specimens of the Hope Entomological Collections at the Oxford University Museum of Natural History where Pickard-Cambridge's collection is held. Inquiries have been made in this direction.

The BMNH specimen is missing the diagnostic sections of the right palp. The left palp is disarticulated and is of *E. welchi*. Dentition of the palpal femora confirms that these two elements belong together.

No type specimen was designated by Jackson (1911). Pack-Beresford refers to the "type specimens" (1929). It is uncertain as to whether the two missing specimens will be located. The Jackson specimen in the BMNH is presently designated "co-type", a term now avoided and replaced by syntype or paratype. It is not possible to correlate with certainty any of the extant specimens with Jackson's description and illustrations. As such it is warranted to designate the male specimen from NMINH the lectotype for this species. The NMINH female and the BMNH male thus become paralectotypes as will the missing specimens if found. For the present, the specimens of *E. dentipalpis* and the partial male will be held in the same jar, though in a separate tube, as the type material of *E. welchi*.

E. welchi has a very limited distribution in Europe. In the British Isles, it also occurs in Co. Clare (Locket *et al.*, 1974; Parker, 1978) and in twelve 10km grid squares in Britain where it has Nationally Scarce (Notable A) status. Elsewhere in Europe, it has apparently been recorded from France, Scandinavia, Estonia, and Moldavia.

Conclusions

It is not remarkable that a couple of species should be deleted from the Irish spider list. A casual browse through Carpenter's (1898) major contribution to Irish arachnology allows one to query a number of his records simply because of the somewhat dubious material described. Bristowe suggests that Carpenter's diagnoses "were sometimes unreliable" due to his attempt to know too many different animal groups (Locket and Millidge, 1951).

It may be the case that there are unpublished Irish records of some of the above named species and it is hoped that the above notes will encourage their revelation.

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References

Cambridge, O. Pickard- (1911) On new and rare arachnids noted and observed in 1910. *Proc. Dorset Nat. Hist. Field Club* **32**: 33-54.

Carpenter, G. H. (1895) Arachnida. *Ir. Nat.* **4**: 254-256.

Carpenter, G. H. (1896) Spiders. *Ir. Nat.***5**: 225-228.

Carpenter, G. H. (1898) A list of the spiders of Ireland. *Proc. R. Ir. Acad.* **5**: 128-210.

Cawley, M (2004) Some further records for uncommon spiders (Araneae), including four species new to Ireland. *Bull. Ir. biogeog. Soc.* **28**: 207-228.

Harvey, P. R., Nellist, D. R. and Telfer, M. G. (eds) (2002) *Provisional atlas of British spiders (Arachnida, Araneae).* **1** and **2**. Biological Records Centre, Huntingdon.

Helsdingen, P. J. van (1996) The county distribution of Irish spiders, incorporating a revised catalogue of the species. *Ir. Nat. J. Spec. Zool. Suppl.* 1–92.

Jackson, A. R. (1911) On a spider new to science recently found in Ireland. *Ir. Nat.* **20**: 28-31.

Locket, G. H. and Millidge, A. F. (1951, 1953) *British Spiders*. **1** and **2**. Ray Society, London.

Locket, G. H., Millidge, A. F. and Merrett, P. (1974) *British Spiders*. **3**. Ray Society, London.

Mackie, D. W. and Millidge, A. F. (1970) Spiders and harvestmen from the west of Ireland. *Ir.*

Nat. J. **16**: 334–338.

McWeeney, E. J. and Praeger R. L. (1896) Notes on the fauna and flora of Clonbrock, Co. Galway. *Ir. Nat.* **5**: 217-221.

Merrett, P. and Murphy, J. (2000) A revised check list of British spiders. *Bull. Br. arachnol. Soc.* **11**: 345–58.

O'Meara, M. (ed.) (2002) The spiders of county Waterford. A catalogue of the spiders of County Waterford at the start of the twenty-first century. *Fauna of Waterford Series*. **No. 5**.

Pack-Beresford, D. R. (1911) Some new Irish spiders. *Ir. Nat.* **20**:173-177.

Pack-Beresford, D. R. (1929) Report on recent additions to the Irish Fauna and Flora: Araneida. A revision of the Irish spider list. *Proc. R. Ir. Acad.* **39B**: 41-52.

Parker, J. R. (1978) The habitat of *Erigone welchi* Jackson. *Newsl. Br. arachnol. Soc.* **21**: 10-12.

Platnick, N. I. (2004) *The world spider catalogue, version 4.5*. American Museum of Natural History, online at http://research.amnh.org/entomology/spiders/catalog81-87/index.html.

Praeger, R. L. (1895) Report of the conference and excursion held at Galway, July 11th to 17th, 1895. *Ir. Nat.* **4**: 225-235.

Roberts, M. J. (1993) *The Spiders of Great Britain and Ireland*. Compact edition. **I-III**. Harley Books, Colchester.

Stelfox, A. W. (1909) Additional notes on the land and freshwater mollusca of north-west Donegal. *Ir. Nat.* **18**: 86-92.

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