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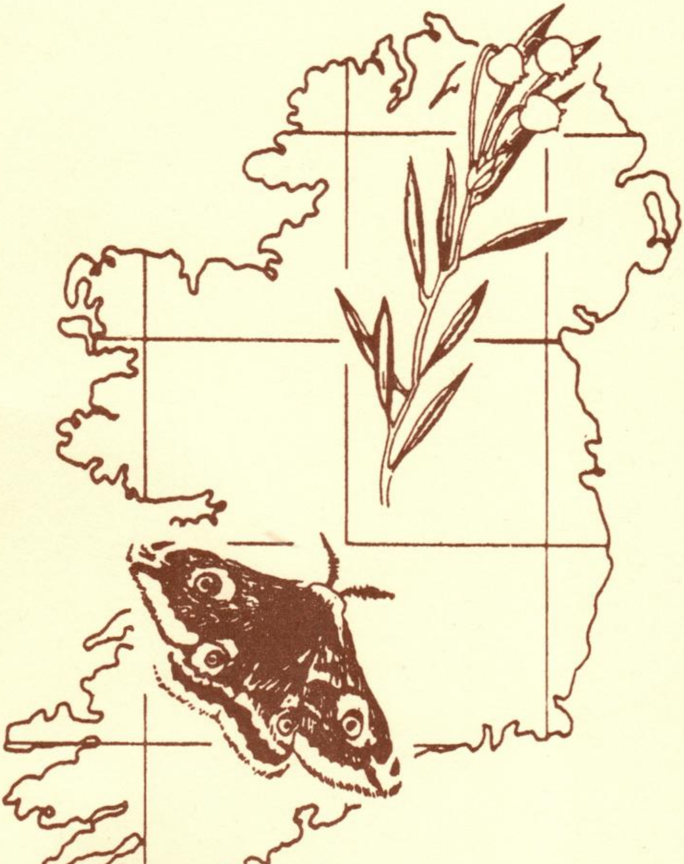

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This Bulletin is dedicated to the memory of E. C. Pelham-Clinton (1920-1988) in recognition of his important research on the Irish Microlepidoptera.

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BULLETIN OF THE IRISH BIOGEOGRAPHICAL SOCIETY

Number 29

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Bull. Ir. biogeog. Soc. No. 29 (2005)

EDITORIAL

This year has been another successful one for the Society. In March, *Occasional Publication* **Number 8** was published. Compiled by the Editor and entitled " A catalogue and index of the publications of the Irish Biogeographical Society (1977-2004)", it provides a convenient and concise access to the contents of the Society's publications. This book will be sent free of charge to all members. At the same time, the Society launched its website. This may be viewed at www.irishbiogeographicalsociety.com. We are very grateful to Kevin O'Connor for setting it up. In July, another book "First supplement to A Bibliography of Irish Entomology" was published jointly with The National Museum of Ireland. It was compiled by the Editor, Patrick Ashe and John Walsh. The Society is indebted to the Director of the Museum, Dr Pat Wallace, and the Head of Collections, Mr Raghnall Ó Floinn, for their support of this joint project.

Bulletin **Number 29** is the largest one ever published by the Society. Without our sponsors, we could not produce such a large issue. It contains a marvellous range of articles and many thanks are due to all our authors for their contributions and to the referees for their excellent reports. The Society is also very grateful to Dr Pat Wallace for his support of the Society's work. The Editor wishes to thank Mr J. M. C. Holmes for his help with the *Bulletin* and the Committee for their encouragement.

J. P. O'Connor
Editor
29 September 2005

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 (Please add €4 for postage outside Ireland for each publication).

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

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

Published 1993. 149pp. Price €15.

Number 3. *A checklist of Irish aquatic insects*

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

Published 1998. 80pp. Price €7.

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.

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

M. Kelly-Quinn and J. J. Bracken

Published 2000. 223pp. Price €12.

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

J. P. O'Connor, R. Nash and Z. Bouček

Published 2000. 135pp. Price €10.

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.

Number 8 *A catalogue and index of the publications of the Irish Biogeographical Society (1977-2004)*

J. P. O'Connor

Published 2005. 74pp. Price €10.

SURVEYS OF THE INSECTS, SPIDERS AND OTHER INVERTEBRATES OF FENS IN COUNTIES ARMAGH, DOWN AND TYRONE, NORTHERN IRELAND

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Introduction

In 1994, the University of Sheffield undertook a botanical and habitat survey of fens in counties Armagh and Down (ECUS, 1995) under contract to Environment and Heritage Service (Northern Ireland) (EHS). The outcome was a list of 30 fens which were considered to be of greatest conservation interest and worthy of designation as Areas of Special Scientific Interest (ASSI). As virtually no information was available on the invertebrates of these sites, the Ulster Museum was contracted by EHS to investigate the fauna of these wetlands in 1997. The sampling approach taken and the groups chosen for evaluating the sites were largely dictated by the expertise available and the quality of existing information on the invertebrate groups in Northern Ireland. The principal target groups selected for investigation were the spiders (Arachnida: Araneae), ground beetles (Coleoptera: Carabidae), water beetles (Coleoptera: Dytiscidae, Noteridae, Gyrinidae, Helophoridae Hydrophilidae and Hydrochidae), the aquatic and semi-aquatic bugs (Heteroptera: Corixidae, Gerridae, Hebridae, Hydrometridae, Nepidae, Notonectidae, Saldidae and Veliidae) and odonates (Odonata). Pitfall trapping was selected as the main sampling methodology, supplemented by field collection where required. In 2000, the author was contracted by EHS to investigate another six sites in Co. Tyrone using similar methodology.

This paper documents the full findings of the survey work. Reports on both surveys were submitted to EHS which gave full details of the methodology and preliminary results. (Nelson, 1998, 2001). Some of the records have appeared in other publications including papers on water beetles (Nelson *et al.*, 1997, 1998), notable beetle records (Nelson and Anderson, 1999) and the atlas of ground beetles of Northern Ireland (Anderson *et al.*, 2000). The intention of this paper is to list all the species recorded, highlighting the most interesting and notable records and to discuss the work in the context of similar work carried out elsewhere in Ireland and Britain in particular the floodplains in Co. Offaly (Helsdingen, 1996a), Pollardstown Fen, Co. Kildare (Helsdingen, 1997) and the East Anglian Fen Invertebrate Survey in England (Lott *et al.*, 2002).

The sites investigated, whilst all defined as fens by their plant communities, varied considerably in nature. Some were natural fens but many were clearly secondary habitats that have developed on cutover raised bogs. These could be identified by the relict areas of bog and wet heath and the flooded peat cuttings. Many of these sites had only small areas of open water. A number of the sites, including all the Co. Tyrone examples apart from Mullaghdrolly, were associated with lakes.

Methods

The thirty sites in Armagh and Down identified as being of high conservation value by the habitat survey were selected for sampling. However, five of these sites had to be excluded from the invertebrate survey as either they could not be located or access was not possible. Four sites (indicated by R in Table 1) were added as replacements to the list. Three of these, Brackagh Moss, Derryleckagh and Turmennan, are already recognised by ASSI designation as being amongst the best examples of fen habitat in Northern Ireland. The final site the Montiaghs Moss, also an ASSI and actually in Co. Antrim, is a large cutover raised bog with a complex mosaic of wetland habitats including some areas of fen. Some elements of the fauna, especially the aquatic species, of these four sites have been well-studied, but information was generally lacking for spiders, ground beetles and other terrestrial groups. The sites in Co. Tyrone were selected by EHS staff following habitat survey work in the county. Most of these sites had not been surveyed for any invertebrate groups.

On each site, five pitfall traps comprising plastic 1 litre capacity tubs with a mouth diameter of 9cm, set flush with the ground and containing a small amount of commercial antifreeze (ethylene glycol), were laid out in a rough transect with each trap spaced at approximately 15 metres intervals. The exact location chosen depended on the local topography and ground conditions when the site was visited. Generally this meant that traps were set in the area of fen or wetland habitat that was most easily accessed and was not obviously grazed by stock.

In the Armagh/Down survey three pitfall trap sessions were planned, each of approximately four weeks duration covering the spring (mid-April to mid May; session 1), mid-summer (July; session 2) and late summer (end of August to end of September; session 3). Table 1 details trapping effort on each site. The variation in effort was caused by a combination of factors including weather, access difficulties and disturbance by grazing stock and people. Flooding was a particular problem in 1997 affecting the second sampling period and the abandonment of trapping at some sites.Table 2 shows the trapping effort on the Tyrone sites. For a variety of reasons only two trap sessions were possible on these sites, covering May/June and July. The traps were operated continuously on these sites, but each was checked and emptied midway through the sampling period.

The pitfall trapping was supplemented by field collection on the sites which lacked records of the target groups (the sites are listed in Tables 1 and 2). The principal target groups were the water beetles, the aquatic and semi-aquatic bugs and the odonates. Other groups were noted on a casual basis. In both surveys the field collecting was done mainly in June with some supplementary work in August.

Results

The results of each survey are presented separately as they are not directly comparable. The total number of invertebrate taxa identified from the Armagh/Down sites was 399; 226 taxa were identified from the six Tyrone sites. The species recorded in the survey and their occurrences on the sites are listed in the Appendix. Tables 3 and 4 gives the total number of species identified from each site and the site totals for each of the target groups. All the records have been entered on the CEDaR database in the Ulster Museum. Voucher material for rare and critical taxa have also been retained.

SPIDERS (ARACHNIDA: ARANEAE)

Armagh/Down: there appear to have been no published or unpublished records of spiders from any of the sites investigated with the exception of a small number of species recorded at the Montiaghs Moss by Cowden *et al.* (1990). A total of 78 species of spider were recorded on all the sites, the vast majority from the pitfall traps. Individual site totals ranged between 6 and 27 species (Table 3). Numerically the most common spiders were ground-living species, particularly Lycosidae. The tetragnathid *Pachygnatha clercki* was the most frequently recorded species, only absent from one site. Four other species, *Pirata piraticus*, *Pardosa amentata*, *Antistea elegans* and *Pardosa pullata*, were recorded from 20 or more sites. The majority of the spiders trapped were ground-dwelling wetland species. Arboreal spiders are under-recorded by pitfall trapping though some, for example *Araneus quadratus*, *Larinoides cornutus*, *Neriene montana* and *N. clathrata*, were occasionally recorded in this survey.

Tyrone: twenty-three species were recorded in the pitfall samples of the six sampled sites with an additional three species (*Argyroneta aquatica*, *Pirata piscatorius* and *Tetragnatha extensa*) collected during field samples. Individual sites totals varied between 5 and 13 species (see Table 4). The lycosid spider *Pirata piraticus* was the most numerous species in the samples on all sites except at Derrycloony, where it was outnumbered by *Pardosa pullata*. Eighteen of the 26 recorded species in the Tyrone fens were also found in the Armagh/Down sites. Of the species exclusive to Tyrone sites, four were wetland species. *Silometopus elegans* was found at three sites. Records in the CEDaR database show this to be a northern and western species in Northern Ireland. Both *Erigionella ignobilis* and *Kaestneria pullata* are apparently rare in

Northern Ireland but have been recorded from wetland sites elsewhere in Ireland (Helsdingen, 1996a). The other, *Tetragnatha extensa*, is a common, widespread species. Some spiders common in the Armagh/Down fens were absent or very rare at the Tyrone sites, most notably *Antistea elegans*, *Gnathonarium dentatum*, *Lophomma punctatum*, *Pachygnatha clercki* and *Pirata piscatorius*.

The following spiders appear to be new to one of the three counties according to the published county lists in Helsdingen (1996b).

LINYPHIIDAE

Agyneta decora: ARMAGH

Previously recorded from five Irish counties including Antrim and Fermanagh in Northern Ireland (Helsdingen, 1996b). Occurs amongst moss and grass (Locket and Millidge, 1953) although not closely associated with wetlands.

Agyneta olivacea: TYRONE

Only recognised as present in Britain and Ireland in 1985 and its habitat requirements are unclear, but it has been found on blanket bog in Scotland (Harvey *et al.*, 2002).

Allomengea vidua: ARMAGH

A species of unshaded, moist vegetation in lowland wetlands (Helsdingen, 1996a; Harvey *et al.*, 2002). Known from just five Irish counties, it was recorded in the Co. Offaly floodplains (Helsdingen, 1996a).

Araeoncus crassiceps: ARMAGH, DOWN

Occurs amongst debris, moss and short vegetation in damp habitats particularly heathland (Harvey *et al.*, 2002). In Northern Ireland, it has been reported from Fermanagh and Antrim by Cowden *et al.* (1990) and Tyrone (Helsdingen, 1996b) but these are the first records from Armagh and Down.

Bathyphantes approximatus: ARMAGH, TYRONE

Found at many sites in both surveys but previously unrecorded from both Armagh and

Tyrone. It was recorded in the Offaly floodplains (Helsdingen, 1996a). This spider is found amongst moss and low vegetation in wet, marshy places (Harvey *et al.*, 2002; Locket and Millidge, 1953).

Bathyphantes gracilis: TYRONE

A widespread, ubiquitous species in Britain found in low vegetation in woods, heaths and wetlands (Harvey *et al.*, 2002). Clearly widespread also in Ireland (Helsdingen, 1996b), although there appear to have been no published records from Co. Tyrone.

Bathyphantes setiger: DOWN, TYRONE

Listed from just five Irish counties (Helsdingen, 1996b). Found in the Offaly floodplains (Helsdingen, 1996a). Helsdingen (1996a) states that *B. setiger* is 'generally a rare species and is usually found in bogs in *Sphagnum*'. In Britain, it is considered very local and uncommon where it is found on 'wet boggy areas' (Harvey *et al.*, 2002). These records suggest a wider association with wet sites. Johnston and Cameron (2002b) published the first record from Northern Ireland from a site in Co. Tyrone also in 2000.

Carorita paludosa: DOWN

This is arguably the most notable species recorded in either survey. A single male of *C. paludosa* was taken during the spring trapping session at Derryleckagh in a trap placed amongst *Sphagnum*-dominated vegetation beneath sparse *Phragmites*. Derryleckagh is a large transition mire in a flat-bottomed valley with overgrown peat cuttings and pools. There are few Irish records of this tiny spider. It was described from specimens collected at Lough George (R335913), Co. Clare on 27 September 1969 and again on 5 June 1970 (Duffey, 1971) and it was found recently in Leitrim and Sligo by Cawley (2004). It is rare throughout its known range in Belgium, Britain, Germany, Ireland and Sweden (Decleer and Bosmans, 1989; Harvey *et al.*, 2002). Decleer and Bosmans (*op. cit.*) described the ecology and habitat of *C. paludosa* in Belgium. There, it has been found in oligotrophic and eutrophic wetlands on peaty soil. The largest populations were found in eutrophic wetlands with an undisturbed leaf litter layer. The description of the vegetation at the original Clare locality ('thin layer of wet moss growing over the floor of an old peat cutting being invaded by cotton-grass (*Eriophorum sp.*))' (Duffey, 1971), and the sites in England (Harvey *et al.*, 2002), Leitrim and Sligo (Cawley, 2004) appear to closely correspond to the habitat it was found in at Derryleckagh. The British records have been collected in September, October and February (Harvey *et al.*, 2002), while in Belgium, adults have been recorded in all months from February to October (Decleer and Bosmans, 1989). The Sligo and Leitrim specimens were collected in April (Cawley, 2004).

Ceratinella brevipes: ARMAGH

A money spider found amongst litter in wet woodlands and grasslands (Harvey *et al.*, 2002). Widespread in Ireland but this is apparently the first Armagh record (Helsdingen, 1997b).

Cnephalocotes obscurus: ARMAGH

This spider is generally recorded in moss, debris and short vegetation. In Britain, it has been found in many habitats (Harvey *et al.*, 2002). There are published records from Antrim and Down but otherwise it is known only from the southern half of Ireland (Helsdingen, 1997b).

Floronia bucculenta: DOWN

This money spider is found in bushes and tall vegetation usually in woods or wetlands (Locket and Millidge, 1953; Harvey *et al.*, 2002). There have been only two published Irish records. Helsdingen (1996b) lists it only from Co. Carlow and Nolan (2000) recorded it from Carnsore Point area of Co. Wexford. A single male of *F. bucculenta* was found in the third trap session at Carrowcarlin in an area of ungrazed fen with scattered *Phragmites* and scrub. All the adult records in Britain have been in late summer and early autumn (Harvey *et al.*, 2002).

Hypomma fulvum: ARMAGH, DOWN

A money spider most commonly found in marsh and fen habitats on *Phragmites* or underneath it (Roberts, 1987; Harvey *et al.*, 2002). In Britain, it is rare, and largely confined to South-East England (Harvey *et al.*, 2002). In the East Anglian fens in eastern England, *H. fulvum* is found in sites with high water levels (Lott *et al.*, 2002). In Ireland, *H. fulvum* was first recorded from Crom, Co. Fermanagh in 1988 (Cowden *et al.*, 1990). Individuals were trapped during the spring session at two sites, Clonalig Lough (♂2♀♀) and Derryleckagh (5♂♂♀). The traps at Clonalig Lough were set in fen bordering a *Phragmites* bed. Those at Derryleckagh were on a cutover bog with a carpet of *Sphagnum* and sparse well-scattered plants of *Phragmites*.

Kaestneria pullata: DOWN, TYRONE

A widespread species in Ireland (Helsdingen, 1996a). This is a wetland spider which lives amongst low vegetation (Harvey *et al.*, 2002).

Lophomma punctatum: ARMAGH, DOWN

This was one of the most frequent spiders in the Armagh/Down survey, but there have been no previous published records from either county (Helsdingen, 1996b). It was not found at any of the Tyrone sites. It was recorded in the Offaly floodplain survey (Helsdingen, 1996a). *L. punctatum* is a wetland spider inhabiting litter and low vegetation in many wet habitats from brackish marshes to upland blanket bog (Harvey *et al.*, 2002).

Micrargus herbigradus: ARMAGH

Found in moss often in woodland (Roberts, 1987), but in South-East England also found in many open habitats including wetlands (Harvey *et al.*, 2002). Listed from just three Irish counties (Antrim, Clare and Tyrone (Helsdingen, 1996b)) but also found in the Offaly floodplains (Helsdingen, 1996a).

Monocephalus fuscipes: ARMAGH

A widespread species in Ireland (Helsdingen, 1996a), this appears to be the first Armagh record. Found in detritus in coniferous and broad-leaved woods, but also in open habitats (Harvey *et al.*, 2002).

Saaristoa abnormis: TYRONE

Inhabits moss and low vegetation in many habitats including marshland and bogs. A widespread but mainly southern distribution is evident in Ireland (Helsdingen, 1997).

Tallusia experta: DOWN

This is a typical species of fens and quaking bogs (Helsdingen, 1997) and it is particularly found beneath flattened clumps of *Juncus* (Harvey *et al*., 2002). It was recorded at Pollardstown fen (Helsdingen, 1997). Mostly found in southern Ireland but it has been recorded previously in Northern Ireland in both Antrim and Armagh (Helsdingen, 1996b) and now Down.

Walckenaeria kochi: ARMAGH

This is the second Irish record, the species having been first recorded in Antrim (Helsdingen, 1996b). In Britain, it is found at the roots of vegetation in wet habitats including bogs, moorland and saltmarshes (Roberts, 1987; Harvey *et al.*, 2002).

LYCOSIDAE

Arctosa leopardus: ARMAGH

A wolf spider found amongst moss and detritus in wetlands (Locket and Millidge, 1951; Harvey *et al.*, 2002). There are no recently published Northern Ireland records but it has previously been reported from Antrim and Fermanagh (Helsdingen, 1996b). It was found in the Offaly floodplains (Helsdingen, 1996a).

Pirata piscatorius: ANTRIM, DOWN, TYRONE

There is only one published Northern Ireland record of this large lycosid (from Co. Armagh) (Helsdingen, 1996b). *P. piscatorius* is 'invariably found in very wet areas, most often near standing water' (Harvey *et al.*, 2002). The number of new sites for this species is clearly very significant. It has been recorded from Pollardstown Fen (Helsdingen, 1997). An additional record from Portmore Lough, Co. Antrim, is also a new county record. A single female was found here by the author in a pitfall trap operated between 23 July and 20 August 1999 in an area of bare ground beside a newly constructed pond in wet grassland.

Trochosa spinipalpis: ARMAGH, DOWN, TYRONE

This wetland-inhabiting wolf spider was added to the Irish fauna by Higgins (1990) from

Co. Cavan and first recorded from Northern Ireland in 1988 at the Montiaghs Moss (Cowden *et al.*, 1990). It is also known from sites in Co. Fermanagh (Cowden *et al.*, 1990), the Offaly floodplains (Helsdingen, 1996a) and Pollardstown fen, Co. Kildare (Helsdingen, 1997). *T. spinipalpis* was found at 14 of the surveyed sites in the Armagh/Down survey and three of the Tyrone sites, and it is seen as one of the characteristic species of the habitat at least in this part of Ireland.

HAHNIIDAE

Antistea elegans: ARMAGH, DOWN

This spider can be found in a variety of wet habitats including reed beds, marshes and upland and lowland bogs (Harvey *et al.*, 2002). It was one of the most frequently recorded species in the 1997 survey in Armagh and Down, but these are apparently the first records from either county (Helsdingen, 1996b). It was much less frequently recorded in the Tyrone sites.

CLUBIONIDAE

Clubiona stagnatilis: ARMAGH, DOWN

A wetland species associated particularly with fens and bogs (Harvey *et al.*, 2002; Helsdingen, 1997). It is apparently uncommon in Northern Ireland where it has only been recorded from Co. Fermanagh (Cowden *et al.*, 1990). Recorded at Pollardstown fen (Helsdingen, 1997) and in the Offaly floodplains (Helsdingen, 1996a).

GNAPHOSIDAE

Zelotes latreillei: ARMAGH

A ground-living spider species usually found under stones in short vegetation in grassland and heaths (Harvey *et al.*, 2002). Also recorded in 1997 from Co. Armagh by Johnston and Cameron (2002a).

ZORIDAE

Zora spinimana: ARMAGH

Found amongst moss and close to soil in dense vegetation in heaths, open woodland and raised bogs (Harvey *et al.*, 2002; Helsdingen, 1997). The published records indicate a southern distribution in Ireland with the exception of an old record from Co. Londonderry (Helsdingen, 1996b). Helsdingen (1997) lists it from Pollardstown fen.

Summary and comparison with other surveys

There have been a number of published accounts of surveys of spiders in wetland sites in Ireland and Great Britain. Helsdingen (1996a) detailed the spiders found on two floodplains in Offaly based on material collected with pitfall traps and is the most comparable to this survey. The spider fauna of Pollardstown fen, Co. Kildare, one of the largest and most intact examples of the habitat anywhere in Ireland, was investigated by Helsdingen (1997). A total of 58 spider species were found by a variety of collecting methods techniques and so the results are not directly comparable with these surveys. Lott *et al.* (2002) presented the results of the East Anglian fen invertebrate survey which was similar to the two Northern Ireland surveys, but differed in extent and precise methodology. However, it does provide very useful information on the habitat requirements of many of the species. In total, 63 spider species were recorded on the Offaly sites and 42 of these were shared with the Armagh/Down sites and 17 with the Tyrone sites.

It is usually the case in pitfall traps surveys that lycosid spiders are the most abundant species as they are ground-dwelling, active spiders. This was evident in this survey and also those in Offaly and East Anglia. The dominant species in the catches in the Armagh/Down survey were *Pirata piraticus*, *Pardosa pullata* and *P. amentata*. In the Tyrone sites, the only consistently abundant species was *P. piraticus*. Lycosid spiders were amongst the most abundant species in the East Anglian fens as in these surveys. The five commonest lycosids in the East Anglian fens were, in descending order, *Pirata piraticus*, *P. hygrophilus*, *Pardosa prativaga*, *P. pullata* and *P. latitans*. Only the first and fourth species on this list were found in either of the Northern. Ireland surveys. The other three species appear much rarer in Ireland with few published records (Helsdingen, 1996b) although two (*P. prativaga* and *P. latitans*) were recorded in Offaly by Helsdingen (1996a). Rather more rare lycosids were found in the Offaly sites (notably *P. latitans*, *P. palustris* and *P. prativaga*) than in either of the two northern surveys. *Trochosa spinipalpis* was found in both Offaly sites but not as commonly as in the Armagh/Down fens. *P. piscatorius* a feature of many of the northern sites was also not found in any of the samples taken in Co. Offaly.

The differences in the three surveys may be related to geography and climate but the timing of the surveys may also have been significant. It is known that pitfall trapping of spiders reflects spider activity and catches can show great annual and site variation (Eyre and Woodward, 1996). The finding by Helsdingen (1996a) that the early trapping session in the Offaly floodplain survey produced both more species and more individuals was apparent also in the Armagh/Down sites. The number of species caught in each of the three trapping sessions was 58, 41 and 29. However, in the Tyrone survey more species were caught in the second session (18) than in the first session (11). It would appear from the results of both surveys that the most productive period for spiders is in the spring but this should be supplemented by trapping in mid to late summer.

GROUND BEETLES (COLEOPTERA: CARABIDAE)

Armagh/Down: The 29 sites yielded 42 species of ground beetle. Individual site totals ranged from two to 17. Most of the species are generalist or typical wetland species with a widespread distribution in similar habitats in Northern Ireland (Anderson *et al.*, 2000). *Pterostichus rhaeticus* was easily the most frequently recorded species; it was found on all but three sites, often in large numbers. The most notable ground beetle recorded was *Pterostichus aterrimus* (Nelson and Anderson, 1999). This species was confined apparently to the largest sites. An additional record of the species was discovered in 1998 in pitfall traps on Selshion Bog, Co. Armagh (H9854), a large cutover bog site similar to some of the sites investigated in 1997.

Tyrone: a total of 23 ground beetle species were recorded from the six sites. Individual site totals ranged from two to 14. Fymore was easily the most species rich site and the numbers recorded far exceeded those from any other site. This site also had the best representation of wetland ground beetle species in the Tyrone survey. As in the Armagh/Down survey, the ground beetles recorded were a mix of wetland and habitat generalist species. The species recorded were with just three exceptions (*Agonum assimile*, *Pterostichus madidus* and *Chlaenius nigricornis*) recorded in Armagh/Down. *Agonum assimile* (= *Platynus assimile* in Anderson *et al.*, 2000) is a species of wet woodland and carr found throughout Northern Ireland. *P. madidus* is not a wetland species (Lott, 2003), so its occurrence on these sites is not significant. *C. nigricornis* was the most notable record. It is a species of base-rich wetlands, which is Northern Ireland is confined to Fermanagh (Anderson *et al.*, 2000) apart from a 1999 record from Portmore Lough. This is the first record of this species from Co. Tyrone in what appears to be typical habitat.

WATER BEETLES

Water beetles were collected mainly by netting on those sites where little or no previous collecting of these insects had been done. A significant number of species and individuals were found in the pitfall traps, particularly some dytiscid and *Cercyon* species. The number of water beetle species recorded from each of the sites surveyed is shown in Table 3 and 4. This indicates the total number of species found in the survey and in all previous studies.

Armagh/Down: the majority of records from this survey were included in Nelson *et al.* (1997, 1998). Amongst the most significant records were those of a suite of species considered relict fen species and in particular *Hydaticus seminiger*, *Hydroporus scalesianus*, *Laccornis oblongus* and *Rhantus grapii*. *Cercyon ustulatus,* a species rarely reported in Northern Ireland before, was found to be frequent in the Armagh/Down fens and was often abundant (Nelson *et al.*, 1998).

Tyrone: water beetle diversity in the Tyrone sites was generally low in comparison to the

Armagh/Down sites. Only a few of the species were not recorded in any of the Armagh/Down sites. *Graptodytes granularis* was the most notable of these additional species. It is a northern and western species in Northern Ireland (Nelson *et al.*, 1997).

OTHER BEETLES

Considerable numbers of beetles in other families were recorded in both surveys. Many of these were generalist and widespread species typical of wetland sites. Others have been collected rarely or are of obscure ecology so the significance of the records is unknown. Rove beetles (Staphylinidae) were the commonest family represented in the samples in terms of numbers of species, but most were taken on just a few sites and represented by few individuals. Staphylinids are amongst the most species diverse families of wetland insects, but pitfall traps appear inefficient at sampling them in wetland habitats (Lott, 2003). Wetland rove beetles are well-adapted to moving on liquid surfaces and are adept at avoiding capture in pitfall traps (Lott, *op. cit.*).

Armagh/Down: a total of 133 species of other beetles were caught in the traps and a few by netting. On many sites carrion beetles, *Nicrophorus* species (Silphidae), were common especially in the mid-summer session. *N. vespilliodes* was the most frequently caught species found at 18 sites. This was also the commonest *Nicrophorus* species in the East Anglian fens (Lott *et al.*, 2002). Three other species *N. humator*, *N. investigator* and *N. vespillo* were each caught at five sites.

The following records are of note additional to those reported elsewhere:-

***Aleochara curtula* (Staphylinidae)**

Apparently rare, these are only recent records from Northern Ireland. Associated with decaying vegetation. It is not listed as a wetland species by Lott (2003).

***Phyllotreta exclamationis* (Chrysomelidae)**

This flea beetle feeds on crucifers in wetlands. There have been few previous Irish records but as it was found at 13 of the sites it appears to be a common inhabitant of fens. It was the commonest *Phyllotreta* species in the East Anglian Fens (Lott *et al.*, 2002).

***Trissemus impressus* (Pselaphidae)**

Rare, lives in moss carpets. There have been only a few Irish records. Defined as a wetland species by Lott (2003).

Tyrone: 82 species of other beetles were recorded in these sites. The species lists are dominated by carrion and plant-feeding species. Examples of the former group include the rove beetle *Atheta strandiella* which was found in four of the Tyrone fens. Prior to these two surveys, *A. strandiella* had rarely been recorded in the British Isles (Hyman, 1994). It is defined as a wetland species by Lott (2003). Species of sexton beetle *Nicrophorus* and *Silpha atrata* were also frequent in the traps and widespread across the sites.

The other major group of beetle represented in the lists are the phytophagous leaf beetles. As with *A. strandiella*, some of these species had been considered very rare in Northern Ireland at least, but have now been shown to be common and characteristic species of these fens e.g. *Phyllotreta exclamationis* and *P. flexuosa*. Both of these were common in the Armagh/Down fens and were well-represented in the Tyrone sites. Another group of phytophagous and exclusively wetland beetles are the reed or donaciine beetles. These were found commonly at a few of the sites especially Cullentra and Fymore Lough. *Donacia bicolora*, a Red Data Book 2 species in Britain (Menzies and Cox, 1996), was found at the latter site. This species which is associated with *Sparganium*, is however widespread and locally abundant in Ireland (Nelson and Anderson, 1999; author unpublished records).

HEMIPTERA

Relatively few Hemiptera were caught in the pitfall traps in both surveys. Netting did produce more records, mostly of aquatic and semi-aquatic species. A notable feature of the two Northern Ireland surveys was the almost complete absence of Auchenorhyncha. This is in marked contrast to their abundance in the East Anglian fens survey (Lott *et al.*, 2002). Whilst this may be due the differences in the survey methodologies, it must also reflect a genuine scarcity of Auchenorrhyncha in Northern Irish fens.

Saldid bugs were amongst the most commonly recorded Hemiptera in the two surveys. One identification still unresolved is the identity of the specimens of a large *Salda* species caught at six sites (three in each survey). Initially these were considered to be *Salda muelleri*, but they are now considered all to be *S. morio*. However, firm identification cannot be made due to the lack of named and verified Irish material of both species.

Armagh/Down: thirty-nine species of Hemiptera were recorded on all the sites. Most of these were terrestrial species. The sites supported few species of open water Heteroptera species as this habitat element is absent from many of the closed fens. The following were the most significant records:-

***Dictyla convergens* (Tingidae)**

This is plant bug which feeds on water forget-me-not *Myosotis scorpiodes* L. There have not been many Irish records (Halbert, 1935) and these records are apparently the first for Northern Ireland. It was found in low numbers in the East Anglian fens (Lott *et al.*, 2002).

***Gerris lateralis* (Gerridae)**

This pondskater was recorded at ten sites, a significant addition to the known number in Northern Ireland (Nelson, 1995). Most of these records came from pitfall traps, which may partly explain its relative scarcity. Clearly these sites are important for this species, which prefers densely-vegetated water bodies rather than the open sites favoured by other gerrid species (Nelson, *op. cit.*).

***Hebrus ruficeps* (Hebridae)**

Found in moss carpets in fens. Previously known from just five sites in Northern Ireland (Nelson, 1995). It was recorded from three new sites in this survey.

***Limnoporus rufoscutellatus* (Gerridae)**

A pond skater found on lakes and ponds amongst open vegetation. These two new records are the first from Co. Armagh for over 100 years (Nelson, 1995; Nelson, 1997).

***Salda morio/muelleri* (Saldidae)**

As stated above many specimens of a large *Salda* species were collected at three sites in Armagh and Down and three sites on Tyrone. The specimens are all considered of the same species and although initially considered to be *S. muelleri* they are now considered to be *S. morio*. There have been few records of either species in Ireland, but as reported by Aukema and Aukema (2001) this is probably due to under-recording as *S. morio* was found in some numbers at sites in Clare and Galway in 1998 and 2000.

***Velia saulii* Tamanini (Veliidae)**

Typically found on lakeshores and rivers (Savage, 1989). There is only one published record from Northern Ireland plus some unpublished ones (Nelson, 1997; author unpublished), and the species is still considered under-recorded. It is not a typical fen species and was only found at two sites where the fen were associated with open water.

Tyrone: there were records of 32 species of Hemiptera. There were single records of *Hebrus ruficeps* and *Gerris lateralis*. Many specimens of *Salda morio/muelleri* were found at Fymore Lough. The blue shieldbug *Zicrona caerulea* was found at Cullentra Lough. It had been recorded here before, but this confirms its status at one of its most northerly sites in Ireland, and one of only two known sites in Northern Ireland.

ODONATA

There was information on the Odonata from many of the sites prior to the survey especially in Armagh and Down and some were already known to support notable populations. The expectation was that some of the unsurveyed sites would prove also to have rich odonate assemblages and rare species. However this turned out not to be the case and relatively few species were found.

OTHER INVERTEBRATES

Casual recording and pitfall traps produced some interesting records of which the following are considered the most significant.

***Chrysops sepulchralis* (Diptera: Tabanidae)**

This was found at three sites in south Armagh. *C. sepulchralis* is a rare species in Britain mainly confined to heaths and bogs in Dorset and the New Forest (Falk, 1991; Stubbs and Drake, 2001). There have been few Irish records and these are the first for Northern Ireland. The preferred habitat is said to be bog pools with floating rafts of *Sphagnum* and other plants (Stubbs and Drake, *op. cit.*).

***Oplodontha viridula* (Diptera: Statiomyidae)**

This is a common species of aquatic soldierfly in southern parts of Britain and Ireland, but this is apparently the first record for Northern Ireland. It is found in open, sunny lowland wetlands, including fens, with lush vegetation (Stubbs and Drake, 2001).

***Tetrix subulata* (Orthoptera: Tetrigidae)**

In Northern Ireland, *T. subulata* has been recorded from the grazed, stoney shore of Upper Lough Erne (Anderson, 1985). Perhaps significantly the three sites at which *T. subulata* was found were all grazed.

Discussion

This survey has been the first invertebrate work undertaken on many of these sites and on others it has provided additional records of a poorly known fauna. The results have revealed that a number of the sites support a rich and varied fauna of wetland invertebrates including many previously poorly recorded and rare species. Sufficient information is now available from this and more general recording of some of the groups to identify a suite of species which can be considered indicative of fens in this part of Ireland. These species (listed in Table 5), which come from a number of variety of taxa, were selected on the basis of their frequency in the sampled sites compared to that in other habitats. The list is considered provisional as it may need to be altered in the light of additional survey work, but the species listed are considered suitable for assessing site quality and monitoring of sites.

Invertebrate data is increasingly being used to evaluate site quality for conservation. The most popular criteria are rarity and overall diversity (Lott *et al.*, 2003). Overall species richness is difficult to measure consistently to allow site comparison and site diversity values can be inflated by vagrant species (Lott *et al.*, *op. cit.*). Studies in Great Britain have increasingly used an index calculated from individual species scores which reflect their range. The species scores are derived from a count of the number of occupied squares or the Red Data Book listing. These scores are then averaged producing the final figure. This approach has been used just once in Ireland to rank sites based on their aquatic coleoptera fauna (Foster *et al.*, 1992). There are problems with this approach despite its obvious appeal as an objective method (Lott *et al.*, *op. cit.*). The two most serious are the assignment of species scores and the problem of species-poor sites. The former requires a recent assessment of the species range in the region, usually the results of a 10km mapping scheme. For many invertebrate groups in Ireland, this information is not available (or, if it is, it is unpublished) and the scores for most of the taxa investigated on these sites cannot be calculated. The latter problem can be serious one as the index scores calculated from these sites can be greatly influenced by just one or two rare species. This can be seen in analysis of the Irish water beetle site lists, where the highest scoring sites were upland, naturally species-poor sites (Foster *et al.*, *op. cit.*). So despite the attractiveness and objectivity of this approach it was not attempted in this survey.

Instead, the sites were evaluated using a combination of the measured species richness, the number of the characteristic species present, sites features (area and extent of habitat) and subjective assessment of habitat quality. This included aspects such as water quality, the surrounding land use and evidence of disturbance.

The Armagh/Down sites were judged to be in one of three categories of importance, high, medium and low. Twelve sites were placed in the highest category because of their overall species diversity and/or the presence of rare species or suites of species. The sites had in common good structural and habitat diversity in particular large areas of mossy fen and open water. Most of the large sites surveyed were included in this category. Size is probably an important factor in preserving the fauna in particular as the habitat is buffered from outside influences particularly enrichment. However some relatively small sites are also included e.g. Loughaveely, Ballynagross, Brackagh, Clonalig, Corbally, Derryleckagh, Drumcarn, Drumlougher Lough, Kiltubbrid, Lurgan Lough, Loughaveely, Montiaghs and Moyrourkan.

The second category included 11 sites. These were considered of lesser importance for invertebrates. Some are species-rich sites and contain some rare species, usually in just one of the groups. However this second-tier of sites lacked some of the indicator species which were considered to be typical of intact fens. In the event of further work covering other groups this categorisation could be revised. Sites included in this category were:- Brackly Lough, Carrowcarlin, Castle Enigan, Cashel Lough, Derryadd, Dunmore, Heron Lough, Lough Money, Lough Keelan, Railway Road, Turmennan.

The remaining six sites were considered to be of no more than of local significance, being generally the smallest or most degraded sites. They are:- Ballard, Ballybannan, Ballycam, Crossbane Lough, Drumnamether, Greenan Lough.

Based on the same criteria, four of the six Tyrone sites (Cullentra, Derrycloony, Fymore and Fadda) were placed in the medium category. Whilst they were species-rich in a number of the target groups, they each lacked some of the expected elements of the fauna. The remaining two sites, Mullygruen and Mullaghdrolly, were judged to be in the lowest category. These were both relatively species-poor, had very poor representation of the characteristic species and were clearly suffering from habitat degradation.

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TABLE 1. Summary of sampling effort in Counties Armagh and Down in 1997.

SITE	Grid Ref	Pitfall sessions			Field visit
		1	2	3	
1. Ballard, Co. Armagh	J027230	15.4 - 13.5	2.7-28.7	28.8-23.9	Y
2. Ballybannan, Co. Down	J371357	15.4 - 12.5	30.6-28.7	29.8-24.9	Y
3. Ballycam, Co. Down	J523348	14.4 - 12.5	30.6-28.7	none	Y
4. Ballynagross Lower, Co. Down	J537434	14.4 - 12.5	30.6-28.7	29.8-24.9	Y
5. Brackagh Moss, Co. Armagh (R)	J018509	15.4 - 14.5	2.7-29.7	28.8-23.9	N
6. Brackly Lough, Co. Armagh	H820310	18.4 - 13.5	None	28.8-23.9	Y
7. Carrowcarlin, Co. Down	J559487	14.4 - 12.5	30.6-28.7	29.8-24.9	Y
8. Cashel Loughs, Co. Armagh	H967203	18.4 - 13.5	2.7-29.7	28.8-23.9	Y
9. Castle Enigan, Co. Down	J121322	15.4 - 12.5	30.6-28.7	29.8-24.9	Y
10. Clonalig Lough, Co. Armagh	H900121	18.4 - 13.5	2.7-29.7	28.8-23.9	Y
11. Corbally, Co. Down	J451382	14.4 - 12.5	30.6-28.7	29.8-24.9	Y
12. Crossbane Lough, Co. Armagh	H807299	16.4 - 13.5	2.7-29.7	none	Y
13. Derryadd Lough, Co. Armagh	H915604	15.4 - 13.5	2.7-29.7	28.8-23.9	N
14. Derryleckagh, Co. Down (R)	J118252	15.4 - 12.5	30.6-28.7	28.8-23.9	N
15. Drumcarn, Co. Armagh	H811285	16.4 - 13.5	2.7-29.7	28.8-23.9	N
16. Drumlougher Lough, Co. Armagh	H895185	18.4 - 13.5	2.7-29.7	28.8-23.9	Y
17. Drumnamether, Co. Armagh	H991436	16.4 - 14.5	None	none	Y
18. Dunmore fen, Co. Down	J358449	14.4 - 12.5	30.6-28.7	29.8-24.9	N
19. Railway Road fen, Co. Armagh	J057198	15.4 - 13.5	2.7-28.7	28.8-23.9	Y
20. Greenan Lough, Co. Down	J120225	15.4 - 12.5	30.6-28.7	none	N
21. Heron Lough, Co. Down	J504582	14.4 - 12.5	30.6-28.7	29.8-24.9	N

22. Kiltubbrid Lough, Co. Armagh	H769395	16.4 - 13.5	2.7-29.7	28.8-23.9	Y
23. Loughaveely, Co. Armagh	H954140	18.4 - 13.5	2.7-29.7	28.8-23.9	Y
24. Loughkeelan, Co. Down	J561450	14.4 - 12.5	30.6-28.7	none	Y
25. Loughmoney, Co. Down	J538459	14.4 - 12.5	30.6-28.7	29.8-24.9	Y
26. Lurgan Lough Upper, Co. Armagh	H950156	18.4 - 13.5	2.7-29.7	28.8-23.9	Y
27. Montiaghs Moss, Co. Antrim (R)	J097658	20.4 - 14.5	2.7-29.7	28.8-23.9	
28. Moyrourkan Lough, Co. Armagh	H984425	16.4 - 14.5	2.7-29.7	28.8-23.9	Y
29. Turmennan, Co. Down (R)	J483505	14.4 - 12.5	none	none	N
TOTAL		29	27	23	

TABLE 2. Summary of sampling effort in Co. Tyrone in 2000.

SITE	Grid Ref	Pitfall sessions		Field visit
		1	2	
Cullentra Lough	H475472	24.5 – 26.6	26.6 - 2.8	Y
Derrycloony Lough	H584509	24.5 – 26.6	26.6 - 2.8	Y
Lough Fadda	H448484	24.5 – 26.6	26.6 - 2.8	Y
Fymore Lough	H596519	24.5 – 26.6	26.6 - 2.8	Y
Mullaghdrolly	H789605	24.5 – 26.6	26.6 - 2.8	Y
Mullygruen Lough	H758651	24.5 – 26.6	26.6 - 2.8	Y

TABLE 3. The total number of species and the number of species in each of the main target groups at twenty-nine fens in Cos Armagh and Down. Figures in brackets show the total number of species recorded from the site for the main target groups (where this is different) (Sources: spiders — Cowden *et al.* (1990); ground beetles — CEDaR databases, Ulster Museum; water beetles — Foster *et al.* (1992) and author unpublished; aquatic Hemiptera — Nelson (1997 and unpublished); Odonata — DragonflyIreland database, Ulster Museum).

SITE	Total	Spiders	Ground beetles	Water beetles	Aquatic Hemiptera	Odonata
Ballard	78	15	11	23	4	3
Ballybannan	41	9	5	10	5	1
Ballycam	40	12	2 (3)	11	4	0
Ballynagross Lower	96	20	17 (18)	27	8	0
Brackagh Moss	51	8	17 (27)	15 (52)	2 (9)	1 (14)
Brackly Lough	61	11	10	19	7	1
Carrowcarlin	63	23	8	18	0	0
Cashel Loughs	55	18	10	9 (29)	4	2 (10)
Castle Enigan	55	18	8	7 (21)	3 (5)	0
Clonalig Lough	83	20	3	26	5	5
Corbally	90	18	7 (13)	33	8	0
Crossbane Lough	53	6	9	17	9	1
Derryadd Lough	33	11	3 (15)	8 (28)	1 (12)	0 (13)
Derryleckagh	53	15	9	10 (52)	3 (12)	0 (9)
Drumcarn	44	13	9	6 (22)	3 (11)	0 (14)

Drumlougher Lough	90	27	10	21 (29)	4 (12)	0 (13)
Drumnamether	68	14	2	22	4	2
Dunmore fen	33	11	4	5 (41)	1 (6)	1 (10)
Greenan Lough	59	18	10	8 (14)	4 (9)	0 (3)
Heron Lough	40	14	6	7 (44)	0 (6)	0 (8)
Kiltubbrid Lough	68	8	5	30	4	2 (6)
Loughaveely	100	22	5	32	8	3
Loughkeelan	54	17	5	10 (20)	2 (5)	0 (8)
Loughmoney	68	16	14	12 (27)	4	1
Lurgan Lough Upper	99	21	13	30	4	4 (8)
Montiaghs Moss	57	18 (25)	12 (15)	0 (56)	1 (15)	0 (14)
Moyrourkan Lough	59	13	5 (6)	16 (36)	3	0
Railway Road	77	20	5	20	1	0
Turmennan	23	10	5	3 (42)	1 (5)	0 (3)

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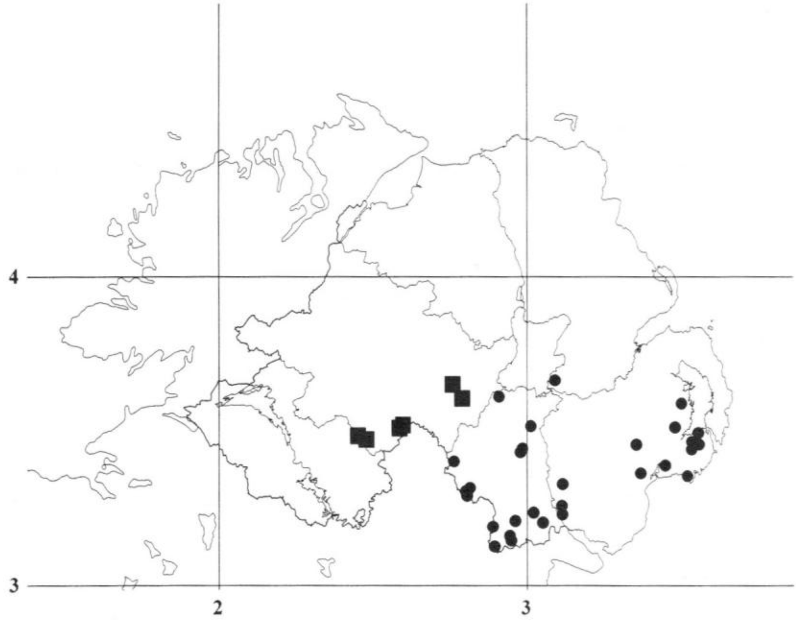
TABLE 4. Total number of species and the number of species in each of the main target groups in 1997 at six fens in Co. Tyrone. Figures in brackets show the total number of species recorded from the site for the main target groups (where this is different) (Sources: spiders — author unpublished records; ground beetles — CEDaR databases, Ulster Museum; water beetles — author unpublished records; aquatic Hemiptera — author unpublished records; Odonata — DragonflyIreland database, Ulster Museum).

SITE	Total	Spiders	Ground beetles	Water beetles	Aquatic Hemiptera	Odonata
Cullentra Lough	72	13	2	16 (25)	1 (2)	4 (9)
Derrycloony Lough	76	9	9	17	11	1
Lough Fadda	68	6 (7)	6 (7)	15 (24)	4 (7)	6 (11)
Fymore Lough	103	8	14	21	14	3
Mullaghdrolly	52	5	9	11	4	0
Mullygruen Lough	54	5	7	7	3	0

TABLE 5. List of characteristic species of fens in Cos Armagh and Down. Number of new sites refers to number of sites discovered in the survey of 29 sites in 1997; previous number is the number of sites in CEDaR database, Ulster Museum.

SPECIES	New sites	Previous Number	% of records in sampled sites
Pirata piscatorius	16	1	94
Trochosa spinipalpis	15	14	52
Cercyon ustulatus	13	4	88
Gerris lateralis	7	10	59
Hydaticus seminiger	7	12	63
Pterostichus aterrimus	6	1	100
Hydroporus scalesianus	4	11	53
Rhantus grapii	4	10	83
Hebrus ruficeps	3	5	50
Tetrix subulata	2	2	75
Dytiscus circumcinctus	1	5	50
Gyrinus natator	0	11	55
Cymbiodyta marginella	1	3	67

FIGURE 1. Map showing location of the sites surveyed in Cos. Armagh and Down in 1997 (circles) and Co. Tyrone in 2000 (squares).



APPENDIX 1. List of all species recorded in both surveys. Occurrences in the Armagh/Down sites are listed first. The numbers (1,2,3) denote the pitfall session in which the species was caught (see tables for dates of these). The date of capture is given for those species collected in the field sampling.

ARACHNIDA: ARANEAE (SPIDERS)

Nomenclature and the order of families follows Harvey *et al.* 2002. Species are listed alphabetically within families. All material identified BN, confirmed Dr Peter van Helsdingen.

THERIDIIDAE

Robertus lividus (Blackwall)	Derryadd L. 1; Drumlougher L. 2
Theridion impressum L. Koch	Fymore L. 2; Mullygruen L. 2

LINYPHIIDAE

Agyneta decora (O.P.-Camb.)	Cashel L. Lower 2; Clonalig L. 2; Drumlougher L. 1
Agyneta olivacea (Emerton)	Cullentra L. 2
Allomengea scopigera (Grube)	Railway Road 3
Allomengea vidua (L. Koch)	Clonalig L. 3; Drumcarn 3; Moyrourkan L. 2, 3; Railway Road 3
Araeoncus crassiceps (Westring)	Ballybannan 2; Castle Enigan 2; Corbally 1, 2; Derryleckagh 1; Drumcarn 1; Drumlougher L. 1; Dunmore 1; Greenan L. 1; Loughkeelan 1; Railway Road 1, 3
Baryphyma trifrons (O.P.-Camb.)	Ballycam 1
Bathyphantes approximatus (O.P.-Camb.)	Ballard 3; Ballynagross Lower 1; Brackagh Moss 1; Brackly L. 1; Cashel L. Lower 1; Clonalig L. 1; Derryleckagh 1; Drumlougher L. 1; Drumnamether 1;

	Greenan L. 1; Heron L. 1; Lurgan L. Upper 1, 2; Moyrourkan L. 1, 2
	Derrycloony L. 2
Bathyphantes gracilis (Blackwall)	Ballard 1, 2; Ballybannan 2; Ballycam 1; Ballynagross Lower 1, 2; Carrowcarlin 1; Corbally 2, 3; Derryadd L. 3; Drumlougher L. 1; Drumnamether 1; Dunmore 1; Greenan L. 1; L. Money 1; Loughaveely 1; Loughkeelan 1; Lurgan L. Upper 1; Montiaghs Moss 1, 2; Railway Road 1, 3
	Cullentra L. 2; L. Fadda 2
Bathyphantes parvulus (Westring)	Ballynagross Lower 3; Railway Road 3
Bathyphantes setiger F.O.P.-Camb.	Corbally 1, 2; L. Money 2
	L. Fadda 2
Carorita paludosa Duffey	Derryleckagh 1
Centromerita bicolor (Blackwall)	Greenan L. 1; Turmennan 1
Ceratinella brevipes (Westring)	Castle Enigan 1; Drumcarn 1; Heron L. 2
Cnephalocotes obscurus (Blackwall)	Castle Enigan 1; Dunmore 1; Loughaveely 2; Lurgan L. Upper 1
Dicymbium nigrum (Blackwall)	Carrowcarlin 1; Drumlougher L. 1; Greenan L. 1; Loughkeelan 1; Lurgan L. Upper 1; Montiaghs Moss 1
Diplocephalus permixtus (O.P.-Camb.)	Ballynagross Lower 1; Carrowcarlin 1; Castle Enigan 1; Clonalig L. 1; Corbally 1; Drumlougher L. 1; Drumnamether 1; Dunmore 1; Greenan L. 1; L. Money 1, 2; Loughkeelan 1; Montiaghs Moss 1; Turmennan 1

Drepanotylus uncatus (O.P.-Camb.)	Ballynagross Lower 1; Carrowcarlin 1; Cashel L. Lower 1; Clonalig L. 1; Crossbane L. 1; Derryleckagh 1; Drumnamether 1; Greenan L. 1, 2; L. Money 1; Loughaveely 1; Moyrourkan L. 1; Railway Road 1; Turmennan 1
Erigone atra (Blackwall)	Ballard 1; Ballycam 1; Ballynagross Lower 1, 2; Brackly L. 1; Carrowcarlin 1; Castle Enigan 1; Corbally 1; Crossbane L. 1, 2; Derryadd L. 1; Drumcarn 1; Drumlougher L. 1; Dunmore 1; Greenan L. 1, 2; Heron L. 1; L. Money 1, 2; Loughkeelan 1; Lurgan L. Upper 2; Montiaghs Moss 1
	Fymore L. 2; L. Fadda 2; Mullaghdrolly 1, 2; Mullygruen L. 2
Erigone dentipalpis (Wider)	Ballynagross Lower 2; Castle Enigan 1; Drumlougher L. 1; Greenan L. 1; L. Money 1, 2; Loughkeelan 1; Montiaghs Moss 2
Floronia bucculenta (Clerck)	Carrowcarlin 3
Gnathonarium dentatum (Wider)	Ballycam 1; Ballynagross Lower 1; Brackly L. 1; Carrowcarlin 1; Cashel L. Lower 10 June 1997; Castle Enigan 1; Clonalig L. 2; Corbally 1; Crossbane L. 1; Derryleckagh 1; Greenan L. 1, 2; Heron L. 1; L. Money 1, 2; Loughaveely 1, 2, 3; Loughkeelan 1; Lurgan L. Upper 1; Turmennan 1
Gonatium rubens (L.)	Lurgan L. Upper 3

Gongylidiellum vivum (O.P.-Camb.)	Heron L. 2
Hypomma bituberculatum (Wider)	Ballard 1; Ballycam 1; Ballynagross Lower 1; Corbally 1; Derryleckagh 1; Drumlougher L. 1; Heron L. 1, 2
Hypomma cornutum (Blackwall)	Carrowcarlin 1
Hypomma fulvum (Bösenborg)	Clonalig L. 1; Derryleckagh 1
Kaestneria pullata (O.P.-Camb.)	Turmennan 1
	Cullentra L. 2
Lepthyphantes cristatus (Menge)	Loughaveely 1
Lepthyphantes flavipes (Blackwall)	Castle Enigan 2
	Cullentra L. 2
Lepthyphantes mengei Kulczynski	Railway Road 3
Lepthyphantes tenuis (Blackwall)	Ballynagross Lower 3; Castle Enigan 2; Corbally 3; Derryadd L. 3; L. Money 2; Loughaveely 3; Railway Road 2, 3
Lepthyphantes zimmermanni Bertkau	Ballard 3; Ballynagross Lower 2; L. Money Fen 1; Loughaveely 2; Railway Road 3
Leptorhoptrum robustum (Westring)	L. Money 2; Lurgan L. Upper 2
Lophomma punctatum (Blackwall)	Ballard 1; Ballybannan 2; Ballycam 1; Ballynagross Lower 1; Brackagh Moss 1, 3; Brackly L. 1; Carrowcarlin 1, 3; Cashel L. Lower 1, 2; Castle Enigan 1; Clonalig L. 1, 2; Derryleckagh 1; Drumcarn 1; Drumlougher L. 1; Drumnamether 1; Greenan L. 1;

	Heron L. 2; Loughaveely 1, 2; Loughkeelan 1; Lurgan L. Upper 1; Moyrourkan L. 2; Railway Road 1, 2, 3; Turmennan 1
Maso sundevalli (Westring)	Cullentra L. 1, 2; L. Fadda 1, 2
Micrargus herbigradus (Blackwall)	Crossbane L. 1
Monocephalus fuscipes (Blackwall)	Lurgan L. Upper 1
Neriene clathrata (Sundevall)	Clonalig L. 1
Neriene montana (Clerck)	Drumlougher L. 1; Lurgan L. Upper 1
Oedothorax fuscus (Blackwall)	Ballycam 1; Ballynagross Lower 2; Carrowcarlin 1; Greenan L. 1; L. Money 1; Loughaveely 1; Loughkeelan 1; Montiaghs Moss 1
	Fymore L. 2
Oedothorax gibbosus (Blackwall)	Ballard 2; Ballycam 1; Carrowcarlin 2; Drumnamether 1; Greenan L. 1; Heron L. 2; Moyrourkan L. 2
Oedothorax retusus (Westring)	Montiaghs Moss 1
Pelecopsis mengei (Simon)	Drumlougher L. 1; Railway Road 1, 2, 3
	Cullentra L. 1
Peponocranium ludicrum (O.P.-Camb.)	Carrowcarlin 1
Pocadicnemis juncea Locket & Millidge	Montiaghs Moss 1
Saaristoa abnormis (Blackwall)	Cullentra L. 2
Silometopus elegans (O.P.-Camb.)	Railway Road 2
	Cullentra L. 1, 2; Derrycloony L. 2; Mullygruen L. 2

Tallusia experta (O.P.-Camb.)	Ballynagross Lower 1; Carrowcarlin 1, 2; Greenan L. 1
Tapinopa longidens (Wider)	Railway Road 3
Tiso vagans (Blackwall)	Drumlougher L. 1
Walckenaeria acuminata Blackwall	Carrowcarlin 1; Cashel L. Lower 1; Lurgan L. Upper 1
Walckenaeria cuspidata Blackwall	Ballard 2; Cashel L. Lower 1
Walckenaeria kochi (O.P.-Cambridge)	Cashel L. Lower 1
TETRAGNATHIDAE	
Pachygnatha clercki Sundevall	Ballard 1, 2, 3; Ballybannan 1; Ballycam 1; Ballynagross Lower 1, 2, 3; Brackagh Moss 1, 3; Brackly L. 1; Carrowcarlin 1; Cashel L. Lower 1, 2; Castle Enigan 1, 2, 3; Clonalig L. 1; Corbally 1, 2; Crossbane L. 1; Derryadd L. 1; Derryleckagh 1, 2; Drumcarn 1, 2, 3; Drumlougher L. 1; Drumnamether 1; Dunmore 1, 2; Greenan L. 1; Heron L. 1, 2; Kiltubbrid L. 1, 2; L. Money 1, 2, 3; Loughaveely 1, 2; Loughkeelan 1; Lurgan L. Upper 1; Montiaghs Moss 1; Moyrourkan L. 1, 3; Railway Road 3; Turmennan 1
	Cullentra L. 1; Derrycloony L. 1; Mullaghdrolly 1, 2
Pachygnatha degeeri Sundevall	Ballynagross Lower 2; Corbally 2; Drumlougher L. 1; Drumnamether 1; Loughaveely 1; Loughkeelan 1; Lurgan L. Upper 1; Montiaghs Moss 1, 2
Tetragnatha extensa (L.)	Cashel L. Lower 10 June 1997

ARANEIDAE	
Araneus quadratus Clerck	Heron L. 3
Larinioides cornutus (Clerck)	Clonalig L. 3; Drumlougher L. 3
LYCOSIDAE	
Alopecosa pulverulenta (Clerck)	Drumlougher L. 1; Loughaveely 1; Montiaghs Moss 1, 2
Arctosa leopardus (Sundevall)	Drumlougher L. 2
Pardosa amentata (Clerck)	Ballybannan 1, 2, 3; Ballycam 1; Ballynagross Lower 1 2; Brackagh Moss 1 2; Brackly L. 1; Carrowcarlin 1 2; Cashel L. Lower 1 2; Castle Enigan 2; Clonalig L. 1; Corbally 1; Derryleckagh 1; Drumcarn 1, 2; Drumlougher L. 1, 2; Drumnamether 1; Dunmore 2; Greenan L. 1; Heron L. 1, 2; Kiltubbrid L. 1, 2; L. Money 1; Loughaveely 1; Loughkeelan 1; Montiaghs Moss 1; Moyrourkan L. 1, 2, 3; Railway Road 3; Turmennan 1
	Cullentra L. 2; Derrycloony L. 1, 2; Fymore L. 1, 2; Mullaghdrolly 1, 2; Mullygruen L. 1
Pardosa nigriceps (Thorell)	Ballard 3; Cashel L. Lower 2
Pardosa palustris (L.)	L. Money 1
	Fymore L. 1, 2
Pardosa pullata (Clerck)	Ballard 2, 3; Ballybannan 2, 3; Carrowcarlin 1, 2; Cashel L. Lower 1, 2; Castle Enigan 1, 2, 3; Clonalig L. 1, 2, 3; Corbally 1, 2, 3; Derryadd L. 1, 3; Drumcarn 1, 2, 3; Drumlougher L. 1, 2; Drumnamether 1; Dunmore 2; Heron L. 1; Loughaveely 1, 2; Loughkeelan 1; Lurgan L. Upper 2; Montiaghs Moss 1, 2, 3; Moyrourkan L. 2;

	Railway Road 2, 3; Turmennan 1
	Cullentra L. 1, 2; Derrycloony L. 1, 2; Fymore L. 2; Mullaghdrolly 1
Pirata piraticus (Clerck)	Ballard 3; Ballybannan 1, 2, 3; Ballycam 2; Ballynagross Lower 1, 2, 3; Brackagh Moss 2; Brackly L. 3; Carrowcarlin 2, 3; Cashel L. Lower 2, 3; Castle Enigan 2, 3; Clonalig L. 2, 3; Corbally 2, 3; Crossbane L. 2; Derryadd L. 1; Derryleckagh 1, 2, 3; Drumcarn 2, 3; Drumlougher L. 2, 3; Greenan L. 1, 2; Heron L. 2, 3; Kiltubbrid L. 2; L. Money 2, 3; Loughaveely 1, 2, 3; Lurgan L. Upper 2; Montiaghs Moss 2; Moyrourkan L. 1, 2, 3; Railway Road 2
	Cullentra L. 1,2; Derrycloony L. 1, 2; Fymore L. 1, 2; L. Fadda 1, 2; Mullaghdrolly 1,2; Mullygruen L. 1, 2
Pirata piscatorius (Clerck)	Ballard 2; Ballybannan 3; Ballynagross Lower 1; Brackagh Moss 1, 2; Brackly L. 1; Clonalig L. 1, 2; Corbally 1, 2; Derryleckagh 1; Drumcarn 1, 2; Drumlougher L. 2; Dunmore 2; Kiltubbrid L. 2; Loughaveely 1; Loughkeelan 1; Moyrourkan L. 1, 2; Railway Road 2
	L. Fadda 14 June 2000
Pirata uliginosus (Thorell)	Derryadd L. 1
Trochosa spinipalpis (F.O.P.-Camb.)	Brackagh Moss 1; Brackly L. 1; Cashel L. Lower 1, 2, 3; Castle Enigan 1, 3; Clonalig L. 1, 2, 3; Derryleckagh 1; Drumcarn 1, 2; Drumlougher L. 1; Drumnamether 1;

	Kiltubbrid L. 1; Loughaveely 1; Lurgan L. Upper 1; Montiaghs Moss 1, 2, 3; Moyrourkan L. 1
	Cullentra L. 1; Derrycloony L. 1, 2; Fymore L. 1
Trochosa terricola Thorell	Ballybannan 2; Ballycam 1, Brackly L. 1; Carrowcarlin 1; Clonalig L. 3; Corbally 1; Drumcarn 1997 Drumlougher L. 1; Drumnamether 1; Loughaveely 1; Loughkeelan 1; Montiaghs Moss 1
CYBAEIDAE	
Argyroneta aquatica (Clerck)	Ballard 10 June 1997; Carrowcarlin 1; Cashel L. Upper 10 June 1997; Castle Enigan 1, 2; Corbally 24 June 1997; Drumnamether 19 June 1997; Dunmore 2; Kiltubbrid L. 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997.
	Derrycloony L. 13 June 2000
HAHNIIDAE	
Antistea elegans (Blackwall)	Ballard 1, 2; 3; Ballynagross Lower 1, 2; Brackagh Moss 1, 2; 3; Brackly L. 3; Carrowcarlin 1, 3; Cashel L. Lower 1, 2; 3; Castle Enigan 2, 3; Clonalig L. 1, 2; 3; Corbally 1, 2; 3; Derryadd L. 1, 3; Derryleckagh 3; Drumcarn 1, 3; Drumlougher L. 1, 2; Drumnamether 1; Dunmore 1, 2; Greenan L. 2; Heron L. 1, 2; Kiltubbrid L. 2; L. Money 2; 3; Loughaveely 1, 2, 3; Loughkeelan 1; Lurgan L. Upper 1, 2; Montiaghs Moss 1, 2; Moyrourkan L. 1, 2, 3; Turmennan 1
	Derrycloony L. 1

LIOCRANIDAE

Agroeca proxima (O.P.-Camb.)	Carrowcarlin 3; Clonalig L. 3; Loughaveely 3; Lurgan L. Upper 3

CLUBIONIDAE

Clubiona phragmitis C.L. Koch	Clonalig L. 1
Clubiona reclusa O.P.-Camb.	Derryadd L. 1
Clubiona stagnatilis Kulczynski	Carrowcarlin 1; Cashel L. Lower 3; Derryleckagh 1; Lurgan L. Upper 1; Moyrourkan L. 1; Railway Road 3

GNAPHOSIDAE

Zelotes latreillei (Simon)	Loughaveely 1

ZORIDAE

Zora spinimana (Sundevall)	Derryadd L. 1

THOMISIDAE

Ozyptila trux (Blackwall)	Kiltubbrid L. 2; Railway Road 2
Xysticus cristatus (Clerck)	Castle Enigan 1, 3; Corbally 1; Drumlougher L. 2; Loughkeelan 1; Montiaghs Moss 1, 3

MOLLUSCA (SNAILS AND SLUGS)

All material determined by Dr Roy Anderson.

LYMNAEIDAE

Lymnaea palustris (Müller)	Ballycam 1, 2; Drumlougher L. 1; Greenan L 1; Montiaghs Moss 2; Railway Road 2
Lymnaea truncatula (Müller)	Ballybannan 1, 2; Ballycam 1; Brackly L. 3; Clonalig L. 2; Corbally 1, 2; Crossbane L. 1, 2; Drumcarn 1;

	Dunmore Fen 2; Greenan L. 2; Kiltubbrid L. 1; Loughkeelan 1, 2; Turmennan 1
	Fymore L.
SUCCINEIDAE	
Oxyloma pfeifferi (Rossmässler)	Ballybannan 1, 2; Ballycam 1, 2; Ballynagross Lower 1, 2; Brackagh Moss 2; Corbally 2; Dunmore 2; Greenan L. 2; Heron L. 2; Kiltubbrid L. 1; Loughkeelan 1, 2; Railway Road 2
	Fymore L; Mullaghdrolly
ARIONIDAE	
Arion ater (L.)	Ballycam 2
ZONITIDAE	
Nesovitrea hammonis (Ström)	Ballybannan 2
Zonitoides nitidus (Müller)	Ballycam 1, 2; Ballynagross Lower 2; Brackagh Moss 2; Corbally 1, 2; Heron L. 1; Kiltubbrid L. 1; Loughkeelan 1, 2
	Fymore L; Mullaghdrolly; Mullygruen L.
EUCONULIDAE	
Euconulus alderi (Gray)	Ballycam 2
	Fymore L.

GNATHOBDELLIDA (LEECHES)

Determined by BN.

HIRUDINIDAE

Haemopis sanguisuga (L.)	Ballard 1, 2, 3; Ballynagross Lower 3; Brackagh Moss 1, 3; Brackly L. 1, 3; Carrowcarlin 3; Cashel L. 1, 3; Castle Enigan 1, 2, 3; Clonalig L. 1, 3; Corbally 3; Crossbane L. 1, 2; Derryadd L. 3; Derryleckagh 2, 3; Drumcarn 1, 2, 3; Drumlougher L. 1, 3; Drumnamether 1; Dunmore Fen 2, 3; Greenan L. 2; Heron L. 3; Kiltubbrid L. 1, 2, 3; L. Money 3; Loughaveely 1, 3; Lurgan L. 1, 3; Moyrourkan L. 1, 2, 3; Railway Road 1, 2, 3 Cullentra L. 1, 2; Derrycloony L. 1, 2; Fymore L. 1, 2; L. Fadda 1; Mullaghdrolly 1, 2; Mullygruen L. 1

COLEOPTERA

The nomenclature and order of the families follow Anderson *et al.* (1997). Species are listed alphabetically within families. The Irish checklist includes the Pselaphidae, whereas more recent treatment places them within the Staphylinidae (Lott, 2003).

GYRINIDAE

Determined by BN.

Gyrinus caspius Ménétriés	Ballynagross Lower 26 June 1997; Carrowcarlin 26 June 1997; Clonalig L. 17 June 1997; Loughaveely 17 June 1997
Gyrinus marinus Gyllenhal	Brackly L. 19 June 1997; Corbally 24 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997

Gyrinus minutus Fabr.	Corbally 24 June 1997
Gyrinus paykulli Ochs	Clonalig L. 17 June 1997
Gyrinus substriatus Stephens	Ballard 10 June 1997; Ballynagross Lower 26 June 1997; Cashel L. Upper 10 June 1997; Corbally 24 June 1997; Kiltubbrid L. 19 June 1997; Loughaveely 17 June 1997

HALIPLIDAE

Determined by BN.

Haliplus confinis Stephens	Clonalig L. 17 June 1997
Haliplus fulvus (Fabr.)	Cashel L. Upper 10 June 1997; Lurgan L. Upper 17 June 1997
Haliplus lineatocollis (Marsham)	Ballynagross Lower 26 June 1997
Haliplus ruficollis (De Geer)	Kiltubbrid Loughs 19 June 1997; Lurgan L. Upper 17 June 1997

NOTERIDAE

Determined by BN.

Noterus clavicornis (De Geer)	Corbally 24 June 1997; Crossbane L. 19 June 1997; Drumnamether 1; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997 Derrycloony L. 25 Aug 2000
Noterus crassicornis (Müller)	Kiltubbrid Loughs 19 June 1997

DYTISCIDAE

Determined by BN.

Acilius sulcatus (L.)	Ballard 10 June 1997
Agabus affinis (Paykull)	Ballard 1, 2, 3, 10 June 1997; Brackagh Moss 2; Brackly L. 1; Castle Enigan 3; Clonalig L. 17 June 1997;

	Derryadd L. 2; Drumlougher L. 17 June 1997; Drumnamether 1, 19 June 1997; Kiltubbrid Loughs 19 June 1997; Loughaveely 1, 2; Railway Road 1, 2, 10 June 1997
	Cullentra L. 2, 14 June 2000
Agabus bipustulatus (L.)	Ballard 2; Ballybannan 24 June 1997; Ballycam 24 June 1997; Brackagh Moss 3; Brackly L. 1; Clonalig L. 17 June 1997; Corbally 3, 24 June 1997; Crossbane L. 19 June 1997; Derryadd L. 2, 3; Derryleckagh 1, 3; Drumlougher L. 17 June 1997; Heron L. 1; Kiltubbrid L. 3, 19 June 1997; Loughaveely 3, 17 June 1997; Lurgan L. Upper 1, 17 June 1997; Moyrourkan L. 3; Railway Road 1, 3, 10 June 1997
	Cullentra L. 1, 14 June 2000; Derrycloony L. 2, 13 June 2000; Fymore L. 1, 13 June 2000, 25 Aug 2000
Agabus montanus (Stephens)	Ballard 10 June 1997; Drumnamether 1
Agabus paludosus (Fabr.)	Ballybannan 24 June 1997
Agabus sturmii (Gyllenhal)	Ballard 2, 3; Ballycam 24 June 1997; Ballynagross Lower 2, 3, June 1997; Carrowcarlin 3; Clonalig L. 2, 17 June 1997; Derryadd L. 2, 3; Loughaveely 2, 17 June 1997; Loughkeelan 2
	Mullygruen L. 1
Agabus unguicularis (Thomson)	Ballard 2, Ballycam 24 June 1997; Ballynagross Lower 1, 2, 3; Carrowcarlin 26 June 1997; Clonalig L. 2; Corbally 24 June 1997; Kiltubbrid Loughs 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June;

	Railway Road 1, 3, 10 June 1997
Colymbetes fuscus (L.)	Ballynagross Lower 26 June 1997; Kiltubbrid Loughs 19 June 1997; Lurgan L. Upper 17 June 1997; Moyrourkan L. 2
Dytiscus circumcinctus Ahrens	Kiltubbrid L. 2
Dytiscus marginalis L.	Ballard 3; Brackagh Moss 3; Moyrourkan L. 1 Mullaghdrolly 2
Dytiscus semisulcatus Müller	Ballybannan 2; Brackagh Moss 2; Clonalig L. 2; Derryleckagh 2; Greenan L. 2; Kiltubbrid L. 2, 3 Fymore L. 1
Graptodytes granularis (L.)	Cullentra L.1, 14 June 2000; Derrycloony L. 1
Graptodytes pictus (Fabr.)	Cashel L. Upper 10 June 1997; Lurgan L. Upper 17 June 1997
Hydaticus seminiger (De Geer)	Ballynagross Lower 3; Brackagh Moss 2, 3; Carrowcarlin 26 June 1997; Clonalig L. 1, 17 June 1997; Corbally 3; Derryadd L. 2; Drumlougher L. 1; L. Money 2; Moyrourkan L. 1, 2 L. Fadda 2, 14 June 2000
Hydroporus angustatus Sturm	Ballynagross Lower 26 June 1997; Corbally 24 June 1997; Derryleckagh 3; Drumlougher L. 17 June 1997; Drumnamether 19 June 1997; Kiltubbrid Loughs 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997; Railway Road 10 June 1997 Derrycloony L. 25 Aug 2000; L. Fadda 14 June 2000
Hydroporus erythrocephalus (L.)	Ballard 2, 10 June 1997; Ballycam 24 June 1997; Ballynagross Lower 26 June 1997; Clonalig L. 2;

	Corbally 24 June 1997; Crossbane L. 19 June 1997; Drumlougher L. 17 June 1997; Drumnamether 19 June 1997; Kiltubbrid Loughs 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997; Moyrourkan L. 14 May 1997; Railway Road 10 June 1997
	Cullentra L. 14 June 2000
Hydroporus gyllenhalii (Schiödte)	Ballard 1; Castle Enigan 1; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997
	Cullentra L. 14 June 2000
Hydroporus incognitus Sharp	Ballard 10 June 1997; Ballynagross Lower 26 June 1997; Railway Road 10 June 1997
Hydroporus memnonius Nicolai	Cashel L. Lower 2; Clonalig L. 2, 17 June 1997; Drumnamether 19 June 1997; Kiltubbrid Loughs 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997; Railway Road 10 June 1997
	Cullentra L. 14 June 2000; Derrycloony L. 1, 25 Aug 2000; Mullygruen L. 1
Hydroporus nigrita (Fabr.)	Drumnamether 1; Railway Road 10 June 1997
Hydroporus obscurus Sturm	Ballard 2, 10 June 1997; Loughaveely 17 June 1997
Hydroporus palustris (L.)	Ballycam 24 June 1997; Ballynagross Lower 26 June 1997; Brackly L. 1; Carrowcarlin 26 June 1997; Corbally 24 June 1997; Drumnamether 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997; Moyrourkan L. 14 May 1997
	Derrycloony L. 25 Aug 2000; Mullaghdrolly 1
Hydroporus planus (Fabr.)	Kiltubbrid Loughs 19 June 1997

Hydroporus pubescens (Gyllenhal)	Ballard 2, 10 June 1997; Brackly L. 3; Crossbane L. 19 June 1997; Drumlougher L. 17 June 1997; Drumnamether 1; Loughaveely 17 June 1997 Derrycloony L. 25 Aug 2000
Hydroporus scalesianus Stephens	Brackly L. 19 June 1997; Corbally 24 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997
Hydroporus striola (Gyllenhal)	Brackly L. 1; Drumlougher L. 1; Kiltubbrid L. 19 June 1997; Loughaveely 2, 17 June 1997; Lurgan L. Upper 17 June 1997; Moyrourkan L. 14 May 1997; Railway Road 1, 10 June 1997; Turmennan 1 Derrycloony L. 25 Aug 2000; L. Fadda 14 June 2000
Hydroporus tessellatus Drapiez	Drumnamether 19 June 1997 Fymore L. 13 June 2000
Hydroporus tristis (Paykull)	Ballard 10 June 1997; Drumlougher L. 1 Cullentra L. 14 June 2000
Hydroporus umbrosus (Gyllenhal)	Carrowcarlin 26 June 1997; Corbally 24 June 1997; Drumnamether 19 June 1997; Loughaveely 17 June 1997; Railway Road 10 June 1997
Hygrotus impressopunctatus (Schaller)	Mullaghdrolly 12 June 2000
Hygrotus inaequalis (Fabr.)	Corbally 24 June 1997; Crossbane L. 19 June 1997; Drumcarn 2; Kiltubbrid L. 1, 19 June 1997; L. Money 3; Lurgan L. Upper 17 June 1997
Hyphydrus ovatus (L.)	Clonalig L. 17 June 1997; Corbally 24 June 1997; Crossbane L. 19 June 1997

Ilybius ater (De Geer)	Ballynagross Lower 26 June 1997; Brackagh Moss 2; Clonalig L. 17 June 1997; Corbally 2; Crossbane L. 2, 19 June 1997; Drumcarn 2; Drumlougher L. 2; Drumnamether 1; Kiltubbrid L. 2; Loughaveely 2, 17 June 1997 Lurgan L. Upper 2, 17 June 1997; Moyrourkan L. 1, 2
	Derrycloony L. 25 Aug 2000; Mullaghdrolly 1, 2
Ilybius fuliginosus (Fabr.)	Ballycam 24 June 1997; Ballynagross Lower 26 June 1997; Brackagh Moss 2; Cashel L. Upper 10 June 1997; Clonalig L. 17 June 1997
	Derrycloony L. 13 June 2000; Fymore L. 1, 13 June 2000
Ilybius guttiger (Gyllenhal)	Carrowcarlin 26 June 1997; Clonalig L. 17 June 1997; Corbally 24 June 1997; Derryleckagh 1; Drumlougher L. 17 June 1997; Kiltubbrid L. 2, 19 June 1997; Loughaveely 2; Moyrourkan L. 3; Railway Road 10 June 1997
Ilybius quadriguttatus (Lacordaire)	Ballard 2; Ballynagross Lower 2, 26 June 1997; Brackagh Moss 1, 2; Clonalig L. 2; Corbally 2, 3, 24 June 1997; Crossbane L. 19 June 1997; Derryleckagh 2; Drumlougher L. 1, 2; Heron L. 2; Kiltubbrid L. 2, 3; Loughaveely 1, 2; Lurgan L. Upper 2; Moyrourkan L. 1, 2, 14 May 1997
	Cullentra L. 1, 2; Fymore L. 1; Mullaghdrolly 1, 2
Laccornis oblongus (Stephens)	Brackagh Moss 1; Drumlougher L. 1, 17 June 1997; Drumnamether 1; Loughaveely 17 June 1997;

	Moyrourkan L. 14 May 1997
	Derrycloony L. 1, 25 Aug 2000
Nebrioporus depressus (Fabr.)	Cashel L. Upper 10 June 1997
Porhydrus lineatus (Fabr.)	Corbally 24 June 1997
Rhantus exsoletus (Forster)	Ballard 2; Brackly L. 3; Carrowcarlin 3; Clonalig L. 2; Crossbane L. 19 June 1997; Derryadd L. 2; Lurgan L. Upper 17 June 1997
	Fymore L. 13 June 2000
Rhantus grapii (Gyllenhal)	Ballynagross Lower 2, 3; Corbally 1, 3, 24 June 1997; Heron L. 1; Loughkeelan 2; Moyrourkan L. 2
	L. Fadda 14 June 2000
Suphrodytes dorsalis (Fabr.)	Carrowcarlin 26 June 1997; Clonalig L. 2; Corbally 24 June 1997; Lurgan L. Upper 17 June 1997

CARABIDAE

Determined by Dr Roy Anderson.

Abax parallelepipedus (Piller and Mitterpacher)	Cashel L. Lower 1; Clonalig L. 1; Lurgan L. Upper 1, 2
Agonum afrum (Duftschmid)	Ballynagross Lower 3; Derryleckagh 1
	Fymore L.
Agonum assimile (Paykull)	Derrycloony L.
Agonum fuliginosum (Panzer)	Ballard 2; Ballynagross Lower 2; Carrowcarlin 2, 3; Cashel L. Lower 1, 2; Drumlougher L. 2; Lurgan L. Upper 2
	Cullentra L., L. Fadda, Mullaghdrolly, Mullygruen L.
Agonum gracile Sturm	Ballard 10 June 1997, Drumnamether 19 June 1997; Greenan L. 1

	Cullentra L., Mullaghdrolly
Agonum marginatum (L.)	L. Money 1
Agonum muelleri (Herbst)	Brackly L. 1, 3; Corbally 1; L. Money 1; Moyrourkan L. 2, 3
Agonum piceum (L.)	Brackly L. 1; Carrowcarlin 3; Greenan L. 1; L. Money 1; Lurgan L. Upper 17 June 1997
	Mullaghdrolly
Agonum thoreyi Dejean	Ballybannan 1; Brackagh Moss 1, 3; Brackly L. 1; Cashel L. Lower 3; Castle Enigan 2; Derryleckagh 1; Heron L. 2; Loughaveely 1, 2; Lurgan L. Upper 2, 17 June 1997; Moyrourkan L. 1, 2
	L. Fadda, Mullaghdrolly, Mullygruen L.
Agonum viduum (Panzer)	Cashel L. Lower 3; Greenan L. 1; Kiltubbrid L. 1
	Derrycloony L., Fymore L.
Amara aenea (De Geer)	Turmennan 1
Amara plebeja (Gyllenhal)	Ballynagross Lower 3
Amara similata (Gyllenhal)	Drumnamether 1
Bembidion aeneum Germar	Railway Road 1
Bembidion doris (Panzer)	Ballard 10 June 1997
Bembidion guttula (Fabr.)	Ballynagross Lower 1; Drumcarn 1; Moyrourkan L. 3
Bembidion lampros (Herbst)	Drumlougher L. 1; L. Money 3
Bembidion mannerheimii (Sahlberg)	Ballybannan 2; Ballynagross Lower 1; Brackly L. 1, 3; Crossbane L. 1; Heron L. 1; Lurgan L. Upper 1
	Derrycloony L.,
Blethisa multipunctata (L.)	Ballynagross Lower 2; Brackly L. 1; Drumcarn 1; L.

	Money 1
Bradycellus sharpi Joy	Drumcarn 1
Calathus melanocephalus (L.)	Lurgan L. Upper 2
Carabus granulatus L.	Ballycam 1; Ballynagross Lower 1, 2, 3; Brackagh Moss 1; Brackly L. 1; Carrowcarlin 1; Cashel L. Lower 1; Castle Enigan 1; Clonalig L. 1, 2; Corbally 1, 2; Drumcarn 1; Drumlougher L. 1, 3; Dunmore 2; Greenan L. 1; Heron L. 1, 2; L. Money 1; Loughaveely 1; Loughkeelan 1; Lurgan L. Upper 1, 2; Montiaghs Moss 1, 2; Railway Road 1; Turmennan 1
	Derrycloony L., Fymore L., Mullygruen L.
Carabus nemoralis Müller	Castle Enigan 1; Lurgan L. Upper 1
	Derrycloony L.,
Carabus problematicus Herbst	Ballard 2
Chlaenius nigricornis (Fabr.)	Fymore L.
Dyschirius globosus (Herbst)	Drumlougher L. 2; Montiaghs Moss 1
	Fymore L.
Elaphrus cupreus (Duftschmid)	Ballard 1, 2; Ballybannan 1; Ballycam 1; Ballynagross Lower 1, 2; Brackly L. 1; Carrowcarlin 1, 26 June 1997; Crossbane L. 1; Drumcarn 1; Drumlougher L. 1; Dunmore 2; Greenan L. 1; L. Money 1, 2; Turmennan 1
	L. Fadda, Fymore L., Mullaghdrolly
Elaphrus riparius (L.)	L. Money 1
Harpalus latus (L.)	Montiaghs Moss 2
Leistus terminatus (Hellwig)	Ballard 2; Cashel L. Lower 3
Loricera pilicornis (Fabr.)	Ballard 2; Ballynagross Lower 2, 3; Cashel L. Lower 3;

	Crossbane L. 1; L. Money 1; Railway Road 1
	L. Fadda, Fymore L.
Nebria brevicollis (Fabr.)	Ballard 2; Ballynagross Lower 3; Corbally 3; Greenan L. 1; L. Money 3; Montiaghs Moss 2
	Fymore L.
Pterostichus anthracinus (Illiger)	Montiaghs Moss 1, 2
Pterostichus aterrimus (Herbst)	Brackagh Moss 3; Castle Enigan 2; Derryleckagh 1, 2; Drumcarn 1, 2; Kiltubbrid L. 2; Lurgan L. Upper 1; Moyrourkan L. 3
Pterostichus crenatus (Duftschmid)	Montiaghs Moss 2
	Fymore L.
Pterostichus diligens (Sturm)	Ballybannan 1; Ballynagross Lower 2; Carrowcarlin 1; Cashel L. Lower 1, 2; Castle Enigan 1; Corbally 1; Derryleckagh 1; Drumcarn 2; Drumlougher L. 1; Dunmore 2; Greenan L. 1; Heron L. 1; Kiltubbrid L. 1; Loughaveely 1; Loughkeelan 1; Lurgan L. Upper 1; Railway Road 1
	Fymore L.
Pterostichus madidus (Fabricius)	Derrycloony L.
Pterostichus melanarius (Illiger)	Ballynagross Lower 3; Cashel L. Lower 2; Crossbane L. 2; Derryadd L. 2; Derryleckagh 2; Drumcarn 1; Drumlougher L. 1; Lurgan L. Upper 2, 3; Montiaghs Moss 1, 2
	L. Fadda, Mullaghdrolly, Mullygruen L.
Pterostichus minor (Gyllenhal)	Ballynagross Lower 2; Brackly L. 1; Carrowcarlin 1;

	Castle Enigan 1; Corbally 1; Crossbane L. 1; Derryleckagh 1; Drumlougher L. 1, 2; Greenan L. 2; Heron L. 1; L. Money 1; Loughaveely 1, 17 June 1997; Loughkeelan 1; Montiaghs Moss 1
	Derrycloony L., Fymore L., Mullaghdrolly, Mullygruen L.
Pterostichus niger (Schaller)	Ballard 2; Ballynagross Lower 3; Brackagh Moss 3; Brackly L. 1, 3; Carrowcarlin 3; Castle Enigan 2; Corbally 2, 3; Crossbane L. 2; Derryadd L. 2, 3; Drumlougher L. 1, 2; L. Money 3; Lurgan L. Upper 2, 3; Montiaghs Moss 2
	Derrycloony L., L. Fadda, Fymore L., Mullaghdrolly, Mullygruen L.
Pterostichus nigrita (Paykull)	Ballard 1, 2; Ballynagross Lower 1, 2; Crossbane L. 1; Greenan L. 1; Kiltubbrid L. 1; L. Money 1, 2; Loughkeelan 1; Montiaghs Moss 1, 2; Turmennan 1
	Fymore L.
Pterostichus rhaeticus Heer	Ballard 2; Ballybannan 1; Ballynagross Lower 1, 2, 3; Brackly L. 1; Cashel L. Lower 1; Castle Enigan 1, 2; Clonalig L. 1; Corbally 1; Crossbane L. 1, 2; Derryadd L. 3; Derryleckagh 1, 2; Drumcarn 1, 2; Drumlougher L. 1, 2; Dunmore 2; Greenan L. 1; Heron L. 1; Kiltubbrid L. 1; L. Money 1; Loughaveely 1, 2, 3 ; Loughkeelan 1, 2; Lurgan L. Upper 1; Montiaghs Moss 1, 2; Moyrourkan L. 1; Railway Road 1, 10 June 1997; Turmennan 1

	Derrycloony L., Fymore L., Mullaghdrolly, Mullygruen L.
Pterostichus strenuus (Panzer)	Ballynagross Lower 2; Crossbane L. 1
Pterostichus versicolor (Sturm)	Montiaghs Moss 1, 2
Trechus obtusus Erichson	Carrowcarlin 2

LEIODIDAE

Determined by Dr Roy Anderson.

Catops fuliginosus Erichson	L. Fadda
Catops fuscus (Panzer)	Drumlougher L. 2
	L. Fadda
Catops morio (Fabr.)	Derryleckagh 2
	Cullentra L., Derrycloony L., L. Fadda, Mullygruen L.
Choleva agilis (Illiger)	Carrowcarlin 2; Lurgan L. Upper 1
Choleva oblonga Latreille	Lurgan L. Upper 2
Ptomaphagus sericatus (Chaudoir)	Carrowcarlin 2; L. Money 1, 2; Loughaveely 2
Sciodrepoides fumata (Spence)	Brackagh Moss 2; Cashel L. Lower 2; Derryadd L. 2; Derryleckagh 2; Dunmore 2; Greenan L. 2; Heron L. 2; L. Money 2; Loughaveely 2; Lurgan L. Upper 2; Moyrourkan L. 2; Railway Road 2
	Cullentra L., Derrycloony L., L. Fadda, Mullygruen L.
Sciodrepoides watsoni (Spence)	Cullentra L., Mullygruen L.

HYDRAENIDAE

Determined by BN.

Hydraena britteni Joy	L. Fadda
Hydraena riparia Kugelann	Lurgan L. Upper 17 June 1997
Ochthebius dilatatus Stephens	Mullaghdrolly 1

SCYDMAENIDAE

Determined by Dr Roy Anderson.

Euconnus hirticollis (Illiger)	Fymore L., Mullygruen L.

SILPHIDAE

Determined by BN.

Nicrophorus humator (Gleditsch)	Brackagh Moss 3; Castle Enigan 1; Drumcarn 3; Loughaveely 1; Montiaghs Moss 3
	Cullentra L. 1; Derrycloony L. 1; Fymore L. 1; L. Fadda 1, 2; Mullaghdrolly 1; Mullygruen L. 1
Nicrophorus investigator Zetterstedt	Clonalig L. 2; Derryadd L. 2; Drumcarn 2; Kiltubbrid L. 2; Loughaveely 2
	Cullentra L. 2; Mullaghdrolly 2; Mullygruen L. 2
Nicrophorus vespillo (L.)	Brackagh Moss 2, 3; Derryadd L. 2, 3; Kiltubbrid L. 2, 3; Loughaveely 2; Montiaghs Moss 3
Nicrophorus vespilloides Herbst	Ballard 2, 3; Brackagh Moss 2, 3; Carrowcarlin 2, 3; Cashel L. Lower 2, 3; Clonalig L. 2; Corbally 2; Derryadd L. 3; Derryleckagh 2, 3; Drumcarn 2, 3; Drumlougher L. 2; Dunmore 2; Heron L. 2; Kiltubbrid L. 2; Loughaveely 2; Lurgan L. Upper 2; Montiaghs Moss 3; Moyrourkan L. 2; Railway Road 2, 3
	Cullentra L. 1, 2; Derrycloony L. 1, 2; L. Fadda 1, 2; Mullygruen L. 1, 2
Phosphuga atrata L.	Carrowcarlin 2; Cashel L. Lower 3; Clonalig L. 2; Drumlougher L. 1; Heron L. 3; Montiaghs Moss 2; Moyrourkan L. 2; Railway Road 2

	Cullentra L. 1, 2; Fymore L. 1, 2; L. Fadda 1, 2; Mullaghdrolly 1, 2; Mullygruen L. 1, 2
Thanatophilus rugosus (L.)	Derrycloony L., Mullygruen L.

STAPHYLINIDAE

Determined by Dr Roy Anderson.

Aleochara curtula (Goeze)	Crossbane L. 1; Dunmore 2; Moyrourkan L. 2
Anotylus rugosus (Fabr.)	Ballard 1; Carrowcarlin 2; Derryleckagh 1; Heron L. 1, 2; Lurgan L. Upper 1; Montiaghs Moss 2; Turmennan 1 Derrycloony L., Mullygruen L.
Atheta strandiella Brundin	Cullentra L., Derrycloony L., L. Fadda, Mullaghdrolly
Deubelia picina (Aubé)	Derrycloony L., Mullygruen L.
Dilacra luteipes (Erichson)	Lurgan L. Upper 17 June 1997
Drusilla canaliculata (Fabr.)	Castle Enigan 2; Derryadd L. 2; Drumlougher L. 2; Loughaveely 2; Montiaghs Moss 2
Erichsonius cinerascens (Gravenhorst)	Drumcarn 1
Gabrius coxalus (Hochhuth)	Carrowcarlin 2; Drumlougher L. 2
Geostiba circellaris (Gravenhorst)	Derryleckagh 2
Gymnusa brevicollis (Paykull)	Ballard 2, 10 June 1997; L. Money 1; Loughaveely 1
Gyrohypnus fracticornis (Müller)	Derryadd L. 1
Hygronoma dimidiata (Gravenhorst)	Derrycloony L.,
Lathrobium brunnipes (Fabr.)	Ballard 1; Cashel L. Lower 2; Clonalig L. 2; Drumcarn 1; Heron L. 1; Loughkeelan 1; Railway Road 10 June 1997
Lathrobium elongatum (L.)	Brackly L. 19 June 1997

Lathrobium fovulum Stephens	Ballynagross Lower 2
Lathrobium terminatum Gravenhorst	Ballard 2, 10 June 1997; Ballybannan 1; Carrowcarlin 1; Castle Enigan 1; Crossbane L. 1; Derryleckagh 1; Drumlougher L. 2; Drumnamether 1, 19 June 1997; L. Money 1; Loughkeelan 1; Moyrourkan L. 2; Railway Road 1, 2, 10 June 1997
	Cullentra L., Fymore L., Mullaghdrolly
Lesteva sicula Erichson	Brackagh Moss 1; Clonalig L. 1; Derryadd L. 1; Drumnamether 19 June 1997; Heron L. 1; Loughkeelan 1; Railway Road 1
	Mullaghdrolly, Mullygruen L.
Lesteva longoelytrata (Goeze)	Clonalig L. 1
Lesteva punctata Erichson	L. Money 1
Myllaena dubia (Gravenhorst)	Drumnamether 19 June 1997
Ocypus aeneocephalus (De Geer)	Fymore L.
Ocyusa maura (Erichson)	L. Fadda
Olophrum fuscum (Gravenhorst)	Cullentra L.
Olophrum piceum (Gyllenhal)	Drumcarn 1
Omalium rivulare (Paykull)	Loughaveely 1
Ontholestes tesselatus (Geoffroy)	Cullentra L.
Oxypoda elongatula Aubé	Moyrourkan L. 2
Oxytelus laqueatus (Marsham)	Loughaveely 1
Paederus riparius (L.)	Cashel L. Lower 1; Castle Enigan 2; Clonalig L. 1, 2, 17 June 1997; Corbally 2, 24 June 1997; Derryleckagh 1; Drumcarn 1; Drumlougher L. 2; Kiltubbrid Loughs 19

	June 1997; Loughaveely 2, 17 June 1997; Lurgan L. Upper 17 June 1997; Railway Road 1, 10 June 1997
	Cullentra L., Derrycloony L., Mullygruen L.
Philonthus carbonarius (Gravenhorst)	Brackagh Moss 1; Derryleckagh 1; Drumlougher L. 2; L. Money 2; Montiaghs Moss 1; Turmennan 1
Philonthus cognatus Stephens	Montiaghs Moss 1
Philonthus intermedius (Lacordaire)	Ballycam 1
	Derrycloony L.
Philonthus laminatus (Creutzer)	Ballynagross Lower 2; Derryadd L. 2
Philonthus marginatus (Ström)	Castle Enigan 1
	Cullentra L., L. Fadda, Mullygruen L.
Philonthus micans (Gravenhorst)	Brackly L. 3, 19 June 1997; Corbally 1; Greenan L. 1; Loughkeelan 1; Moyrourkan L. 2
Philonthus nigrita (Gravenhorst)	Ballard 1, 2, 10 June 1997; Ballynagross Lower 26 June 1997; Corbally 1; Drumnamether 19 June 1997; Greenan L. 2; Lurgan L. Upper 17 June 1997; Railway Road 10 June 1997
Philonthus quisquiliarius (Gyllenhal)	Ballynagross Lower 2; Corbally 1; L. Money 1
Philonthus tenuicornis Mulsant and Rey	Cullentra L., L. Fadda, Mullygruen L.
Philonthus varians (Paykull)	Ballybannan 1; Ballynagross Lower 2; Drumlougher L. 2; L. Money 1; Loughaveely 1; Montiaghs Moss 2
	Fymore L., Mullygruen L.

Quedius curtipennis Bernhauer	Crossbane L. 2; Lurgan L. Upper 1
	Cullentra L.
Quedius fuliginosus (Gravenhorst)	Ballard 1; Brackly L. 3; Carrowcarlin 1; Castle Enigan 1; Corbally 1; Derryleckagh 2; Drumlougher L. 2; Drumnamether 1, 19 June 1997; Lurgan L. Upper 1, 17 June 1997; Railway Road 1, 2, 10 June 1997
Quedius maurorufus (Gravenhorst)	Ballynagross Lower 26 June 1997; Corbally 1; Drumnamether 1; Kiltubbrid L. 19 June 1997; L. Money 1; Railway Road 1
Quedius molochinus (Gravenhorst)	Clonalig L. 17 June 1997
	Mullygruen L.
Staphylinus erythropterus L.	Cashel L. Lower 1; Derryleckagh 2; Drumlougher L. 2
	Mullygruen L.
Stenus bifoveolatus Gyllenhal	Castle Enigan 1; L. Money 1
Stenus bimaculatus Gyllenhal	L. Fadda
Stenus cicindeloides (Schaller)	Ballynagross Lower 26 June 1997; Drumnamether 19 June 1997; Montiaghs Moss 2; Railway Road 2
Stenus clavicornis (Scopoli)	Montiaghs Moss 1
Stenus fulvicornis Stephens	Drumlougher L. 2; Greenan L. 2; Railway Road 2
Stenus juno (Paykull)	Ballynagross Lower 2, 26 June 1997; Loughaveely 17 June 1997; Moyrourkan L. 2; Turmennan 1
	Mullaghdrolly, Mullygruen L.
Stenus latifrons Erichson	Moyrourkan L. 2
	L. Fadda,

Stenus nitens Stephens	Cashel L. Lower 1; Derryleckagh 1
Stenus pallitarsis Stephens	L. Money 1
Tachinus laticollis Gravenhorst	Lurgan L. Upper 17 June 1997
	Mullaghdrolly
Tachinus marginellus (Fabr.)	Drumnamether 1; Montiaghs Moss 2
Tachinus signatus Gravenhorst	Carrowcarlin 2; Lurgan L. Upper 1; Montiaghs Moss 1
	Cullentra L., Fymore L., Mullaghdrolly
Tachyporus chrysomelinus (L.)	Castle Enigan 1; Railway Road 2
Tachyporus dispar (Paykull)	Ballard 1
Tachyporus pallidus Sharp	Drumnamether 19 June 1997
Tachyporus transversalis	
Gravenhorst	Brackly L. 19 June 1997
Xantholinus linearis (Olivier)	Brackagh Moss 1; Castle Enigan 1; Drumlougher L. 2;
	Montiaghs Moss 1, 2
Zyras collaris (Paykull)	Corbally 24 June 1997; Greenan L. 1
	Mullygruen L.

PSELAPHIDAE

Determined by Dr Roy Anderson.

Brachygluta fossulata	
(Reichenbach)	Moyrourkan L. 2; Railway Road 10 June 1997
Brachygluta haematica	
(Reichenbach)	L. Fadda,
Pselaphus heisei Herbst	Cullentra L., L. Fadda 14 June 2000, Fymore L.
Rybaxis longicornis (Leach)	Drumnamether 1, 19 June 1997; Railway Road 3
	L. Fadda, Mullygruen L.
Trissemus impressus (Panzer)	Brackly L. 19 June 1997; Kiltubbrid Loughs 19 June

1997

SCARABAEIDAE

Determined by Dr Roy Anderson.

Aphodius fimetarius (L.)	Brackagh Moss 1
Aphodius fossor (L.)	Fymore L.
Aphodius prodromus (Brahm)	Brackly L. 1; Greenan L. 1; Loughkeelan 1
Aphodius rufipes (L.)	Kiltubbrid L. 2; Loughkeelan 2
	Mullygruen L.
Aphodius sphacelatus (Panzer)	Ballycam 1; Brackagh Moss 1; Corbally 1; Loughkeelan 1

HELOPHORIDAE

Determined by BN.

Helophorus aequalis Thomson	Ballard 10 June 1997; Ballybannan 1; Ballynagross Lower 26 June 1997; Crossbane L. 1; Drumcarn 1, 2; Drumnamether 1, 19 June 1997; Dunmore 2; Kiltubbrid Loughs 19 June 1997; L. Money 1; Loughaveely 17 June 1997; Loughkeelan 1; Lurgan L. Upper 17 June 1997; Railway Road 10 June 1997
	Fymore L. 1
Helophorus brevipalpis Bedel	Ballard 2; Ballybannan 1, 24 June 1997; Ballynagross Lower 1, 26 June 1997; Brackly L. 1; Clonalig L. 2; Corbally 24 June 1997; Crossbane L. 2; Drumlougher L. 1; Drumnamether 19 June 1997; Greenan L. 1; Kiltubbrid Loughs 19 June 1997; L. Money 1; Lurgan L. Upper 2, 17 June 1997
	Cullentra L. 1, Derrycloony L., Fymore L., L. Fadda,

	Mullaghdrolly
Helophorus flavipes Fabr.	Fymore L. 25 Aug 2000
Helophorus grandis Illiger	Ballybannan 1; Brackly L. 1; Corbally 1; Crossbane L. 1; Drumnamether 19 June 1997; Dunmore 2; Kiltubbrid L. 1, 19 June 1997; L. Money 1; Loughaveely 17 June 1997; Loughkeelan 1

HYDROPHILIDAE

Determined by BN and Dr Roy Anderson.

Anacaena globulus (Paykull)	Ballard 1, 2, 3; Ballybannan 1, 2; Brackly L. 1; Carrowcarlin 2, 3; Cashel L. Lower 1, 2, 3; Castle Enigan 2, 3; Clonalig L. 2; Derryadd L. 1, 3; Derryleckagh 1; Drumcarn 1, 2; Drumlougher L. 1, 2; Drumnamether 1, 19 June 1997; Dunmore 2; Heron L. 1, 2; Loughaveely 1, 2, 3, 17 June 1997; Lurgan L. Upper 1, 2, 3; Railway Road 1, 2, 3, 10 June 1997
	Cullentra L. 14 June 2000, Derrycloony L., L. Fadda
Anacaena limbata (Fabr.)	Ballard 10 June 1997; Ballynagross Lower 1, 26 June 1997; Brackagh Moss 3; Clonalig L. 2; Corbally 1, 24 June 1997; Drumlougher L. 1; Drumnamether 1; Heron L. 1; Kiltubbrid L. 1, 19 June 1997; Lurgan L. Upper 17 June 1997; Railway Road 10 June 1997
	Cullentra L. 2; Fymore L. 2; Mullygruen L.
Anacaena lutescens Stephens	Brackly L. 1; Derryadd L. 1; Drumlougher L. 2; Greenan L. 1; Moyrourkan L. 2; Railway Road 1
Cercyon convexiusculus Stephens	Ballynagross Lower 2; Brackagh Moss 1, 2, 3; Brackly L. 1; Carrowcarlin 1, 2; Castle Enigan 1; Corbally 1;

	Crossbane L. 1, 2; Drumlougher L. 1, 17 June 1997; Greenan L. 1; Heron L. 1, 2, 3; Kiltubbrid L. 1, 2; L. Money 1, 2; Loughaveely 1, 2; Loughkeelan 1, 2; Lurgan L. Upper 3, 17 June 1997; Moyrourkan L. 2, 3, 14 May 1997; Railway Road 1, 3; Turmennan 1
	Cullentra L., Derrycloony L., L. Fadda, Fymore L., Mullaghdrolly, Mullygruen L.
Cercyon haemorrhoidalis (Fabr.)	Ballynagross Lower 2
Cercyon impressus (Sturm)	Brackagh Moss 3; Heron L. 3; Kiltubbrid L. 2
	L. Fadda, Fymore L., Mullygruen L.
Cercyon lateralis (Marsham)	Ballynagross Lower 1; Brackagh Moss 2; Carrowcarlin 2; Derryleckagh 2
	L. Fadda, Fymore L.
Cercyon marinus Thomson	Ballynagross Lower 2; Brackly L. 1
Cercyon melanocephalus (L.)	Ballycam 1; Ballynagross Lower 2; Brackly L. 1; Loughaveely 2
	L. Fadda
Cercyon tristis (Illiger)	Corbally 1
	L. Fadda, Fymore L., Mullaghdrolly
Cercyon ustulatus (Preyssler)	Ballycam 1; Ballynagross Lower 1, 2; Brackly L. 1; Carrowcarlin 1, 2; Castle Enigan 1; Corbally 1; Crossbane L. 1, 2; Drumlougher L. 1; Greenan L. 1; Kiltubbrid L. 1; L. Money 1, 2; Loughaveely 1; Loughkeelan 1, 2
	Cullentra L. 2, Fymore L., Mullaghdrolly, Mullygruen L.
Chaetarthria seminulum (Herbst)	Castle Enigan 1; Corbally 1; Railway Road 1, 3

	Fymore L.
Coelostoma orbiculare (Fabr.)	Ballard 10 June 1997; Ballybannan 24 June 1997; Ballycam 1; Ballynagross Lower 1, 2; Brackagh Moss 1, 3; Brackly L. 1, 19 June 1997; Carrowcarlin 2, 3, 26 June 1997; Castle Enigan 2; Clonalig L. 17 June 1997; Corbally 1, 3, 24 June 1997; Crossbane L. 1, 2; Derryleckagh 2; Drumcarn 1; Drumlougher L. 1, 2; Drumnamether 1; Dunmore 2; Greenan L. 1; Kiltubbrid L. 1, 2, 3, 19 June 1997; L. Money 1, 2; Loughaveely 1, 17 June 1997; Loughkeelan 1; Lurgan L. Upper 17 June 1997; Moyrourkan L. 2, 14 May 1997; Railway Road 1, 10 June 1997.
	Cullentra L. 2, 14 June 2000, L. Fadda, Fymore L.
Cymbiodyta marginella (Fabr.)	Corbally 24 June 1997
Enochrus coarctatus (Gredler)	Brackly L. 1, 19 June 1997; Carrowcarlin 2, 3, 26 June 1997; Clonalig L. 2; Corbally 24 June 1997, Derryleckagh 1; Drumnamether 19 June 1997; Kiltubbrid Loughs 19 June 1997; L. Money 1; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997.
	Cullentra L. 14 June 2000, L. Fadda 14 June 2000
Enochrus ochropterus (Marsham)	Ballard 10 June 1997; Clonalig L. 2; Drumlougher L. 17 June 1997
Enochrus testaceus (Fabr.)	Clonalig L. 17 June 1997; Drumnamether 19 June 1997; Loughaveely 17 June 1997
	Fymore L. 25 Aug 2000; L. Fadda 14 June 2000

Hydrobius fuscipes (Linnaeus)	Ballard 10 June 1997; Ballybannan 1; Ballycam 1; Ballynagross Lower 1, 2, 3, 26 June 1997; Brackagh Moss 1, 2, 3; Brackly L. 1; Carrowcarlin 26 June 1997; Clonalig L. 17 June 1997; Corbally 1; Crossbane L. 1; Derryadd L. 2; Drumlougher L. 1; Drumnamether 1, 19 June 1997; Dunmore 2; Greenan L. 1; Kiltubbrid L. 2, 19 June 1997; L. Money 1, 2, 3; Loughaveely 17 June 1997; Loughkeelan 1, 2; Lurgan L. Upper 17 June 1997; Railway Road 1, 10 June 1997; Turmennan 1
	Cullentra L. 14 June 2000; Derrycloony L. 13 June 2000; Fymore L. 1; Mullaghdrolly 1
Laccobius biguttatus Gerhardt	Corbally 24 June 1997
Laccobius bipunctatus (Fabr.)	Ballybannan 1, 2; Ballycam 1, 2; Carrowcarlin 26 June 1997; Drumcarn 1; Kiltubbrid Loughs 19 June 1997; L. Money 1
	Fymore L.
Megasternum obscurum (Marsham)	Carrowcarlin 2; Cashel L. Lower 3; L. Money 1; Loughkeelan 2; Lurgan L. Upper 3; Moyrourkan L. 2, 3; Railway Road 1, 3
	Derrycloony L., Mullygruen L.
Sphaeridium lunatum Fabr.	Ballynagross Lower 2; Cashel L. Lower 1

HISTERIDAE

Determined by Dr Roy Anderson.

Hister unicolor L.	Drumlougher L. 2

SCIRTIDAE

Determined by Dr Roy Anderson.

Cyphon hilaris Nyholm	Ballard 2; Cashel L. Lower 2; Castle Enigan 2; Clonalig L. 2; Derryadd L. 2; Dunmore 2; Heron L. 2; Loughaveely 2; Lurgan L. Upper 2; Moyrourkan L. 2; Railway Road 2
	Cullentra L., Derrycloony, L. Fadda, Mullaghdrolly, Mullygruen L.
Cyphon ochraceus Stephens	Heron L. 2
Cyphon padi (L.)	Clonalig L. 1; Drumcarn 1
	Cullentra L.
Cyphon punctipennis Sharp	Ballard 1; Drumlougher L. 2; Loughaveely 1
Cyphon variabilis (Thunberg)	Ballycam 1; Clonalig L. 1; Derryleckagh 1
	Cullentra L., Derrycloony L., L. Fadda
Microcara testacea (L.)	Ballard 10 June 1997; Brackagh Moss 2; Clonalig L. 2; Lurgan L. Upper 17 June 1997; Moyrourkan L. 2
	L. Fadda; Mullaghdrolly

BYRRHIDAE

Determined by Dr Roy Anderson.

Cytilus sericeus (Forster)	Brackagh Moss 1; Drumcarn 1; Railway Road
	Fymore L.

DRYOPIDAE

Determined by Dr Roy Anderson.

Dryops luridus (Erichson)	Ballynagross Lower 1, 2; Cashel L. Lower 1; Corbally 1; Crossbane L. 1; Derryleckagh 1; Greenan L. 1; Kiltubbrid L. 1; Loughkeelan 1

	Derrycloony L., Fymore L.

ELATERIDAE

Determined by Dr Roy Anderson.

Hypnoidus riparius (Fabr.)	Montiaghs Moss 1, 2

CANTHARIDAE

Determined by Dr Roy Anderson.

Cantharis cryptica Ashe	Montiaghs Moss 2
	Cullentra L.
Cantharis figurata Mannerheim	Greenan L. 2
	L. Fadda, Fymore L.
Cantharis nigra De Geer	Castle Enigan 2; Derryleckagh 2; Drumnamether 19 June 1997; Lurgan L. Upper 17 June 1997; Moyrourkan L. 2
	Fymore L.
Cantharis pallida Goeze	L. Money 2
Cantharis rufa L.	Fymore L.
Cantharis thoracica (Olivier)	Ballynagross Lower 2; Brackagh Moss 2; Greenan L. 2; Heron L. 2; L. Money 2; Loughaveely 2; Loughkeelan 26 June 1997; Moyrourkan L. 2
	Cullentra L., Derrycloony L., L. Fadda, Mullygruen L.
Rhagonycha fulva (Scopoli)	Montiaghs Moss 2
	Fymore L.

BRACHYPTERIDAE

Determined by Dr Roy Anderson.

Kateretes pedicularius (L.)	L. Fadda
Kateretes rufilabris (Latreille)	Lurgan L. Upper 17 June 1997

COCCINELLIDAE

Determined by BN.

Coccidula rufa (Herbst)	Drumlougher L. 2; Montiaghs Moss 1
Coccinella hieroglyphica L.	Derrycloony L. 25 Aug 2000
Coccinella septempunctata L.	Greenan L. 1
Propylea quattuordecimpunctata L.	Brackly L. 19 June 1997
Psyllobora vigintiduopunctata L.	Fymore L. 13 June 2000

CORTICARIIDAE

Determined by Dr Roy Anderson.

Enicmus histrio Joy and Tomlin	L. Money 2

CERAMBYCIDAE

Determined by BN.

Rhagium bifasciatum Fabr.	Fymore 13 June 2000

CHRYSOMELIDAE

Donacia and *Plateumaris* spp. determined by BN; others determined by Dr Roy Anderson.

Altica oleracea (L.)	Ballard 1; Brackly L. 19 June 1997; Castle Enigan 1; Clonalig L. 1; Drumlougher L. 2, 17 June 1997; Railway Road 1, 10 June 1997
Aphthona lutescens (Gyllenhal)	Derryleckagh 1
Asiorestia ferruginea (Fabr.)	Montiaghs Moss 2
Chaetocnema concinna (Marsham)	Ballynagross Lower 1
Donacia bicolora Zschach	Kiltubbrid Loughs 19 June 1997
	Fymore L. 13 June 2000

Donacia clavipes Fabr.	L. Fadda 14 June 2000
Donacia impressa Paykull	Loughaveely 17 June 1997, Lurgan L. Upper 17 June 1997
Donacia obscura Gyllenhal	Cullentra L. 14 June 2000
Donacia thalassina Germar	Cullentra L. 14 June 2000
Donacia vulgaris Zschach	Fymore L. 13 June 2000
Galerucella lineola (Fabr.)	Cullentra L., Derrycloony L.
Galerucella nymphaeae (L.)	Ballybannan 24 June 1997, Clonalig L. 1; Drumcarn 2; Drumlougher L. 17 June 1997; Loughaveely 2; Lurgan L. Upper 1, 2, 17 June 1997; Moyrourkan L. 2
Galerucella pusilla (Duftschmid)	Mullygruen L.
Galerucella sagittariae (Gyllenhal)	Drumnamether 1
Galerucella tenella (L.)	Loughkeelan 1
Altica palustris Weise	Cullentra L., Fymore L.
Hydrothassa marginella (L.)	Montiaghs Moss 1
	Fymore L.
Lochmaea crataegi (Forster)	Cashel L. Lower 1
Lochmaea suturalis (Thomson)	L. Fadda
Longitarsus gracilis Kutschera	Fymore L.
Longitarsus holsaticus (L.)	Ballynagross Lower 1; Derryleckagh 1; Dunmore 2; Loughkeelan 1
Longitarsus luridus (Scopoli)	Brackagh Moss 1; Cashel L. Lower 2; Castle Enigan 1; Derryleckagh 1; Drumnamether 1; Greenan L. 1; L. Money 1, 2; Montiaghs Moss 2; Railway Road 1

Longitarsus melanocephalus (De Geer)	Clonalig L. 1; Greenan L. 1 Fymore L.
Phaedon cochleariae (Fabr.)	Ballynagross Lower 26 June 1997; Drumnamether 19 June 1997 Fymore L.
Phyllotreta exclamationis (Thunberg)	Brackagh Moss 1; Brackly L. 19 June 1997; Castle Enigan 1; Clonalig L. 1; Corbally 1, 2; Crossbane L. 1, 2; Derryleckagh 1; L. Money 1; Loughaveely 1 2, 17 June 1997; Loughkeelan 26 June 1997; Moyrourkan L. 1; Railway Road 1 Cullentra L., Derrycloony L., Fymore L., Mullaghdrolly
Phyllotreta flexuosa (Illiger)	Corbally 2; Crossbane L. 2; Drumlougher L. 2; Drumnamether 1; Greenan L. 1, 2; Loughaveely 1; Railway Road 10 June 1997 Cullentra L.
Plateumaris discolor (Panzer)	Crossbane L. 19 June 1997
Plateumaris sericea (L.)	Ballard 2; Dunmore 2
Prasocuris junci (Brahm)	Fymore L.
Prasocuris phellandrii (L.)	Ballynagross Lower 1, 2, 26 June 1997; Greenan L. 2 Derrycloony L. 25 Aug 2000; Fymore L.
Psylliodes chrysocephala (L.)	Fymore L.

BRENTIDAE

Determined by Dr Roy Anderson.

Apion virens Herbst	L. Money 2

CURCULIONIDAE

Determined by Dr Roy Anderson.

Alophus triguttatus (Fabr.)	Ballynagross Lower 1
Anoplus plantaris (Naezen)	Drumlougher L. 2
Bagous collignensis (Herbst)	Drumlougher L. 1; Loughaveely 1; Moyrourkan L. 3
	Cullentra L.
Barynotus obscurus (Fabr.)	Corbally 2
Barypeithes araneiformis (Schrank)	Castle Enigan 2
	Derrycloony L., Fymore L.
Barypeithes pellucidus (Boheman)	Brackagh Moss 2
	Mullaghdrolly
Dorytomus taeniatus (Fabr.)	Railway Road 10 June 1997
Gymnetron villosulum Gyllenhal	Drumnamether 19 June 1997
Leiosoma deflexum (Panzer)	Railway Road 1
Limnobaris dolorosa (Goeze)	Ballard 10 June 1997; Brackagh Moss 1; Corbally 2; Crossbane L. 19 June 1997; Drumnamether 19 June 1997; Loughaveely 2; Lurgan L. Upper 17 June 1997
	Derrycloony L., Fymore L.
Liophloeus tessulatus (Müller)	L. Fadda
Notaris acridulus (Fabr.)	Ballynagross Lower 1; Crossbane L. 1
Pelonomus quadrituberculatus (Fabr.)	Loughkeelan 1
Rhinoncus pericarpius (L.)	Brackagh Moss 1
	Derrycloony L.
Rhynchaenus fagi (L.)	L. Fadda

Sitona lineatus (L.)	Castle Enigan 1; Drumnamether 1; Greenan L. 1; L. Money 1
Thryogenes nereis (Paykull)	Drumnamether 19 June 1997

HEMIPTERA: HETEROPTERA

Nomenclature and the order of families follow Aukema and Reiger (1995, 1996, 1999, 2001). All determined by BN.

NEPIDAE

Nepa cinerea L.	Ballard 1, 10 June 1997; Ballybannan 1, 2; Ballycam 1; Ballynagross Lower 3, 26 June 1997; Brackagh Moss 1; Brackly L. 1, 3; Castle Enigan 2; Clonalig L. 1, 17 June 1997; Corbally 1, 2, 3, 24 June 1997; Crossbane L. 1, 2, 19 June 1997; Derryadd L. 1; Drumcarn 1, 2; Dunmore 2; Drumlougher L. 1; Greenan L. 1; Kiltubbrid L. 1; L. Money 2; Lurgan L. Upper 17 June 1997; Moyrourkan L. 1, 3, 14 May 1997
	Cullentra L. 14 June 2000; Derrycloony L. 13 June 2000; Fymore L. 1; L. Fadda 1, 14 June 2000; Mullygruen L. 1, 2

CORIXIDAE

Callicorixa praeusta (Fieber)	Derrycloony L. 25 Aug 2000; Fymore L. 25 Aug 2000
Corixa dentipes (Thomson)	Corbally 24 June 1997
	Fymore L. 13 June 2000, 25 Aug 2000
Cymatia bonsdorffii (C. Sahlberg)	Fymore L. 13 June 2000, 26 Aug 2000
Hesperocorixa castanea (Thomson)	Ballard 10 June 1997

Hesperocorixa linnaei (Fieber)	Clonalig L. 17 June 1997; Corbally 24 June 1997; Drumnamether 19 June 1997; Loughaveely 17 June 1997 Derrycloony L. 25 Aug 2000
Hesperocorixa sahlbergi (Fieber)	Ballynagross Lower 26 June 1997
Sigara distincta (Fieber)	Corbally 24 June 1997
Sigara dorsalis (Leach)	Ballynagross Lower 26 June 1997
Sigara falleni (Fieber)	Derrycloony L. 25 Aug 2000; Fymore L. 25 Aug 2000
Sigara fossarum (Leach)	Cashel L. Upper 10 June 1997; Corbally 24 June 1997 Derrycloony L. 25 Aug 2000
Sigara scotti (Douglas and Scott)	Crossbane L. 19 June 1997
Sigara semistriata (Fieber)	Corbally 24 June 1997; Crossbane L. 19 June 1997
NOTONECTIDAE	
Notonecta glauca L.	Crossbane L. 19 June 1997; Loughaveely 1 Derrycloony L. 13 June 2000; Fymore L. 13 June 2000
HEBRIDAE	
Hebrus ruficeps (Thomson)	Brackly L. 19 June 1997; Castle Enigan 1; Kiltubbrid L. 3, 19 June 1997 L. Fadda 2
HYDROMETRIDAE	
Hydrometra stagnorum (L.)	Ballycam 1; Ballynagross Lower 26 June 1997; Cashel L. Upper 10 June 1997; Corbally 24 June 1997; Derryleckagh 2; Loughaveely 17 June 1997 Derrycloony L. 13 June 2000; Fymore L. 13 June 2000
VELIIDAE	
Microvelia reticulata (Burmeister)	Brackly L. 1; Drumlougher L. 17 June 1997;

	Loughaveely 17 June 1997
	Derrycloony L. 2, 25 Aug 2000
Velia caprai Tamanini	Ballynagross Lower 2
	L. Fadda 2; Fymore L. 13 June 2000
Velia saulii Tamanini	Brackly L. 1; Crossbane L. 1
GERRIDAE	
Gerris argentatus Schummel	Cashel L. Upper 10 June 1997; Crossbane L. 19 June 1997; Drumlougher L. 1; Kiltubbrid L. 3; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997
	Fymore L. 13 June 2000; L. Fadda 14 June 2000
Gerris lacustris (L.)	Ballard 10 June 1997; Cashel L. Upper 10 June 1997; Drumcarn 2; Drumnamether 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997; Montiaghs Moss 3
	Derrycloony L. 13 June 2000; Fymore L. 13 June 2000
Gerris lateralis Schummel	Ballybannan 1, 24 June 1997; Ballycam 1; Ballynagross Lower 2, 26 June 1997; Clonalig L. 1; Greenan L. 1; L. Money 2
	Mullaghdrolly 1
Gerris odontogaster (Zetterstedt)	Ballybannan 1; Brackly L. 1; Clonalig L. 2; Corbally 24 June 1997; Crossbane L. 17 June 1997; Drumnamether 1
	Fymore L. 25 Aug 2000
Limnoporus rufoscutellatus (Latreille)	Loughaveely 17 June 1997

SALDIDAE

Chartoscirta cincta (Herrich-Schaeffer)	Ballard 1; Ballybannan 1, 24 June 1997; Ballycam 1; Ballynagross Lower 1, 26 June 1997; Brackagh Moss 1; Brackly L. 1, 19 June 1997; Castle Enigan 1; Clonalig L. 1, 17 June 1997; Crossbane L. 1; Derryleckagh 1; Drumcarn 1; Drumnamether 19 June 1997; Drumlougher L. 1; Greenan L. 1, 2; Kiltubbrid L. 2, 19 June 1997; L. Money 1; Loughaveely 17 June 1997; Loughkeelan 1; Lurgan L. Upper 17 June 1997; Moyrourkan L. 14 May 1997; Railway Road 10 June 1997; Turmennan 1 Derrycloony L. 1, 2, 25 Aug 2000; Fymore L. 25 Aug 2000; Mullaghdrolly 2; Mullygruen L. 2
Salda littoralis (L.)	Fymore L. 13 June 2000
Salda morio (Zetterstedt)/ *muelleri* (Gmelin)	Ballynagross Lower 2; Derryleckagh 2; Moyrourkan L. 2 Fymore L. 2; Mullaghdrolly 1, 2; Mullygruen L. 2
Saldula saltatoria (L.)	Ballybannan 1; Brackly L. 1; Crossbane L. 1; Greenan L. 2; L. Money 1; Loughkeelan 1 Derrycloony L. 2, 25 Aug 2000; Mullaghdrolly 1, 2

TINGIDAE

Dictyla convergens (Herrich-Schaeffer)	Ballynagross Lower 26 June 1997; Brackly L. 17 June 1997

MIRIDAE

Grypocoris stysi (Wagner)	Loughaveely 17 June 1997
Capsus ater (L.)	Ballybannan 24 June 1997; Drumnamether 19 June 1997
Cyrtorhinus caricis (Fallén)	Fymore L. 25 Aug 2000
Heterocordylus tibialis (Hahn)	Drumlougher L. 15 June 1997; Drumnamether 19 June 1997
Phytocoris tiliae (Fabr.)	Montiaghs Moss 28 Aug 1997
Pithanus maerkeli (Herrich-Schaeffer)	Ballynagross Lower 26 June 1997
	L. Fadda 2
Psallus haematodes (Gmelin)	Derrycloony L. 25 Aug 2000
Stenodema calcarata (Fallén)	Crossbane L. 19 June 1997; Drumnamether 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997
	Derrycloony L. 25 Aug 2000

NABIDAE

Nabis lineatus Dahlbom	Mullygruen L. 2

ANTHOCORIDAE

Anthocoris confusus Reuter	Montiaghs Moss 28 Aug 1997
Anthocoris nemorum (L.)	Drumlougher L. 15 June 1997
	Fymore L. 25 Aug 2000
Temnostethus gracilis Horváth	Fymore L. 25 Aug 2000

LYGAEIDAE

Chilacis typhae (Perris)	Clonalig L. 17 June 1997
Drymus sylvaticus (Fabr.)	Mullaghdrolly 2; Mullygruen L. 2

Pachybrachius fracticollis (Schilling)	Clonalig L. 17 June 1997; Corbally 24 June 1997; Drumlougher L. 17 June 1997; Drumnamether 19 June 1997; Kiltubbrid L. 19 June 1997; Loughaveely 1, 17 June 1997; Lurgan L. Upper 17 June 1997; Moyrourkan L. 14 May 1997; Railway Road 10 June 1997 Mullaghdrolly 2; Mullygruen L. 10 May 2000, 12 June 2000
Stygnocoris sabulosus (Schilling)	Lurgan L. Upper 3; Moyrourkan L. 3 Mullaghdrolly 2; Mullygruen L. 2
Cymus glandicolor Hahn	Brackagh Moss 3; Clonalig L. 17 June 1997; Corbally 24 June 1997; Drumlougher L. 17 June 1997; Kiltubbrid L. 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997 Derrycloony L. 13 June 2000; Mullygruen L. 12 June 2000

PENTATOMIDAE

Picromerus bidens (L.)	Cullentra L. 2 Aug 2000
Zicrona caerulea (L.)	Cullentra L. 1

HEMIPTERA: AUCHENORRHYNCHA

Determined by BN.

CERCOPIDAE

Aphrophora alni (Fallén)	Mullaghdrolly 2
Neophilaenus lineatus (L.)	Mullaghdrolly 2
Philaenus spumarius (L.)	Derrycloony L. 2; Mullaghdrolly 2

CICADELLIDAE

Ulopa reticulata (Fabr.)	Ballard 1

DELPHACIDAE

Chloriona smaragdula (Stål)	Corbally 24 June 1997
Conomelus anceps (Germar)	Mullaghdrolly 2

HYMENOPTERA

Determined by BN.

APIDAE

Bombus lucorum L.	Ballard 28 July 1997
	Cullentra L. 14 June 2000, L. Fadda 14 June 2000
Bombus muscorum (L.)	Clonalig L. 28 Aug 1997; Railway Road 28 Aug 1997
Bombus pascuorum (Scopoli)	Cullentra L. 14 June 2000, L. Fadda 14 June 2000

DIPTERA

Determined by BN.

STRATIOMYIDAE

Oplodontha viridula (Fabr.)	Kiltubbrid L. 19 June 1997

SYRPHIDAE

Chrysotoxum bicinctum (L.)	Fymore L. 26 June 2000
Sericomyia silentis (Harris)	Ballard 28 Aug 1997
	Fymore L. 26 June 2000, 2 Aug 2000

TABANIDAE

Chrysops sepulchralis (Fabr.)	Drumlougher L.; Loughaveely 17 June 1997; Lurgan L. 17 June 1997

DERMAPTERA

Determined by BN.

FORFICULIDAE

Forficula auricularia L.	Ballard 2

ORTHOPTERA

Determined by BN.

ACRIDIDAE

Omocestus viridulus (L.)	Ballynagross 2; Corbally 2, 28 July 1997; Kiltubbrid L. 19 June 1997; Loughaveely 3; Loughkeelan 28 July 1997; Montiaghs 2

TETRIGIDAE

Tetrix subulata (L.)	Corbally 1; Kiltubbrid L. 2
Tetrix undulata (Sowerby)	Ballybannan 1; Carrowcarlin 1: Castle Enigan 1; Clonalig L. 1, 2, 17 June 1997; Drumcarn 2; Kiltubbrid L. 19 June 1997; Loughkeelan 1; Montiaghs 2, 3

ODONATA

Determined by BN.

AESHNIDAE

Aeshna grandis (L.)	Cullentra L. 14 June 2000, 26 June 2000; Derrycloony L. 2 Aug 2000; L. Fadda 26 June 2000, 2 Aug 2000
Brachytron pratense (Müller)	Cullentra L. 14 June 2000; L. Fadda 14 June 2000

COENAGRIONIDAE

Coenagrion puella (L.)	Clonalig L. 17 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997
Coenagrion pulchellum (Vander Linden)	Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997
	Cullentra L. 10 May 2000; L. Fadda 14 June 2000
Ischnura elegans (Vander Linden)	Ballybannan 24 June 1997; Brackly L. 17 June 1997; Cashel L 10 June 1997; Clonalig L. 17 June 1997; Drumnamether 19 June 1997; Kiltubbrid L. 19 June 1997; Loughaveely 17 June 1997; Lurgan L. Upper 17 June 1997
	Fymore L. 10 May 2000; L. Fadda 14 June 2000
Pyrrhosoma nymphula (Sulzer)	L. Fadda 14 June 2000

LESTIDAE

Lestes sponsa (Hansemann)	Ballard 28 Aug 1997

LIBELLULIDAE

Libellula quadrimaculata L.	Clonalig L. 17 June 1997; Crossbane L. 19 June 1997; Drumnamether 19 June 1997; Kiltubbrid L. 19 June 1997; Lurgan L. Upper 17 June 1997
	Cullentra L. 14 June 2000; L. Fadda 14 June 2000; Fymore L. 2 Aug 2000
Sympetrum danae (Sulzer)	Ballard 23 Sept 1997
Sympetrum sanguineum (Müller)	Brackagh Moss 23 Sept 1997; Clonalig L. 23 Sept 1997

Sympetrum striolatum (Charpentier)	Ballard 23 Sept 1997; Cashel L. 23 Sept 1997; Clonalig L. 23 Sept 1997; Dunmore 3; L. Money 3; Lurgan L. Upper 23 Sept 1997 Fymore L. 2 Aug 2000

LEPIDOPTERA

Determined by BN.

PIERIDAE

Anthocaris cardamines (L.)	Cullentra L. 10 May 2000; Derrycloony L. 10 May 2000; Fymore L. 10 May 2000
Pieris napi (L.)	Ballard 10 June 1997; Ballybannan 28 July 1997; Ballycam 28 July 1997; Ballynagross Lower 28 July 1997; Corbally 28 July 1997; Carrowcarlin Fen 28 July 1997; Castle Enigan 28 July 1997; Clonalig L. 13 May 1997; Dunmore Fen 28 July 1997; Greenan L. 28 July 1997; Heron L. 28 July 1997; L. Money 28 July 1997; Loughkeelan 28 July 1997; Lurgan L. Upper 13 May 1997; Moyrourkan L. 29 July 1997; Railway Road 28 July 1997 Cullentra L. 10 May 2000; Derrycloony L. 10 May 2000; Fymore L. 10 May 2000

LYCAENIDAE

Polyommatus icarus Rottemberg	Ballard 28 July 1997

SATYRIDAE

Maniola jurtina (L.)	Ballard 28 July 1997; Ballynagross Lower 28 July 1997;

	Corbally 24 June 1997; Carrowcarlin 28 July 1997; Dunmore 28 July 1997; Kiltubbrid L. 19 June 1997; L. Money 28 July 1997; Loughaveely 29 July 1997; Loughkeelan 28 July 1997; Moyrourkan L. 29 July 1997; Railway Road 28 July 1997
	Derrycloony L. 26 June 2000; Fymore L. 26 June 2000
Aphantopus hyperantus (L.)	Ballybannan 28 July 1997; Carrowcarlin 26 June 1997; Loughkeelan 26 June 1997
NYMPHALIDAE	
Aglais urticae L.	Ballycam 28 July 1997; Loughaveely 28 Aug 1997; Lurgan L. Upper 28 Aug 1997
ARCTIIDAE	
Tyria jacobaea (L.)	Ballybannan 24 June 1997; Railway Road 10 June 1997 Fymore L. 26 June 2004

MEGALOPTERA

SIALIDAE

Sialis lutaria L.	Brackly L. 18 April 1997

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AN UPDATE ON BLACKFLY SPECIES (DIPTERA: SIMULIIDAE) AND THEIR DISTRIBUTIONS IN IRISH FRESHWATER HABITATS

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Summary

Collation of simuliid records from published and unpublished sources, museum records and identification of preserved simuliid specimens from projects based at University College Dublin was undertaken. It was supplemented by field sampling of both larvae and pupae in under-represented national grid squares. This resulted in records from 322 10km squares of the Irish national grid for the Simuliidae (blackflies). Records for eighteen species and three species pairs were updated. One additional species was encountered, a member of the *Simulium tuberosum* (Lundström, 1911) complex. This brings the total number of simuliid species for Ireland to twenty-seven or twenty-eight if *S. naturale* Davies is included. Two species previously recorded in Ireland: *S. latipes* and *S. juxtacrenobium* were not encountered during this study. Species distribution maps (plotted on Geographical Information Systems using Arcview Software) were compiled.

Introduction

Simuliids or blackflies are dipterans, which are commonly encountered in limnological investigations and have generally been recorded as 'Simuliidae spp.' (Bass, 1990). They are rarely identified to species level because of the lack of taxonomic expertise on this group and difficulties encountered in identification. There are 32 species recorded in Britain (Bass, 1998). Crosskey (1991) listed 23 species as being present in Ireland. This increased to 25 species (excluding *Simulium naturale*, a sibling species of *Simulium vernum*) in the checklist compiled by Ashe *et al.* (1998).

A small number of publications provide identifications of simuliids to species level (Bass, 1990; Dowling, O'Connor and O'Grady, 1981; Fahy, 1972a, 1972b, 1973, 1975a, 1975b; Frost, 1942; Schröder, 1988; Schröder and Schweder, 1986; Wright *et al.*, 2000) but these tend to be limited geographically. Four of the studies (Bass, 1990; Dowling *et al.*, 1981; Schröder, 1988; Schröder and Schweder, 1986) were concentrated in Co. Kerry. Frost (1942) investigated two sites on the River Liffey. Wright *et al.* (2000) surveyed the macroinvertebrate fauna of Northern Ireland. Until recently, the study by Fahy (1972a) covered the widest geographical area with 46 sites. Crosskey (2004) gives details of simuliid distributions from a collection made in the early 1970's from seventy-one 10km squares. Both studies provide valuable distribution data but are dated. Only five publications actually focus on simuliids (Bass, 1990; Crosskey, 2004; Fahy, 1972a; Schröder, 1988; Schröder and Schweder, 1986).

The publications cover a wide time period. Identifications made from collections do not necessarily reflect the publication date. The most recently collected records were made in 1990 (Wright *et al.,* 2000) with occasional sampling carried out from 1990 to 1993. Thus the present project was initiated to collate and update the information available on the distribution of simuliid species in Irish freshwaters.

Materials and methods

A literature survey was carried out to locate and extract all references to the species of Simuliidae found in Ireland. The collection of simuliid specimens held in the Natural History Museum, Dublin, was consulted and details noted. Preserved material, collected from 1999 to 2003 inclusive, for projects based at the Limnology Unit, Department of Zoology, University College Dublin was made available for identification. This was supplemented by field sampling of both larvae and pupae in under-represented national grid squares. For each record, a national grid reference was derived where none was provided. If a precise location could not be ascertained for a record, it was assigned to the appropriate 10km square.

The standard FBA key (Bass, 1998) was used for the determination of specimens. Only last instar larvae and pupae were identified. Species-level identification was carried out on suitable material only. A number of species can only be identified as adults. These were recorded as species pairs and refer to six species. The information collected was compiled into a database. An overview of the distribution of each species and species pairs is presented on a series of maps prepared using ArcView software on a Geographical Information Systems (GIS). A distribution map for each species is presented. The 10km square distribution is also given for each species and is summarised as follows:-

10km square distribution: this is the total number of 10km squares for the combined records. However, the number of dots on a map may exceed the total number of 10km squares because there may be more than one record per 10km square.

Unpublished: these are the records resulting from identifications made for this study combined with the Northern Ireland data. Distributions can overlap with lists for published data and *vice versa*.

Published: these are all the records from published literature. Museum records are also included in this category.

Results

The Museum collection contained sixteen species of Simuliidae (Table 1). Their geographic distribution covered fourteen 10km squares. Details of the collection are given in Appendix I, Table 1. The published literature provided records for an additional ten species (Table 1) covering one hundred and nineteen 10km squares. A summary of the species lists with the source publications is presented in Appendix I, Table 2. A number of publications are not included because they provide no additional information on distribution. They are the three published species checklists by Ashe *et al.* (1998), Crosskey (1991), Crosskey and Howard (1997) and two other publications of Schröder (1987) and Bass and Brockhouse (1990). Wright *et al.* (2000) gave a species list but no locations. However, permission was obtained to use the simuliid data with locations from a report on the same study (Wright *et al.*, 1995). This extended the distribution maps into Northern Ireland and covered an additional sixty 10km squares.

The current study resulted in the updating of the records for eighteen species and the three species pairs (Table 1). The species pairs can only be separated as adults. One additional species was encountered, *Simulium tuberosum* Lundström (Tierney and Kelly-Quinn, 2005). This brings the total number of simuliid species for Ireland to twenty-seven or twenty-eight if *S. naturale* Davies is included. The recent records cover one hundred and eighty-six 10km squares. In all, the combined records for the twenty-seven species comprise three hundred and twenty-two 10km squares. There is an overlap of fifty-seven 10km squares between the published and unpublished data. Two previously recorded species, *S. juxtacrenobium* Bass and Brockhouse, 1990 and *S. latipes* (Meigen, 1804) were not encountered.

Distribution of species

A map of Ireland with the county boundaries and the 10km squares of the national grid delineated is presented in Fig. 1. Species distributions by county are summarised in Table 2.

Prosimulium

To date all three species of *Prosimulium* have only been recorded from streams in the Wicklow Mountains.

***Prosimulium hirtipes* (Fries)**

The sole published record of *Prosimulium hirtipes* is from the River Liffey at Ballysmuttan (Frost, 1942). There is no specimen of this species in the Natural History Museum. One larva was collected during the present study from the Cloghoge River, Co. Wicklow. *P. hirtipes* is a single generation species with pupation occurring in April and May. It has been found mainly in small streams in upland areas (Bass, 1998).

10km square distribution:1 (Fig. 2)

Unpublished: O1.

Published: O1.

***Prosimulium latimucro* (Enderlein)**

There is a specimen of this species in the Natural History Museum from Glencree and two published records (Crosskey, 2004) of specimens collected in the early 1970s. *Prosimulium latimucro* was collected from the Cloghoge River, the Annalecka Brook and the Lugduff Brook, all in Co. Wicklow in the present study. This species is considered to have a restricted distribution, being confined to high mountain streams (Bass, 1998).

10km square distribution: 5 (Fig. 3)

Unpublished: (4), O1, O10, O11, T19.

Published: (2), O11, T9.

***Prosimulium tomosvaryi* (Enderlein)**

Fahy (1972a, 1973) recorded *Prosimulium tomosvaryi* from T1899 and Glenmalur, Co. Wicklow, respectively. There are larval specimens from the Derrypark Stream, Powerscourt, Enniskerry, Co. Wicklow in the Natural History Museum. It was also recorded in the present study from the Cloghoge River, Co.Wicklow.

10km square distribution: 5 (Fig. 4)

Unpublished: (2) O10, O11.

Published: (4) O1, O11, T9, T19.

Simulium

Subgenus *Hellichiella*

***Simulium (Hellichiella) latipes* (Meigen)**

There are several adult specimens in the Natural History Museum but the exact locations are only known for two specimens. There are two published records from south-west Kerry (Bass, 1990) and Foxford, Co. Mayo (Crosskey, 1985; Crosskey, 2004). *Simulium latipes* was not collected during the current project. According to Bass (1998), *S. latipes* is a rare but widespread species restricted to a single spring generation by its choice of habitat - temporary water bodies.

10km square distribution: 4 (Fig. 5)

Published: (4), GO, G20, O21, V55.

Subgenus *Nevermannia*

***Simulium (Nevermannia) angustitarse* (Lundström)**

There is one published record of *Simulium angustitarse* (Fahy, 1972a) and an adult specimen in the Museum. One pupa was collected during the current project from Spancelhill River, Co. Clare. This species has a limited distribution and occurs in low numbers. It is generally found in streams.

10km square distribution: 3 (Fig. 6)

Unpublished: (1), R38.

Published: (2), M26, M95.

***Simulium (Nevermannia) lundstromi* (Enderlein)**

There are two published records (Bass, 1990; Schröder and Schweder, 1986) of *Simulium lundstromi*, both from Co. Kerry. There are no specimens in the Museum. It was recorded at an additional six locations in the present study all in lowland agricultural areas. The species is probably widespread in distribution but with a specific habitat preference for lowland rivers. The larvae are readily recognisable by the grey smear that runs approximately half way from the postgenal cleft to the hypostomium.

10km square distribution: 8 (Fig. 7)

Unpublished: (6), M48, M88, N66, N83, R58, S78.

Published: (2), Q40, V55.

Simulium (_Nevermannia_) _cryophilum_ (Rubtsov) complex

There are extensive published records for the species complex, the most recent based on specimens collected from 1990-1993 (Wright *et al.*, 2000). It was also frequently encountered in this study. The Museum had no specimens. The species complex has a widespread distribution and is typically found in small to medium size streams.

10km square distribution: 111 (Fig. 8)

Unpublished: (73) B91, C60, D2, D31, G1, G3, G31, G41, G43, G78, G88, H4, H6, H12, H14, H37, H55, J18, J21, J31, J33, J49, M18, M29, N20, N92, N98, O0, O1, O10, O11, O12, O21, R32, R38, R46, R59, R72, R81, R82, R83, R85, R91, R95, R96, S4, S5, S21, S29, S43, S52, S62, S67, S68, S78, S84, S92, S97, S99, T1, T9, T17, T19, T27, V78, W6, W8, W28, W39, W46, W57, W58, W79.

Published: (48) B90, F50, F83, F90, G52, G74, G78, G98, J1, L55, L75, L76, L86, L96, M5, M33, N38, N48, N97, O0, O10, O11, Q40, Q41, Q50, R83, S10, S22, S65, S84, T15, T19, V9, V39, V55, V56, V66, V68, V77, V78, V79, V86, V94, V96, V98, W6, W8, W17.

Simulium (_Nevermannia_) _vernum_ Macquart complex

There are both published and Museum records of this species complex. Wright *et al.* (2000) provides the most recent record. It has a widespread distribution in Ireland, occurring mainly in streams and small rivers often with *Simulium cryophilum* or *S. armoricanum*.

10km square distribution: 49 (Fig. 9)

Unpublished: (31) G1, G3, G20, G41, G78, G88, H48, H55, H68, M2, M13, M18, M19, M29, O0, O1, O10, O11, O21, R59, R91, S68, S78, S82, S84, S89, S97, S99, T27, V78, W8.

Published: (25) B90, G52, G78, G89, G98, M26, N48, N20, N76, N85, O0, O1, O2, O10, O11, R91, S10, S22, T9, T15, V55, V66, V78, V86, V89.

Simulium (_Nevermannia_) _juxtacrenobium_ Bass and Brockhouse

Bass (1990) found this species, the first and only existing record, in south-west Kerry. It has a single generation in early spring and has mainly been recorded from acid streams (Bass, 1990; Brockhouse and Bass, 1990). *Simulium juxtacrenobium* was not encountered in the present study.

10km square distribution: 2 (Fig. 10)

Published: (2) V55, V98.

***Simulium (Nevermannia) armoricanum* Doby and David**

Crosskey (2004) recorded *Simulium armoricanum* from several sites. There are no Museum specimens The species is mainly confined to fast flowing streams in mountainous areas.

10km square distribution: 31 (Fig. 11)

Unpublished: (28) G3, G20, G31, G52, G78, G88, G94, M29, N20, O0, O1, O10, O11, O12, O21, O93, R59, R82, R91, S21, S84, S99, T9, T17, T18, T19, V85, W46.

Published: (9) F50, O0, O10, O11, S84, T19, V85, V94, W6.

***Simulium (Nevermannia) urbanum* Davies and *Simulium (Nevermannia) dunfellense* Davies**

Simulium dunfellense and S. *urbanum* can only be identified to species level at the adult stage. Crosskey (2004) recorded *S. dunfellense* from four sites. There are also adult specimens in the Museum collection, the most recent collected in 1981. The published record for S. *urbanum* is more than thirty years old (Fahy, 1972a). There is no specimen of S. *urbanum* in the Museum collection. Larvae and pupae of *S. dunfellense/urbanum* were encountered during the present study. The extent of the current distribution of the species pairs suggests that the individual species possibly remain as prevalent as previously recorded.

10km square distribution: 22 (Fig. 12)

Simulium dunfellense

Published: (5) F83, M26, N85, O11, V69.

S. *urbanum*

Published: (3) G78, G98, S44.

Simulium dunfellense/urbanum

Unpublished : (16) B91, G41, G78, G88, O1, O10, O11, O12, O21, R46, R96, S21, S84, S97, S99, T9.

Subgenus *Eusimulium*

There are three species belonging to the subgenus *Eusimulium*, two of which can only be identified to species level as adults. The subgenus is widespread.

10km square distribution: 35 (*Eusimulium* records, Northern Ireland).

Unpublished: C60, C70, C82, D14, D31, G95, H4, H6, H15, H16, H24, H26, H37, H46, H47, H48, H57, H58, H68, H74, H97, H65, H18, H38, H25, J3, J5, J14, J21, J22, J29, J31, J44, J49, J18 (Northern Ireland data).

***Simulium* (*Eusimulium*) *aureum* Fries**

There are nine publications with records for *Simulium aureum* (Bass, 1990; Crosskey, 2004; Fahy, 1972a; Schröder, 1988; Schröder and Schweder, 1986). There is one Museum record from Blarney, Co. Cork, 16 April 1958. The species was also encountered during this study. It is widespread but confined to specific habitats usually small streams of low pH (Bass, 1998). *S. aureum* usually occurs in low numbers.

10km square distribution: 22 (Fig. 13)

Unpublished: (7) M75, R58, S47, S78, S84, W47, W69.

Published: (12) F50, F83, G89, O1, O9, Q50, S44, V55, V66, V76, V98, W47, - *S. aureum* groups: O11, S43, W16.

***Simulium* (*Eusimulium*) *velutinum* (Santos Abreu)/ *Simulium* (*Eusimulium*) *angustipes* Edwards**

There are Museum records for *Simulium velutinum*. Crosskey (2004) has records for the two species. Both larva and pupa of the species pair were encountered in the present study in streams, rivers and outflows from lakes. The extent of the current distribution of the species pairs suggests that the individual species possibly remain as prevalent as previously recorded.

10km square distribution: *25* (Fig. 13)

S. velutinum

Published: (5) L75, M26, N92, Q90, R46.

S. angustipes

Published: (1) X18.

S. velutinum/angustipes

Unpublished: (19) G20, M2, M70, M75, M87, M88, N45, N46, R31, R44, S39, S52, S67, S77, S87, S89, W6, W24, W57.

Subgenus *Wilhelmia*

Pupae of *Simulium equinum, S. lineatum* and *S. pseudequinum* Séguy can be identified to species level. There is no record of S. *pseudequinum* from Ireland. *Wilhelmia* is a widespread subgenus but *S. equinum* and *S. lineatum* are usually found in lowland weedy rivers.

S. equinum/lineatum (larvae)

10km square distribution: 22 (additional to species level identification – Fig. 14)

Unpublished: (22) C82, C90, D10, D14, H13, H24, H25, H37, H47, H57, H65, H74, H87, H97, J1, J8, J18, J19, J29, J31, J44, W99.

***Simulium* (*Wilhelmia*) *equinum* (Linnaeus)**

There are some published records for this species, the most recent from 1986 (Bass, 1990) and there are Museum specimens. *Simulium equinum* was found at lowland sites generally in low numbers attached to instream vegetation such as rushes and often in association with high numbers of *S. ornatum/intermedium/trifasciatum*. It is widespread and common.

10km square distribution: 69 (Fig. 14)

Unpublished: (51) C93, D1, G20, G62, G71, H34, H46, H48, J5, J14, M18, M37, M48, M54, M62, M64, M74, M75, M82, M86, M88, N17, N46, N75, N82, N83, N85, O15, R31, R42, R53, R58, R87, R89, R93, R97, S1, S4, S21, S39, S47, S51, S74, S77, S87, S89, S99, W57, W60, W67, W69.

Published: (18) L85, M26, N48, N64, N66, N92, R29, R46, R81, R82, R85, S22, S43, V78, V88, V89, W34, W89.

***Simulium* (*Wilhelmia*) *lineatum* (Meigen)**

Crosskey (2004) and Fahy (1972a) are the only published records for this species. There are no specimens in the Museum. *Simulium lineatum* was generally found at lowland sites in low numbers and often in association with or among high numbers of *S. ornatum /intermedium/trifasciatum* attached to rushes. *S. equinum* was also usually present. It is not as prevalent or as abundant as *S. equinum.*

10km square distribution:12 (Fig. 15)

Unpublished: (8) M54, M74, M86, N17, N75, N85, S22, S77.

Published: (4) N48, R29, R85, S5.

Subgenus *Boophthora*

***Simulium* (*Boophthora*) *erythrocephalum* (De Geer)**

There are two published records, one from the River Liffey (Frost, 1942), another from Kerry (Bass, 1990) and five unpublished records from Northern Ireland (Wright *et al.*, 1995). There is also an adult specimen in the Museum collected in 1981. It is not common and is usually confined to large rivers. *Simulium erythrocephalum* was recorded from seven sites in the present study, including the River Inny and two outflows: the Lough Owel feeder and below Lake Curraghlicky.

10km square distribution: 16 (Fig. 16)

Unpublished: (13) G71, H13, H24, H37, H42, H46, M88, N36, N45, R22, R58, V98, W24.

Published: (3), O1, V89, V98.

Subgenus *Simulium*

There are eleven species belonging to this subgenus. A total of nine species have been recorded in Ireland. This subgenus is widely distributed.

***Simulium intermedium* Roubaud / *Simulium ornatum* Meigen / *Simulium trifasciatum* Curtis**

These three taxa cannot be clearly separated as larvae. Larvae of *Simulium ornatum/intermedium/trifasciatum* were found in large rivers and were widespread and common. *S. trifasciatum* can be identified at the pupal stage by the spinous form of the tubercles on the thoracic cuticle. Of the samples examined from ninety two sites (eighty-two 10km squares), seven sites yielded *S. trifasciatum* and then only a single specimen in each case. It would seem that *S. trifasciatum* is relatively rare compared to the frequency of occurrence of the *S. ornatum/intermedium* species pair. The summarised distribution for the unpublished records of *S. ornatum/ intermedium/trifasciatum* and *S. ornatum/intermedium* larvae do not overlap and do not include the distribution for *S. trifasciatum*.

10km square distribution: 90 (Fig. 17)

Unpublished: (90) C41, C60, C70, C82, C90, C93, D1, D2, D3, D10, D14, D22, D30, D31, G1, G40, G41, G50, G52, G71, G78, G88, H4, H6, H13, H14, H15, H16, H18, H24, H25, H26, H34, H37, H38, H42, H46, H47, H48, H55, H57, H58, H59, H65, H68, H74, H77, H83, H87, H88, H97, H99, J1, J3, J5, J8, J14, J18, J19, J21, J22, J25, J29,J31, J44, J49, M10, M50, M70, N3, N56, N75, N82, N84, N92, O1, O48, R23, R50, R60, R67, R68, R89, R98, S22, S29, S74, S88, V78, W59.

Simulium ornatum / intermedium

This species pair is common in large lowland rivers and was particularly prevalent in moderately polluted rivers. However, *Simulium ornatum* has sibling species and thus would be expected to be widespread.

10km square distribution: 86 (Fig. 18)

Unpublished: (83) B91, G43, G62, L65, M2, M12, M29, M37, M46, M48, M54, M56, M62, M64, M68, M74, M75, M76, M82, M86, M87, M88, N17, N34, N46, N54, N83, N93, N98, O4, O5, O14, O15, O16, O93, R7, R12, R58, R87, R88, R91, R93, R96, R97, R99, S1, S4, S5, S7, S18, S19, S39, S40, S43, S47, S48, S51, S52, S53, S57, S62, S67, S68, S77, S78, S81, S82,

S87, S89, S91, S92, S97, S98, W4, W24, W28, W36, W57, W58, W67, W97, W98, W99.

Published: (3) V55, V79, V86.

***Simulium* (*Simulium*) *intermedium* Roubaud**

There are published (Crosskey, 2004; Fahy; 1972a, 1972b, 1975a, 1975b) and Museum records for *Simulium intermedium*. The most recent record was for an adult caught in Tomies Woods, Killarney, Co. Kerry, in 1981. Published records show this species to prefer streams but it has been recorded from rivers (Bass, 1998).

10km square distribution: 72 (Fig. 19)

Published: (72) B90, F70, F83, F90, G42, G52, G78, G84, G89, G98, H33, J1, J14, L55, L65, L74, L84, L85, L86, L89, L96, M5, M33, M80, M95, N48, N66, N77, N84, N88, N90, N98, O0, O9, O10, Q40, Q50, Q51 Q70, Q90, R12, R14, R48, R81, R85, R86, R93, S1, S5, S10, S22, S44, S65, T15, T19, V66, V67, V76, V77, V78, V85, V88, V94,V96, V98, V99, W6, W8, W16, W17, W34, X18.

***Simulium* (*Simulium*) *ornatum* Meigen complex**

There are published (Crosskey, 2004; Fahy; 1972a; Frost, 1942) and Museum records for this species complex. The most recent record is for an adult specimen collected in 1981. The species has been found from most types of flowing water (Bass, 1998).

10km square distribution: 8 (Fig. 20)

Published: (8), V55, V78, V79, V86, V96, V98, V99.

***Simulium* (*Simulium*) *trifasciatum* Curtis**

There are two publications with records of *S. trifasciatum* collected in the early 1970s (Crosskey, 2004; Fahy, 1972a). There are no specimens of this species in the Museum.

10km square distribution: 11 (Fig. 21)

Unpublished: (7) M13, O21, R22, R72, R73, R82, W46.

Published: (4) O0, O2, R83, S22.

***Simulium (Simulium) argyreatum* Meigen and *Simulium (Simulium) variegatum* Meigen**

Simulium argyreatum and *S. variegatum* can only be reliably separated at the pupal stage. The paired anteriodorsal swellings (so-called 'patagia') on the thorax of *S. variegatum* pupa are easily recognised and are a feature unique to this species. There are Museum and published records for both species. The last published records for *S. variegatum* and *S. argyreatum* were from the mid 1980s (Schröder, 1988). Both species are widespread and occur in fast flowing streams and rivers. Generally, *S. argyreatum* is found in greater abundance and has a wider distribution than *S. variegatum*. The summarised distribution of the unpublished records of *S. argyreatum/variegatum* larvae does not include the distribution for the individual species (pupal identifications).

S. argyreatum /S. variegatum

10km square distribution: 44 (Fig. 22)

Unpublished: (37) C41, C60, C70, D30, D31, G3, G20, G32, G41, G52, G84, G94, H6, H16, H55, H59, H88, J18, J19, J21, J33, J49, L85, M19, M29, N20, N92, O0, O12, Q70, R38, R67, S74, S92, T27, V68, W67.

Published: (8), F90, V56, V68, V77, V86, V96, V99, W8.

S. argyreatum

10km square distribution: 88 (Fig. 23)

Unpublished: (67), B91, C1, C34, D22, G1, G31, G43, G78, G88, G95, H12, H14, H42, M13, M50, N30, O1, O2, O10, O21, O32, O93, Q40, Q90, R7, R22, R31, R32, R59, R68, R81, R82, R86, R91, R95, S21, S29, S43, S51, S52, S57, S62, S84, S99, T1, T9, T17, V78, V85, W4, W28, W36, W46, W49, W79, W97, W98.

Published: (37), D21, F83, G4, G74, G89, G98, L65, L75, L76, L85, L86, N20, O0, O1, O10, O11, Q40, Q41, Q50, Q51, Q70, Q71, R83, S10, T9, T18, T19, T29, V66, V67, V78, V79, V85, V94, V98, W6, W17.

S. variegatum

10km square distribution: 69 (Fig. 24)

Unpblished: (54), B91, C34, D2, D14, D22, G31, G40, G43, G50, G88, H2, L65, M18, M50, O1, O2, O21, O32, O93, Q51, R7, R31, R68, R81, R82, R85, R95, R96, S5, S21, S47, S51, S84, S88, S89, S99, T9, T18, T19, V77, V78, V85, V88, W4, W8, W27, W28, W37, W39, W48, W49, W58, W79, W97.

Published: (19) G4, G43, G52, G98, L76, M8, O11, Q40, Q50, Q51, R14, R85, S11, S65, V78, V79, V85, V88, V98.

***Simulium* (*Simulium*) *tuberosum* (Lundström) complex**

The *Simulium tuberosum* (Lundström) complex has not been previously recorded in Ireland until the present study. Both larvae and pupae were encountered. It was included in the species list by Crosskey (1991) but its occurrence was questionable. Specimens have now been identified as the species *S. tuberosum* (Tierney and Kelly-Quinn, 2005). It has a widespread distribution but occurs in low numbers.

10km square distribution: 10 (Fig. 25)

Unpublished: (10) B91, G79, G88, M2, M12, M13, 01, 021, Q70, T9.

***Simulium* (*Simulium*) *reptans* (Linnaeus)**

There are many published records for this species (Crosskey, 2004; Dowling *et al.*, 1981; Fahy, 1972, 1975; Frost, 1942; Schröder 1988, Schröder and Schweder, 1986; Wright *et al.*, 2000). It has a widespread distribution but was never found in abundance. The postgenal cleft in the larva of *Simulium reptans* has a characteristically high and round shape (Bass, 1998). The majority of larvae encountered in this study had pointed postgenal clefts similar to the cleft in *S. tuberosum* complex.

10km square distribution: 75 (Fig. 26)

Unpublished: (44) C41, D2, D22, D31, G1, G40, G41, G43, G52, G79,H47, H48, H58, H59, H68, H74, J19, L65, M18, N3, O1,O21, Q51, R7, R12, R23, R85, R91, R96, S21, S29, S39,

S89, S98, S99, T18, T19, T27, W8, W27, W37, W39, W59, W67.

Published: (36) F90, G43, G74, G78, G84, G89, G98, L86, N90, N92, O1, Q50, Q51, Q70, R12, R14, R81, R82, R91, S5, S43, S65, S96, V66, V67, V78, V79, V85, V88, V89, V95, V96, W8, W16, W27, W89.

***Simulium* (*Simulium*) *noelleri* Friederichs**

This species was recorded by Fahy (1972a) at three sites and by Dowling *et al.* (1981) from the River Caragh, Co. Kerry. There is also a specimen in the Museum collection from the Raheny Ponds, Co. Dublin collected in 1894. *Simulium noelleri* normally occurs in outlets from lakes and ponds (Bass, 1998). It has a widespread distribution but is localised due to its habitat preference.

10km square distribution: 7 (Fig. 27)

Unpublished: (3), N45, N95, W24.

Published: (4) L89, M26, S84, V78.

***Simulium* (*Simulium*) *rostratum* (Lundström)**

Simulium rostratum was collected in the early 1980s from the Bunnow, Owenmore and Cloghane River sytems in Co. Kerry (Schröder, 1988; Schröder and Schweder, 1986). Crosskey (2004) also recorded this species from collections made in the 1970s. It has been encountered at a single site in Northern Ireland (Wright *et al.*, 1995). Four new records were established during this study. *S. rostratum* prefers outlets from lakes and ponds (Bass, 1998) which accounts for its widespread but localised distribution.

10km square distribution: 10 (Fig. 28)

Unpublished: (5), H13, M12, M13, S29, W8.

Published: (6), G42, G84, Q40, V66, W6, W8.

Discussion

The records for eighteen simuliid species and the three species pairs were updated. The species pairs can only be separated as adults. One additional species was encountered *viz.* *Simulium tuberosum* (Tierney and Kelly-Quinn, 2005). This brings the total number of simuliid species for Ireland to twenty-seven or twenty-eight if *S. naturale* Davies is included. It is difficult to ascertain whether any change in the individual species distributions has occurred, because there was little overlap between the published records and records from the present study for comparison. However, given the similar number of grid squares examined the prevalence of species seems to be the same. Prosimulini remain limited in distribution to upland areas in Co. Wicklow. Other species such as *S. angustitarse* and *S. lundstromi* have patchy distributions and further investigation into their habitat requirements would be warranted.

Assuming the *Simulium tuberosum* complex is not a recent introduction, the taxon could easily have been overlooked. The authors noted during the present study that it shares key characteristic features with both *S. reptans* and *S. argyreatum*. The larvae could be confused with the larvae of *S. reptans* and the pupae might be mistaken for *S. argyreatum*. This is in addition to the *S. tuberosum* complex being scarce in abundance and scant in distribution.

Two species: *S. latipes* and *S. juxtacrenobium* were not encountered during the study. *S. latipes* is generally found in temporary water bodies and thus has completed its life-cycle by early summer. *S. juxtacrenobium* is a single generation species that has a preference for small acid or moorland streams (Bass, 1998). Thus the probability of encountering either species without specifically targeting potential habitats is considerably reduced.

Five species recorded in Britain *viz. Metacnephia amphora* Ladle and Bass, *Simulium costatum* Friedrichs, *S. pseudequinum* Seguy, *S. moristans* Edwards and *S. posticatum* Meigen, remain unrecorded in Ireland. *M. amphora* was first found in a temporary water body (Ladle and Bass, 1975) and is a single generation species. *S. pseudequinum* has been misidentified as *S. lineatum*, (to which it bears a close resemblance) in collections in Britain (Bass, 1998). It is unlikely this species occurs in Ireland given the wide geographical coverage of the current study combined with previous work. However, given the rarity and scant distribution of *S. lineatum*, it is not beyond the bounds of possibility. *S. costatum* is closely associated with springs generally in limestone areas and is rarely found more than 100m downstream from such sources. Davies (1968) considered *S. morsitans* to be a species of large weedy streams and rivers. *S. posticatum* has a single spring generation and is also found in slow-flowing weedy rivers.

The lack of records for species pairs is because they cannot be separated at the larval and pupal stage. Furthermore, adult flies are rarely collected nor are they generally hatched out from pupae. They are also difficult to identify to species level. This highlights the continuous need for well–trained or experienced taxonomists not only in larval and pupal identification but also in adult fly recognition. The discovery of a species new to the Irish list highlights the need for targeted surveying and for periodic updating of species distributions. Targetting of specific habitats such as springs, high latitude stream sources, temporary water bodies, lake outflows and large flowing rivers too deep to wade (often canal like) might reveal new species and expand the known distribution of existing species.

Acknowledgements

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TABLE 1. A summary of species records and their origin.

List of Species	*Museum*	*Published*	*Current Study*	*Summary*
Prosimilium				
Prosimulium hirtipes (Fries, 1884)		√	√	√
P. latimucro (Enderlein, 1925)	√	√	√	√
P. tomosvaryi (Enderlein, 1921)	√	√	√	√
Simlium				
Simulium (Hellichiella) latipes (Meigen, 1804)	√	√		√
Simulium (Nevermannia) angustitarse (Lundström, 1911)	√	√	√	√
Simulium (Nevermannia) lundstromi (Enderlein, 1921)		√	√	√
Simulium (Nevermannia) armoricanum Doby & David, 1961		√	√	√
Simulium (Nevermannia) cryophilum (Rubtsov, 1959)		√	√	√
Simulium (Nevermannia) vernum Macquart, 1826 (spp. complex)	√	√	√	√
Simulium (Nevermannia) naturale Davies, 1966 (*S. vernum* spp. complex)	√	√		√
Simulium (Nevermannia) juxtacrenobium Bass & Brockhouse, 1990		√		√
Simulium (Nevermannia) urbanum Davies, 1966		√	*	√
Simulium (Nevermannia) dunfellense Davies, 1966	√	√	*	√
Simulium (Eusimulium) velutinum (Santos Abreu, 1922)	√	√	*	√
Simulium (Eusimulium) angustipes Edwards, 1915		√	*	√
Simulium (Eusimulium) aureum Fries, 1824	√	√	√	√
Simulium (Wilhelmia) lineatum (Meigen, 1804)		√	√	√
Simulium (Wilhelmia) (Linnaeus, 1758)	√	√	√	√
Simulium (Boophthora) erythrocephalum (De Geer, 1776)	√	√	√	√
Simulium (Simulium) intermedium Roubaud, 1906 (spp. complex)	√	√	*	√
Simulium (Simulium) ornatum Meigen, 1818 (spp. complex)	√	√	*	√
Simulium (Simulium) trifasciatum Curtis, 1839		√	√	√
Simulium (Simulium) argyreatum Meigen, 1838	√	√	√	√
Simulium (Simulium) variegatum Meigen, 1818	√	√	√	√
Simulium (Simulium) tuberosum (Lundström, 1911) complex			√	√
Simulium (Simulium) rostratum (Lundström, 1911)		√	√	√
Simulium (Simulium) reptans (Linnaeus, 1758)	√	√	√	√
Simulium (Simulium) noelleri Friederichs, 1920	√	√	√	√
No. of species/complexes	16	27	19	**27**
No of indistinguishable sets			3**	

* species pairs not separable, represents 6 species

FIGURE 1. A map of Ireland with the county boundaries and the 10km grid squares of the national grid delineated.

Legend: AM = Antrim, AH = Armagh, CW = Carlow, CN = Cavan, CE = Clare, C = Cork, DY = Derry, DL = Donegal, DN = Down, D = Dublin, FH = Fermanagh, GY = Galway, KY = Kerry, KE = Kildare, KK = Kilkenny, LS = Laois, LM = Leitrim, LK = Limerick, LD = Longford, LH = Louth, MO = Mayo, MH = Meath, MN = Monaghan, OY = Offaly, RM = Roscommon, SO = Sligo, TY = Tipperary, TE = Tyrone, WD = Waterford, WH = Westmeath, WX = Wexford and WW = Wicklow.

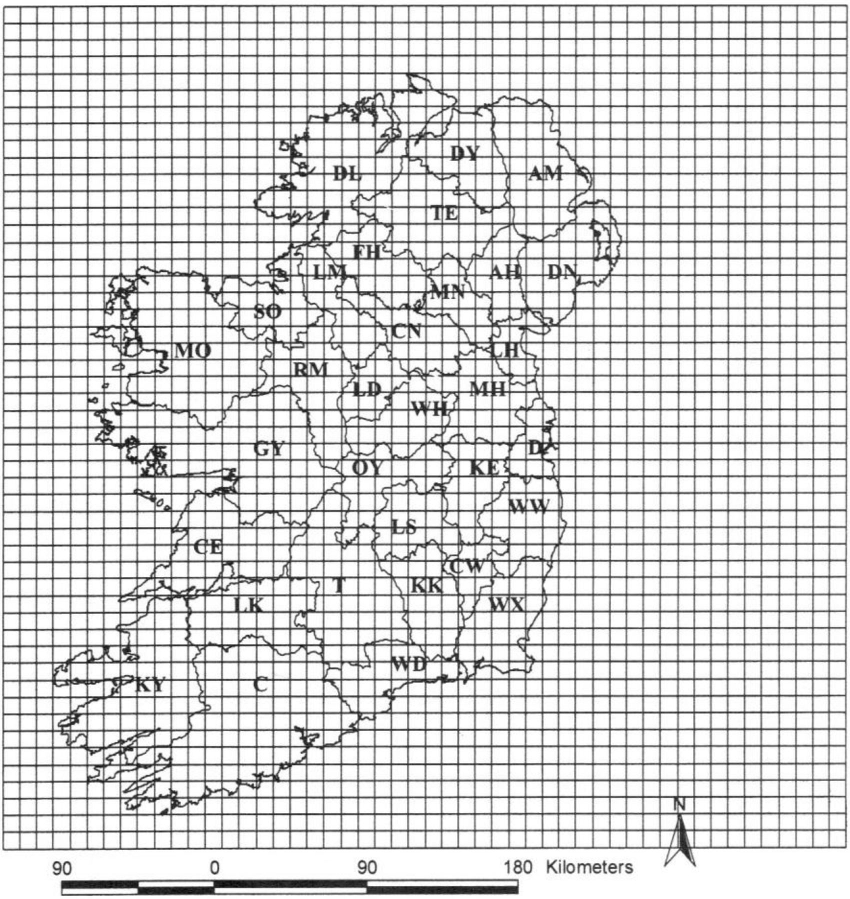
DY
AM
DL
TE
FH
LM
AH
DN
MN
SO
CN
MO
LH
RM
LD
MH
WH
GY
D
OY
KE
WW
LS
CE
CW
T
KK
WX
LK
WD
KY
C
N
90
0
90
180 Kilometers

TABLE 2. Simuliid species distributions by county.

List of Species	AM	AH	CW	CN	CE	C	DY	DL	DN	D	FH	GY	KY	KE	KK	LS	LM	LK	LD	LH	MO	MH	MN	OY	RM	SO	TY	TE	WD	WH	WX	WW
Prosimulium hirtipes																																√
P. latimucro										√																						√
P. tomosvaryi																																√
Simulium latipes																					√											
S. angustitarse					√																√				√							
S. lundstromi					√	√								√		√					√				√							√
S. armoricanum					√	√		√		√			√				√				√			√		√	√		√		√	√
S. cryophilum	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√		√	√	√	√	√	√	√
S. vernum			√		√					√		√	√			√					√	√		√		√	√	√	√	√	√	√
S. juxtacrenobium													√																			
S. urbanum / dunfellense					√			√		√		√								√		√				√	√		√		√	√
S. urbanum								√							√																	
S. dunfellense												√										√										√
S. aureum					√	√	√					√	√	√	√	√				√							√				√	
S. velutinum					√							√	√								√											
S. angustipes						√							√																			
S. velutinum / angustipes			√			√						√			√	√		√			√				√				√	√		√
Eusimulium	√	√				√	√		√		√				√		√						√					√				
S. lineatum			√		√							√						√	√			√			√		√		√			
S. equinum	√	√	√	√	√	√			√	√	√	√	√	√	√	√		√	√		√	√			√	√	√	√		√		√
S. equinum/ lineatum	√	√					√		√		√										√		√					√	√			
S. erythrocephalum				√	√	√					√		√	√				√							√	√		√		√		√
S. intermedium / ornatum / trifasciatum	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√		√	√	√		√	√	√	√	√	√	√	√	√
S. intermedium / ornatum			√		√	√		√		√		√	√	√	√	√	√	√	√		√	√		√	√	√	√		√	√	√	√
S. intermedium				√		√		√	√		√	√	√		√		√	√		√	√	√			√	√	√		√		√	√
S. ornatum				√	√	√		√		√		√	√	√	√			√			√	√				√	√		√		√	√
S. trifasciatum						√				√		√						√											√			√
S. argyreatum / variegatum	√			√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√			√		√	√	√	√		√	√
S. argyreatum	√	√		√	√	√		√	√	√	√	√	√	√	√	√		√			√		√			√	√		√	√	√	√
S. variegatum	√			√	√	√		√			√	√	√	√	√	√		√			√			√		√	√		√	√	√	√
S. tuberosum								√				√	√																			√
S. rostratum						√					√	√	√			√	√									√						
S. reptans	√	√	√		√	√	√	√					√	√	√	√	√	√			√			√		√	√	√	√			√
S. noelleri						√		√					√					√				√		√						√		

FIGURE 2. The distribution of *Prosimulium hirtipes* (Fries).

FIGURE 3. The distribution of *Prosimulium latimucro* (Enderlein)

FIGURE 4. The distribution of *Prosimulium tomosvaryi* (Enderlein).

FIGURE 5. The distribution of *Simulium latipes* (Meigen)

FIGURE 6. The distribution of *Simulium angustitarse* (Lunström).

FIGURE 7. The distribution of *Simulium lundstromi* (Enderlein).

FIGURE 8. The distribution of *Simulium cryophilum* (Rubtsov) complex.

FIGURE 9. The distribution of *Simulium vernum* Macquart complex.

FIGURE 10. The distribution of *Simulium juxtacrenobium* Bass and Brockhouse.

FIGURE 11. The distribution of *Simulium armoricanum* Doby and David.

FIGURE 12. The distribution of *Simulium urbanum* Davies, *S. dunfellense* Davies with larval records of *S. urbanum/dunfellense*.

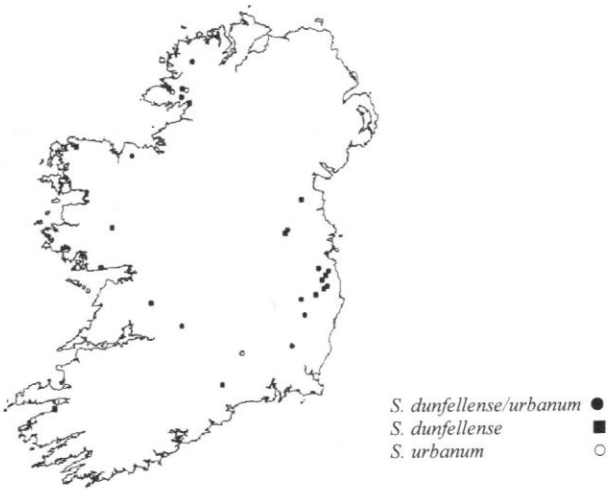

FIGURE 13. The distribution of *Eusimulium* (Northern Ireland data), *Simulium aureum* Fries, *S. velutinum* (Santos Abreu), *S. angustipes* Edwards and larval records of *S. velutinum/angustipes*.

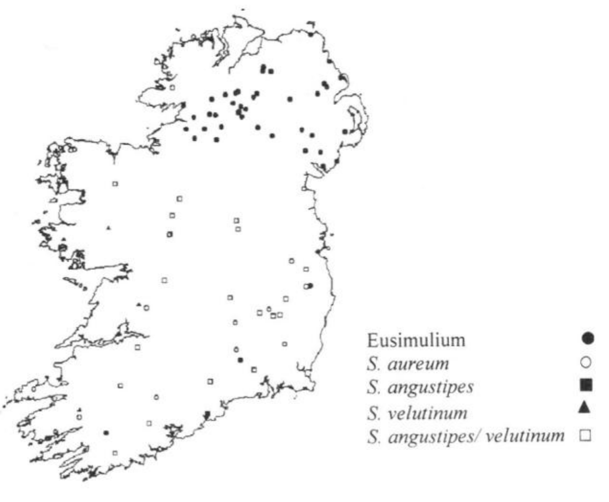

FIGURE 14. The distribution of *Simulium equinum/lineatum* and of *S. equinum* (Linnaeus).

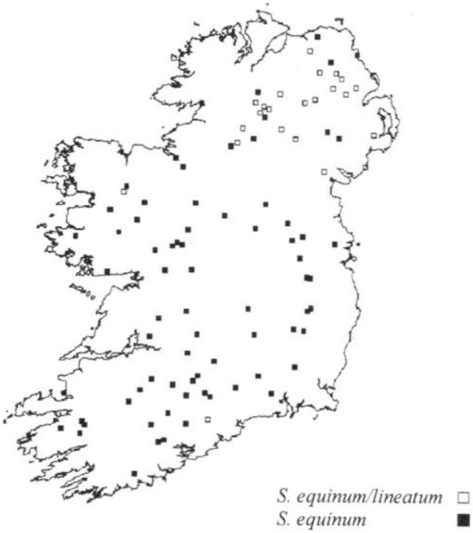

FIGURE 15. The distribution of *Simulium lineatum* (Meigen).

FIGURE 16. The distribution of *Simulium erythrocephalum* (De Geer).

FIGURE 17. The distribution of *Simulium intermedium* Roubaud / *S. ornatum* Meigen complex/ *S. trifasciatum* Curtis.

FIGURE 18. The distribution of *Simulium intermedium* Roubaud/*S. ornatum* Meigen complex.

FIGURE 19. The distribution of *Simulium intermedium* Roubaud.

FIGURE 20. The distribution of *Simulium ornatum* Meigen complex.

FIGURE 21. The distribution of *Simulium trifasciatum* Curtis

FIGURE 22. The distribution of *Simulium argyreatum/variegatum* larval records.

FIGURE 23. The distribution of *Simulium argyreatum* Meigen.

FIGURE 24. The distribution of *Simulium variegatum* Meigen.

FIGURE 25. The distribution of *Simulium tuberosum* (Lundström) complex.

FIGURE 26. The distribution of *Simulium reptans* (Linnaeus).

FIGURE 27. The distribution of *Simulium noelleri* Friederichs.

FIGURE 28. Distribution of *Simulium rostratum* (Lundström).

APPENDIX I

TABLE 1. Details of the simuliid specimens in the Natural History Museum, Dublin.

Species	Location, Date and Collector
Prosimulium latimucro	Glencree, Co. Dublin, May 1908, J. N. Halbert (as *Simulium hirtipes* (Fries) male)
	Deerpark stream, Powerscourt Estate, Enniskerry, Co. Wicklow, 18.iii.1984, J. P. & M. A. O'Connor- larvae
Prosimulium tomosvaryi	Deerpark stream, Powerscourt Estate, Enniskerry, 18.iii.1984, J. P. & M. A. O'Connor - larvae
Prosimulium sp.	Glencree, May 1908, J. N. Halbert (as *Simulium hirtipes* (Fries) female)
Simulium latipes	Rocky Valley, April 1915, (as *Simulium subexcisum*)
	No location, A. H. Haliday – 4 male and 1 female specimen
	Glendaire, Achill, Co. Mayo, 5.vi.1909, J. N. Halbert
	No location, A. H. Haliday – 4 specimens
S. angustitarse	Hollymount, Co. Mayo, 26.ix.1922, W. Ruttledge
S. vernum complex	Hollymount, Co. Mayo, 28.iii.1923, W. Ruttledge (as *S. latipes*)
	Hollymount, Co. Mayo, 28.iii.1923, W. Ruttledge
	Hollymount, Co. Mayo, 26.iv.1923, W. Ruttledge
	Hollymount, Co. Mayo, 4.iv.1923, W. Ruttledge (as *S. latipes*)
	Hollymount, Co. Mayo, 26.iv.1923, W. Ruttledge
	Hollymount, Co. Mayo, 16.ix.1922, W. Ruttledge
S. naturale	Hollymount, Co. Mayo, 26.iv.1923, W. Ruttledge – 2 specimens
S. dunfellense	Rosbehy, Co. Kerry, 12.ix.1981, J. P .& M. A. O'Connor
	Hollymount, Co. Mayo, 26.iv.1923, W. Ruttledge – 4 specimens
	Dunnes, Rossbehy, Co. Kerry, 12.ix.1981, J. P .& M. A. O'Connor

S. aureum	Blarney, Co. Cork, 16.iv.1958, P. Makings
S. velutinum	Grand Canal, Ponsby Bridge, Co. Kildare, 14.xi.1981, J. P. & M. A. O' Connor
	Hollymount, Co. Mayo, 28.iii.1923, W. Ruttledge
	Hollymount, Co. Mayo, 24.ix.1923, W. Ruttledge
	Hollymount, Co. Mayo, 30.iii.1923, W. Ruttledge
S. equinum	Hollymount, Co. Mayo, 1.iv.1923, W. Ruttledge
	Hollymount, Co. Mayo, 3.iv.1923, W. Ruttledge
S. erythrocephalum	Tomies Wood, Killarney, Co. Kerry, 15.ix.1981, J. P. O'Connor – 7 specimens in total all from the same location
S. ornatum complex	Stud in Co. Meath on horses, 15.iii.1981, T. Murphy (Ms. O'Keefe, Glenlowe, Osberstown, Tara.) – 2 specimens
	Clare Island, Co. Mayo, July 1910
	Grand Canal, Ponsby Bridge, Co. Kildare, 14.xi.1981, J. P. & M. A. O' Connor – 2 specimens
	Found in Railway Carriage between Ballymoney and Ballycastle Co. Antrim, April 1921, A. W. Stelfox.
	Hollymount, Co. Mayo, on tree leaves, 24.ix.1922, W. Ruttledge
	Hollymount, Co. Mayo, window indoors, 26.iii.1923, W. Ruttledge
	Hollymount, Co. Mayo, stable indoors, 25.iii.1923, W. Ruttledge – 2 specimens.
	Hollymount, Co. Mayo, window indoors, 7.x.1922, W. Ruttledge
	Hollymount, Co. Mayo, 4.iv.1923, W. Ruttledge
	Hollymount, Co. Mayo, on laurel leaves, 30.iii.1923, W. Ruttledge
	Hollymount, Co. Mayo, around humans by day, 24.iii.1923, W. Ruttledge

	No location, A. H. Haliday.
S. intermedium	Tomies Wood, Killarney, Co. Kerry, 15.ix.1981, J. P. O'Connor
	Glengarriff, Co. Cork, 1902, Col Yerbury, determined by F. W. Edwards 1920
S. argyreatum	Devil's Glen, Co. Wicklow, 6.iv.1924, (*S. argyreatum* syn *S. rheophilum*) –2 specimens [T2599]
S. variegatum	Belclare, Co Mayo, July1910, J. N. Halbert
	River Caher, Burren, Co. Clare, 17.vii.1981, J. P. & M. A. O'Connor
S. reptans	Between Killarney and Killorglin, Co. Kerry, 1920, determined by F. W. Edwards
S. noelleri	Raheny Ponds, Co. Dublin, April 1894, J. N. Halbert.

TABLE 2. A summary of the simuliid species listed in each published paper.

Simulium naturale and **S. posticatum* are not included in the species counts.

Species List	Published 1	2	3	4	5	6	7	8	9	10	11	12	13	ALL
Prosimulium hirtipes (Fries)										√				1
P. latimucro (Enderlein)		√												1
P. tomosvaryi (Enderlein)		√			√		√							3
Simulium latipes (Meigen)	√	√	√											2
S. angustitarse (Lundström)					√									1
S. lundstromi (Enderlein)	√										√	√		3
S. armoricanum Doby & David		√												1
S. cryophilum (Rubtsov) complex	√	√		√	√	√		√			√	√	√	9
S. vernum Macquart complex	√	√		√	√					√			√	6
S. naturale* Davies *(S. vernum)		√		√										
S. juxtacrenobium Bass & Brockhouse	√													1
S. urbanum Davies		√			√									2
S. dunfellense Davies		√												1
S. velutinum (Santos Abreu)		√												1
S. angustipes Edwards		√												1
S. aureum Fries	√	√			√					√	√	√	√	6
S. lineatum (Meigen)		√			√									2
S. equinum (Linnaeus)	√	√		√	√					√				5
S. erythrocephalum (De Geer)	√									√			√	3
S. ornatum / intermedium/trifasciatum													√	1
S. ornatum / S. intermedium	√			√										2
S. intermedium Roubaud		√			√	√		√	√		√	√		6
S. ornatum Meigen complex		√			√					√	√	√		5
S. trifasciatum Curtis		√			√									2
S. argyreatum / S. variegatum	√							√						2
S. argyreatum Meigen		√		√	√						√	√	√	6
S. variegatum Meigen		√		√	√						√	√		5
S. rostratum (Lundström)		√									√	√	√	4
S. posticatum Meigen										√*				
S. reptans (Linnaeus)		√		√	√			√		√	√	√	√	9
S. noelleri Friederichs		√		√	√									3
No. of species	8	21	1	8	15	2	1	3	1	7	9	9	7	21

Bass (1990)	1	Fahy (1975a)	8
Crosskey (2004)	2	Fahy (1975b)	9
Crosskey (1985)	3	Frost (1942)	10
Dowling et al. (1981)	4	Schröder (1988)	11
Fahy (1972a)	5	Schröder & Schweder (1986)	12
Fahy (1972b)	6	Wright et al. (2000)	13
Fahy (1973)	7	* - never confirmed	

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SOME DISTRIBUTION RECORDS FOR IRISH SAWFLIES (HYMENOPTERA: SYMPHYTA)

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Recently, JPOC had a large collection of Irish sawflies (Hymenoptera: Symphyta) identified by A. D. Liston. The material was collected by the author and his wife over several years. The collection included many rare species including several new to Ireland (Liston and O'Connor, in press; O'Connor, in press). This paper reports interesting distributional data. All are new county records. The previous distributions and host information are from O'Connor *et al.* (1997). Voucher specimens have been deposited in the National Museum of Ireland. The following abbreviations are used:- JMOC: J. P. and M. A. O'Connor; JPOC: J. P. O'Connor.

***Aglaostigma aucupariae* (Klug, 1817)**

CLARE: near Fanore (M1307), green road in Burren, 24.v.1985, JMOC.

OFFALY: Charleville Wood, Tullamore (N3222), 29.v.1987, JPOC.

WEXFORD: Oaklands (S7125), mixed woodland, 29.v.1987, JPOC.

***Aneugmenus coronatus* (Klug, 1818)**

CORK: Coill Seislinn, Kilworth, (R8404), 31.vi.1985, JPOC.

WATERFORD: Dunhill (S5304), 29.vi.1988, JPOC; Nier Valley (S2417), 13.vii.1987, JPOC.

WEXFORD: near Glenbough (T0929), 28.v.1987, JPOC.

This species was previously only known from Cos Dublin and Kerry. As the host plants are lady-fern *Athyrium felix-femina* (L.) Roth, male-fern *Dryopteris filix-mas* (L.) Schott and bracken *Pteridium aquilinum* (L.) Kuhn, it is surprising that there are so few Irish records.

***Arge gracilicornis* (Klug, 1814)**

CAVAN: Lough Sheelin (N4686), 6.viii.1990, JMOC.

***Arge ustulata* (Linnaeus, 1758)**

MEATH: Batterjohn Big (N8953), 7.v.1991, JPOC.

***Cladius pectinicornis* (Geoffroy, 1785)**

WATERFORD: Passage East (S6811), 13.vi.1990, JPOC.

***Empria liturata* (Gmelin in Linnaeus, 1790)**

KILDARE: Carton (N9637), 29.iv.1987, JPOC.

WICKLOW: Avondale (T1985), 27.v.1988, JPOC.

***Empria longicornis* (Thomson, 1871)**

CAVAN: Virginia (N5987), mixed woodland, 15.v.1989, JPOC.

KILDARE: Carton (N9637), 29.iv.1987, JPOC.

MEATH: Batterjohn Big (N8953), gravel pit, 31.v.1989, JPOC.

WEXFORD: Oaklands (S7125), mixed woodland, 7.vi.1986 and 29.v.1987, JMOC.

***Endelomyia aethiops* (Fabricius, 1781)**

WEXFORD: Killoughrim Forest (S8941), 4.vi.1987, JPOC.

***Eutomostethus luteiventris* (Klug, 1816)**

CLARE: Kilshanny (R1292), 31.vi.1992, hedgerows, JPOC.

***Euura* (*Euura*) *atra* (Jurine, 1807)**

CLARE: Burren, The Burren (M2711), 4.vi.1992, JMOC.

***Fenella nigrita* Westwood, 1839**

WICKLOW: Mount Usher, Ashford (T2796), 27.v.1991, JMOC.

***Hoplocampa pectoralis* Thomson, 1871**

CLARE: Corker Pass, Burren (M3010), 27.v.1992, JPOC.

WEXFORD: Slieve Coiltia (S7221), swept from hawthorn *Crataegus*, 14.vi.1990, JPOC.

***Monophadnus pallescens* (Gmelin in Linnaeus, 1790)**

MEATH: Kilmessan (N8857), 19.v.1991, JMOC.

WEXFORD: Oaklands (S7125), mixed woodland, 29.v.1987, JPOC

***Nematus* (*Pteronidea*) *incompletus* Förster, 1854**

WEXFORD: Oaklands (S7125), mixed woodland, 29.v.1987, JPOC.

***Nematus* (*Pteronidea*) *poecilonotus* Zaddach, 1875**

WESTMEATH: Ballynafid Lough (N4060), 5.v.1987, JPOC.

The species was previously only known from Cos Cavan and Roscommon. The larvae feed on birch *Betula*.

***Pontania* (*Pontania*) *proxima* (Serville, 1823)**

WEXFORD: near Glenbough (T0929), kettlehole, 28.v.1987, JPOC.

The species was previously only known from Cos Antrim, Cavan and Dublin. In Ireland, it has been reared from galls on white willow *Salix alba* L. and crack willow *S. fragilis* L.

***Pristiphora* (*Pristiphora*) *atlantica* Lacourt, 1987**

WESTMEATH: Ballynafid Lough (N4060), 5.v.1987, JPOC.

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The author is very grateful to A. D. Liston for identifying the specimens and to his wife Mary for her help with field work.

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THE STATUS OF THE MEMBERS OF THE GENUS *OLIGIA* HÜBNER, 1821 (LEPIDOPTERA: NOCTUIDAE) IN IRELAND

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Introduction

Four species currently placed in the genus *Oligia* Hübner, 1821, are known from Ireland. One of these, *O. fasciuncula* (Haworth, 1809) is widely distributed, and can be identified on wing markings alone. The three remaining species, *O. strigilis* (Linnaeus, 1758) (Marbled Minor), *O. latruncula* (Denis and Schiffermüller, 1775) (Tawny Marbled Minor) and *O. versicolor* (Borkhausen, 1792) (Rufous Minor), present difficulties for identification, due to both the wide range of variation in wing pattern and coloration found in each species, and to the occurrence of very similar forms in more than one of the three. Examination of the genitalia is therefore generally recognised as the only reliable means of identification.

Published records of Irish *Oligia* species present a confused picture. Kane (1901) lists a wide variety of forms of *O. strigilis* (as *Miana strigilis*) from various Irish localities, but at that time these were all considered to be varieties of a single species. Donovan (1936) was the first to treat *O. latruncula* as a distinct species in Ireland, mentioning that Foster's specimens from Down, Armagh and Antrim had been determined as this species by H. J. Turner. His account did, however, imply that he considered *O. strigilis* to be widely distributed; that the two species occurred together, and that the "smaller, browner and more variable forms should be relegated to the next species, *latruncula*". Greer (1944) added *O. versicolor* to the Irish list, on the basis of two specimens taken at sugar in Co. Tyrone in 1903, which he reports were seen by the Danish Lepidopterist, Neils L. Wolff. Cockayne (1952) also reported *O. versicolor* as new to the Irish list, based on a specimen he detected in the Donovan collection, taken at Ummera, near Timoleague, Co. Cork in 1931. This record is not mentioned in the *Revised Catalogue* of Baynes (1964), but Baynes does include Greer's record. Both *O. latruncula* and *O. strigilis* have been recorded from a Rothamsted light-trap at Pallaskenry (Woiwod, pers. comm.). Huggins (1953) in his list of the Lepidoptera of the Glengarriff area, Co. Cork, records both *O. strigilis* and *O. latruncula*, while implying that the former was the commoner species. Baynes (*op. cit.*) stated that *O. latruncula* was abundant where he lived (Glenageary, Co. Dublin), while he had never taken *O. strigilis* there. In the investigations of the Lepidoptera of the Burren, Co. Clare, carried out by Bradley, Mere and Pelham-Clinton in the years 1951-65, Pelham-Clinton (1962) recorded only *O. latruncula*, but the same author later (1964) reported both *O. strigilis* and *O latruncula*, stating that at that time (*i.e.* 1962) the former was less common than *O. latruncula*, and that "all *strigilis* were darker than *latrunculus* [*latruncula*]". Of the three species, only *O. latruncula* has been recorded in the more recent reports by Langmaid (1989) (Newport, Co. Mayo) and Heckford and Langmaid (1991) (eastern Burren). Myers (pers. comm.) reports *O. latruncula* as "very common" at Fountainstown, Co. Cork in the years 1971-2005, the dates ranging from 8 May to 27 July, but only a single *O. versicolor* over the same period. The distribution map for *O. strigilis* in Goater (1983) shows several widely distributed Irish locations, but apart from the Burren records, it appears to be based on records of specimens that have not been critically checked.

Methods

In order to clarify the Irish status of *O. strigilis*, *O. latruncula* and *O. versicolor* specimens from a wide range of locations over Ireland have been examined. Almost all these records are of specimens taken at light, the great majority from mercury-vapour light-traps. In addition to recently obtained field material, specimens from the collections held by the National Museum of Ireland (NMI), Dublin, and the Ulster Museum (UM), Belfast have been examined.

Specimens submitted for identification by several field workers have also been included in this study. Permanent genitalia slides of about 20 Irish female *Oligia* spp. and at least one male of each species have been prepared, although in the great majority of cases it has been possible to identify the males by microscopic examination of the external genitalia. The genitalia illustrations in Goater (1983) have been used to confirm the identifications. The resulting records have been mapped, along with all published records considered reliably identified (Figs 1-3). For the older records it has been necessary to estimate grid references. In general, the 1km square considered most appropriate has been selected, but for mapping purposes it has been necessary to add zeros to produce a six-figure reference. All estimated grid reference have therefore been placed in square brackets, and should not be taken to indicate precise locations.

Results

The results are summarised in the list of identifications in Table 1. Apart from identifications by the author, the records indicated by Baynes (1964), Cockayne (1952), Mere *et al.* (1962, 1964), Mere and Pelham-Clinton (1966) and Heckford and Langmaid (1991) are considered reliable and are therefore also mapped. It should be noted that that distribution maps for *O. latruncula* and *O. versicolor* in Goater (1983) place the records from Pallaskenry, Co. Limerick in square R35 instead of R45.

Discussion

As shown by Table 1, it is clear that *O. latruncula* is the species most frequently encountered in Ireland of the three under discussion. It appears to be widely distributed over much of the east, centre and south, and seems to be particularly common in coastal areas of the east and south, where only representative samples were taken from larger samples at light traps on several occasions. It has been taken at light over a wide range of grassland sites including agricultural ones.

The most localised species is *O. strigilis*, which is confirmed from only the Burren area and from Kilcolman Wildfowl Reserve, Co. Cork, where only a single specimen has been recorded.

O. versicolor has been identified form several localities in the south and east, and a museum specimen from Co. Sligo has recently been identified. Little is known about the ecology of this and the other two species in Britain, but Goater (1983) suggests that *O. versicolor* has a preference for "rather open, deciduous woodland". Several of the Irish sites for *O. versicolor* are characterised by adjacent patches of relatively well-developed deciduous woodland, and the paucity of records from coastal sites may also reflect a preference for grassland associated with nearby woodland.

While the widespread distribution of *O. latruncula* and the more localised status of *O. versicolor* in Ireland broadly match the situation in Britain, the status of *O. strigilis* is strikingly different. In Britain, *O. strigilis*, like *O. latruncula* is widespread and often common, and likewise extends to Northern Scotland. Similarly, in the Isle of Man both species are common, and have been taken in numbers together close to the cliffs of the west coast (pers. obs.). In Ireland, *O. strigilis* appears to be confined to the limestone districts of the Burren, apart from the Kilcolman record, from what is essentially fen habitat, although a few small limestone surface outcrops do also occur there. Kilcolman is therefore the only Irish site where all these three species have been recorded.

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TABLE 1. Irish Records of *Oligia* spp. based on genitalia dissections or critical examination of males, arranged by vice-county (v.c.). Grid references deduced from place names are placed in brackets.

Species	Locality and county	v.c.	IGR	date	source
strigilis	Kilcolman Wildfowl Res., Cork	H5	R583111	21 Jun. 1992	KGMB
latruncula	Killaha, Kerry	H1	V896688	9 Jul. 1982	KGMB
"	Ballyseedy Wood, Kerry	H2	Q866124	2 Aug. 2002	KGMB
"	Farranfore (airport), Kerry	H2	Q946046	28 Jun. 1991	KGMB
"	Killarney, Kerry	H2	[V970890]	12 Jul. 1924	NMI
"	Knockmichael Mtn, Kerry	H2	Q838101	15 Jun. 1992	KGMB
"	Coolsnaghtig, Cork	H3	W212560	(5) 4 Aug. 2002	KGMB
"	Cork City (S. Ring Rd), Cork	H4	W646692	9 Jul. 2001	KGMB
"	Demesne, Cork	H3	W240541	20 Jun. 1996	KGMB
"	Harbour View, Cork	H3	W525437	21 Jul. 1981	KGMB
"	Liss Ard, Cork	H3	W131310	13 Jun. 1992	KGMB
"	Sherkin Is. (Marine Sta.), Cork	H3	W007257	3 Jul. 1999	Sherkin Is. Mar. Sta.
"	Sherkin Is. (Farranlough), Cork	H3	W020264	6 Jul. 1983	Sherkin Is. Mar. Sta.

"	Cork City, Cork	H4	W689715	13 Jul. 1976	KGMB
"	Cork City, Cork	H4	W689715	2 Jul. 1977	KGMB
	Cork City, Cork	H4	W668717	12 Jun. 1993	KGMB
"	Douglas, Cork	H4	W711693	27 Jul. 1982	KGMB
"	Douglas, Cork	H4	W701689	6 Jul. 1977	KGMB
"	Douglas, Cork	H4	W711693	19 Jul. 1981	KGMB
"	Fountainstown	H4	W783578	"v. common" 1971-2005	Myers (pers. comm.)
"	Healy's Bridge, Cork	H4	W592735	29 Jun. 1981	KGMB
"	Knockalisheen, Cork	H4	W643662	27 Jun. 1981	KGMB
"	Oysterhaven, Cork	H4	W696487	14 Jul. 1981	KGMB
"	Riverstick, Cork	H4	W666590	27 Jul. 1981	KGMB
"	Ballytrasna, Cork	H5	W980632	13 Jun. 2004	KGMB
"	Cobh, Cork	H5	W782661	1 Jul. 1995	KGMB
"	Cuskinny, Cork	H5	W818673	30 Jun. 1993	KGMB
"	Fota Wildlife Park, Cork	H5	W781713	(12) 12-29 Jul. 1986	Rothamsted trap
"	Harper's Island, Cork	H5	W783726	24 Jun. 1993	KGMB
"	Kilcolman Wildfowl Res., Cork	H5	R583111	1 Jul. 1991, 21 Jun. 1992	KGMB
"	Midleton, Cork	H5	W884720	8 Jul. 1981	KGMB
"	Rathcormack, Cork	H5	W811898	27 Jul. 1985	KGMB
"	Toorgarriff, Cork	H5	W690911	23 Jul. 1982	KGMB
"	Clonmel [S. of river], Tipperary	H6	[S209221]	Jun. 1945	Murray (TCD)

"	Killahaly Wood, Waterford	H6	X089950	18 Jul. 1986	KGMB
"	Tramore, Waterford	H6	S578019	31 May 2004	Tony Bryant
"	Barrigone, Limerick	H8	R300509	6 Jun. 2004	KGMB
"	Pallaskenry, Limerick	H8	R420554	1978	Rothamsted Trap
"	Tory Hill, Limerick	H8	R535430	26 Jun. 1993	KGMB
"	Lavistown Hse, Kilkenny	H11	S544543	1980	I. Kelly
"	Ardamine, Wexford	H12	T199547	3 Jul. 1971	KGMB
"	Ballydoogan Bog, Galway	H15	M677179	29 Jun. 2002	KGMB
"	Lough Cutra, Galway	H15	R468984	23 Jun. 1996	KGMB
"	Hurney's Point, Galway	H16	M252310	(3) 19-27 Jun. 2003	KGMB
"	Renvyle, Galway	H16	[L680630]	pre-1903	Kane NMI
"	Keekill, Galway	H17	M268423	(4) 27 Jun.-8 Jul. 2003	KGMB
"	Tuam, Galway	H17	[M430520]	1900	NMI
"	Shannon Harbour, Offaly	H18	[N030190]	pre-1900	Kane NMI
"	Cronykeery, Wicklow	H20	T292989	12 Jun. 2003	Angus Tyner
"	Roundwood, Wicklow	H20	T211995	14 Jul. 1984	KGMB

"	Clontarf, Dublin	H21	O198366	5 Jul. 1972	KGMB
"	Firhouse, Dublin	H21	O116272	02 Jul. 1983	KGMB
"	Killiney, Dublin	H21	O258254	10 Jul. 1976	KGMB
"	Lambay, Dublin	H21	[O310510]	unknown	NMI
"	Rathfarnham, Dublin	H21	O148292	20 Jun. 1983	KGMB
"	Stepaside, Dublin	H21	O193243	17 Jun. 1984	KGMB
"	Stillorgan, Dublin	H21	O210269	28 Jun. 1984	KGMB
"	Newcastle House, Meath	H22	N793911	8 Jul. 1999	KGMB
"	Kilbeggan, Westmeath	H23	N340348	4 Jul. 1983	KGMB
"	Killynon, Westmeath	H23	[N520570]	pre-1903	NMI
"	Newport, Mayo	H27	L983939	Aug. 1986	Langmaid (1989)
"	Markree, Sligo	H28	[G690250]	pre-1903	NMI
"	Cornamagh, Cavan	H30	N740990	19 Jul. 2002	KGMB
"	Dundalk, Louth	H31	[J040070]	unknown	NMI
"	Crom Castle, Fermanagh	H33	H359248	21 Jun. 1988	KGMB
"	Coolmore, Donegal	H34	[G860660]	pre-1895	NMI
"	Favour Royal, Tyrone	H36	[H617527]	pre-1903	Kane NMI
"	Kircubbin, Down	H38	[J590620]	Jul. 1906	Johnson NMI

					Foster
"	Newcastle, Down	H38	[J370310]	5 Aug. 1927	NMI
"	Strangford, Down	H38	[J590490]	unknown	Foster (1932)
versicolor	Timoleague, Cork	H3	W471448	12 Jun. 1931	Huggins (1953)
"	Fountainstown, Cork	H4	W783578	22 Jun. 1998	Myers (pers. comm.)
"	Annesgrove, Cork	H5	R682050	30 Jul. 1985	KGMB
"	Kilcolman Wildfowl Res., Cork	H5	R584111	(6) 4-26 Jul. 1991	KGMB
"	Killahaly Wood, Waterford	H6	X089950	18 Jul. 1986	KGMB
"	Ballybrado Hse, Tipperary	H7	S063204	14 Jul. 1986	KGMB
"	Barrigone, Limerick	H8	R296508	25 Jul. 1990	KGMB
"	Pallaskenry, Limerick	H8	R420554	1978	Rothamsted Trap
"	Corofin (Clifden Hse), Clare	H9	R265891	14 Jun. 1997	KGMB
"	Astagob (Clonsilla), Dublin	H21	O059365	31 Jul. 1980	KGMB
"	Lispopple, Dublin	H21	O137505	26 Jul. 1973	KGMB
"	Lough Gill, Sligo	H28	[G750350]	1915	UM
"	Lissan, Tyrone	H36	[H790820]	1903	Greer (1944)

FIGURE 1. Distribution map for *Oligia strigilis* in Ireland.

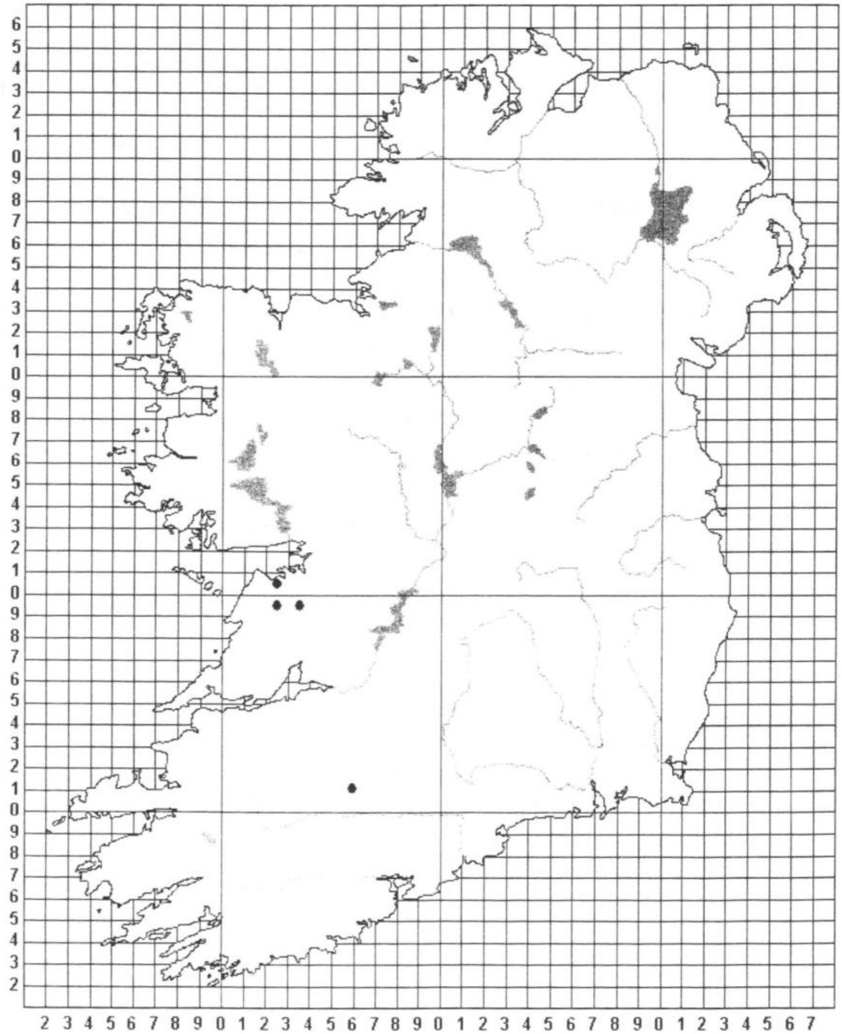


FIGURE 2. Distribution map for *Oligia latruncula* in Ireland.

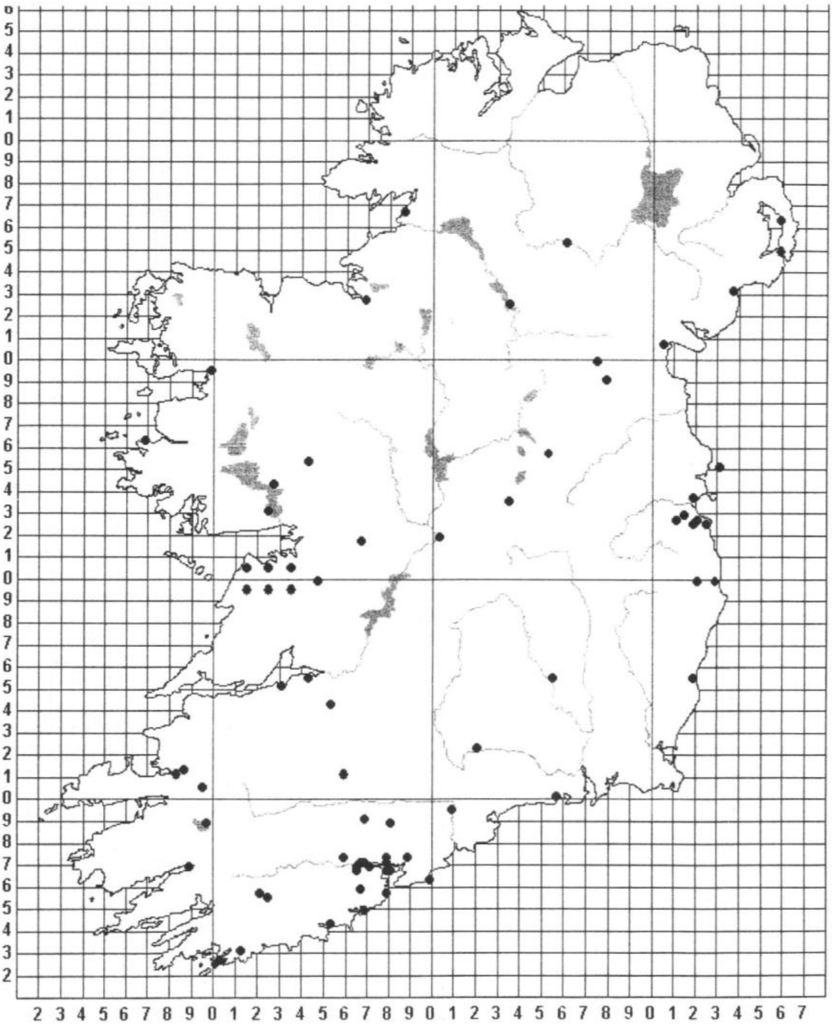
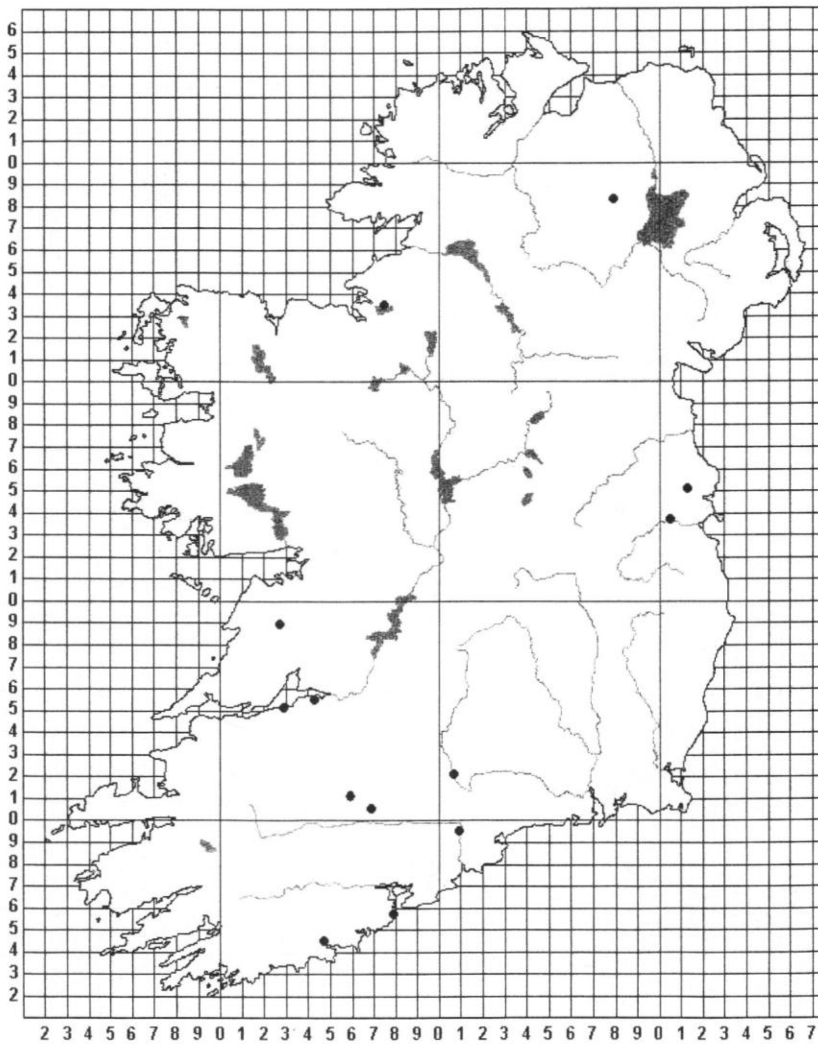


FIGURE 3. Distribution map for *Oligia versicolor* in Ireland.



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THE AQUATIC MOLLUSC FAUNA OF THE GRAND AND ROYAL CANALS, IRELAND

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Introduction

The Grand and Royal Canals are the principal waterways of the calcareous central plain of Ireland. They provide slow-flowing aquatic habitats that are of high conservation value for many species of plants, birds, mammals, dragonflies and other invertebrates including molluscs. Indeed, three of the rarest Irish species of aquatic snail that have been listed in Kerney (1999) as extinct or threatened were known in the past principally from the Grand and Royal Canals. One is a freshwater gastropod (*Myxas glutinosa*) and two are small bivalves or pea mussels (*Pisidium moitessierianum* and *P. pseudosphaerium*).

The Grand Canal was built between 1756 and 1804, and the Royal Canal between 1790 and 1830. The history of the canals has been covered by many authors e.g. Delany (1993, 1995) and Delany and Delany (1966). During the period of time between the cessation of commercial traffic (early 1960s) and the recent drive to facilitate pleasure craft, an increased number of diverse habitats developed in the canal systems.

A major ecological survey was undertaken in both canal systems from 1989 to 1990 (Royal Canal) and in 1991 (Grand Canal) (Dromey, Johnston and Keane, 1992; Dromey, Johnston and Nairn, 1991). These surveys recognised the two canals as important waterways for freshwater plants and animals. However, there appears to be very little work which has focused specifically on the molluscan fauna of the two Canals. Doogue (in Dromey *et al.*, 1990) summarises his work carried out on the Royal Canal in counties Dublin and Kildare between 1975 and 1983. A total of 28 mollusc species was recorded. Most of the earlier work was carried out by R. A. Phillips (1866-1945) and A. W. Stelfox (1883-1972). From the late 1960s through to the mid 1970s, mollusc recording surveys were undertaken in Ireland initially by Michael Kerney, and then with members of the Conchological Society of Great Britain and Ireland. Although the records were collected mostly on a 10km square basis, those for the more uncommon species included more detailed information. These surveys covered several sites on both the Grand and Royal Canals, and for most sites there have been no subsequent records. The results of these studies were included firstly in the *Atlas of the non-marine Mollusca of the British Isles* (Kerney, 1976) and updated in the *Atlas of the land and freshwater molluscs of Britain and Ireland* (1999). More recently, *Myxas glutinosa* was refound in the Grand Canal at Robertstown by Mary Harris (Biggs and Williams, 2002).

In 2003, a wide-ranging survey was carried out with support funding from The Heritage Council with the principal objective of a comprehensive species list of aquatic molluscs in both the Grand and Royal Canals. A particular focus was to establish the current status and distribution of *Myxas glutinosa, Pisidium moitessierianum* and *P. pseudosphaerium,* for which there was no recent information and additionally, to update our knowledge of the extent of the invasive zebra mussel *Dreissena polymorpha.* Additional objectives were to highlight important areas of conservation value, and to provide a basis from which policy recommendations could be made and an informed conservation strategy for the protection of rare aquatic species to be developed. This paper summarises the results of the survey in the form of distribution maps and critical notes. Nomenclature follows Moorkens and Speight (2001) and Killeen *et al.* (2004).

Methodology

The canals were sampled throughout their entire lengths from Dublin to the River Shannon. The sample sites were irregularly spaced at approximately 5km intervals. However, in areas of greater importance for the target mollusc species such as *Myxas glutinosa*, the sample sites were closer together. In addition to the Grand and Royal Canals, the Milltown Feeder was also sampled. This waterway is known to have high quality water and has formerly supported *M. glutinosa*.

Sampling was carried out from the banks using an extendable robust, aluminium-framed pond net equipped with a 0.5mm nylon mesh bag. Both the bivalves (which mainly live in the sediment) and the gastropods (which mainly live on the weeds) were collected. In addition, at sites where such habitat existed, canal walls and submerged rocks were searched for the presence of *Myxas glutinosa* and *Dreissena polymorpha*.

Large bivalve and gastropod species present were recorded in the field by examining the samples in a white tray. All residue (sediment with molluscs) passing through a 4mm mesh sieve and retained by a 0.5mm mesh sieve was retained and analysed in the laboratory. All mollusc species were recorded. Most specimens of *Pisidium* (pea mussels) were removed and dried prior to subsequent identification. Reference material of pea mussels and other species was retained.

After sampling, the nets, sieves, trays and apparel were cleaned in order to prevent the contamination of species between sites, especially *Dreissena polymorpha*.

Results

A total of 100 sites were sampled:- 39 on the Royal Canal, 56 on the Grand Canal and a further five sites on the Milltown Feeder. Of these, 93 were sampled fully whereas the remaining seven (all on the Grand Canal) were examined only for the presence of *Myxas glutinosa*. A total of forty species of aquatic molluscs were recorded comprising 23 gastropods and 17 bivalves (Figs 1-40). This number of species represents 73% of the total Irish freshwater mollusc fauna. The two Canals support 81% of the bivalves and 68% of the gastropods. The Grand Canal supported 37 species (22 gastropods, 15 bivalves), whereas the Royal Canal was slightly less diverse with 34 species (18 gastropods and 16 bivalves). The Milltown Feeder was much less diverse (18 species).

TABLE 1. Summary of species numbers and composition.

Waterbody	Total No. of Species	Gastropods	Bivalves
Ireland	55	34	21
All canal survey sites	40	23	17
Royal	34	18	16
Grand	37	22	15
Milltown Feeder	18	9	9

The molluscan species exhibit a wide range of distributions (see figs 1-40). Many were found to be widespread throughout both canals, whereas others had much more restricted ranges. Five species were found only in the Grand Canal:- *Theodoxus fluviatilis, Potamopyrgus antipodarum, Physella acuta, Aplexa hypnorum* and *Radix auricularia*. Four species were found only in the Royal Canal:- *Planorbis planorbis, Anisus vortex, Anodonta cygnea* and *Sphaerium nucleus*. This was the first record for *S. nucleus* in Ireland (see notes below). *Bithynia tentaculata* was the most frequently occurring species, being found at 82 sites. This was followed by *Sphaerium corneum* (80 sites) and *Pisidium subtruncatum* (79 sites). Eighteen species (45%) out of the total of 40 were found at less than 20 sites.

Table 2 gives a summary of the numbers of species and composition for all sites and each canal separately. The number of species recorded at each of the total of 93 sites where full sampling was conducted ranged from one to 23, with a mean of 12.4 species per site. Sites on the Grand Canal were marginally more diverse with a mean of 13.2 species per site recorded, compared with 11.7 in the Royal Canal.

TABLE 2. Summary of number of species/site.

	All mollusc species		**Gastropods**		**Bivalves**	
Canal	**Mean No/site**	**Range**	**Mean No/site**	**Range**	**Mean No/site**	**Range**
All sites (n=93)	12.4	1 - 23	7.0	1 - 15	5.4	0 - 10
Royal (n=39)	11.7	1 - 21	6.6	1 - 13	5.1	0 – 8
Grand (n=49)	13.2	2 – 23	7.5	1 – 15	5.7	0 – 10
Milltown Feeder (n=5)	10.8	8 – 13	6.4	5 – 8	4.4	0 – 6

The sites on the Grand Canal with the greatest diversity lie mostly to the west of Edenderry and to the east of the Dublin western bypass (M50). On the Royal Canal, the most diverse sites are between Maynooth and Leixlip in the east, and occasionally between Mullingar and Cloondara. The low diversity sites on the Grand Canal lie mostly between Sallins and Lucan, and on the Royal Canal within the M50 motorway, and between Mullingar and Longford.

Notes on selected species

***Myxas glutinosa* (Müller, 1774)**

In the Royal Canal, *Myxas glutinosa* was found living at a line of five sites towards the eastern end between Maynooth and Leixlip. Dead shells were also found at two sites between Enfield and the Hill of Down. In the Grand Canal, the species was more widespread but essentially confined to two sections:- in Dublin within the M50 motorway, and between the confluence of the Barrow Line and Sallins. The species was not found in the Milltown Feeder. The habitat at the Grand Canal locations was similar *viz.* clear water, a rich and diverse macrophyte community, and a substrate of generally shallow silts or fine calcareous grit and some larger rocks. It was found attached to plants such as *Nuphar*, on the open substrate, on rocks and on the canal walls. In the Royal Canal, the habitat at the *Myxas* sites appeared to be more disturbed. However, at two of them, stoneworts (*Chara* spp.) were present suggesting that this area receives spring water which maintains an overall higher water quality.

Historical records suggest that *M. glutinosa* was more widespread in the late 1960s and early 1970s. In the Royal Canal in 1968, Kerney found live individuals at Moyvally, and at Grahamstown (east of Mullingar) where it was noted as abundant. Kerney also recorded freshly dead shells at Mullingar, Ballynacarrigy and at Killashee (near Longford). In the Grand Canal in 1971, Kerney reported *M. glutinosa* as very common or abundant at Sallins, Cloncurry and east of Clondalkin. He also noted it in the canal feeder south of Naas, and in the Barrow Line at Rathangan.

M. glutinosa is well-known for apparently disappearing from a site and then re-appearing after several years although this may in part be an artefact of the time of year when surveys were carried out. The species is an annual which matures throughout the winter and early spring before dying-off in late spring/early summer. In the summer months and early autumn, the snail may be very difficult to find. Furthermore, the species possesses a very thin shell which may not persist on the substrate for long. Therefore it is necessary to exercise caution when examining evidence of decline in populations.

In the Royal Canal, on the basis of the historical record compared with the present survey, there is clear evidence of a geographical decline. The restoration of the section between Dublin and Mullingar in the late 1980s/early 1990s may well have contributed to the loss of populations from this section. At present, the section from Enfield to Mullingar is managed for, and is well-used by, leisure traffic. The combination of management and possible local lowering of water quality may render these sections unsuitable for the species. The Royal Canal to the west of Ballynacarrigy has not been restored and much of the section has almost dried-up, become a swamp, or become ponded with large quantities of floating and decaying weeds and deep, organic muddy sediments. None of this section is now considered to support suitable habitat for *M. glutinosa*.

***Pisidium pseudosphaerium* Schlesch, 1947**

Pisidium pseudosphaerium was found only at five sites on the Royal Canal and at four sites on the Grand Canal (all within the M50 motorway in Dublin). Four of the Royal Canal sites were in the ponded-up or swampy sections between Longford and Abbeyshrule, the other at Leixlip. Given the apparent suitability of the habitat in the western section, it is surprising that the species was not found more frequently. At Leixlip and at the Grand Canal sites in Dublin, *P. pseudosphaerium* was found with *Myxas glutinosa*.

Three of the historical records for *P. pseudosphaerium* were from the Royal Canal between Enfield and Mullingar by Kerney in 1968. He also recorded the species at Leixlip. Later, in 1982 it was noted at Scally's Bridge, Abbeyshrule. There are no previous records for the Grand Canal main channel, although Moorkens (1997) found specimens in the Blackwood Feeder near Prosperus. Therefore, whilst *P. pseudosphaerium* has disappeared from the Royal Canal between Enfield and Mullingar where the habitat is no longer suitable (see above for *Myxas glutinosa*), it has probably increased in frequency to the west where habitat has become more suitable.

***Pisidium moitessierianum* Paladilhe, 1866**

The pygmy pea mussel was considered to have been extinct in Ireland since 1924. However, in November 2002, prior to this survey, living individuals were found in the Grand Canal at two sites east of Tullamore (Killeen and Moorkens, 2003). During this survey, the species was found at a further eight sites on the Grand Canal west of Edenderry, and at a single site on the Royal Canal, west of Enfield. At all locations the substrate was generally rather muddy and overall bivalve diversity was high. *P. moitessierianum* appeared to be relatively uncommon, with less than ten live individuals amongst several hundred *Pisidium* specimens at any one site. The absence of any records of living specimens since the 1920s raises the question as to whether *P. moitessierianum* has always been present since that the time, but has merely been overlooked, or whether it is a relatively recent recolonist.

***Dreissena polymorpha* (Pallas, 1771)**

The zebra mussel, has spread rapidly in the Shannon system since the first Irish record in 1997 (McCarthy *et al.,* 1998). The species was recorded at 18 of the 56 sample sites in the Grand Canal, being found at virtually every site from Shannon Harbour through to Toberdaly, west of Edenderry. *Dreissena polymorpha* was recorded at only one of the sample sites in the Royal Canal, at Cloondara near the River Shannon confluence, where it was common on the canal walls. It seems likely that the zebra mussel will continue to spread eastwards along the Grand Canal. Once it reaches the Robertstown area, it may well become a threat to the populations of *Myxas glutinosa*.

In addition to the serious problems of biofouling infrastructure by *D. polymorpha*, the species has elsewhere been responsible for the extermination of local populations of native unionid mussels. The two Canals support large, often dense populations of the duck mussel, *Anodonta anatina*. However, at most localities on the western half of the Grand Canal where both species were present, a significant portion of the duck mussels were found with several zebra mussels attached to their shells. Inevitably this will lead to the duck mussels starving and becoming locally extinct.

***Sphaerium nucleus* (Studer, 1820) New to Ireland**

The swamp orb mussel was recorded for the first time in Ireland during this survey. Specimens were found at two locations in the western end of the Royal Canal south of Longford. The canal at these locations was ponded-up and swampy with dense vegetation. It is likely that *S. nucleus* will be found elsewhere in similar habitats in Ireland. The species was also only recently recognized as part of the British fauna (Killeen *et al.*, 2004). To date it has been found in richly-vegetated ditches on grazing marsh systems in south-east England and East Anglia.

Discussion

The two canals support a high diversity of freshwater molluscs, 40 species out of the total Irish fauna of 55 species. However, no one site supports more than 23 species and the mean number of species per site was only 12.4. There are very few species of freshwater snails or bivalves which may be regarded as catholic with respect to environmental conditions – some require a specific type of substrate, some (particularly the gastropods) require aquatic macrophytes, some require swampy habitats (e.g. *Sphaerium nucleus, Pisidium pseudosphaerium, Planorbis planorbis*), some require high levels of calcium, and some require high water quality (e.g. *Myxas glutinosa, Pisidium pulchellum*). As there is no one site on either canal which supports such a wide range of different habitats and conditions, it is unsurprising that the number of species at each site is relatively low. However, this high number of mollusc species reflects the range of habitats that the two canals support. In addition, whilst there is considerable local variation in the distribution of any one species compared with another, a significant number of the mollusc species are widely distributed in both canals, but others are much more restricted. Thus, conservation of molluscan diversity requires preservation of a wide range of habitats over a wide geographical area.

The results of this survey have highlighted the importance of management to the molluscan species richness in general, and to the continued presence and future potential for populations of *Myxas glutinosa, Pisidium moitessierianum, P. pseudosphaerium* and *Sphaerium nucleus* in particular.

On average, a navigable canal needs maintenance dredging every 10-12 years. Both land and water-based dredgers are used to deepen the canals and remove excess reed fringe. The land based machinery is also used to raise the banks above the water level to a minimum of 600mm to prevent overflow. In general, the best quality habitats for molluscs have been managed to allow marginal vegetation to be retained, where dredging has been carried out from one bank only and where spoil is not evident close to either bank. The best quality habitats were found to be in the Grand Canal inside the M50. The recent management of the Grand Canal in Dublin city centre is considered to be positive and is providing beneficial conditions for the two rare molluscan species there. The Grand Canal west of Tullamore is also of high quality. The molluscan diversity may be high due to its proximity to the Shannon River, from which snails may be rapidly dispersed. There is a possibility that habitat quality is being aided by the water filtering effects of *Dreissena polymorpha*. This improvement in water clarity and quality will be temporary, as the living biomass of zebra mussel is keeping the filtered nutrients out of the system, and they will be returned as time moves on. The poorest quality habitat is east of Sallins, where boat traffic is heavy and nutrients are elevated. Mats of algae were common, suggesting excessive nutrient inputs in this area. Their source should be identified and action taken to prevent them in the future.

The Royal Canal was not as high in habitat quality for molluscs as the Grand Canal, but the areas around Leixlip were the best in terms of management and perhaps natural water supply. The Dublin city centre stretch of the Royal Canal was of much poorer quality than the Grand Canal in Dublin, and the management used in each should be compared in order to understand what may be the cause of the depressed habitat quality in the Royal Canal.

Acknowledgements

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FIGURE 1. The distribution of *Theodoxus fluviatilis* (L.). Solid circles = species present; open circles = species absent.

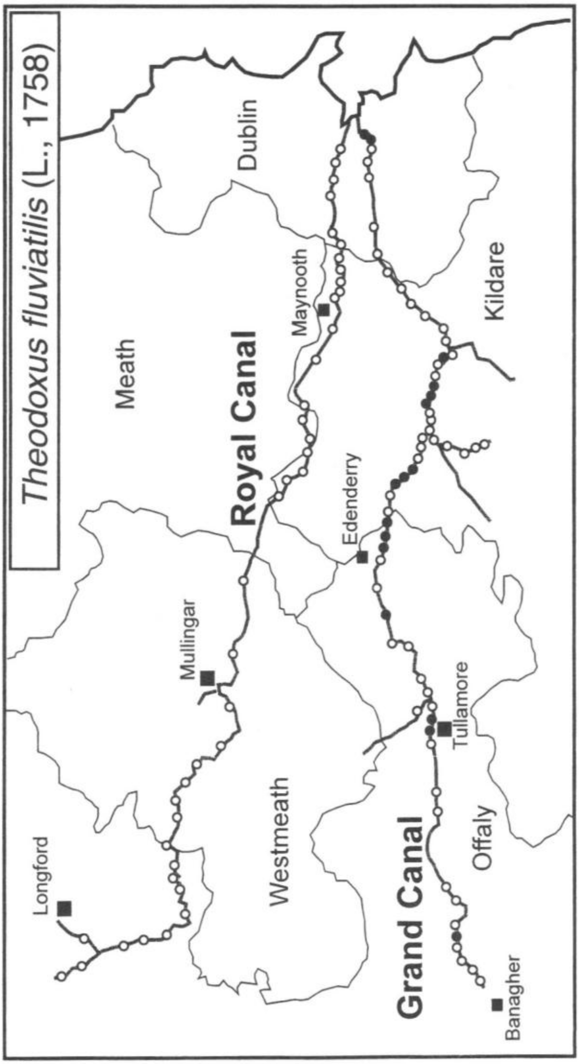

FIGURE 2. The distribution of *Bithynia tentaculata* (L.). Solid circles = species present; open circles = species absent.

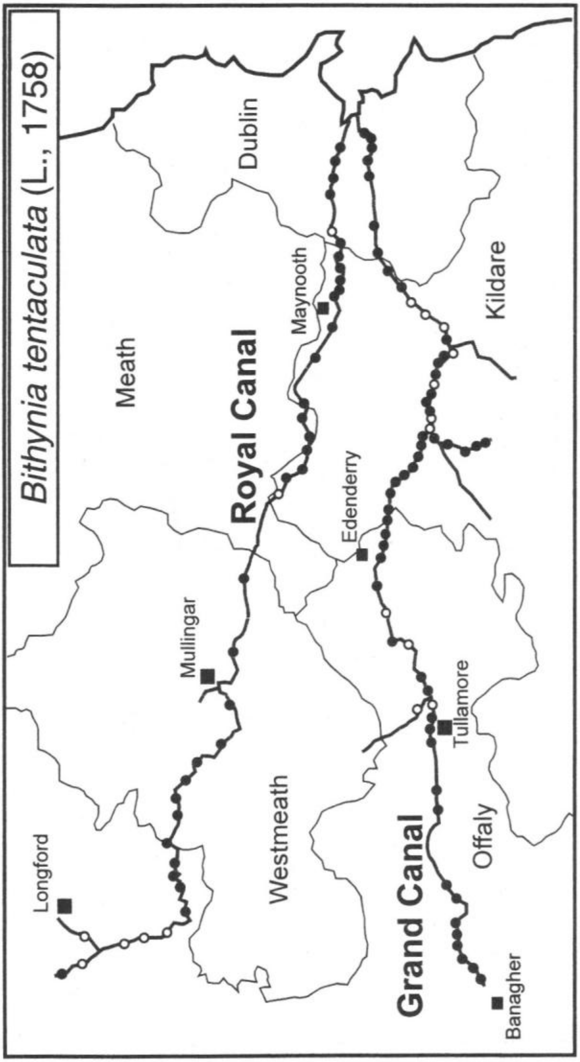

FIGURE 3. The distribution of *Bithynia leachii* (Sheppard, 1823). Solid circles = species present; open circles = species absent.

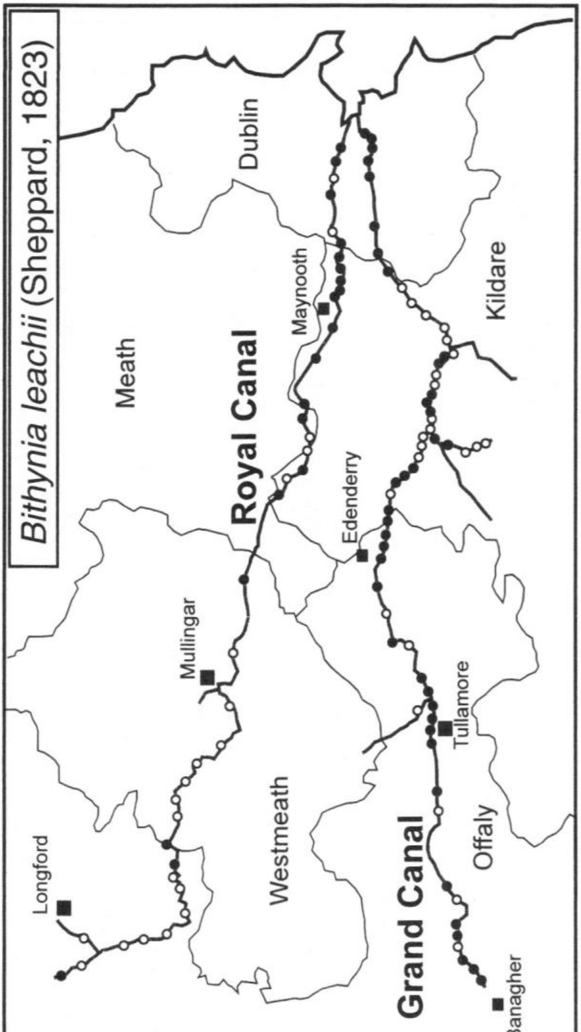

FIGURE 4. The distribution of *Potamopyrgus antipodarum* (Gray). Solid circles = species present; open circles = species absent.

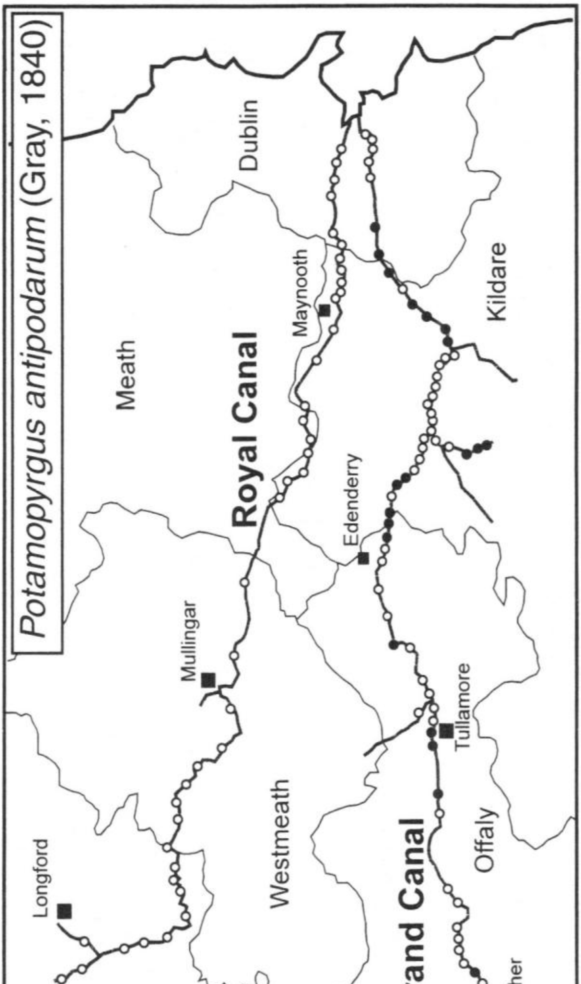

FIGURE 5. The distribution of *Valvata cristata* Müller. Solid circles = species present; open circles = species absent.

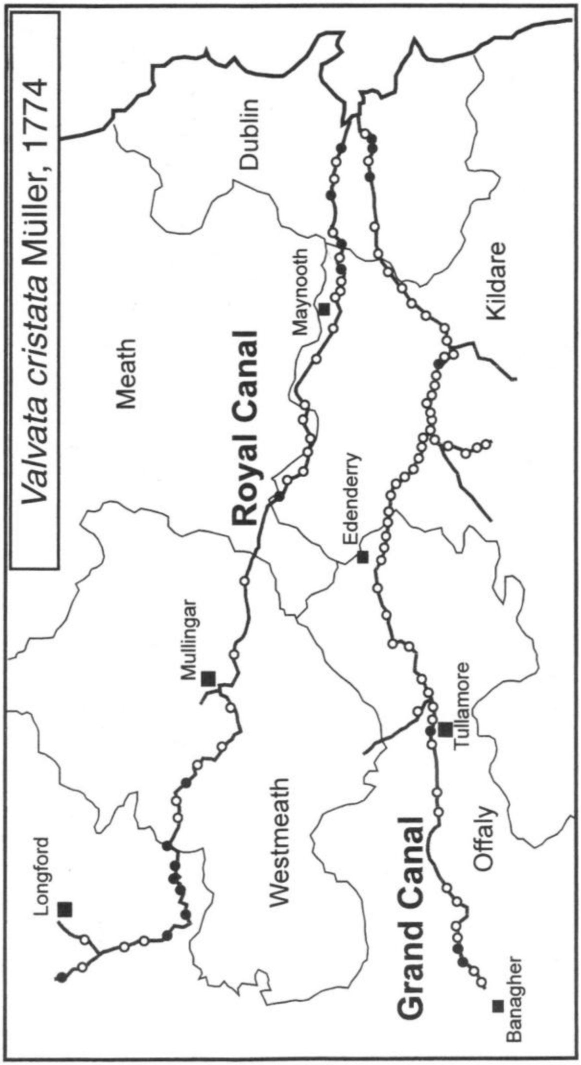

FIGURE 6. The distribution of *Valvata piscinalis* Müller. Solid circles = species present; open circles = species absent.

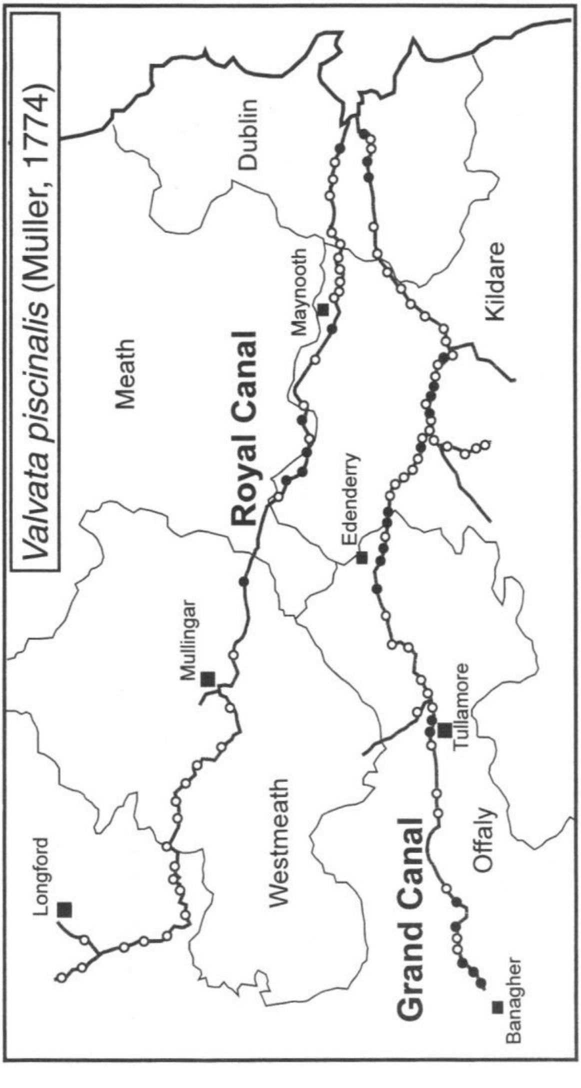

FIGURE 7. The distribution of *Acroloxus lacustris* (L.). Solid circles = species present; open circles = species absent.

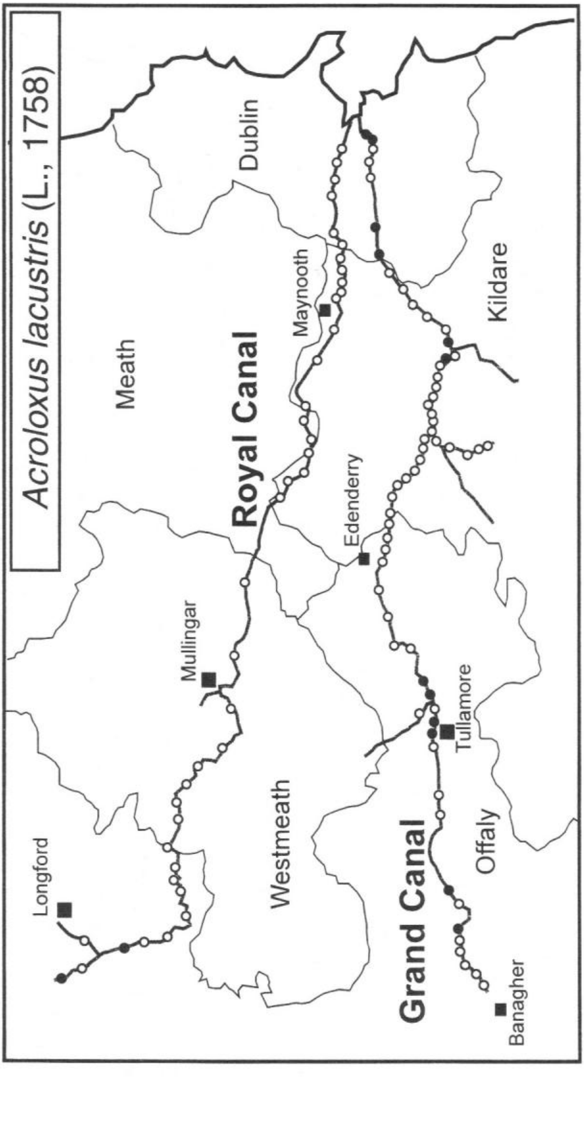

FIGURE 8. The distribution of *Lymnaea stagnalis* (L.). Solid circles = species present; open circles = species absent.

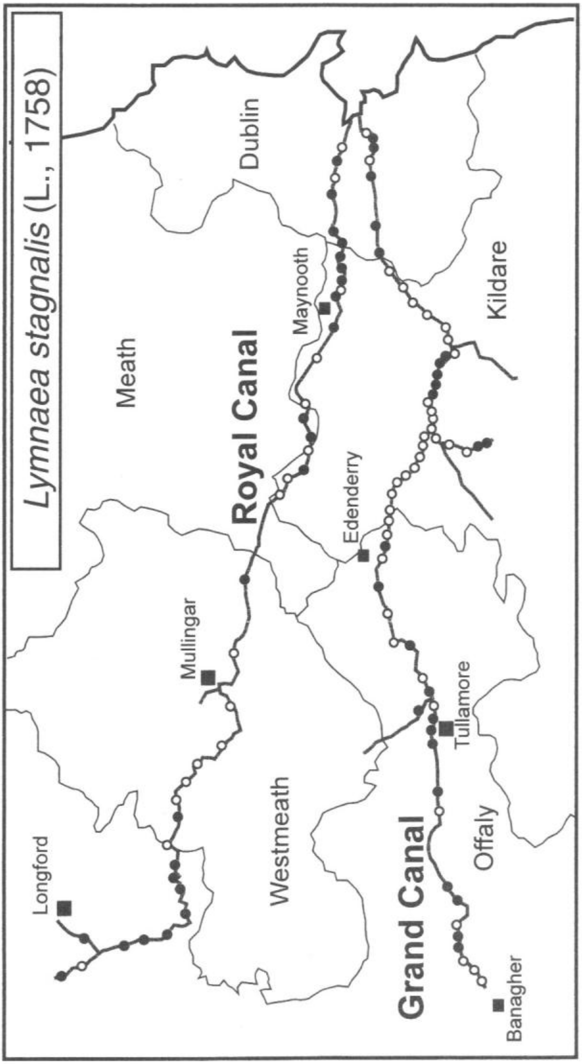

FIGURE 9. The distribution of *Stagnicola fuscus* (Pfeiffer). Solid circles = species present; open circles = species absent.

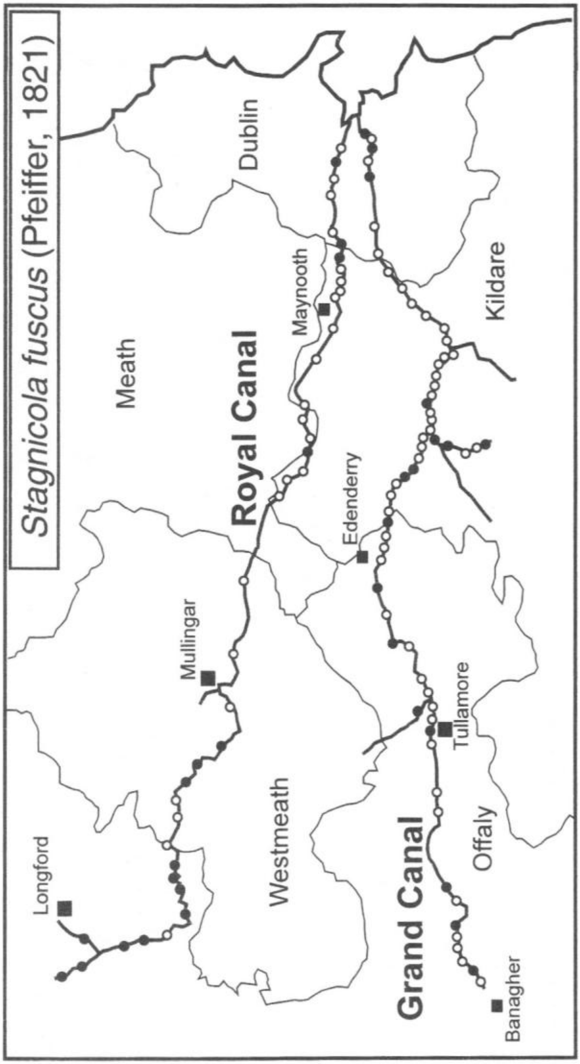

FIGURE 10. The distribution of *Radix auricularia* (L.). Solid circles = species present; open circles = species absent.

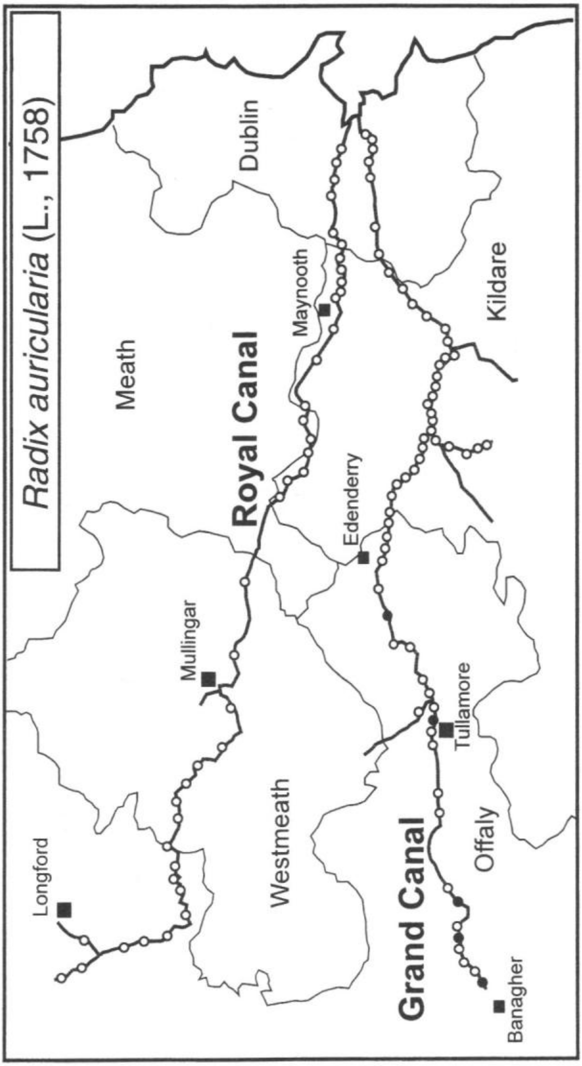

FIGURE 11. The distribution of *Radix balthica* (L.). Solid circles = species present; open circles = species absent.

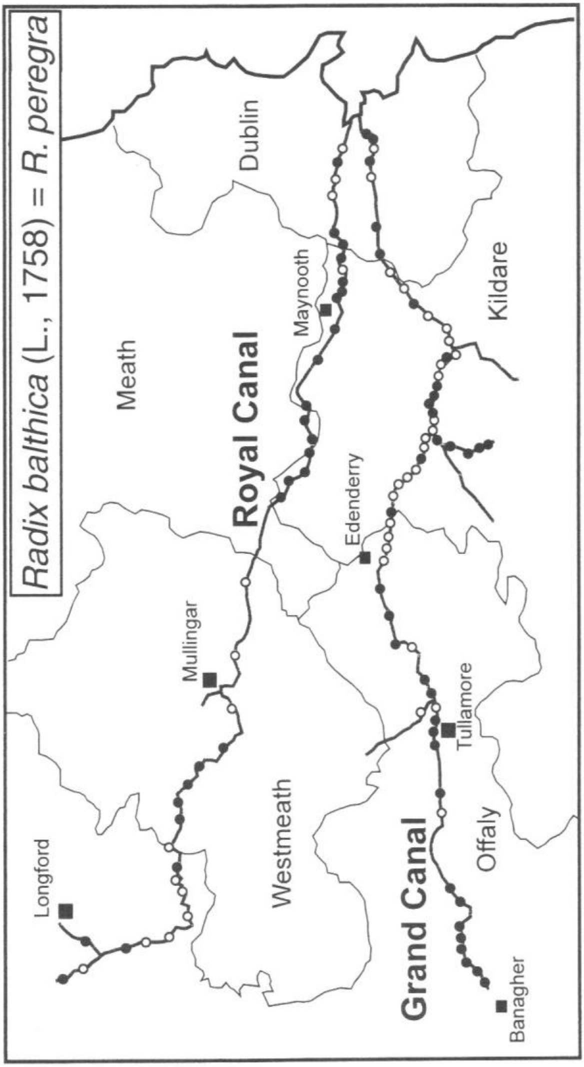

FIGURE 12. The distribution of *Myxas glutinosa* (Müller). Solid circles = species present; open circles = species absent.

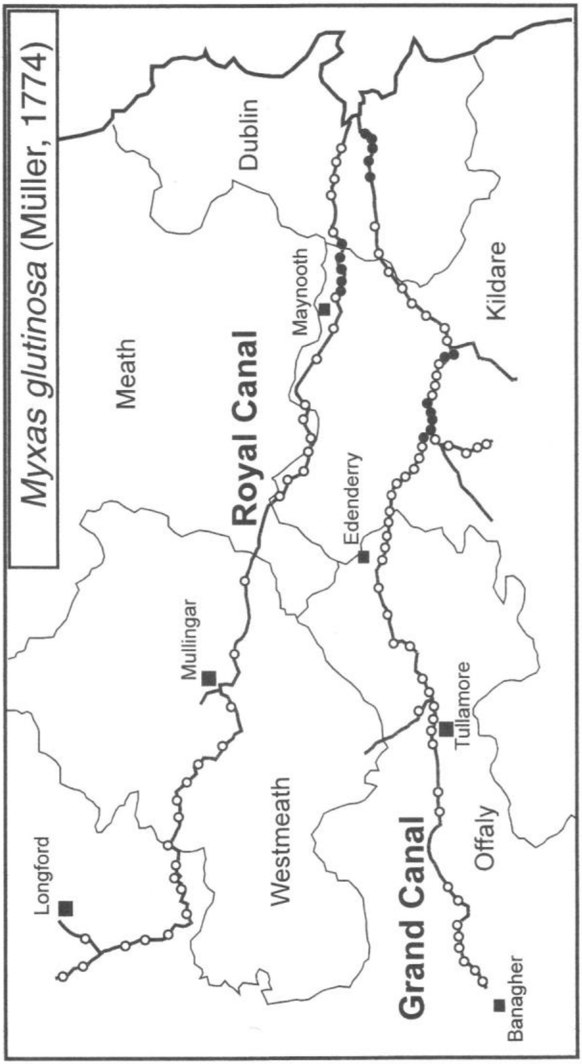

FIGURE 13. The distribution of *Physa fontinalis* (L.). Solid circles = species present; open circles = species absent.

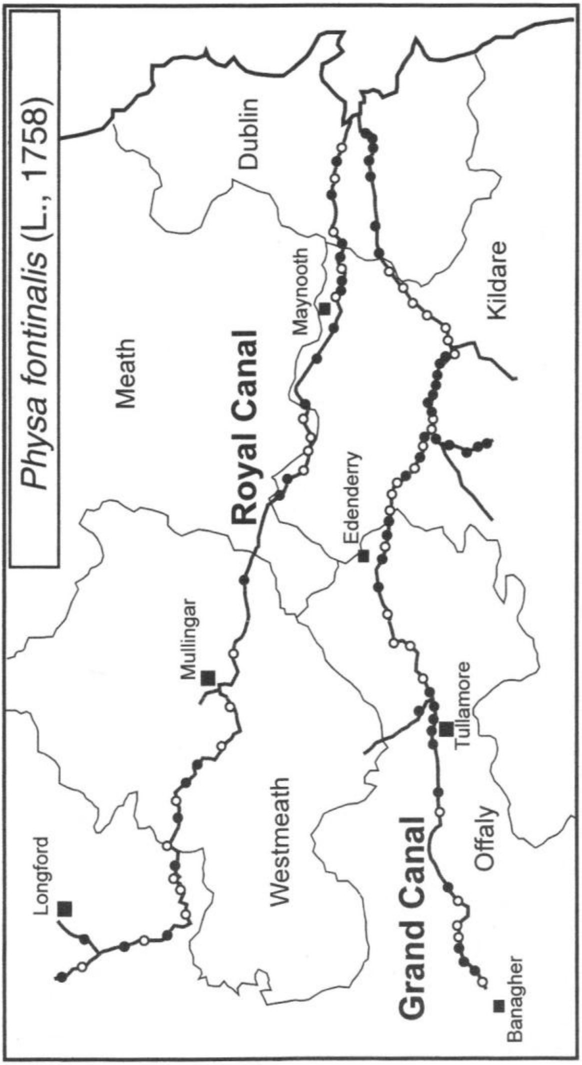

FIGURE 14. The distribution of *Physella acuta* (Draparnaud). Solid circles = species present; open circles = species absent.

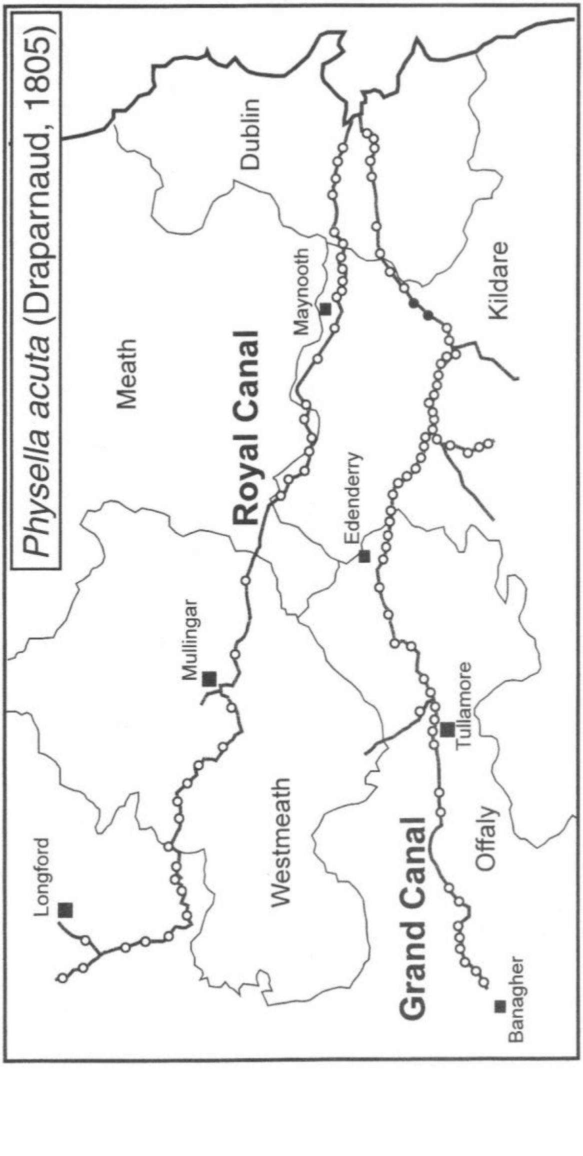

FIGURE 15. The distribution of *Aplexa hypnorum* (L.). Solid circles = species present; open circles = species absent.

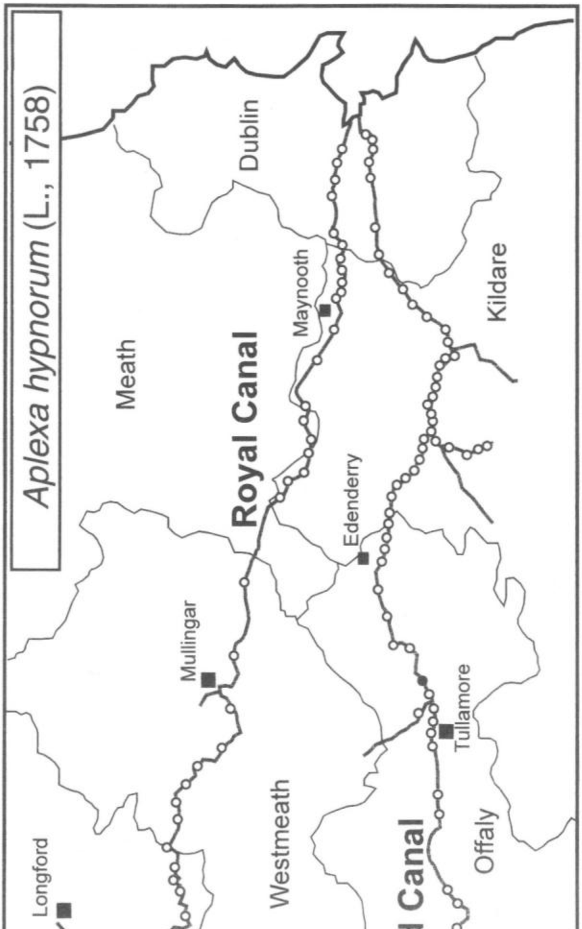

FIGURE 16. The distribution of *Planorbarius corneus* (L.). Solid circles = species present; open circles = species absent.

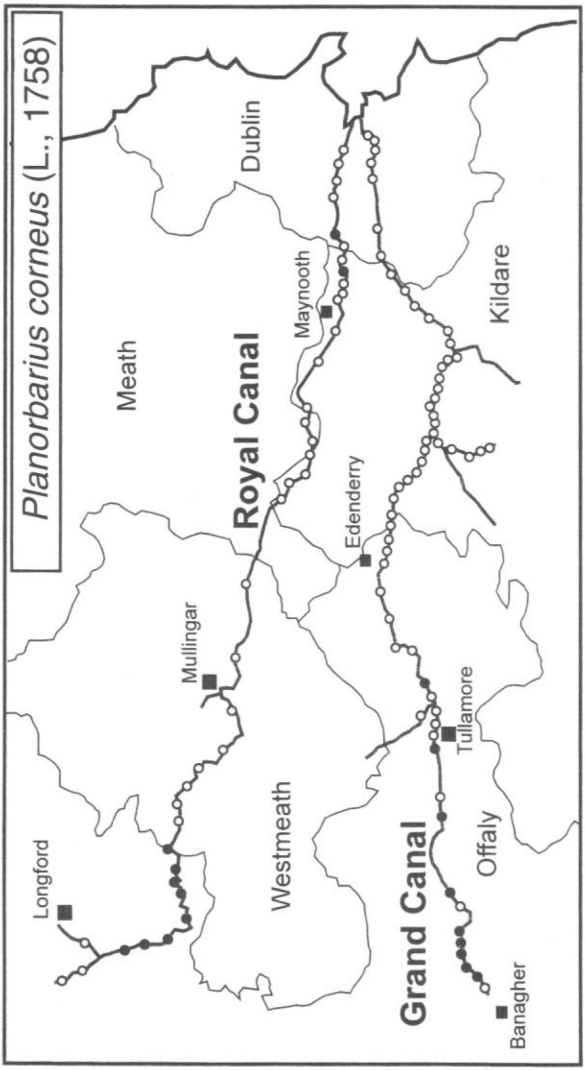

FIGURE 17. The distribution of *Planorbis planorbis* (L.). Solid circles = species present; open circles = species absent.

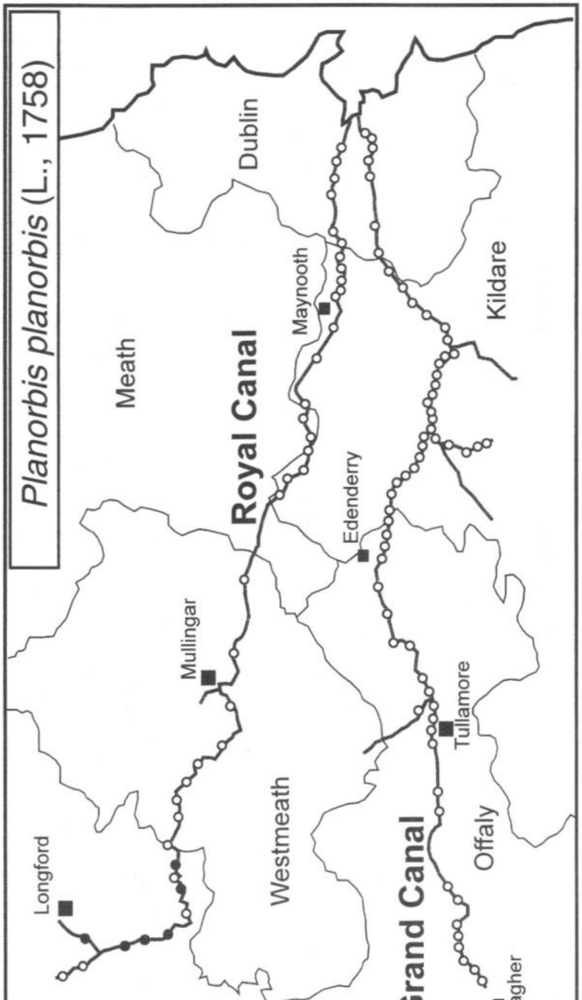

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FIGURE 18. The distribution of *Planorbis carinatus* Müller. Solid circles = species present; open circles = species absent.

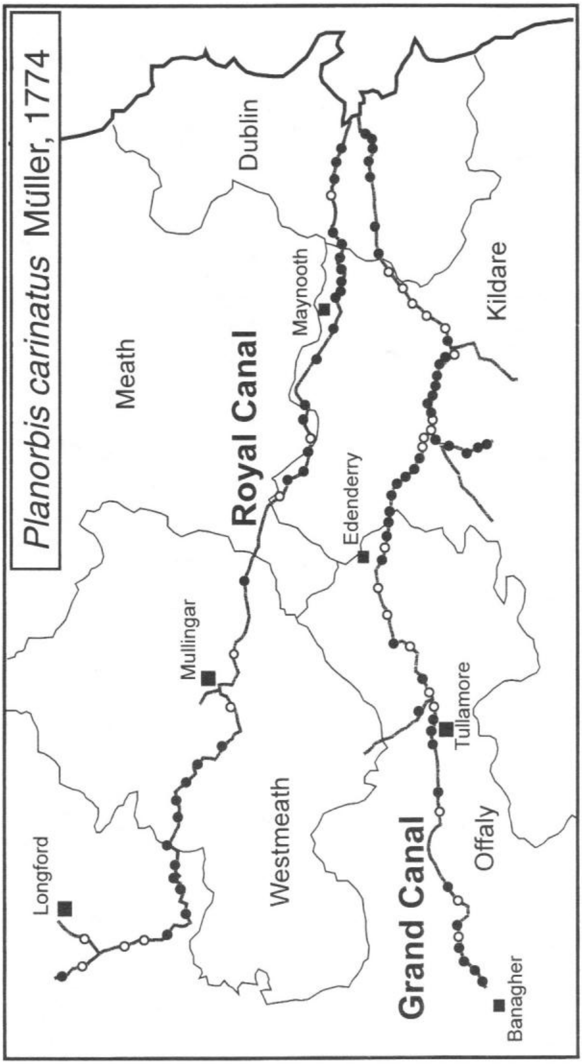


FIGURE 19. The distribution of *Anisus vortex* (L.). Solid circles = species present; open circles = species absent.

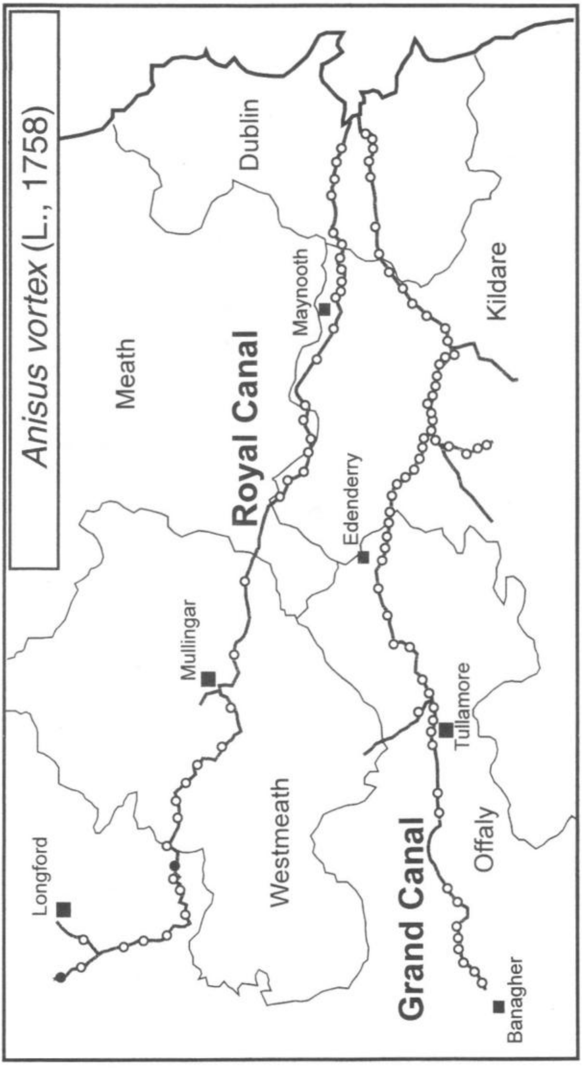


FIGURE 20. The distribution of *Bathyomphalus contortus* (L.). Solid circles = species present; open circles = species absent.

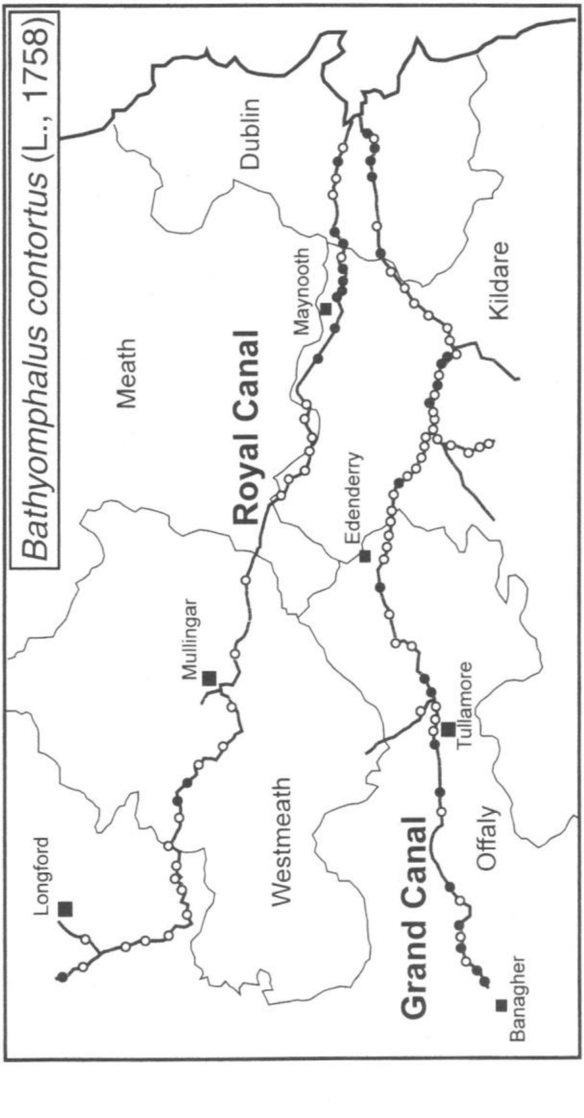


FIGURE 21. The distribution of *Gyraulus albus* (Müller). Solid circles = species present; open circles = species absent.

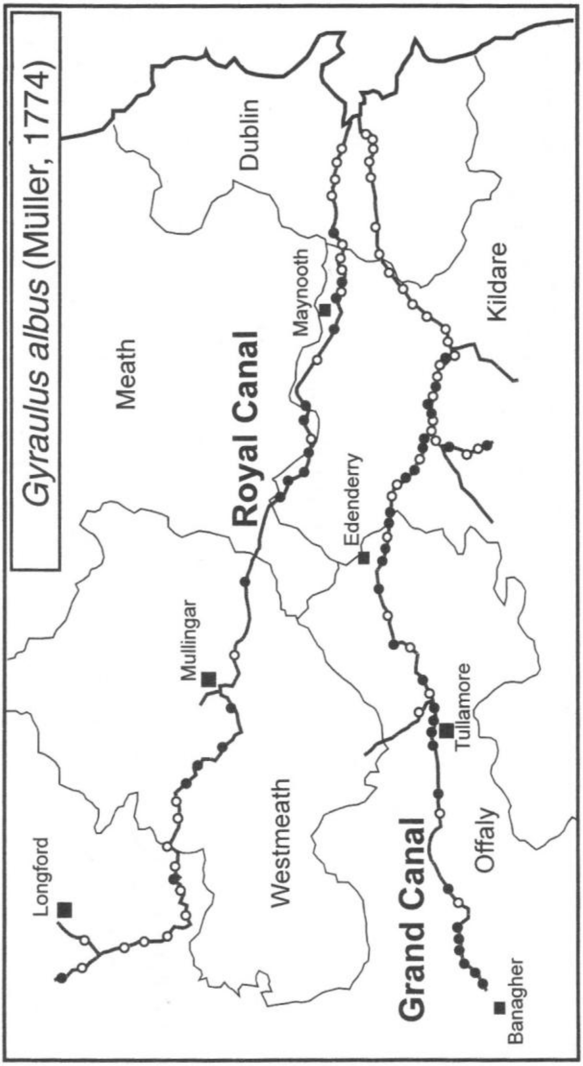


FIGURE 22. The distribution of *Gyraulus crista* (L.). Solid circles = species present; open circles = species absent.

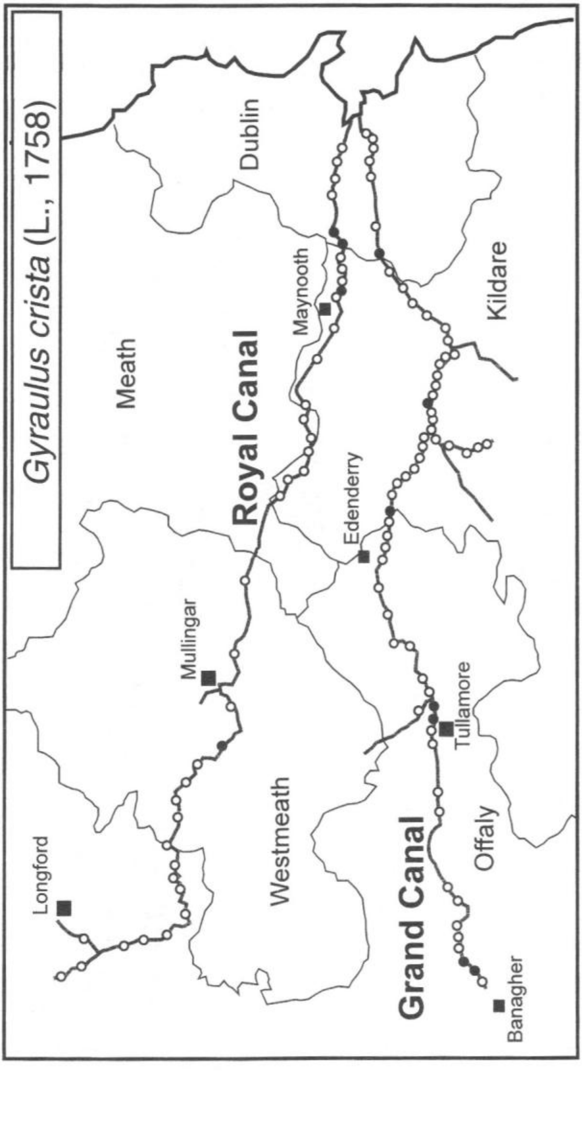


FIGURE 23. The distribution of *Hippeutis complanatus* (L.). Solid circles = species present; open circles = species absent.

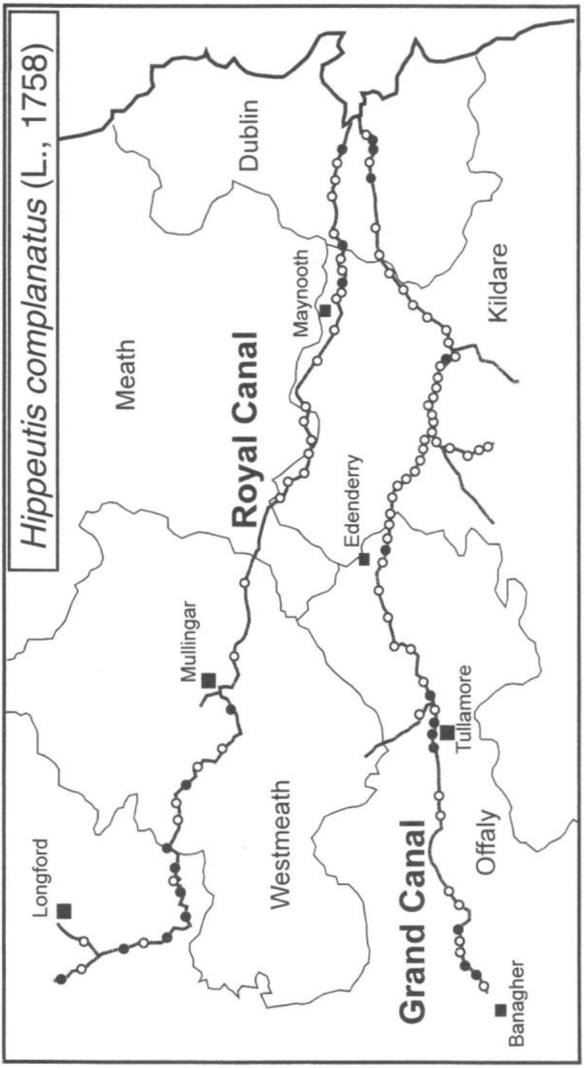


FIGURE 24. The distribution of *Anodonta cygnea* (L.). Solid circles = species present; open circles = species absent.

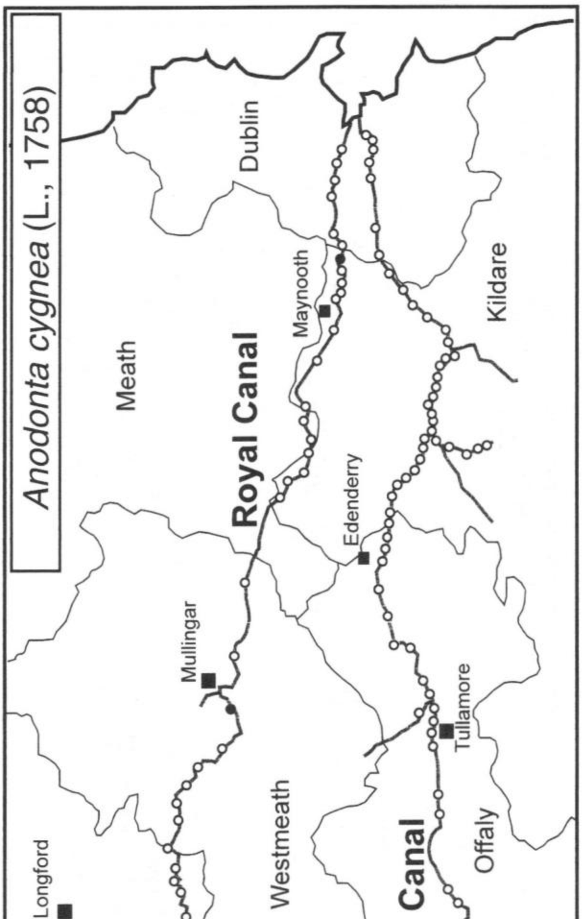


FIGURE 25. The distribution of *Anodonta anatina* (L.). Solid circles = species present; open circles = species absent.

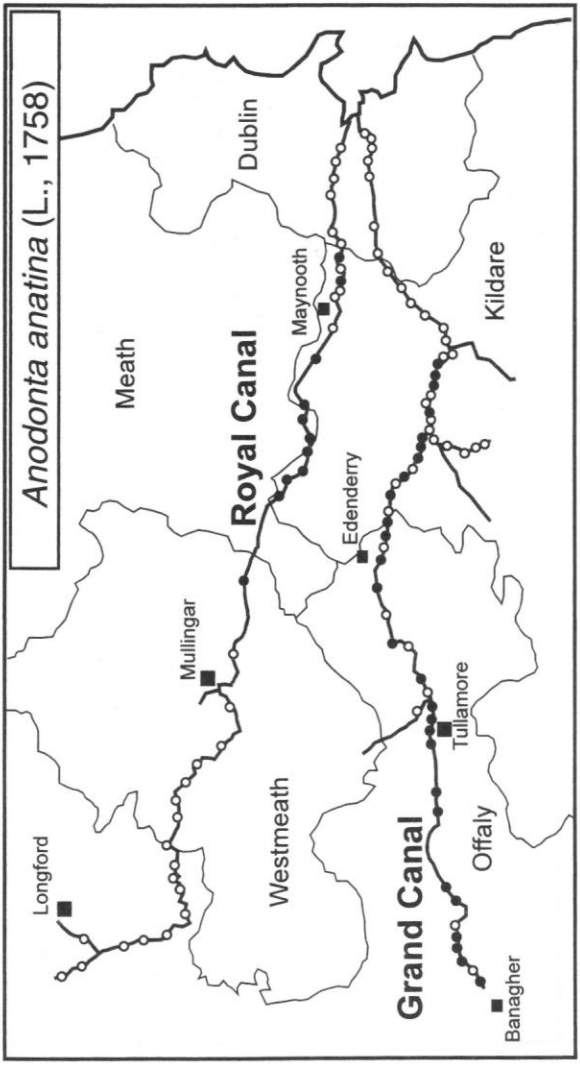


FIGURE 26. The distribution of *Sphaerium corneum* (L.). Solid circles = species present; open circles = species absent.

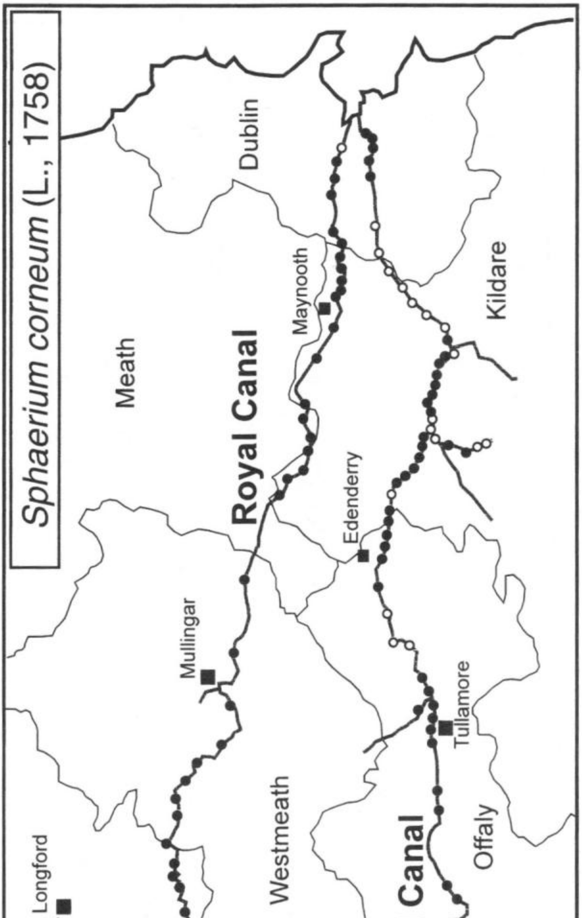


FIGURE 27. The distribution of *Sphaerium nucleus* (Studer). Solid circles = species present; open circles = species absent.

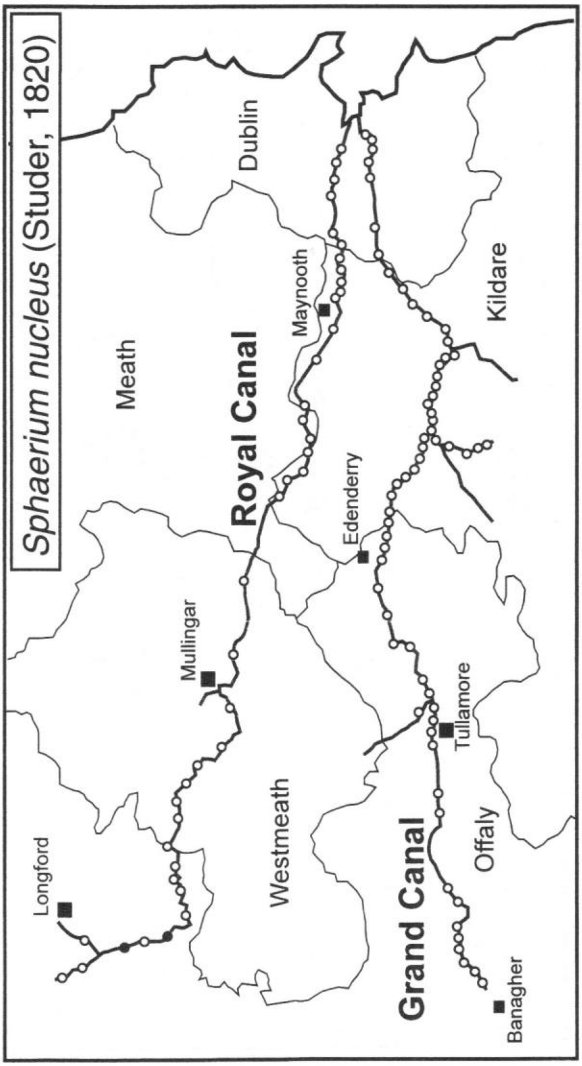


FIGURE 28. The distribution of *Musculium lacustre* (Müller). Solid circles = species present; open circles = species absent.

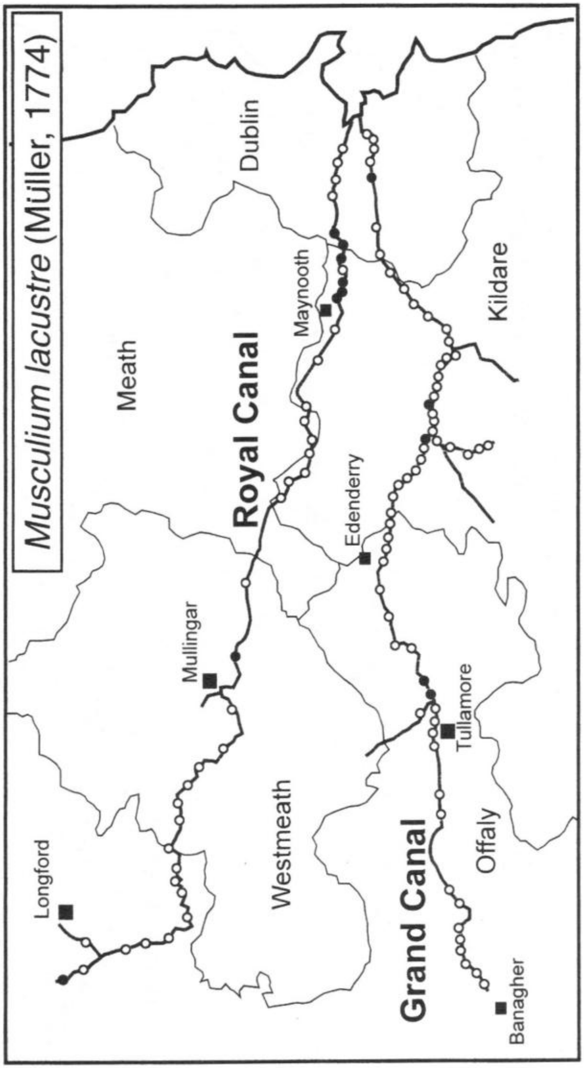


FIGURE 29. The distribution of *Pisidium amnicum* (Müller). Solid circles = species present; open circles = species absent.

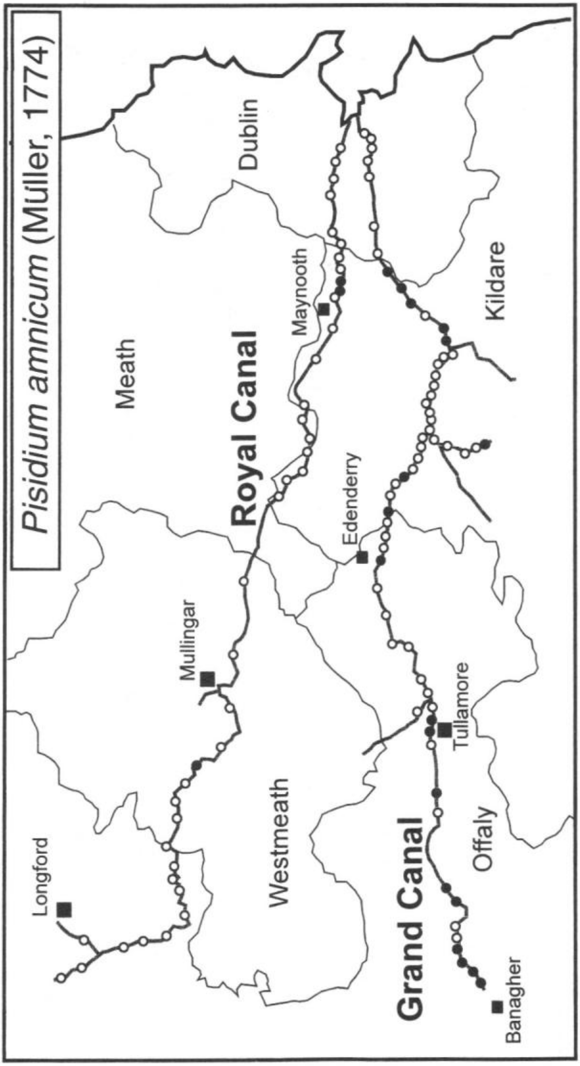


FIGURE 30. The distribution of *Pisidium casertanum* (Poli). Solid circles = species present; open circles = species absent.

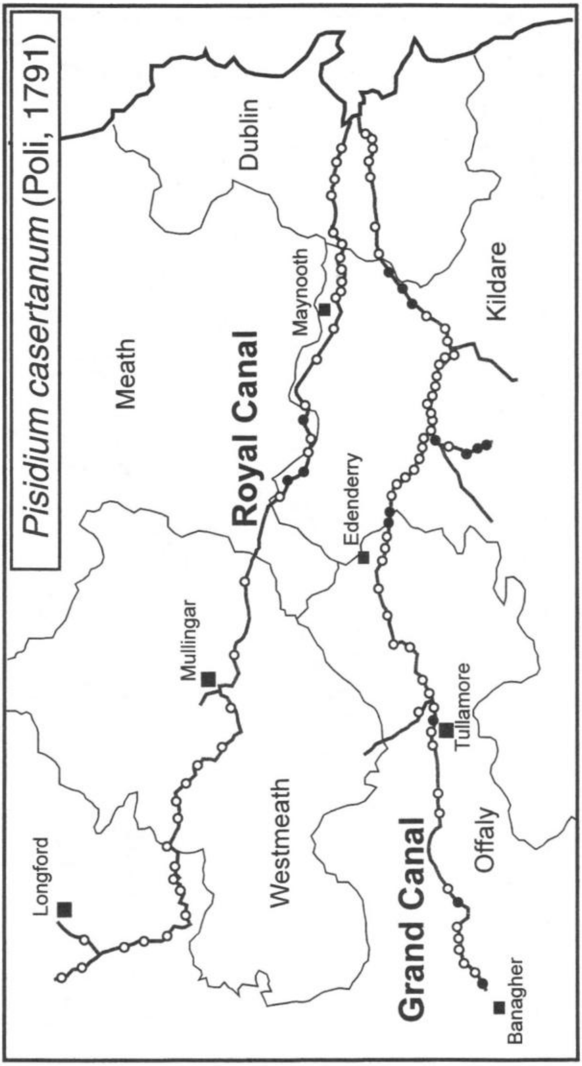


FIGURE 31. The distribution of *Pisidium henslowanum* (Sheppard). Solid circles = species present; open circles = species absent.

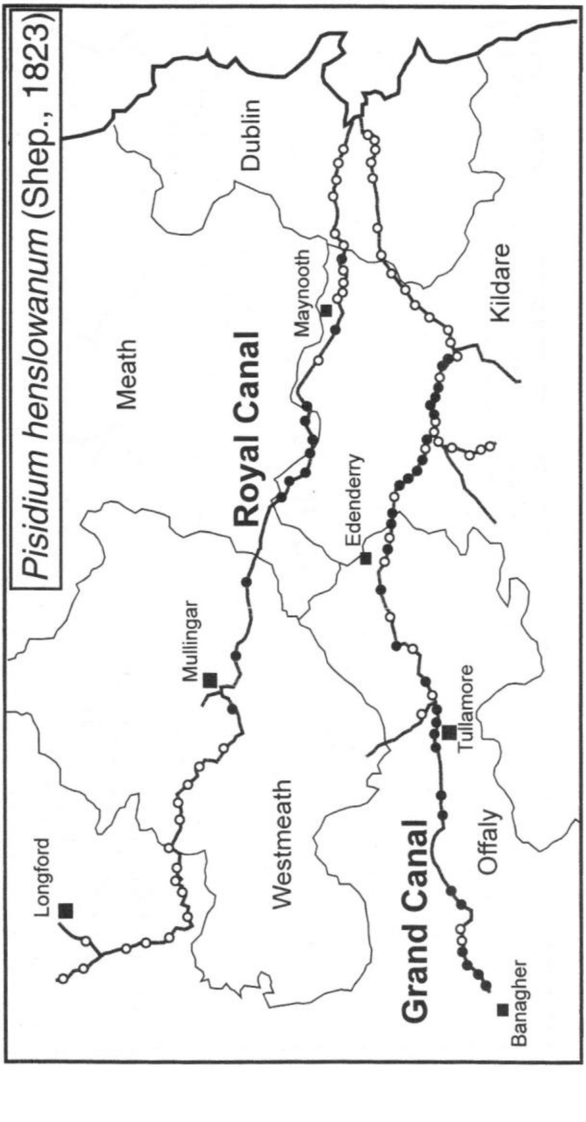


FIGURE 32. The distribution of *Pisidium hibernicum* Westerlund. Solid circles = species present; open circles = species absent.

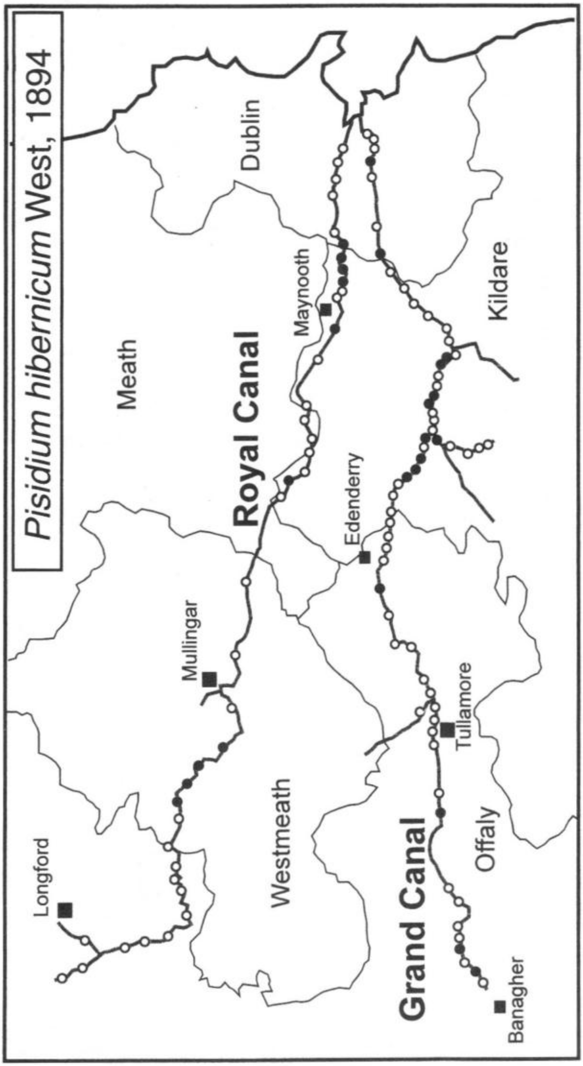


FIGURE 33. The distribution of *Pisidium milium* Held. Solid circles = species present; open circles = species absent.

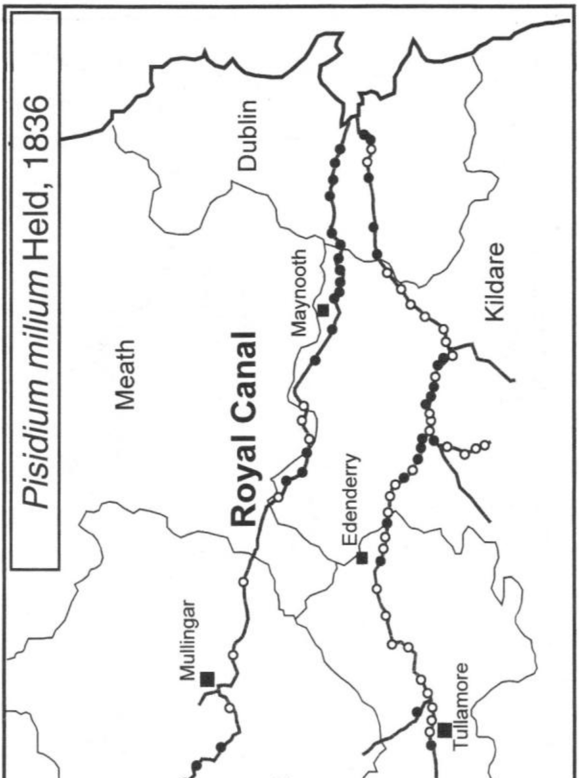


FIGURE 34. The distribution of *Pisidium moitessierianum* Paladilhe. Solid circles = species present; open circles = species absent.

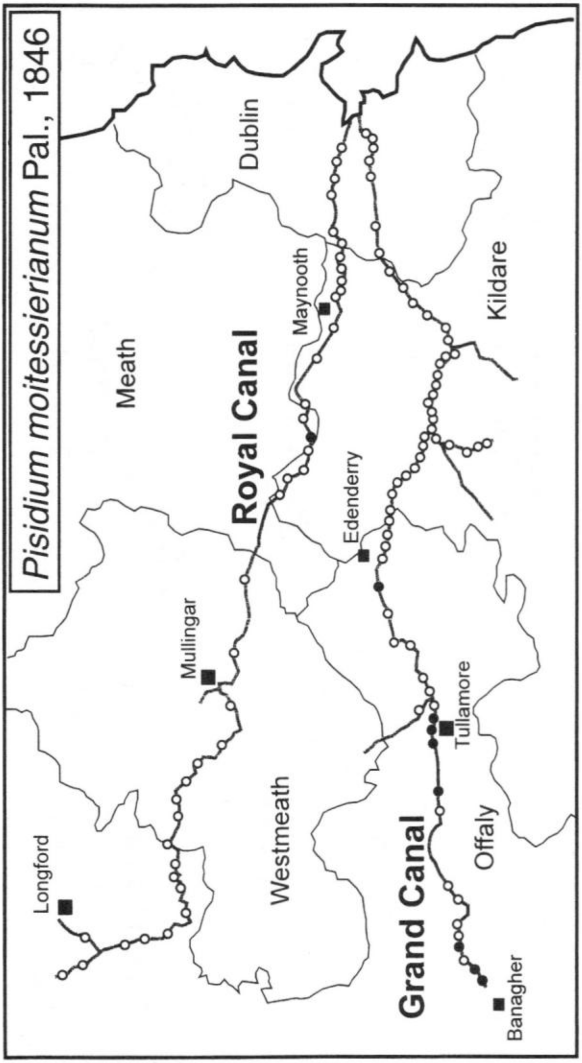


FIGURE 35. The distribution of *Pisidium nitidum* Jenyns. Solid circles = species present; open circles = species absent.

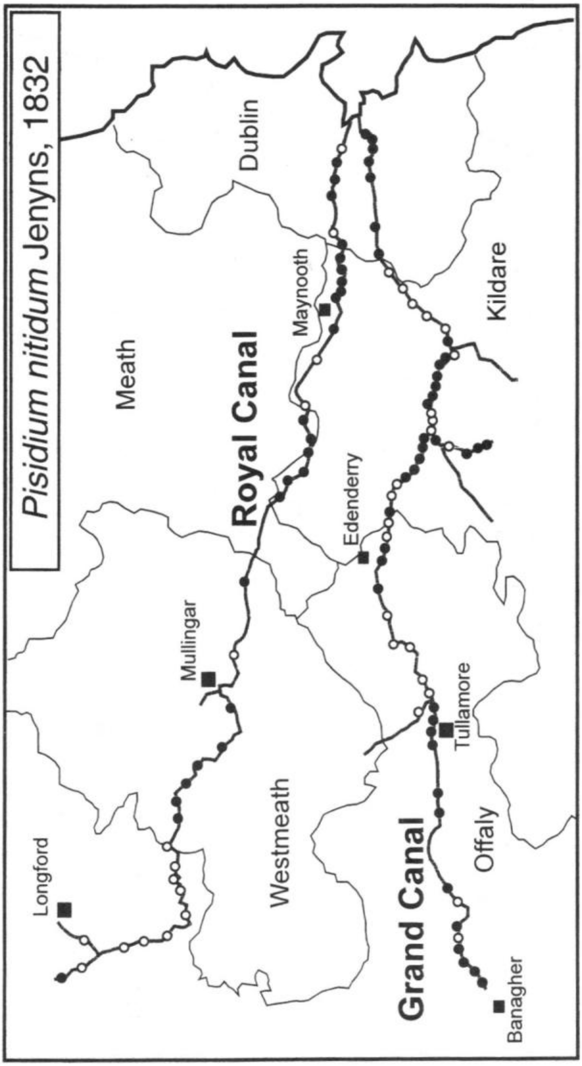


FIGURE 36. The distribution of *Pisidium obtusale* (Lamarck). Solid circles = species present; open circles = species absent.

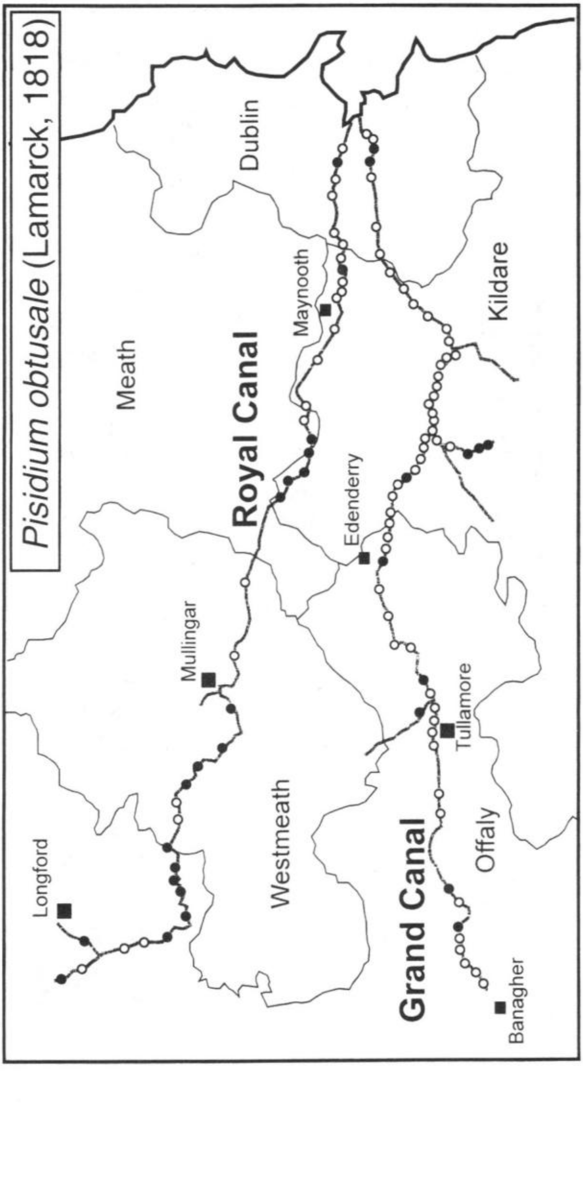


FIGURE 37. The distribution of *Pisidium pseudosphaerium* Schlesch. Solid circles = species present; open circles = species absent.

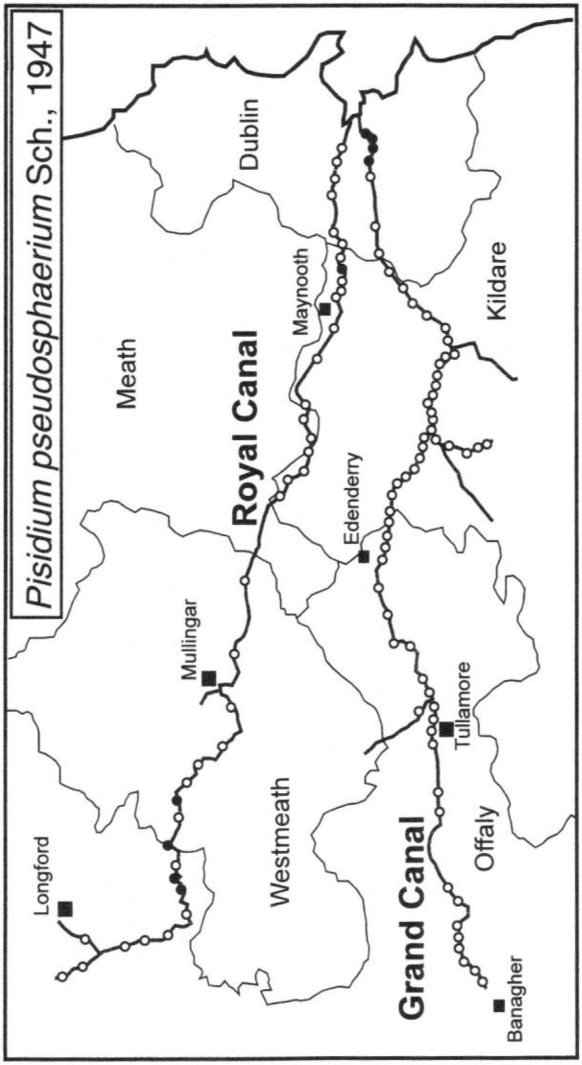


FIGURE 38. The distribution of *Pisidium pulchellum* Jenyns. Solid circles = species present; open circles = species absent.

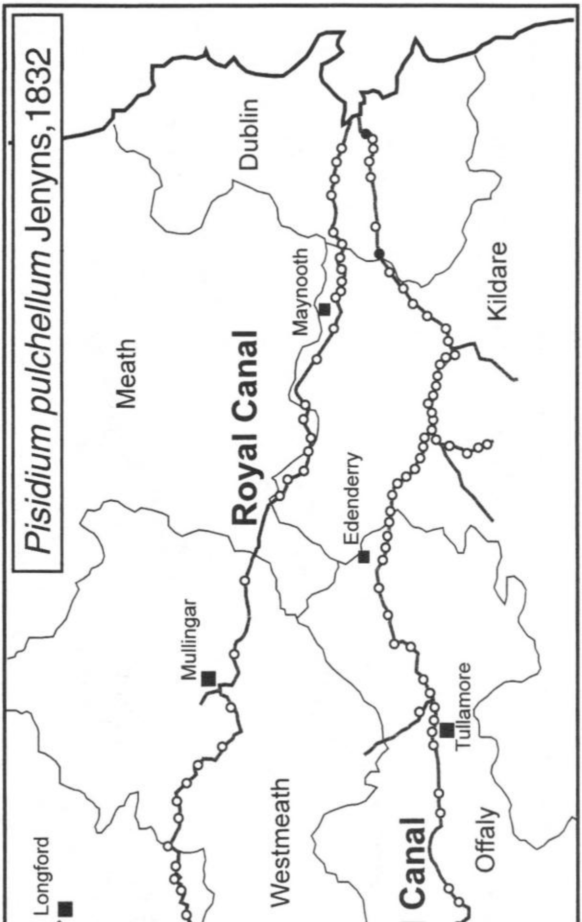


FIGURE 39. The distribution of *Pisidium subtruncatum* Malm. Solid circles = species present; open circles = species absent.

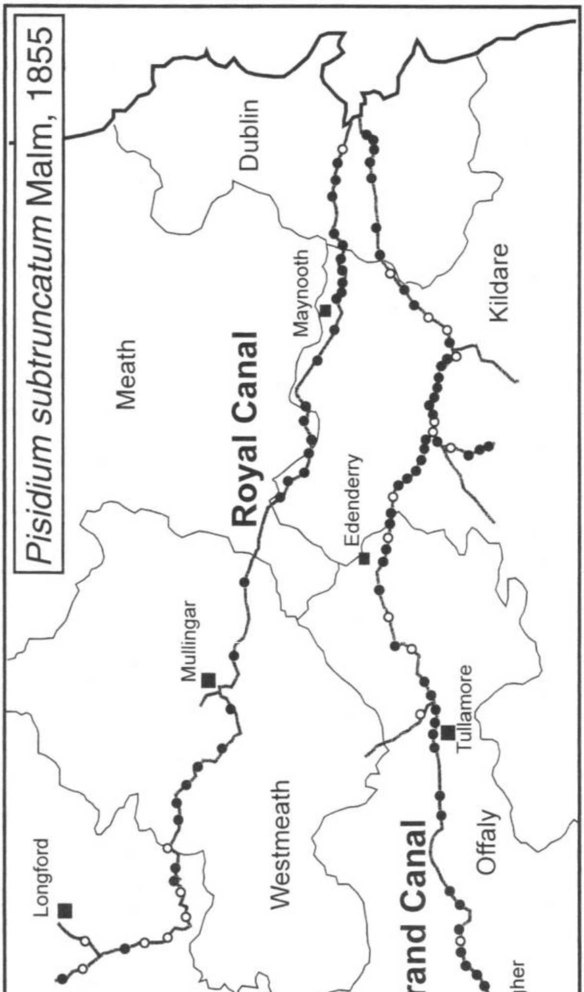
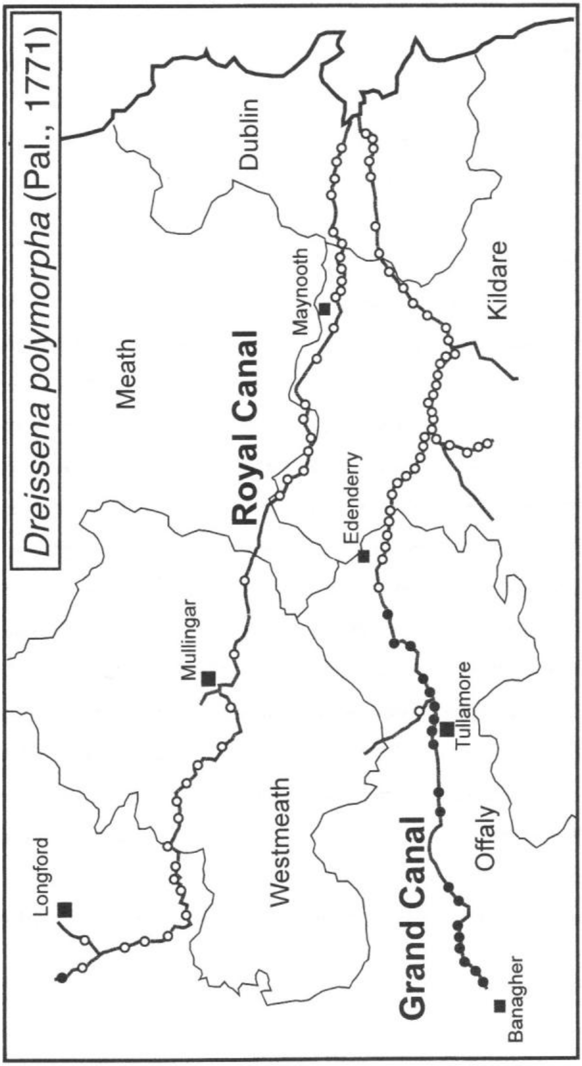


FIGURE 40. The distribution of *Dreissena polymorpha* (Pallas). Solid circles = species present; open circles = species absent.



Bull. Ir. biogeog. Soc. No. 29 (2005)

INTERPRETING BREEDING HABITAT FROM THE PRESENCE OF ADULTS WHEN STAPHYLINIDAE (COLEOPTERA) ARE USED IN BIODIVERSITY ASSESSMENTS

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Abstract

In order to clearly interpret presence/absence data of adult (imaginal) holometabolous insects for local biodiversity assessments of habitat types, or defined areas of land, species which are breeding should be distinguished from species which are not. This is especially so when either a few species are critical to the assessment, or when many species are represented by singletons in a sample. We examine several methods of determining breeding habitat including sampling larvae, trapping emerging adults and inferring breeding habitat from the presence of adult females during the oviposition period. Comparative samples of staphylinid adults and larvae collected from a wheat field show that sampling and identification of staphylinid larvae is impractical (identification to species is not possible in many cases). Samples from rapidly-installed emergence traps (without dug-in margins) from a fen spring and flushes demonstrate that this type of trap is unreliable for determining breeding habitat ('dug-in' traps were not practical in this case). These problems can be avoided by restricting sampling to the oviposition period, and using the repeated or numerous presence of females of a species as a basis on which to infer that the sampled habitat can support a breeding population of that species. In the wheat field samples, staphylinid species abundant during the oviposition period as adults were nearly all represented as larvae. However, where single females of a probable diffusively rare species

occur in a sample during the oviposition period, they should also be considered as valid breeding species.

Introduction

Insects have important roles in ecosystems, as well as containing approximately two-thirds of global species (Stork, 1997). They require assessment, therefore, in a variety of circumstances where plant assemblages fail to represent their biodiversity and its contribution to ecosystem function. Biodiversity assessments of habitats (vegetation-, soil- or sediment-defined) using insect groups are often made using presence/absence data from samples of adult insects. However, adult (imaginal) insects are generally more vagile than vascular plants (mature sporophytes). So the presence of an insect species in a habitat does not mean that it is part of the characteristic biodiversity of that habitat, at least to the same extent as a vascular plant growing therein. Such species may be merely foraging or dispersing vagrants ('tourists'), or aestivating or hibernating individuals, breeding in other habitats. For spring-breeding beetles, for instance, with relatively short-lived pre-imaginal stages and relatively long adult lives, their breeding habitat requirement is likely to be more important in understanding the basis for their diversity than the variety of habitats in which they can occur as adults.

As an example, two species of staphylinid beetle (*Philonthus fumarius* and *Stenus opticus*) were recorded from a *Juncus maritimus* salt marsh on peat soil, on the shore of Lough Tanaí in Co. Galway (Good and Butler, 1998). Both species are local in Great Britain and Ireland and restricted in their habitat to marshes and bogs (see Good and Butler, 1998), but could breed in *Juncus maritimus* salt-marsh on peat. They were represented by one and four individuals, respectively. Were these species characteristic of this habitat type, and therefore part of its biodiversity at this site? It is not clear without some evidence that they breed in the habitat.

For holometabolous insect assemblages there are a number of methods of determining breeding habitat, such as sampling larvae by extraction methods, trapping adults emerging after pupation, or recording ovipositing females. The results of sampling staphylinid larvae by Tullgen funnel extraction (from a wheat field) and the results of sampling adult staphylinid beetles in rapidly-installed emergence traps (from a fen) are reported here, with a discussion of the most feasible means of determining staphylinid breeding habitat. To what extent breeding habitat can be inferred from the presence of adult females is also discussed.

Methods

Sampling larvae

Staphylinid larvae were sampled from a winter wheat field in the suburbs of Wageningen (The Netherlands) (grid reference Wageningen XY), using open Tullgren funnel extraction of 24 soil samples (10 x 10 x 5cm deep) taken on 30 May 1989. The sorted larvae were subsequently mounted in polyvinyl lactophenol stained with lignin pink, and identified (as far as possible) using the following works: Boller (1983), Kasule (1966, 1968, 1970), Lipkow (1966), Paulian (1941), Pototskaya (1967), Smetana (1962), Steel (1970), Szujecki (1965), Topp (1975, 1978), Weinreich (1968) and Welch (1965). Larvae could only be identified to species-group in some cases, either because the larvae of these species were undescribed or the specimens did not fit existing descriptions. For example, larvae of *Xantholinus linearis/longiventris* species-group did not fit the illustrations of either Kasule (1970) or Pototskaya (1967), and the *Aloconota gregaria/Philhygra elongatula* species-group keyed out as *P. elongatula* in Topp (1975), despite *A. gregaria* being far more abundant as an adult in the wheat field (see Table 2).

Adult staphylinid beetles were captured in the same field prior to larval sampling, from 32 pitfall traps (with water + detergent as preservative), between 8-27 May 1989, and were determined to species. Nomenclature of Staphylinidae follows Lott and Duff (2003), with the exception of the genus concept of *Atheta*, where Anderson *et al*. (1997) is followed.

Emergence traps

As part of a sampling programme for Psychodidae (Diptera), four Owen emergence traps (Owen, 1989, 1992), with their bases removed, were operated at three locations in Pollardstown Fen, Co. Kildare) as follows:-

(a) Tufaceous *Palustriella commutata*/*Carex acutiformis*-dominated spring (N777152), 30 May-25 July 2001;

(b) Wet *Juncus subnodulosus*/*Calliergonella cuspidata*-dominated fen (N772166), 5 June-25 July 2001;

(c) *Schoenus nigricans*-*Molinia caerulea* dominated fen flush (N771168), 5 June-25 July 2001.

Adult Staphylinidae captured in these traps were identified to species; nomenclature is as mentioned above. Plant nomenclature follows Stace (1997) and Smith (2004).

Results

Sampling larvae

Fourteen taxa of staphylinid larvae were identified from the Tullgren extracted soil samples taken on 30 May 1989. Four taxa could be determined to species level, five to species-group level, one to genus level, and four aleocharines to subfamily level only (Table 1). Over 1600 adult staphylinid beetles were recorded from pitfall traps from the same field between 8-27 May 1989.

Of the six dominant (>100 individuals) species or species-groups recorded as adults from the wheat field, four were represented by determined larvae, one by Aleocharinae sp. larvae, and a further one (*Tachyporus obtusus*) was not represented by larvae (Table 2). However, *T. obtusus* larvae would not be expected to be present at the time of sampling (May), as it apparently breeds in cereal crops later than other *Tachyporus* species (Lipkow, 1966).

Of the 12 subdominant (> 10 individuals) species recorded as adults from the wheat field, seven were represented by determined larvae, three by Aleocharinae sp. larvae, and a further two (*Omalium rivulare* and *Philonthus cognatus*) were not represented by larvae (Table 2). However, the absence of both the latter species can be explained. *O. rivulare* was represented by ten adults, but this species is a univoltine autumn breeder and the larval phase would be expected to be completed by late May (Topp, 1986). In the case of *P. cognatus*, the large active larvae of this species may have escaped from the open Tullgren samples.

Of the remaining larval taxa (Table 1), *Gabrius breviventer / nigritulus* were represented by adults (nine individuals of each species), but *Stenus* sp. A was not represented by adults. This can be explained either by the failure of pitfall traps to collect *Stenus* species which could escape with well-developed climbing tarsi (see Renkonen, 1934), or by the presence of a single female of a colonising *Stenus* species which oviposited in the field, since all the *Stenus* larvae were from one soil sample only.

Nearly all species abundant as adults had, therefore, for those breeding at this time of year, an equivalent determined or potential larval taxon for that species (Table 2). Thus, the results do not refute the hypothesis that spring-breeding species present in numbers as adults, in a seasonally disturbed habitat during late spring or early summer, are actually breeding in the habitat in which they occur.

Emergence traps

In total, 22 staphylinid species were recorded as adults from emergence traps in tufaceous spring habitat at Pollardstown Fen, during May-July 2001 (Table 3). Of these, 15 (68%) were recorded from Malaise traps at the same spring during 1998-2003, and 18 (81%) from Malaise traps throughout the fen during the same period (Table 3). The microhabitats present under the traps were *Palustriella commutata* moss, *Carex/Agrostis/Festuca* litter, *Carex/Agrostis/ Festuca* plants, and stands of *Rorippa nasturtium-aquaticum*. No bare sediment occurred, but despite this, three species with a reported microhabitat preference for bare sediment occurred in the trap samples (Table 3). One species (*Aleochara lanuginosa*) breeds in dung and carrion (Table 3), although this microhabitat did not occur under the traps.

Three of the five species recorded from wet *Juncus/Calliergonella* fen, also at Pollardstown Fen, are species of agricultural grassland, one of which (*Philonthus marginatus*) breeds in dung (Table 3).

The high correlation between Malaise and emergence trap species, and the occurrence of species whose known breeding microhabitat was not represented under the traps, strongly indicates that many species recorded in the traps entered from the outside, rather than emerged from under the traps. It was not possible to dig in the hems of these emergence traps. This was because the conservation value of the localised tufaceous spring habitat (a priority habitat under the EU Habitats Directive) precluded cutting small trenches into which the trap hems could be buried, and the presence of tough tussocks of *Schoenus nigricans* made such tussocks impenetrable in the *Schoenus* flush without an exccessive amount of microhabitat disturbance.

Discussion

There are at least seven methods by which the larval habitat (or microhabitat) of staphylinids may be determined (Table 4). Direct sampling and identification of larvae, the use of rapidly-installed emergence traps, and recording females during the oviposition period are discussed in more detail below, as is the difficulty involved in interpreting the presence of species represented by singletons in a sample.

Sampling larvae

It is not feasible to sample larvae of staphylinid species as part of biodiversity assessments. The main difficulty, as shown by the results in Table 1, is that only a small proportion of species can be reliably determined to species. Indeed some of the aleocharine tribe Athetini appear so similar as larvae, that it may be impossible to find sufficient diagnostic morphological characters to easily determine them to species, despite there being a clearly laid out system for identifiying setal patterns (see Ashe and Watrous, 1984). Identification also requires precise mounting to avoid distortion of key characters, which can also be time-consuming, and there is sometimes a problem of geographical variability in some characters used in the available keys (see also Frania (1986)), which may lead to misdeterminations. A further difficulty is that large numbers of samples are required for soil extraction, making larval sampling laborious; other sampling problems are listed in Table 4.

Emergence traps

The type of emergence trap used at Pollardstown Fen (see methods) gave unreliable breeding records. The results indicate that a number of species had entered the trap from outside. There were often gaps between the hem of the traps and the soil surface, and adult staphylinids (*Stenus* species in particular) were observed on occasion to use the hem buried under vegetation and moss as shelter. The emergence trap sides may be acting as miniature flight-interception traps: flying staphylinids hit the trap, fall down to the base, crawl under the hem of the trap, and subsequently take flight again within the trap and enter the trap bottle.

The trap could be improved if the basal hem of the trap net could be dug into and buried in the soil or sediment. Funke (1971) describes and illustrates a 1m x 1m emergence trap ('photo-eclector') with its base frame dug several cm into the soil, and with a further few cm of soil heaped against the outside of the frame. However, as can be seen from the example of the tufa spring and *Schoenus* flush (see results), this is not always feasible. Also, in non-saturated clay soils, cracks can appear on the margin of the trap in dry weather, allowing ingress and egress of adult beetles (Jagers op Akkerhuis, 1993).

A further problem is whether vagrant adults already present in the soil prior to trap emplacement are caught in the sample bottle several months after the trap began operation (e.g. when the trap heats up in summer), having survived in the soil and litter layer in the meantime. This risk might be reduced by operating the traps over a long enough period prior to the emergence of the generation represented by larvae in the soil or substrate, and disregarding the pre-emergence samples.

Unpublished data (A. Froese, J. A. Good and A. El Titi) from the photo-eclector type of trap also indicate that they are not efficient at capturing Steninae or Staphylininae, thus they would be unlikely to record *Philonthus fumarius* mentioned in the introduction, for instance, even if it did breed in the *Juncus maritimus* habitat. This could be overcome, in wetland soils, by placing one or more pitfall traps in the photoeklektor, so that emerging Staphylininae can be caught. Funke (1971) also points out the necessity to use a pitfall trap within the photo-eclector to remove predators of emerging insects.

Other advantages and disadvantages of *in-situ* emergence traps are listed in Table 4.

Ovipositing females

To overcome the problems associated with the above methods, females recorded ovipositing in a habitat or microhabitat can be used as evidence of breeding by a species in a habitat. However, for soil- and litter-dwelling insects such as staphylinids, the opportunities for field observation of oviposition are very restricted compared to larger insects in easily visible circumstances, such as dragonflies on pools or butterflies on host-plants. The next best approximation to actual observation would be the dissection of females which are frequently found in the habitat or microhabitat, to determine if they have ripe eggs in their oviducts, but this is laborious.

All of the dominant and subdominant species recorded in the wheat field in Wageningen (Tables 1 and 2) could either be correlated with a larval taxon, did not breed at that time of year, or were large enough to escape from the unenclosed Tullgren funnels. If this correlation between adult abundance and larval presence is true for staphylinid habitats in general, then it may be acceptable to rely on the presence of a reasonable number of conspecific females during the oviposition period as representing a breeding species.

In many cases, however, it is impractical to restrict sampling to spring, which is the oviposition time for most species. For instance, in the case of Lough Tanaí mentioned in the introduction, sampling was carried out in late summer because this particular survey had not begun until after mid-summer. This is a limitation on the use of ovipositing females to estimate breeding, as is the inability of this approach to deal with singletons, or species represented only by males, within the sample.

Diffusively rare species represented by singletons

In some studies, species represented by singletons have been classed either as 'tourists' (*sensu* Moran and Southwood, 1982) or as genuine habitat-associated species, based on their dietary microhabitat. For instance, Ødegaard (2004) classed tropical leaf-chewing, leaf-mining and fruit-feeding beetles as tourists, while considering saproxylic species as genuine host records, although at a weak level of confidence. Such classification is inevitably somewhat arbitrary, and where a few species are critical to a habitat assessment, the risk of incorrectly assigning one or more of these species by such coarse methods is high.

Some species are 'diffusively rare'; these are species regularly breeding in non-preferred microhabitats, or are generalist species using a range of microhabitats but rare in any one of them (Novotný and Basset, 2000). There is a strong possibility that many staphylinids are diffusively rare because of the way they utilise a range of scattered ephemeral resources (e.g. see Topp *et al.*, 1982). The two species from Lough Tanaí (mentioned in the introduction) could fall into this category (see discussion in Good and Butler (2000: pp 121-122)).

There is a much higher probability of capturing such diffusively rare species by techniques for sampling adult beetles, than by rearing or emergence techniques, because the former can cover a much larger area and diversity of microhabitats than the latter. In other words, all the methods for sampling larval habitat listed in Table 4 are inefficient over a relatively large spatial area. Even the estimation of the numbers of females during the breeding season does not address diffusively rare species represented by only one or two females in a sample, but which are nonetheless breeding in the habitat.

Conclusion

The most practical means of inferring larval habitat of Staphylinidae, as part of biodiversity assessments, is by the repeated or numerous presence, during the oviposition period, of females of a species in the sampled habitat. Other methods on their own, for the reasons mentioned in Table 4, are generally not practical for use on a regular basis. However, where only males or one or a few females occur, or where sampling occurs outside the oviposition period, the accumulation of circumstantial rather than direct evidence can greatly increase the confidence that the larval habitat has been correctly identified. This can be achieved by a combination of several of the methods listed in Table 4. Equally, it would be incorrect to interpret the *absenc*e of recorded breeding as a reason for dismissing species as non-breeding, where such species are potentially diffusively rare and opportunistically utilising a wide range of habitats and microhabitats to maintain their populations.

In conclusion, in cases like the Lough Tanaí *Juncus maritimus* habitat, sampling should be carried out in Spring when both *Philonthus fumarius* and *Stenus opticus* are breeding, rather than at other times of the year. Where single females of a probable diffusively rare species (e.g. *P. fumarius*) occur during the oviposition period, they should be considered as valid breeding species.

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TABLE 1. Staphylinid larvae from Tullgren extraction of soil samples (total $0.75m^2$) taken from a winter wheat field on 30 May 1989 in Wageningen (The Netherlands).

Taxon	No.
Aloconota gregaria (Erichson)/*Philhygra elongatula* (Gravenhorst)	24
Tachyporus hypnorum (Fabricius)/*chrysomelinus* (L.)/*dispar* (Paykull)	21
Atheta amplicollis (Mulsant & Rey)/*fungi* (Gravenhorst)	11
Aleocharinae sp. A	9
Anotylus rugosus (Fabricius)	7
Xantholinus linearis (Olivier)/*longiventris* Heer	7
Lathrobium fulvipenne (Gravenhorst)	6
Stenus sp. A	5
Aleocharinae sp. B	3
Gabrius breviventer (Sperk)/*nigritulus* (Gravenhorst)	2
Aleocharinae sp. C	1
Aleocharinae sp. D	1
Philonthus carbonarius (Gravenhorst)	1
Tachinus signatus Gravenhorst	1

TABLE 2. Dominant and subdominant staphylinid beetles recorded from pitfall traps in a wheat field in Wageningen (The Netherlands), for comparison with larval data from Tullgren funnel extraction given in Table 1. In the absence of generic descriptions of larvae, unidentified aleocharine larvae (A-D) are arbitrarily assigned to the most abundant species, and it is assumed that species groups can contain more than one species of larvae (e.g. *Aloconota gregaria* and *Philhygra elongatula* are both considered to be represented by larvae within the *A. gregaria / P. elongatula* taxon).

Species	**Equivalent larval taxon in Table 1**
Dominant species (n > 100)	
Aloconota gregaria (Erichson)	*A. gregaria / P. elongatula*
Atheta amplicollis (Muls. & Rey) / *fungi* (Gravenhorst)	*A. amplicollis / fungi*
Dinaraea angustula (Gyllenhal)	Aleocharinae sp. A
Tachinus signatus Gravenhorst	*T. signatus*
Tachyporus hypnorum (Fabricius)	*T. hypnorum / chrysomelinus / dispar*
Tachyporus obtusus (Linnaeus)	-
Subdominant species (n>10)	
Amischa analis (Gravenhorst)	Aleocharinae sp. B
Anotylus rugosus (Fabricius)	*A. rugosus*
Atheta graminicola (Gravenhorst)	Aleocharinae sp. C
Geostiba circellaris (Gravenhorst)	Aleocharinae sp. D
Lathrobium fulvipenne (Gravenhorst)	*L. fulvipenne*
Omalium rivulare (Paykull)	-
Philhygra elongatula (Gravenhorst)	*A. gregaria / P. elongatula*
Philonthus carbonarius (Gravenhorst)	*P. carbonarius*
Philonthus cognatus Stephens	-
Tachyporus chrysomelinus (Linnaeus)	*T. hypnorum / chrysomelinus / dispar*
Tachyporus dispar (Paykull)	*T. hypnorum / chrysomelinus / dispar*
Xantholinus longiventris Heer	*X. linearis / longiventris*

TABLE 3. Adult Staphylinidae recorded from emergence traps (n=4 per site) placed on *Palustriella/Carex* vegetation in a tufaceous spring ('Spring'), on wet *Juncus/Calliergonella* fen vegetation (ungrazed) ('Fen'), and on a *Schoenus nigricans* flush ('Flush'), at Pollardstown Fen, Co. Kildare, May-July 2001. 'Mal. traps' refers to whether the species were ('yes') or were not ('no') recorded from Malaise traps from springs or flushes in Pollardstown Fen during 1998 - 2003 (Good, 2005). 'Microhabitat' refers to the published microhabitat of the species (from Horion (1963-67), Koch (1989), Good and Giller (1990) and Lott (2003)). 'D.o.m.' refers to decomposing organic matter rich in nutrients.

Species	***Spring***	***Fen***	***Flush***	***Mal. traps***	***Microhabitat***
Acrotona aterrima (Gravenhorst)	1	-	-	yes	Litter
Acrotona muscorum (Brisout)	2	-	-	no	Carrion in dry soil
Aleochara lanuginosa Gravenhorst	1	-	1	yes	Dung & carrion
Aloconota gregaria (Erichson)	5	-	2	yes	Disturbed soils
Aloconota sulcifrons (Stephens)	1	-	-	yes	Bare sediment
Anotylus rugosus (Fabricius)	2	-	-	yes	Litter
Atheta amplicollis (Mulsant & Rey)	1	-	-	yes	Litter & moss
Atheta fungi (Gravenhorst)	2	-	-	yes	Mouldy leaves
Autalia rivularis (Gravenhorst)	1	-	-	yes	Litter
Carpelimus rivularis (Motschulsky)	1	-	-	yes	Litter
Carpelimus corticinus (Gravenhorst)	1	1	-	yes	Litter
Gabrius breviventer (Sperk)	1	-	-	yes	Litter
Liogluta longiuscula (Gravenhorst)	1	-	-	no	Litter
Myllaena dubia (Gravenhorst)	1	-	-	yes	Litter
Neobisnius procerulus (Gravenhorst)	1	-	-	yes	Bare sediment
Philhygra elongatula (Gravenhorst)	50	7	2	yes	Litter
Philhygra luridipennis (Mannerheim)	1	-	-	yes	Bare sediment
Philhygra malleus (Joy)	4	-	-	yes	Litter
Schistoglossa gemina (Erichson)	1	-	-	no	Litter & moss
Stenus cicindeloides (Schaller)	1	-	-	yes	Grass
Stenus nitidiusculus Stephens	1	-	-	no	Moss, emergents
Tachyporus obtusus (Linnaeus)	2	-	-	yes	Litter
Amischa nigrofusca (Stephens)	-	1	-	yes	Litter
Philonthus laminatus (Creutzer)	-	1	-	no	D.o.m. on dry soil
Philonthus marginatus (Müller)	-	1	-	yes	Dung
Eusphalerum minutum (Fabricius)	-	-	2	no	Unknown
Philonthus splendens (Fabricius)	-	-	1	no	D.o.m. on dry soil

TABLE 4. Comparison of advantages and disadvantages of different methods of determining larval habitat of Staphylinidae.

Sampling larvae

Advantage: Definitive breeding record

Disadvantages: Species often cannot be reliably determined; sampling a large area often not feasible; seasonal bias to species breeding at that time of year; larvae may occur in habitat where they do not survive to emergence.

Rearing field-collected larvae

Advantages: Definitive breeding record; larvae can be determined to species by rearing to adult stage (e.g. by methods described in Luff (1991) or Burakowski (1993)).

Disadvantages: Larvae need to be collected alive from habitat or microhabitat, using time-consuming techniques; rearing requires artificial creation of suitable microclimate; artificial diet may be required; predatory larvae need to be kept separately to avoid cannibalism (Luff, 1991).

Teneral adults

Advantage: Teneral adults indicate breeding and successful pupation without need for larval sampling.

Disadvantages: Sampling often does not coincide with emergence from pupation; teneral individuals may fly into different habitat or microhabitat.

In situ emergence traps

Advantages: Emergence demonstrates breeding and successful pupation (Leschen and Allen (1998) found that stress during larval development increased pupal mortality); traps not as laborious as sampling for larvae.

Disadvantages: Some individuals will enter under trap margin if not dug into soil; not always feasible to dig-in margins of trap; non-breeding adults may be present under trap; some groups of staphylinids require pitfall trapping within trap; electric fencing may be required in grazed habitats; many traps may be necessary to sample for scarcer species; traps are bulky and attract attention; several visits required to replace sample bottles.

Ex situ emergence traps

Advantages: Emergence demonstrates breeding and successful pupation; traps not as laborious as sampling for larvae; sampled habitat or microhabitat can be sorted to remove adults before placing sample in trap; only a single site visit necessary.

Disadvantages: Excavation or removal of habitat or microhabitat may be difficult or not permissable; sorting may cause larval mortality; some groups of staphylinids require pitfall trapping within trap; sorting is time-consuming; not all vagrant adults may be removed during sorting.

Numbers of females during oviposition season

Advantage: Utilises adult sample - no extra sampling or trapping required.

Disadvantages: Cannot be used for species which are rare (as females) in sample or represented only by males; assumes presence of numbers of females represents ovipositing in habitat in question (in the case of microhabitats, the assumption is less likely to be valid); requires sampling during oviposition period.

Literature records of breeding from the same habitat or microhabitat

Advantage: No extra sampling required.

Disadvantages: Literature often lacks reliable breeding habitat data; habitat or microhabitat in one climatic region (e.g. *sensu* Polunin and Walters (1985: p.9)) may not be applicable to another.

Bull. Ir. biogeog. Soc. No. 29 (2005)

SPRING-FED FEN AS A HABITAT FOR STAPHYLINIDAE (COLEOPTERA) AT POLLARDSTOWN FEN, CO. KILDARE, IRELAND, WITH AN ASSESSMENT OF STAPHYLINID SAMPLING BY MALAISE TRAPS

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Abstract

A total of 170 species of Staphylinidae were recorded from Pollardstown Fen in Co. Kildare between 1989 and 2003. Of these, 112 species were recorded from Malaise traps (306 trap-weeks over 5 years), 27 species by emergence traps, and 86 species by six other sampling methods. Thirteen species (8%) were considered indicators of well-developed wetland habitat, and indicate the high conservation value of the Fen for wetland soil biodiversity. Malaise traps captured seven indicator species over five years, but the number of indicator species varied from year to year. In contrast, the number of wetland species captured by Malaise traps was more consistent between years and within sampling locations. It is worthwhile sorting Malaise trap samples which are already available from fen surveys, but carrying out a Malaise trapping programme purely for sampling Staphylinidae is inefficient compared to using other methods, unless species of *Philhygra* are particularly important to the study. *Acrotona obfuscata* (Gravenhorst) is recorded new to Ireland.

Introduction

Pollardstown Fen in Co. Kildare is one of the best documented fen sites in Ireland for invertebrates, containing many rare and characteristic species (Bond, 1991; Good, 1991, 1992, 1994; Lott and Foster, 1990; Moorkens 2003; O'Connor *et al.*, 1990; Reynolds, 1980; Speight, 1982, 1986, 2002; Speight and Vockeroth, 1988; Vaillant and Withers, 1992; van Helsdingen, 1997; Withers, 1992, 2002; Withers and O'Connor, 1992). The Fen has a high conservation status, being designated a Statutory Nature Reserve, a candidate Special Area of Conservation and a Ramsar Wetland of International Importance. Staphylinid beetles are particularly diverse in the wet organic soils of fens, and the results of a number of surveys of staphylinids in Pollardstown Fen are reported below, with particular reference to the results of Malaise trapping.

Malaise trapping is a highly efficient technique for sampling flying Diptera and Hymenoptera (Juillet, 1963). Many flying Coleoptera, however, are more inclined to fall when they encounter the trap net, rather than fly up into the collecting bottle. For this reason, adding sample trays at the base of the Malaise trap net is recommended for capturing Coleoptera (Cooter, 1991). However, large numbers of trays with preservative are messy and time-consuming to deal with on a frequent basis, especially if there is any difficulty in accessing the collecting site. Yet, some families of Coleoptera consistently occur in Malaise trap collecting bottles and these traps have been used for sampling Coleoptera (Goodrich, 1994; Hutcheson, 1990; Ohara *et al.*, 1999; Sivasubramaniam *et al.*, 1997). In order to ascertain if it is worthwhile using Malaise traps to collect Staphylinidae, trap samples were sorted during a survey of Syrphidae (Diptera) from Pollardstown Fen, and the results are compared to other collecting methods below.

Methods

Maps of the site and springs are given in Doyle (1984). Pollardstown Fen was sampled for Staphylinidae between 1989 and 2003, with Malaise traps being operated at the margin of the fen near springs, flushes and drains between 1998 and 2003. Details of locations and sampling methods are given in Table 1. Malaise traps were of the design supplied by Marris House Nets, black in colour, and were placed in pairs according to the guidelines of Speight *et al.* (1998: pp 12-15). Suction sampling was carried out using a D-vac suction sampler (Dietrick, 1961); samples being taken during daylight and as described by Good and Giller (1991). Tullgren funnel extraction was undertaken using open uncooled funnels. Pitfall traps were plastic cups with undiluted ethylene glycol (commercial antifreeze) as preservative. Emergence traps are described in Good and Jagers op Akkerhuis (2005).

Species were selected as indicators of well-developed habitat if: (1) they have a restricted preference to the types of microhabitat associated with fens, wet woodland and riparian grassland, 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. By 'well-developed habitat' it is meant that the ecosystem is sufficiently undisturbed by human activity to allow it to retain many local or rare characteristic species.

Typical wetland species were selected from those listed as having high wetland fidelity by Lott (2003), but excluding species which have been recorded in numbers (n>2 / sample) in cereal crops or intensively-managed grassland in Ireland (Good and Giller, 1990). The excluded species are: *Philhygra elongatula, Stenus cicindeloides* and *S. picipes*.

Nomenclature of Staphylinidae 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) and Smith (2004). 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

Species

In total, 170 staphylinid species were recorded from Pollardstown Fen between 1989 and 2003 (Tables 2-8), of which 13 (8%) are considered indicators of well-developed habitat (Table 10). The characteristics by which the following species are considered indicator species have been described previously:- *Aloconota sulcifrons* (Good and Butler, 1995), *Cypha punctum* (Good and Butler, 1998), *Atheta aquatilis, A. strandiella, Philonthus fumarius* and *Quedius* *humeralis* (Good, 2004), *Carpelimus subtilicornis, Philonthus furcifer* and *Schistoglossa gemina* (Good and Butler, 2001).

Acrotona obfuscata has not been previously recorded from Ireland (Anderson *et al*., 1997), and is listed as a notable species in Great Britain on account of its restricted distribution (Hyman and Parsons, 1994), although Lott (2003) has recommended that it be delisted. Elsewhere in Europe, it is local in Belgium (Drugmand and Convent, 2003), Denmark (Mahler, 1987), Central Europe (Benick and Lohse, 1974), Sweden (Palm, 1970) and Poland (Burakowski *et al*., 1981), and is listed as Vulnerable in Finland (Finnish Environment Institute, 2004). In Great Britain, *A. obfuscata* is a riparian wetland species (Hyman and Parsons, 1994; Lott, 2003), but in Central Europe it has been recorded also from fields (straw ricks) and gardens (wet compost) on clay soil, and from wet woodland (Koch, 1989).

Cypha punctum was represented by three males, one of which was teneral, captured by D-vac suction sampler from the margin of the Tufa Spring (Table 8).

There are published records of *Stenus brevipennis* from six localities in Ireland (Anderson, 1984; Good, 1985; Lott and Foster, 1990; Good and Butler, 1996). Although it is not listed as a notable species for Great Britain by Hyman and Parsons (1994), the species appears to be genuinely local in Ireland due to its absence from many suitable sites (Anderson, 1984). It is usually a stenotopic bog species, restricted to moss or *Sphagnum* on peat (Anderson, 1984; Koch, 1989); Anderson (1997) considered it to be a good indicator of undisturbed ombrotrophic peat. However, it is not tyrphobiont throughout its range, according to Horion (1963), who recorded it together with its sibling species, *S. picipes*, in marshy habitats in southern Germany and Austria. Both *S. brevipennis* and *S. picipes* occurred in the same set of samples from the Tufa Spring (Table 8). This should not be surprising, because the surroundings of the spring includes both wet peat soil (favoured by *S. brevipennis*) and vegetation dominated by ash (*Fraxinus excelsior*) and hawthorn (*Crataegus monogyna*) on esker limestone gravels (favoured by *S. picipes*: Kevan and Allen (1961) describe the habitat of this species in Britain as "relatively dry and often wooded situations, mostly on non-acid soils"). Although *S. brevipennis* was represented by two females only, the elytral dimensions were a diagnostic character in distinguishing the species (Szujecki, 1961; Lohse, 1964).

Stenus palustris has been recorded from nine sites in central and western Ireland, but none as far east as Pollardstown Fen (Regan and Anderson, 2004). It is local in Great Britain, but common in northern Scandanavia, and restricted to reed-beds, fen, carr and similar types of wetland (Renkonen, 1934; Horion, 1963; Hyman and Parsons, 1994). Horion (1963) stated the microhabitat of this species to be rotting reeds and other decomposing substances at marshy sites.

The myrmecophile (ant-associate) species *Zyras collaris* is local in Ireland (Anderson, 1997) and Great Britain (Lott, 2002). In Europe it is local in Western and Southern Europe, but more common in Eastern Europe; its range includes Europe, North Africa and the Caucasus (Horion, 1967). It is a stenotopic wetland species, restricted to marsh soils and ditches in wet meadows, frequently occurring in peat soils (Horion, 1967; Koch, 1989; Lott, 2002). Donisthorpe (1927) recorded both beetles and larvae from nests of *Myrmica rubra* from Wicken Fen, demonstrating that the species breeds in ants nests. Although Horion (1967) cited records in the absence of ants, it is not clear whether these were dispersing individuals.

Malaise traps compared to other methods

In total, 112 staphylinid species were captured by Malaise traps (Tables 2-5), 86 by methods other than Malaise or emergence traps (suction sampling, Tullgren funnel extraction, pitfall traps, bait traps, a window trap and hand-collecting; Tables 6-8) and 27 by emergence traps (see Table 3 in Good and Jagers op Akkerhuis, 2005). The Malaise trap samples contained seven indicator species (*Acrotona obfuscata, Aloconota sulcifrons, Atheta aquatilis, Carpelimus subtilicornis, Philonthus fumarius, Stenus palustris, Zyras collaris*), compared to six by other methods (excluding emergence traps), and two by emergence traps. Of the 86 species captured by other methods, 62% were not captured by Malaise traps.

In the aleocharine genus *Philhygra*, seven species were captured by Malaise trap (*P. debilis, P. elongatula, P. hygrotopora, P. luridipennis, P. malleus, P. melanocera, P. palustris*) (Tables 2-5), while only one species (*P. elongatula*) was caught by other methods (Tables 6-8). In the tachyporine genus *Mycetoporus*, six species were captured by Malaise trap (*M. angularis, M. lepidus, M. longulus, M. nigricollis, M. punctus, M. rufescens*) (Tables 2-5), while none were caught by other methods (Tables 6-8), although species of the latter genus prefer woodland rather than wetland habitats (Koch, 1989). On the other hand, Malaise traps did not capture any *Lathrobium* species, and only 33% (n = 2) of the total *Quedius* species, and only 50% (n = 14) of the total *Stenus* species.

Indicator species were not recorded by Malaise traps at the limnocrene spring (Tufa Spring) during two of the sampled years, compared to two and three species in the other years (Table 2), showing that sampling staphylinid indicator species using Malaise traps is a hit-and-miss operation. Also, the correlation (Microsoft Excel CORREL) between total no. trap weeks per year and no. indicator species per year (Table 9) was relatively poor (coefficient = 0.71). In contrast, the total number of wetland species recorded by Malaise traps was consistently greater than a minimum threshold (min. = 4 (range 5-9)) for each of the four years at the Tufa Spring location (Table 2). Also, the correlation between total no. trap weeks per year and no. wetland species per year (Table 9) was very high (coefficient = 0.99). While the number of indicator species provides an indication of the habitat quality of the whole fen, the number of wetland species appears to provide a more consistent measure of habitat quality at any one location than the number of indicator species. Taking four wetland species as a threshold, locations with fen pools (Tufa Spring, Willow Fen, *Schoenus* Field) exceeded the threshold number each year, whereas locations without pools (Springbank Flush, Drained springs/flushes) did not exceed this number in any year.

Discussion

Species

The high number of indicator species (13), plus a further indicator species (*Stenus fornicatus* Stephens) recorded by Lott and Foster (1990), demonstrate that Pollardstown Fen has a high wetland soil biodiversity value. How does this compare with other fens of international status in the Atlantic biogeographical region?

Of 364 species of Staphylinidae recorded from Wicken Fen (Cambridgeshire, UK), 28 (8 %) are listed as high fidelity wetland species by Lott (2003), and of UK conservation status (notable or Red Data Book category) (Friday and Harley, 2000). If these are considered to be equivalent to indicators of well-developed habitat in Ireland, the proportion of wetland indicator species from Pollardstown Fen is the same (8 %) (both sites are roughly similar in size: Pollardstown Fen is 225ha; Wicken Fen is 245ha). While it is incorrect to compare these percentages directly, because they have been derived from different concepts of indicator species, nonetheless it indicates that Pollardstown Fen is as important a site for Irish wetland soil biodiversity as Wicken Fen is for English wetland biodiversity. There the similarity ends, as Pollardstown Fen appears to be much more Atlantic in character than Wicken Fen. Of the 14 indicator species recorded from Pollardstown Fen, only four have also been recorded from Wicken Fen (Table 10), whereas 10 of the 14 indicator species have also been recorded from fens and riparian grasslands in Cos. Clare and Galway (Table 10). The dominance of the peat forming process, and the resistance to extensive scrub invasion, are common characteristics of Pollardstown Fen (Doyle, 1984) and the fens of the West of Ireland, in contrast to the fens of eastern England, and probably account for this difference in character.

Efficiency of Malaise traps

Is it worth using Malaise traps specifically to collect or sample Staphylinidae? The answer, based on this survey, is no. The time involved in erecting and dismantling the traps and servicing sample bottles (including travel to and from the site) over a two to three month period, plus the time sorting through the vast number of insects caught by each trap, represents a large sampling effort relative to the return in terms of characteristic and indicator staphylinid species, especially when compared to use of the same time for other methods.

But where Malaise trap samples are already available (as in this case, because sampling was being carried out for Syrphidae), it *is* worthwhile sorting for Staphylinidae: 76 hours of sample sorting resulted in 112 species, or, on average, 1.5 new species / hour. It is estimated that 11 days (or 88 hours) were involved in obtaining 86 species by the other methods excluding emergence traps (involving travel to and from the fen, sampling and extraction, servicing equipment and sorting samples). This amounts to 1.0 new species / hour.

For indicator species, the yield was 11 h / indicator species for Malaise traps, and 15 h / indicator species for other methods (excluding emergence traps). However, there was large variation in Malaise trap captures of indicator species from year to year. In 2002, eight traps operating for 10 weeks (which would require 20 h of sample sorting) only delivered a single indicator species. In 1998, 6 traps operating for six weeks (9 h of sample sorting) delivered three indicator species, whereas the same amount of sampling effort in 2001 delivered no indicator species. This variability in capturing indicator species (or 'lucky-dip', as described by Disney (1986)) is to be expected, given the low proportion of indicator species in the fen fauna, and the semi-random nature of trapping dispersing beetles. In contrast, the number of wetland species was more consistent between years and within sampling locations. This suggests that the number of wetland species obtained in any one trapping year is a more consistent reflection of staphylinid habitat quality at a specific location in any one year.

A window trap was used on the fen in 1990, but it had a poor yield (Table 6). This was probably due to the location of the trap (not sheltered) and the time of sampling (July; most staphylinids disperse by flight in spring or autumn), since window traps are usually efficient (Lundberg, 1979; Peck and Davies, 1980). As mentioned in the introduction, a major disadvantage of using window and other interception traps is having to deal with the large quantity of rainwater-diluted ethylene glycol preservative in trap troughs or trays. If an interception trap could be designed which used a basal gutter and the type of sample bottle used in Malaise traps, then this would improve their practicality considerably, even if there was a loss of species yield. Were such a trap available, then it would probably be more efficient to erect such traps than to sort existing Malaise trap samples.

In conclusion, sorting previously-collected Malaise trap samples from fens is worthwhile, but carrying out a Malaise trapping programme purely for sampling Staphylinidae is inefficient compared to using other methods, unless species of *Philhygra* are particularly important to the study. However, the development and use of easily-erected hybrid Malaise / window traps would be very useful. Malaise or interception traps should preferably be used as part of a suite of methods for sampling Staphylinidae.

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TABLE 1. Details of sampling locations and dates for Staphylinidae at Pollardstown Fen, Co. Kildare. Location names were devised for the purposes of this survey only. Details of emergence traps are given in Good and Jagers op Akkerhuis (2005).

Location (grid ref.)	Habitat / microhabitat	Sampling dates
Malaise Traps		
Tufa Spring (N777152)	Tufaceous limnocrene spring	1998: 5 - 27 June; 8 - 19 Aug. 2001: 12 June - 25 July 2002: 15 May - 27 July 2003: 22 May - 31 July
Springbank Fen (Upper) (N764158)	Calcareous grassland / fen transition	1999: 14 July - 13 August 2002: 15 May - 27 July 2003: 22 May - 31 July
Springbank Fen (Mid & Lower) (N764159)	Calcareous fen with *Schoenus nigricans* near old silted drain	2003: 22 May - 31 July
Near Willow Drain (N772166)	Flooded *Molinia caerulea* / *Juncus subnodulosus* fen	2001: 12 June - 25 July 2002: 15 May - 27 July 2003: 22 May - 31 July
Schoenus Field (N771168)	*Schoenus nigricans* / *Cladium mariscus* fen transition with pools	1999: 2 - 26 June 2001: 12 June - 25 July 2002: 15 May - 27 July 2003: 22 May - 31 July
Whitethroat Flush (N771155)	*Molinia caerulea* fen near small *Juncus subnodulosus* flushes	2003: 22 May - 31 July
Badger Drain (N768157)	*Carex acutiformis* / *Molinia caerulea* / *Filipendula ulmaria* fen near *Salix* and *Fraxinus* covered crenal drains	1998: 5 - 27 June; 8 - 19 Aug.
Carex Sward (N770155)	*Carex acutiformis* fen near *Salix* and *Fraxinus* covered crenal drains	1998: 5 - 27 June; 8 - 19 Aug. 2003: 22 May - 31 July
Springbank Fen Springs (N766159)	Wet grassland near old fen drains and small limnocrene springs	1998: 5 - 27 June; 8 - 19 Aug.
Other Methods		
Near canal feeder (N773160)	Tullgren funnel extraction of 6 subsamples of old nest of mute swan (*Cygnus olor*)	1989: 24 April
Fen meadow (N777156)	Tullgren funnel extraction of 10 fen meadow sods (carices, grasses)	1989: 22 July
Fen meadow near reedbed (N772157)	Window (interception) trap at margin of fen meadow near *Phragmites* bed	1989: 3-24 September

TABLE 1 (continued)

Location (grid ref.)	**Habitat / microhabitat**	**Sampling dates**
Near canal feeder (N770160)	In Cortinarius sp. sporocarps under *Salix* bushes	1989: 8 October
Shore of lochan (N773155)	Collected by hand from bare mud surface, shore of fen lochan	1989: 7 May
Reedbed (N773154)	Pork carrion baits (3) in *Phragmites australis* bed (partially flooded)	1989: 28 August
Near shore of lochan (N772167)	In 30 hollow stems of dead *Typha latifolia*	1990: 18 February
Scarletstown saw-sedge beds (N771165)	Tullgren funnel extraction of *Cladium mariscus / Carex* spp. litter with moss	1989: 1 April
Tufa Spring (N777152)	Tullgren funnel extraction of *Palustriella commutata* moss	1989: 7 May 1989
Tufa Spring (N777152)	Tullgren funnel extraction of *Phragmites australis* litter, historically eaxcavated margin of spring	1989: 14 May 1989
Tufa Spring (N777152)	D-vac suction sample (1) of *Palustriella commutata* moss / *Carex acutiformis* / *Rorippa nasturtium-aquaticum*, tufaceous spring	1990: 16 July
Near shore of lochan (N773160)	D-vac suction samples (3) of *Phragmites australis* / grasses / carices	1989: 1 May
Tufa Spring (N77152)	Pitfall traps (6) in *Carex / Filipendula /* grasses on fen peat	1998: 12-27 June
Carex Sward (N770155)	Pitfall traps (6) in *Carex acutiformis* fen near *Salix* and *Fraxinus* covered crenal drains	1998: 12-27 June
Badger Drain (N768157)	Pitfall traps (6) in *Carex acutiformis* / *Molinia caerulea* / *Filipendula ulmaria* fen near *Salix* and *Fraxinus* covered crenal drains	1998: 12-27 June
Springbank Fen Springs (N766159)	Pitfall traps (6) in fen grassland near old fen drains and small limnocrene springs	1998: 12-27 June
Tufa Spring (N777152)	D-vac suction samples (3) of *Carex* / grasses/*Phragmites* / *Rorippa* at margin of tufaceous spring	1989: 24 April

TABLE 2. Staphylinid beetles recorded from Malaise traps near a permanent tufaceous limnocrene spring (Tufa Spring) at Pollardstown Fen, 1998 - 2003. Each location represents combined results from two Malaise traps, but note that traps were in a different position in 1998 compared to 2001-03.

Species	1998	2001	2002	2003
Indicator wetland species				
Aloconota sulcifrons (Stephens)	1	-	-	5
Atheta aquatilis (Thomson)	1	-	-	-
Philonthus fumarius (Gravenhorst)	-	-	-	1
Zyras collaris (Märkel)	-	-	-	2
Other wetland species				
Atheta ebenina (Mulsant & Rey)	1	-	-	2
Carpelimus rivularis (Motschulsky)	-	1	-	1
Erichsonius cinerascens (Gravenhorst)	-	1	-	-
Gymnusa brevicollis (Paykull)	2	-	-	-
Hygronoma dimidiata (Gravenhorst)	-	-	1	-
Lesteva sicula Erichson	-	-	1	-
Myllaena intermedia Erichson	-	-	1	-
Neobisnius procerulus (Gravenhorst)	-	1	-	-
Philhygra hygrotopora (Kraatz)	4	-	1	6
Philhygra luridipennis (Mannerheim)	-	-	-	1
Philhygra malleus (Joy)	-	3	-	4
Philhygra melanocera (Thomson)	-	1	-	-
Philonthus umbratilis (Gravenhorst)	-	1	-	-
Stenus bifoveolatus Gyllenhal	-	-	1	-
Stenus melanarius Stephens	-	-	-	1
Total no. wetland species	5	6	5	9
Other species				
Acrotona aterrima (Gravenhorst)	-	-	-	1
Acrotona parvula (Mannerheim)	-	-	-	1
Aleochara lanuginosa Gravenhorst	1	1	-	2
Aloconota gregaria (Erichson)	2	3	2	9
Amischa analis (Gravenhorst)	-	-	1	1

TABLE 2 (continued)

Species	**1998**	**2001**	**2002**	**2003**
Anotylus rugosus (Fabricius)	-	3	-	3
Atheta amplicollis (Mulsant & Rey)	-	-	-	2
Atheta crassicornis-group	-	-	-	2
Atheta eremita (Rye)	1	-	-	-
Atheta fungi (Gravenhorst)	-	2	3	1
Atheta harwoodi (Williams)	-	-	1	2
Atheta ischnocera Thomson	-	1	-	-
Atheta laticollis (Stephens)	51	1	2	37
Atheta liliputana (Brisout)	-	-	1	-
Atheta longicornis (Gravenhorst)	-	-	-	1
Atheta nigripes (Thomson)	-	1	1	-
Atheta triangulum (Kraatz)	1	-	-	-
Autalia rivularis (Gravenhorst)	-	1	-	-
Bisnius fimetarius (Gravenhorst)	2	-	-	5
Callicerus obscurus Gravenhorst	-	-	-	1
Dinaraea aequata (Erichson)	-	-	1	-
Gyrohypnus angustatus Stephens	-	1	-	-
Haploglossa nidicola (Fairmaire)	-	-	1	-
Mycetoporus nigricollis Stephens	-	-	1	-
Neobisnius lathrobioides (Baudi)	-	-	-	3
Oxypoda opaca (Gravenhorst)	-	1	-	1
Philhygra elongatula (Gravenhorst)	1	12	-	5
Philhygra palustris (Kiesenwetter)	-	-	-	1
Philonthus sanguinolentus (Gravenhorst)	1	-	-	-
Philonthus succicola Thomson	-	-	-	1
Philorinum sordidum (Stephens)	-	-	-	1
Quedius cinctus (Paykull)	5	1	-	-
Sepedophilus littoreus (Linnaeus)	1	-	1	-
Stenus brunnipes Stephens	-	-	1	-
Stenus cicindeloides (Schaller)	1	4	7	22
Stenus fulvicornis Stephens	-	-	1	-
Stenus picipes Stephens	2	-	1	-

TABLE 2 (continued)

Stenus similis (Herbst)	2	2	1	5
Tachyporus chrysomelinus (Linnaeus)	1	-	1	-
Tachyporus nitidulus (Fabricius)	-	-	1	-
Tachyporus obtusus (Linnaeus)	-	2	5	3
Tachyporus pallidus Sharp	-	-	-	2

TABLE 3. Staphylinid beetles recorded from Malaise traps at a calcareous grassland / fen transition (Upper) and a *Schoenus nigricans*-dominated flush (Mid and Lower) from Springbank Flush at Pollardstown Fen, 1999 - 2003. Each location represents combined results from two Malaise traps.

Species	**Upper**	**Mid**	**Lower**	
	2002	**2003**	**1999**	**2003**
Indicator wetland species				
None	-	-	-	-
Other wetland species				
Atheta zosterae (Thomson)	-	1	-	-
Carpelimus corticinus (Gravenhorst)	-	1	-	-
Dilacra luteipes (Erichson)	1	-	-	-
Ocyusa picina (Aubé)	1	-	-	-
Philhygra malleus (Joy)	-	-	2	1
Stenus bifoveolatus Gyllenhal	-	-	1	-
Stenus fuscipes Gravenhorst	-	-	-	1
Stenus picipennis Erichson	-	-	-	1
Total no. wetland species	2	2	2	3
Other species				
Acrotona aterrima (Gravenhorst)	4	-	2	1
Aleochara lanuginosa Gravenhorst	2	4	3	-
Aleochara sparsa Heer	-	1	-	-
Aloconota gregaria (Erichson)	5	5	9	3
Amischa analis (Gravenhorst)	2	-	-	-
Amischa decipiens (Sharp)	-	1	-	-

TABLE 3 (continued)

Species	Upper	Mid	Lower	
	2002	2003	1999	2003
Amischa nigrofusca (Stephens)	1	-	-	-
Anotylus rugosus (Fabricius)	-	-	2	-
Anotylus tetracarinatus (Block)	1	-	-	-
Atheta amicula (Stephens)	-	-	2	-
Atheta amplicollis (Mulsant & Rey)	2	3	3	-
Atheta atramentaria (Gyllenhal)	1	-	1	-
Atheta celata (Erichson)	-	-	3	-
Atheta clientula (Erichson)	1	-	-	-
Atheta fungi (Gravenhorst)	2	6	8	1
Atheta laticollis (Stephens)	1	-	-	-
Atheta liliputana (Brisout)	-	-	4	-
Atheta longicornis (Gravenhorst)	-	1	-	-
Atheta macrocera (Thomson)	-	-	1	-
Atheta nigripes (Thomson)	1	-	-	-
Atheta occulta (Erichson)	-	-	1	-
Bisnius fimetarius (Gravenhorst)	-	1	1	-
Gabrius nigritulus (Gravenhorst)	1	-	-	-
Gabrius breviventer (Sperk)	2	-	-	-
Lordithon thoracicus (Fabricius)	1	-	-	-
Mycetoporus lepidus (Gravenhorst)	1	-	-	-
Mycetoporus longulus Mannerheim	1	-	-	-
Oligota inflata (Mannerheim)	-	-	1	-
Philhygra elongatula (Gravenhorst)	-	5	21	-
Philonthus marginatus (Müller)	-	1	-	-
Philorinum sordidum (Stephens)	1	1	-	-
Platystethus arenarius (Fourcroy)	-	-	1	-
Stenus cicindeloides (Schaller)	-	4	4	3
Tachinus marginellus (Fabricius)	1	2	-	-
Tachinus signatus Gravenhorst	1	2	19	-
Tachyporus obtusus (Linnaeus)	1	-	-	-
Tinotus morion (Gravenhorst)	-	-	3	-

TABLE 4. Staphylinid beetles recorded from Malaise traps near permanent springs and seepages on the north margin of Pollardstown Fen, 1999 - 2003 (see Table 1 for details). Each location represents combined results from two Malaise traps, but note that traps were in a different position in 1999 compared to 2001-03.

Species	**Nr Willow Drain**			***Schoenus* Field**			
	2001	**2002**	**2003**	**1999**	**2001**	**2002**	**2003**
Indicator wetland species							
Philonthus fumarius (Gravenhorst)	-	-	-	-	-	-	1
Carpelimus subtilicornis (Roubal)	-	-	-	-	-	1	-
Stenus palustris Erichson	-	-	1	-	-	-	-
Other wetland species							
Dilacra luteipes (Erichson)	-	1	-	-	-	-	1
Erichsonius cinerascens (Grav.)	1	1	-	-	-	-	-
Gabrius appendiculatus Sharp	-	-	-	-	-	-	1
Myllaena dubia (Gravenhorst)	-	-	1	-	-	1	-
Myllaena intermedia Erichson	-	-	-	-	-	-	1
Paederus riparius (Linnaeus)	-	-	-	-	1	-	-
Philhygra debilis (Erichson)	-	-	-	-	-	1	-
Philhygra hygrotopora (Kraatz)	1	-	1	-	-	-	1
Philhygra malleus (Joy)	5	-	2	-	10	-	-
Philhygra melanocera (Thomson)	1	-	1	-	3	-	-
Stenus picipennis Erichson	-	-	-	-	-	-	1
Stenus pubescens Stephens	-	-	-	-	-	-	1
Total no. wetland species	4	2	5	0	3	3	7
Other species							
Acrotona pygmaea (Gravenhorst)	-	-	-	1	-	-	-
Alianta incana (Erichson)	-	-	-	-	-	-	1
Aloconota gregaria (Erichson)	9	-	8	1	7	1	-
Amischa decipiens (Sharp)	-	-	-	-	1	-	-
Anotylus rugosus (Fabricius)	-	-	-	-	2	-	1

TABLE 4 (continued)

Atheta amplicollis (Mulsant & Rey)	1	-	-	-	-	-	2
Atheta atramentaria (Gyllenhal)	-	-	-	-	-	-	1
Atheta celata (Erichson)	-	-	-	-	-	-	1
Atheta fungi (Gravenhorst)	1	3	4	2	1	3	1
Gabrius breviventer (Sperk)	-	-	2	-	1	-	-
Lordithon thoracicus (Fabricius)	-	-	-	-	-	1	-
Mycetoporus angularis Muls. Rey	-	-	-	-	-	1	-
Mycetoporus rufescens (Stephens)	-	-	1	-	-	-	-
Oxypoda opaca (Gravenhorst)	1	-	-	-	-	-	-
Philhygra elongatula (Gravenhorst)	8	-	13	1	29	1	2
Philonthus carbonarius (Grav.)	-	-	-	-	-	-	1
Philorinum sordidum (Stephens)	-	2	-	2	-	7	-
Sepedophilus littoreus (Linnaeus)	-	-	-	-	-	1	-
Stenus cicindeloides (Schaller)	-	-	1	-	1	-	-
Stenus fulvicornis Stephens	-	-	-	-	-	1	-
Stenus similis (Herbst)	1	-	-	-	1	-	2
Tachinus marginellus (Fabricius)	-	1	-	-	-	-	-
Tachyporus chrysomelinus (Linn.)	-	1	-	-	1	1	1
Tachyporus dispar (Paykull)	-	-	1	-	-	-	-
Tachyporus hypnorum (Fabricius)	-	1	2	-	-	-	-
Tachyporus obtusus (Linnaeus)	-	-	3	1	-	4	1

TABLE 5. Staphylinid beetles recorded from Malaise traps near historically drained springs and seepages on the south margin of Pollardstown Fen, 1998 - 2003. Each location represents combined results from two Malaise traps. *Carex* = Carex Sward, *Carex acutiformis* sedge beds / crenal drain; Badger = Badger Drain, *Carex acutiformis* sedge beds / crenal drain; White. = Whitethroat Flush; S.Spr = Springbank Fen Springs. Each location represents combined results from two Malaise traps.

Species	*Carex*	Badger		White.	S.Spr
	1998	2003	1998	2003	1998
Indicator wetland species					
Acrotona obfuscata (Gravenhorst)	-	-	-	1	-
Other wetland species					
Alianta incana (Erichson)	-	-	-	1	-
Philhygra malleus (Joy)	-	-	-	1	-
Total no. wetland species	0	0	0	3	0
Other species					
Acrotona pygmaea (Gravenhorst)	-	-	-	-	1
Aleochara cuniculorum Kraatz	-	-	1	-	-
Aleochara lanuginosa Gravenhorst	-	-	1	1	-
Aloconota gregaria (Erichson)	-	3	1	2	-
Anotylus tetracarinatus (Block)	-	-	-	1	-
Atheta amicula (Stephens)	1	-	-	-	-
Atheta amplicollis (Mulsant & Rey)	-	2	-	2	-
Atheta fungi (Gravenhorst)	-	7	-	1	-
Atheta harwoodi (Williams)	1	-	-	-	-
Atheta laticollis (Stephens)	2	1	1	-	-
Atheta longicornis (Gravenhorst)	-	-	-	-	1
Atheta nigricornis (Thomson)	-	-	1	-	-
Eusphalerum luteum (Marsham)	-	1	-	-	-
Lordithon thoracicus (Fabricius)	-	-	-	1	-
Mycetoporus punctus (Gravenhorst)	-	-	-	1	-

TABLE 5 (continued)

Omalium rivulare (Paykull)	-	-	-	-	1
Oxypoda elongatula Aubé	-	1	-	-	-
Philhygra elongatula (Gravenhorst)	1	-	-	-	-
Philonthus carbonarius (Gravenhorst)	-	-	1	-	-
Platystethus arenarius (Fourcroy)	-	-	1	-	-
Quedius semiaeneus (Stephens)	-	-	-	-	1
Rugilus similis (Erichson)	-	1	-	-	-
Sepedophilus littoreus (Linnaeus)	-	1	-	-	-
Stenus cicindeloides (Schaller)	-	7	1	3	-
Stenus fulvicornis Stephens	-	3	-	-	-
Stenus nanus Stephens	-	1	-	-	-
Stenus picipes Stephens	-	1	-	-	-
Stenus similis (Herbst)	-	-	-	1	-
Tachinus marginellus (Fabricius)	1	-	2	-	-
Tachinus signatus Gravenhorst	3	-	1	-	-
Tachyporus chrysomelinus (Linnaeus)	-	1	-	-	-
Tachyporus dispar (Paykull)	-	1	-	1	-
Tachyporus obtusus (Linnaeus)	-	2	1	-	-
Tinotus morion (Gravenhorst)	-	-	-	-	1

TABLE 6. Staphylinid beetles recorded from Pollardstown Fen using methods other than Malaise traps. Abbreviations: Nest = swan's nest (Tullgren funnel extraction); Meadow = fen meadow (Tullgren funnel extraction); Window = window trap in fen meadow near *Phragmites* bed; Fungi = in *Cortinarius* sp. under *Salix*; Mud = hand collected from muddy lochan shore; Carrion = pork carrion baits in *Phragmites* bed.

Species	Nest	Meadow	Window	Fungi	Mud	Carrion
Indicator wetland species						
Carpelimus subtilicornis (Roubal)	-	1	-	-	1	-
Philonthus furcifer Renkonen	-	-	1	-	-	-
Atheta strandiella (Brundin)	-	-	-	1	-	13
Other wetland species						
Atheta ebenina (Mulsant & Rey)	-	-	-	-	-	1
Atheta zosterae (Thomson)	4	-	-	-	-	-
Myllaena brevicornis (Matthews)	1	-	-	-	-	-
Myllaena minuta (Gravenhorst)	-	5	-	-	-	-
Ochthephilum fracticorne (Paykull)	-	1	-	-	-	-
Ocyusa picina (Aubé)	-	-	-	-	-	1
Philonthus quisquiliarius (Gyllenhal)	-	-	-	-	1	-
Philonthus umbratilis (Gravenhorst)	1	-	-	-	-	-
Stenus binotatus Ljungh	-	-	-	-	1	-
Stenus incrassatus Erichson	-	-	-	-	12	-
Stenus picipennis Erichson	-	-	-	-	1	-
Other species						
Aleochara lanuginosa Gravenhorst	-	-	1	-	-	-
Aloconota gregaria (Erichson)	-	-	-	-	1	-
Amischa analis (Gravenhorst)	-	-	1	-	-	-
Anotylus rugosus (Fabricius)	2	1	-	-	-	58
Atheta aeneicollis (Sharp)	-	-	-	1	-	-
Atheta britanniae (Bernh. & Scheerp.)	-	-	-	-	-	8
Atheta fungi (Gravenhorst)	-	-	-	-	-	5
Bisnius puella (Nordmann)	-	-	-	1	-	-
Habrocerus capillaricornis (Gravenhorst)	-	-	1	-	-	-
Ilyobates nigricollis (Paykull)	-	-	-	-	-	1
Lathrobium brunnipes (Fabricius)	1	-	-	-	-	-
Lathrobium fulvipenne (Gravenhorst)	1	-	-	-	-	-
Lordithon thoracicus (Fabricius)	-	-	-	2	-	-
Philhygra elongatula (Gravenhorst)	-	1	-	-	-	2
Philonthus carbonarius (Gravenhorst)	-	-	1	-	-	-
Philonthus cognatus Stephens	-	-	1	-	-	-
Philonthus laminatus (Creutzer)	-	-	5	-	-	-
Philonthus succicola Thomson	-	-	-	-	-	2
Proteinus ovalis Stephens	-	-	-	7	-	-
Quedius fumatus (Stephens)	-	2	-	-	-	2
Staphylinus erythropterus Linnaeus	-	-	-	-	1	-
Stenus boops Ljungh	-	-	-	-	2	-
Stenus fulvicornis Stephens	-	-	-	-	-	1
Stenus juno (Paykull)	-	-	-	-	2	1
Stenus picipes Stephens	-	-	-	-	1	-
Tachinus laticollis Gravenhorst	-	-	-	2	-	2
Tachinus signatus Gravenhorst	-	-	1	-	-	-
Tachyporus hypnorum (Fabricius)	-	-	1	-	-	-
Tachyporus nitidulus (Fabricius)	-	-	1	-	-	-

TABLE 7. Staphylinid beetles recorded from Pollardstown Fen using methods other than Malaise traps. Abbreviations: *Typha* = winter stems of *Typha latifolia*; *Cladium* = *Carex*/ *Cladium*/moss (Tullgren funnel extraction); Moss = *Palustriella commutata* moss on tufa (Tullgren funnel extraction); Reed = *Phragmites* litter at margin of tufaceous spring (Tullgren funnel extraction); Spring = D-vac suction sample of tufaceous spring *Palustriella* moss / *Carex* /*Rorippa*; Sward = D-vac suction sample of *Phragmites*/grass/carices sward.

Species	***Typha***	***Cladium***	**Moss**	**Reed**	**Spring**	**Sward**
Indicator wetland species						
Carpelimus subtilicornis (Roubal)	-	-	2	-	2	-
Other wetland species						
Alianta incana (Erichson)	4	-	-	-	-	-
Euaesthetus ruficapillus Lacordaire	-	-	-	-	-	1
Hygronoma dimidiata (Gravenhorst)	-	-	-	-	3	-
Lesteva punctata Erichson	-	1	-	-	-	-
Lesteva sicula Erichson	-	-	-	1	1	2
Myllaena infuscata Kraatz	-	6	-	-	-	-
Ocyusa picina (Aubé)	2	-	-	-	-	3
Olophrum fuscum (Gravenhorst)	4	-	-	-	-	-
Olophrum piceum (Gyllenhal)	1	1	-	-	-	-
Paederus riparius (Linnaeus)	3	-	-	-	-	-
Quedius boopoides Munster	-	-	1	-	-	-
Quedius maurorufus (Gravenhorst)	-	1	-	-	-	-
Stenus bifoveolatus Gyllenhal	4	-	-	-	-	-
Stenus latifrons Erichson	5	1	-	-	-	5
Stenus nitens Stephens	-	1	-	-	-	8
Stenus nitidiusculus Stephens	-	-	-	-	3	17
Stenus pallitarsis Stephens	-	-	-	-	-	3
Stenus pubescens Stephens	-	-	-	-	-	1
Stenus pusillus Stephens	-	-	-	-	-	1
Tachyporus pallidus Sharp	-	-	-	-	-	5
Other species						
Anotylus rugosus (Fabricius)	-	-	-	1	-	-
Anotylus tetracarinatus (Block)	-	-	2	-	-	1
Atheta fungi (Gravenhorst)	-	-	-	-	-	1
Euaesthetus bipunctatus (Ljungh)	1	-	-	-	-	-
Lathrobium quadratum (Paykull)	-	-	1	-	-	-
Lathrobium brunnipes (Fabricius)	-	-	-	1	-	1
Quedius fuliginosus (Gravenhorst)	-	-	2	-	-	-
Quedius fumatus (Stephens)	-	-	1	-	-	-
Stenus cicindeloides (Schaller)	10	-	-	-	2	-
Stenus clavicornis (Scopoli)	-	-	-	-	1	-
Stenus impressus Germar	1	1	1	1	-	16
Stenus flavipes Stephens	-	-	-	-	-	1
Stenus juno (Paykull)	1	-	-	-	-	3
Stenus picipes Stephens	3	-	-	-	-	-
Tachyporus chrysomelinus (Linnaeus)	-	1	-	-	-	-

TABLE 8. Staphylinid beetles recorded from Pollardstown Fen Malaise trap locations using methods other than Malaise traps. Abbreviations: Spring fen = pitfall traps in fen peat with *Carex/Filipendula*/grasses near spring and crenal stream (Tufa Spring); *Carex* = pitfall traps in *Carex acutiformis* sedge beds/crenal drain (*Carex* Sward); Drain = pitfall traps in *Carex acutiformis* sedge beds/crenal drain (Badger Drain); *Juncus* = pitfall traps in *Juncus/carices/* grasses near springs (Springbank Fen Springs); Tufa S. = D-vac samples from margin of tufaceous spring with *Carex acutiformis* (Tufa Spring).

Species	**Pitfall traps**				**D-vac**
	Spring fen	***Carex***	**Drain**	***Juncus***	**Tufa S.**
Indicator wetland species					
Quedius humeralis Stephens	-	1	-	-	-
Cypha punctum (Motschulsky)	-	-	-	-	3
Stenus brevipennis Thomson	-	-	-	-	2
Other wetland species					
Atheta graminicola (Gravenhorst)	-	-	-	-	1
Gabrius trossulus (Nordmann)	1	-	-	-	-
Hygronoma dimidiata (Gravenhorst)	-	-	-	-	47
Lesteva sicula Erichson	-	-	-	-	1
Ocyusa picina (Aubé)	-	-	-	-	10
Oxypoda elongatula Aubé	-	-	-	-	1
Philhygra elongatula (Gravenhorst)	-	-	-	-	4
Philonthus nigrita (Gravenhorst)	1	-	-	-	-
Stenus bimaculatus Gyllenhal	1	-	-	-	1
Stenus latifrons Erichson	-	-	-	-	4
Stenus nitens Stephens	-	-	-	-	4
Stenus nitidiusculus Stephens	-	-	-	-	9
Stenus picipennis Erichson	1	-	-	-	5
Tachyporus pallidus Sharp	-	-	-	-	3
Other species					
Aloconota gregaria (Erichson)	-	-	-	-	2
Anotylus rugosus (Fabricius)	8	1	6	1	-
Atheta fungi (Gravenhorst)	1	-	-	-	2
Atheta liliputana (Brisout)	-	-	-	-	1
Atheta orphana (Erichson)	-	-	1	-	-
Lathrobium brunnipes (Fabricius)	-	-	1	-	-
Othius punctulatus (Goeze)	-	1	1	-	-
Quedius curtipennis Bernhauer / *fuliginosus* (Gravenhorst)	1	-	-	-	-
Rugilus erichsoni (Fauvel)	1	-	-	-	-
Staphylinus dimidiaticornis Gemminger	1	-	-	-	-
Staphylinus erythropterus Linnaeus	2	-	-	1	-
Stenus clavicornis (Scopoli)	-	1	-	-	-
Stenus fulvicornis Stephens	-	-	-	-	1
Stenus impressus Germar	-	-	-	-	15
Stenus picipes Stephens	-	-	-	-	4
Tachinus laticollis Gravenhorst	1	-	-	-	-
Tachinus marginellus (Fabricius)	-	1	-	-	-
Tachinus signatus Gravenhorst	5	4	1	-	-
Tachyporus obtusus (Linnaeus)	3	-	-	-	3

TABLE 9. Summary by year of results from Malaise trapping Staphylinidae at Pollardstown Fen, in increasing order of trapping intensity.

Year	*No. trap weeks*	*No. traps*	*Total species*	*Wetland species*	*Indicator species*
1999	14	4	24	2	0
1998	36	6	33	5	3
2001	36	6	27	6	0
2002	80	8	47	11	1
2003	140	14	69	20	4
All years	306	38	170	33	6

TABLE 10. Indicator staphylinid species recorded from Pollardstown Fen compared to their recorded presence from Wicken Fen (Norfolk, England) (Friday and Harley, 2000) and from fens and riparian grassland in Cos. Clare and Galway (Good, 2004; Good and Butler, 2001; Regan and Anderson, 2004). *Stenus fornicatus* was recorded from Pollardstown Fen by Lott and Foster (1990).

Species	*Wicken Fen*	*Clare / Galway fens & riparian grasslands*
Acrotona obfuscata	No	No
Aloconota sulcifrons	No	Yes
Atheta aquatilis	No	Yes
Atheta strandiella	No	Yes
Carpelimus subtilicornis	No	Yes
Cypha punctum	No	No
Philonthus fumarius	Yes	Yes
Philonthus furcifer	No	Yes
Quedius humeralis	Yes	Yes
Schistoglossa gemina	No	Yes
Stenus brevipennis	No	No
Stenus fornicatus	No	Yes
Stenus palustris	Yes	Yes
Zyras collaris	Yes	No

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NEOBISIUM CARPENTERI (KEW) (ARACHNIDA: PSEUDOSCORPIONES) – A FALSE SCORPION NEW TO COUNTY KERRY, IRELAND

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Introduction

It transpires that I was rather hasty in declaring *Neobisium carpenteri* (Kew) as unique to County Cork (Alexander, 2004). A visit to County Kerry in November 2004 revealed a substantial but previously unrecorded population along the south side of the Iveragh Peninsula in South Kerry (VC1). My previous note also drew attention to the adventurous nature of the species, exploring aerial vegetation to its limits, and the South Kerry population is no exception.

The records

The false scorpions were found along the route of the Kerry Way between Lackeen Point and Dromore Castle, along the Kenmare River between Kenmare and Sneem, 1 November 2004, as follows:-

Lackeen Point, V7967

(a) one beaten from western gorse *Ulex gallii* along low rocky outcrops above the River; **(b)** one beaten from ivy *Hedera* on an old pine *Pinus* snag; **(c)** knocked from grassy overhangs on coastal rock outcrops.

Dromore Woods, V8067

(a) a few swept from great wood-rush *Luzula sylvatica* where it grows in patches beneath birches *Betula*; **(b)** seven beaten from bell heather *Erica cinerea* on an open rocky cliff; **(c)** one beaten from western gorse on open rocky cliff.

Associated species

Although the woodlands here are mainly conifer plantations, the false scorpions were found along a lower coastal fringe of semi-natural woodland, scrub, heath and grassland, along the steep rocky slopes between the forestry and the sea, forming an interesting mosaic of habitat for wildlife. Oak *Quercus*, birch and holly *Ilex* form the main components of the wooded fringe, but hazel *Corylus* also occurs locally and there are wet seepages with alder *Alnus* and willow *Salix* . The oaks include maidens of up to 2m girth and there are larger old stools of oak, ash *Fraxinus* and alder. The ground flora includes sanicle *Sanicula europaea* and goldenrod *Solidago virgaurea*. The overall impression is of a relict strip of ancient woodland – this impression is enhanced by the presence of brown snail *Perforatella subrufescens* (Miller) (Mollusca: Helicidae) which is characteristic of ancient woodland over much of its range although less so in western coastal districts. This snail is itself very localised in Ireland and its discovery here provides an update to the pre-1965 record for V86 shown in the latest distribution atlas (Kerney, 1999).

The rest of the invertebrates present were much more widespread species. The vegetation beating also produced the weevil *Strophosoma melanogrammum* (Forster) (Coleoptera: Curculionidae), the predatory bug *Anthocoris nemorum* (L.) (Hemiptera: Anthocoridae), the pill millipede *Glomeris marginata* (Villers) (Diplopoda: Glomeridae), gorse shieldbug *Piezodorus lituratus* (Fab.), the ladybird *Rhyzobius litura* (Fab.) (Coleoptera: Coccinellidae), the ground beetle *Dromius linearis* (Olivier) (Coleoptera: Carabidae), the seed bug *Stygnocoris sabulosus* (Schilling) (Hemiptera: Lygaeidae), and the woodlice *Porcellio scaber* Latreille and *Porcellionides cingendus* (Kinahan) (Oniscoidea: Porcellionidae) – the last a south-western speciality. The plant bug *Dicyphus constrictus* (Boheman) (Hemiptera: Miridae) was present on its foodplant hedge woundwort *Stachys sylvatica*. The snail *Balea perversa* L. (Mollusca: Clausiliidae) was present on mossy tree branches. The only wood-decay species noted was the beetle *Rhizophagus dispar* (Paykull) (Coleoptera: Rhizophagidae) from under bark on a dead oak pole

The ease and frequency with which *Neobisium carpenteri* was found at Lackeen contrasts with the difficulty experienced in finding it at its type locality, Glengarriff, later in the week. A single false scorpion was eventually found by tapping overhangs of woodrush *Luzula campestris* on rocky ground near Lady Bantry's Lookout, V9156, 6 November 2004. Some of the associated invertebrates here are common to Lackeen:- *Perforatella subrufescens*, *Glomeris marginatus* and *Porcellionides cingendus*. The additional species here – *Clausilia bidentata* (Ström) (Mollusca: Clausiliidae), *Dilta hibernica* (Carpenter) (Thysanura: Machilidae), *Philoscia muscorum* Scopoli (Oniscoidea: Philosciidae) and *Cylindrinotus laevioctostriatus* (Goeze) (Coleoptera: Tenebrionidae) and also likely inhabitants of the Lackeen woodland. No false scorpions were found in other areas of South Kerry or West Cork visited during the week.

Acknowledgements

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DISTRIBUTION OF ESTUARINE NAIDIDAE AND TUBIFICIDAE (OLIGOCHAETA) IN MUNSTER, IRELAND

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Introduction

In comparison to many other aquatic taxa, the oligochaete fauna of Irish waters has, until recently, been relatively poorly described, a situation particularly noticeable in the case of the two exclusively aquatic families, Naididae and Tubificidae. This has probably largely been due to a perceived difficulty in identification. Species inventories and distribution data for free-living freshwater oligochaetes were updated by Trodd *et al.* (2005). Published data on the distribution of estuarine and marine oligochaete species around Ireland is less comprehensive. Kennedy (1964) included records of marine species from Dublin, Antrim, West Mayo and West Cork in his study of Irish Tubificidae. McGrath (1975) identified oligochaetes from the marine littoral in Dublin Bay and Inishmore Island, Galway. Healy (1979) described the marine littoral and brackishwater oligochaete fauna of Wexford. Three species of Tubificidae were recorded in a survey of coastal lagoons from Wexford to Donegal (Oliver and Healy, 1998). Prior to the present survey, only two species of estuarine Tubificidae and no estuarine Naididae were represented in the specimen collection of the National Museum (Dublin).

In accordance with the provisions of the EU Water Framework Directive, all member states are required to assess the ecological status of surface waters, including transitional waters (estuaries and coastal lagoons), by considering biological, as well as hydromorphological and physico-chemical elements of quality. As oligochaetes form a significant proportion of the benthic invertebrate fauna of most major estuaries, a description of the oligochaete species composition could be important if the invertebrate fauna is to be included in the biological assessment of transitional waters.

Two Ponto-Caspian oligochaete species have recently arrived in Irish rivers upstream of major sea ports, with one of these species found in the Liffey system and both found in the Shannon system (Sweeney *et al.*, 2003). Evidence from Europe suggests that dispersal of these oligochaete species, among others, is aided in part by transport in the ballast water of ships from which they spread up estuaries to freshwater (Milbrink and Timm, 2001; deVaate *et al.*, 2002). This further highlights the importance of describing the oligochaete fauna currently present and establishing the status of alien species in estuaries.

This paper presents the results of a study aimed at the compilation of data on the distribution of species of Naididae and Tubificidae in Munster estuaries.

Methods

In 2003 and 2004, samples of mud, sand and gravel were collected in 69 estuaries around the coast of Munster, using a pond net and/or a dredge sampler. Where possible, samples included different substrata types from a range of tidal levels in order to maximise the number of species collected. At each of the estuaries of the five largest rivers (Shannon, Bandon, Lee, Munster Blackwater and Suir), samples were collected in two distinct areas, one towards the freshwater end and one farther downstream. Following sieving, samples were hand-sorted in a white sorting-tray and specimens were preserved in 70% ethanol, before mounting in Aquamount on microscope slides. Species were identified using the identification keys of Brinkhurst (1971) and Timm (1999).

Results

Full results of the field survey are presented in Table 1. Twelve oligochaete species were recorded, six Naididae and six Tubificidae. In most estuaries, numbers of Tubificidae far exceeded numbers of Naididae.

Species recorded

Naididae

Chaetogaster diaphanus (Gruithuisen): found in only two estuaries.

Nais elinguis Müller: although found in only twelve estuaries (less than 20% of the total sampled), this species was recorded from all eight vice-counties around the Munster coast.

Nais variabilis Piguet: found in five estuaries, all in Co. Kerry.

Paranais litoralis Müller: the third commonest oligochaete in the present survey, recorded in 29 estuaries and in all vice-counties. High densities were noted in the Dunhill estuary.

Uncinais uncinata (Oersted): found in only two estuaries.

Stylaria lacustris (Linnaeus): found in eight estuaries, distributed around the coast.

Tubificidae

Tubificoides benedeni (Udekem): the second commonest oligochaete in the present survey, recorded in 34 estuaries and in all vice-counties. High densities were noted in several estuaries.

Tubificoides pseudogaster (Dahl): the fourth commonest oligochaete in the present survey, recorded in 20 estuaries and in all vice-counties.

Clitellio arenarius (Müller): found in only one estuary, in predominantly marine littoral conditions.

Heterochaeta costata Claparède: the commonest oligochaete in the present survey, recorded in 54 estuaries and in all vice-counties. High densities were noted in several estuaries.

Potamothrix moldaviensis Vejdovský and Mrázek: found at six locations, all clustered around the inner Shannon Estuary.

Potamothrix vejdovskyi (Hrabe): single specimen found in the inner Shannon Estuary.

A slide collection of these species has been deposited in the National Museum of Ireland (NMINH : 2003.76).

Discussion

In general, although high densities were regularly encountered, the species diversity of oligochaetes in Munster estuaries was found to be low. This low oligochaete species diversity simplifies the task of assessing the oligochaete component of invertebrate fauna of estuaries. In 67 of the 69 estuaries surveyed, no more than four oligochaete species were recorded in each. Five species were recorded in the Lee Estuary (Cork) and seven in the Shannon Estuary.

Of the twelve oligochaete species recorded, only four (*Paranais litoralis*, *Tubificoides benedeni, T. pseudogaster* and *Heterochaeta costata*) were found in more than 20% of the estuaries surveyed. Numerically, these species also tended to dominate the oligochaete fauna at individual sites. These four species, together with *Clitellio arenarius*, are typically found in more saline conditions than the other seven. *H. costata* was notably abundant at several sites around the Munster coast. This species is euryhaline in its salinity tolerance (Brinkhurst, 1964), a factor which allows it to survive and to successfully compete in the range of salinities typically found in estuaries. Seven of the recorded species are generally associated with freshwater habitats.

Most of the more common species recorded have a wide geographical spread. However, the fact that in this survey the five records of *Nais variabilis* were all from Co. Kerry is noteworthy. It is possible that this may reflect a restricted geographical distribution. More extensive surveying of Irish estuaries would be needed to clarify whether this is the case.

Of the twelve locations at which *Nais elinguis* was found, most were downstream of major towns. This may be significant as Brinkhurst (1971) states this species is common and abundant in polluted water.

Potamothrix moldaviensis and *P. vejdovskyi* are alien species of Ponto-Caspian origin. *P. moldaviensis* was recorded at six sites, all towards the inner end of the Shannon Estuary and its tributaries, not far from where large ocean-going ships berth at Limerick Docks. The single specimen of *P. vejdovskyi* found was also from this area. These results add weight to the evidence that these two species, which were recorded by Sweeney *et al.* (2003) in freshwater reaches of the Shannon system, arrived in the ballast waters of ships. It seems probable that at other estuaries visited by ocean-going ships, particularly the Suir and Lee, these alien species will arrive in the future. Other Ponto-Caspian oligochaete species that could be transported to Ireland in ballast water include *P. heuscheri* (Bretscher) and *Paranais frici* Hrabe.

Further studies on the Naididae and Tubificidae in estuaries around the remainder of the Irish coast could provide useful information on species distribution and a baseline against which future changes could be assessed.

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TABLE 1. The occurrence of Naididae and Tubificidae in Munster estuaries.

Species are represented by their initials. *Cd (Chaetogaster diaphanus); Ne (Nais elinguis); Nv (Nais variabilis); Pl (Paranais litoralis); Uu (Uncinais uncinata); Sl (Stylaria lacustris); Tb (Tubificoides benedeni); Tp (Tubificoides pseudogaster); Hc (Heterochaeta costata); Ca (Clitellio arenarius); Pm (Potamothrix moldaviensis); Pv (Potamothrix vejdovskyi).*

Estuaries are identified by the EPA river name and code.

Estuary	**EPA Code**	**Vice-County**	**Grid**	*Cd*	*Ne*	*Nv*	*Pl*	*Uu*	*Sl*	*Tb*	*Tp*	*Hc*	*Ca*	*Pm*	*Pv*
Inagh	28I1	Clare	R1088							+		+			
Annagh	28A3	Clare	R0377		+				+						
Creagh	28C2	Clare	Q9867				+					+			
Doonbeg	28D2	Clare	Q9665				+								
Moyarta	27M1	Clare	Q8451				+					+			
Wood	27W1	Clare	Q9954							+	+	+			
Crompaun	27C5	Clare	R1255				+			+		+			
Cloon	27C2	Clare	R1455							+		+			
Ballynacally	27B4	Clare	R2863									+			
Owenslieve	27O2	Clare	R2865							+					

				Cd	*Ne*	*Nv*	*Pl*	*Uu*	*Sl*	*Tb*	*Tp*	*Hc*	*Ca*	*Pm*	*Pv*
Fergus	27F1	Clare	R3574		+							+		+	
Rine	27R1	Clare	R3771								+	+		+	
Owengarney	27O3	Clare	R4560				+					+			
Cratloe	27C8	Clare	R5158					+	+	+				+	
Shannon	25S1	Limerick	R5656		+				+					+	+
Shannon	25S1	Limerick	R4057		+		+			+		+			
Maigue	24M1	Limerick	R4656	+								+		+	
Deel	24D2	Limerick	R3351									+		+	
Smearlagh	24S2	Limerick	R2850				+								
Owvane	24O2	Limerick	R1949							+	+	+			
Glencorbly	24G3	Limerick	R1347									+			
Ballylongford	24B3	North Kerry	R0046							+	+	+			
Feale	23F1	North Kerry	Q8936		+		+			+		+			
Lee	23L1	North Kerry	Q8113							+	+				
Scorid	23S1	North Kerry	Q5311				+					+			

				Cd	*Ne*	*Nv*	*Pl*	*Uu*	*Sl*	*Tb*	*Tp*	*Hc*	*Ca*	*Pm*	*Pv*
Owenmore	23O3	North Kerry	Q5110									+			
Milltown	22M3	North Kerry	Q4301				+			+					
Owenalondrig	22O1	North Kerry	Q4900	+			+					+			
Emlagh	22E1	North Kerry	Q6500			+	+					+			
Maine	22M1	North Kerry	Q8303				+					+			
Laune	22L1	North Kerry	V7798		+	+		+				+			
Caragh	22C2	North Kerry	V6829			+			+	+					
Behy	22B2	North Kerry	V6591									+			
Ferta	22F1	South Kerry	V5081			+						+			

				Cd	*Ne*	*Nv*	*Pl*	*Uu*	*Sl*	*Tb*	*Tp*	*Hc*	*Ca*	*Pm*	*Pv*
Derreen	22D2	South Kerry	V7645							+					
Emlaghmore	21E1	South Kerry	V4568						+			+			
Inny	21I1	South Kerry	V4969		+						+	+			
Blackwater	21B3	South Kerry	V7968			+						+			
Finnihy	21F01	South Kerry	V9070									+	+		
Roughty	21R1	South Kerry	V9270				+			+					
Dromoghty	21D4	South Kerry	V8767						+			+			
Owenshagh	21O8	South Kerry	V7758							+					
Kealincha	21K2	West Cork	V6350				+								
Adrigole	21A1	West Cork	V8050							+	+	+			

				Cd	*Ne*	*Nv*	*Pl*	*Uu*	*Sl*	*Tb*	*Tp*	*Hc*	*Ca*	*Pm*	*Pv*
Glengarriff	21G3	West Cork	V9256				+			+	+	+			
Owvane	21O7	West Cork	W0053				+					+			
Mealagh	21M1	West Cork	W0050							+					
Fourmile water	21F2	West Cork	V9440				+			+	+	+			
Glan Stream	21G1	West Cork	V8533							+		+			
Ruane	20R1	West Cork	V9935				+			+	+	+			
Ilen	20I1	West Cork	W1133		+							+			
Tinneel	20T2	West Cork	W2937				+			+					
Clonakilty	20C5	West Cork	W3841				+			+		+			
Argideen	20A2	West Cork	W4744							+		+			
Kilbrittain	20K1	West Cork	W5346							+	+	+			
Ballinspittal	20B9	West Cork	W5943				+		+						

				Cd	*Ne*	*Nv*	*Pl*	*Uu*	*Sl*	*Tb*	*Tp*	*Hc*	*Ca*	*Pm*	*Pv*
Bandon	20B2	Mid Cork	W5653		+							+			
Bandon	20B2	Mid Cork	W6049								+	+			
Stick	20S3	Mid Cork	W6653								+				
Minane	20M1	Mid Cork	W7556							+	+	+			
Owenboy	19O1	Mid Cork	W7362							+	+	+			
Glounatouig	None	Mid Cork	W7565									+			
Lee	19L3	Mid Cork	W6772		+		+				+				
Lee	19L3	Mid Cork	W7271							+	+	+			
Glashaboy	19G1	East Cork	W7273							+		+			
Owenacurra	19O3	East Cork	W8872		+		+			+		+			
Womanagh	19W1	East Cork	X0472				+			+	+	+			
Blackwater	18B2	Waterford	X0993		+							+			
Blackwater	18B2	Waterford	X1080				+			+		+			

				Cd	*Ne*	*Nv*	*Pl*	*Uu*	*Sl*	*Tb*	*Tp*	*Hc*	*Ca*	*Pm*	*Pv*
Colligan	17C1	Waterford	X2494				+			+	+	+			
Mahon	17M1	Waterford	X4398						+						
Dunhill	17D2	Waterford	X4998				+								
Suir	16S2	Waterford	S5714									+			
Suir	16S2	Waterford	S6311				+				+	+			

PLATYCHEIRUS AUROLATERALIS, *P. SCUTATUS* AND *P. SPLENDIDUS* (DIPTERA: SYRPHIDAE) IN A CO. DUBLIN GARDEN, IRELAND

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Three European species closely related to the hoverfly *Platycheirus scutatus* (Meigen) have been described within the last eight years. *P. scutatus* has been known from Ireland for a long time. Two of the additional species, *P. aurolateralis* Stubbs and *P. splendidus* Rotheray, were added to the Irish list by Speight *et al.* (2004). The former was derived from the catches of Malaise traps installed in urban Parks in central Dublin, the latter also from Malaise traps, beside hedges in farmland in counties Dublin and Kildare.

It was remarked by Speight *et al.* (2004) that *P. aurolateralis* "might well be present in mature, suburban gardens in the Dublin area". With this thought in mind, I have been expressly looking for that species in our own back garden, bearing in mind the remarkably close resemblance of the male to the male of the abundant, and almost ubiquitous, *P. albimanus* (Fabr.), when seen "in the field". To judge from the data provided by Speight *et al.* (2004), *P. aurolateralis* has two brief flight periods per year in Ireland, one in April and the other at the beginning of September, so I started checking apparent males of *P. albimanus* in the garden in April 2005. This process continued until the first week of May, when I suddenly found males not only of *P. aurolateralis*, but also of *P. albimanus, P. scutatus* and *P. splendidus*, in flight in the garden on the same day. The collection data for all four species are as follows:-

Co. Dublin: 7 May 2005, O1925 (PV4), Sandyford; on foliage of *Ligustrum* hedge, suburban garden, coll. and det. MCDS.

In Speight *et al.* (2004), the 50km UTM square from which the records of both *P. aurolateralis* and *P. splendidus* were derived is erroneously given as PU4. As in the present case, the correct reference is PV4. Also, Speight *et al.* (2004) point out that, in the Malaise trap catches available to them, *P. aurolateralis* appeared on the wing at a time when males of neither *P. albimanus* nor *P. scutatus* were collected. Further, in those Malaise traps catches, *P. aurolateralis* occurred only in Dublin Parks, whereas *P. splendidus* occurred only in farmland. In the present instance, all four species were found in flight together, on the same day, in the same place. Speight *et al.* (2004) discuss the issue of whether *P. aurolateralis and P. splendidus* might be recent arrivals in Ireland, pointing out that, while both species could easily have been overlooked, no material of either of them has been located in existing collections. Both of them are associated with deciduous scrub of one sort or another and might occur in many parts of Ireland, in which case one would expect them to be collected by happenstance, even if not by design. The larvae of *P. splendidus* have been found feeding on aphids on *Silene* and *Ulmus* (Rotheray, 1998). The larvae of *P. aurolateralis* are unknown but it can be presumed they are also aphidophagous, on shrubs and/or tall-growing herb-layer plants. The garden that forms the basis for the present note is within a large housing development that did not exist 20 years ago. At that time the area was entirely covered in poor, heavily-grazed grassland, bounded by hedges. The hedges were eradicated and all topsoil removed during housing construction, so that the gardens within the estate were effectively *tabla rasa* at that stage. Insects that are now associated with tall herb-layer plants or shrubs occurring within these gardens, including *P. aurolateralis* and *P. splendidus,* have almost indubitably arrived over the last 15 years, following planting of their gardens by house occupiers. Clearly then, these syrphids can rapidly occupy appropriate habitat when it becomes available to them in a suburban landscape and are not dependent upon long-established habitat components i.e. their requirements can apparently be met within 15 years of re-vegetation of erstwhile bare ground. It follows that both of these species could now be both widespread and abundant in Dublin's sprawling, expanding suburbia, where neither housing estates nor gardens were present some 25 years ago. But what of their occurrence elsewhere in Ireland? Is the present lack of records of either species away from the periphery of Dublin real, or an artifact of the short time that they have been known to science and the reality that they can easily be overlooked?

It remains the case that only the males of *P. aurolateralis* and *P. splendidus* can be separated from related species - females of *P. aurolateralis* and *P. splendidus* cannot yet be distinguished either from each other or from females of *P. scutatus*. Problems encountered in identifying the males are alluded to in Speight *et al.* (2004), who provide a key for their separation that may be used also for specimens in alcohol (e.g. Malaise trap catches). Other English-language keys are available in Ball *et al.* (2002), Doczkal *et al.* (2002) and van Veen (2004). The only key to the males of all four European species of the *Platycheirus scutatus* complex is that by Doczkal *et al.* (2002). But separation of these species remains difficult. The differences in the pale markings and proportions of the tergites alluded to by Ball *et al.* (2002) are not so useful as one might hope, since the fourth tergite in *P. splendidus* may be as elongate as in *P. scutatus* and the pale marks on tergite 2 can be extremely small in *P. splendidus*, as in *P. aurolateralis*. Similarly, the proportions of the fourth tarsomere of the fore legs, as referred to by Speight *et al.* (2004), are extremely difficult to interpret and van Veen's (2004) reference to the face in *P. aurolateralis* and *P. splendidus* males as "dull black", in comparison with *P. scutatus* where it is stated to be "completely silverish", is simply incorrect. These differences do apply to the colour of the frons, and one has to assume that the intention was to refer to the frons, and not the face. Finally, differences in the coverage of microtrichia observed on the 2nd basal cell of the wings, referred to in all of these keys, do not seem very reliable, since males of *P. scutatus* can have wings almost entirely covered in microtrichia, as in the other species. The pilosity of the ventral surface of the mid tibiae remains probably the most certain way to distinguish *P. aurolateralis* males from those of *P. scutatus* and *P. splendidus*, as indicated in the key by Speight *et al.* (2004). But it would clearly be useful if additional features could be employed for separation of males of *P. scutatus* and *P. splendidus*, especially for specimens in alcohol, where the colour of the frontal d usting, useful in dried specimens, is difficult to interpret.

Examination of the material now available to me (from various parts of Europe) does suggest certain supplementary features could be useful, as follows:-

P. scutatus (male)

- clypeus 2.0-2.5x as long as wide; ventral pale (yellowish) area at the base of the fore femora enclosing three, large, isolated, well-defined black marks; long, lateral facial hairs (as opposed to the short hairs covering the more central parts) usually predominantly (or all) pale, yellowish, though occasionally predominantly black

P. splendidus (male)

- clypeus 2.5-3.0x as long as wide; ventral pale area at the base of the fore femora enclosing one or two rather ill-defined blackish marks; long, lateral, facial hairs predominantly or all black

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FARMS AS BIOGEOGRAPHICAL UNITS 5: THE RESPONSE OF ODONATA TO INCREASED HABITAT AVAILABILITY ON A FARM IN CO. CORK, IRELAND

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Summary

The dragonfly fauna of the case study farm was observed to increase from one to nine species within three years, following installation of a pond and two areas of wetland. Data are presented confirming successful breeding by six of these species in the areas of new habitat, and showing that successful breeding by two of the others is very probable. These results show that, for a taxonomic group - like the Odonata - to which the Irish farmed landscape is still permeable, introduction of wetland/freshwater habitat can result in an almost immediate increase in biodiversity and can potentially provide for approximately 50% of the regional fauna of that taxonomic group. The regime for funding such proactive management within current agri-environmental schemes is discussed. It is concluded that a wetland scheme similar to the Native Woodland Scheme would be a more appropriate means of addressing both the relatively high initial investments costs of wetland creation, and the need for such created habitats to be semi-permanent (i.e. guaranteed for longer than five years).

Introduction

In previous papers in the *Bulletin* (Good, 2001; Speight, 2001; Speight and Good, 2001a, b), we explored the potential role of changes in the production regime of an enclosed farm in determining change in, and maintenance of, components of the biodiversity present in the local landscape. Central to the process of considering how changes in the farm management regime impacted were data on the observed and predicted faunas of two families of Diptera, the Sciomyzidae and Syrphidae. Here we consider changes in the dragonfly fauna of the farm brought about by habitat modification at a scale feasible on any farm, through the provisions of agri-environmental schemes like REPS.

In Good (2001) it was reported that the case-study farm supported one species of dragonfly, *Sympetrum striolatum* (Charpentier). It was also reported that drainage of part of the farm about 25 years previously was seen as the reason for loss of certain species of plant and animal from among those previously supported by the farm. Further, none of the economically viable changes that were envisaged in the farm's management regime included re-establishment of lost wetland or introduction of water bodies. It was subsequently pointed out, by Speight and Good (2001a), that, although there was provision made in contemporary agri-environnmental scheme documentation (DAFF, 2000) for pro-active management as a biodiversity maintenance measure, there was no targeted finance available to achieve re-establishment or maintenance of wetland conditions on a farm. It was concluded that, without such pro-active management, the wetland fauna still observed on the farm could be expected to diminish further.

Nelson and Thompson (2004) do not provide county lists of Irish dragonflies, but it is none the less possible to compile a list for Co. Cork from the distribution information given. Excluding species regarded as non-resident (i.e. migrant or vagrant species) there are 21 species of Odonata recorded from Co. Cork. Of those 21 species, Nelson and Thompson (2004) record three, since the year 2000, from the 10km Irish National grid square in which the farm is located and 16 from adjacent grid squares during the same time period. This suggests that, if appropriate habitat were present, more than one dragonfly species might be expected to occur on the farm. The work carried out on syrphids (Speight, 2001) demonstrated that, while nearly all the species recorded from the farm could probably be supported by habitat represented there, there would be greater likelihood of survival of the wetland species recorded if steps were taken to increase wetland availability on the farm. It was suggested that one species recorded (*Anasimyia lineata* (Fabr.)) was unlikely to be supported by the farm unless appropriate pond margin/wetland habitat was introduced there. Work aimed at establishing which of the sciomyzids recorded from the farm were developing there (Speight, 2004) found no evidence for successful breeding of at least one wetland/freshwater species (*Tetanocera robusta* Loew) repeatedly recorded as the adult fly, also suggesting that an increase in the range and availability of wetland/freshwater habitats on the farm could result in an increase in the diversity of resident species.

Given that wetland habitat had been more extensively available on the farm previously than now, that species seemed available within the vicinity of the farm to colonise appropriate wetland/freshwater habitat that might be introduced to it, and given that introduction of such wetland/freshwater habitat to a farm was at least theoretically feasible, under agri-environmental schemes, it was decided to introduce a standing-water body to the farm and to increase the area of wetland present. These initiatives were carried out in order to test the general hypothesis that invertebrate species known to be available in the vicinity, but apparently not breeding on the farm, would colonise the farm if habitat was available for them there and to gain information on the scale of endeavour required to achieve this result. In the present text the response of the dragonfly (Odonata) fauna is reported. Responses of the sciomyzids and syrphids will be dealt with elsewhere.

Materials and methods

Site modification/habitat creation

Two types of wetland and a pond were created in parts of two adjacent fields at Glinny-Boulaling Farm, near Riverstick, Co. Cork (W668585). Figure 1 can be used to locate these fields on the sketch map of the farm provided by Good (2001). The created habitats are shown diagrammatically in Figure 2 and may be described as follows:-

(1) *Small pond with overland discharge*

An area of scrub (*Ulex europaeus, Salix* sp., and *Rubus fruticosus* agg.) which had developed on drained wet grassland (drained in 1990) located close to one edge of a field on the farm's margin, was fenced off, cleared of scrub and topsoil, and its gleyed clay-loam subsoil excavated, during autumn 2001, to create a shallow hollow with gently shelving margins. The fenced off area is shown as Pond field in Figure 1. A drain running along the edge of this field, and channelling the water from a small upslope spring, was then redirected into this hollow to create a pond, with overflow discharge from the pond occurring through a band (*circa* 10m) of *Molinia caerulea/Filipendula ulmeria* grassland. Four new habitats were thus created: (a) open-water; (b) bare margins to open water; (c) new discharge flush vegetation (including *Glyceria* sp., *Holcus lanatus*, *Juncus* sp., *Mentha aquatica*, etc.); (d) flushed *Molinia/Filipendula*. The latter two habitats are together referred to here as the "outflow wetland". The pond is small, oval and shallow (surface area: 280m^2; maximum depth: 0.7m). A small (*circa* 6m) bay excavated in the pond margin was planted with *Typha latifolia* and *Alisma plantago-aquatica* during winter 2002. Because of elevated nitrate concentrations (27-41 mg/l NO_3) in the inflow water (which originates from a shallow aquifer spring in the adjoining field), algal blooms occur in the pond.

(2) *Created overland-flow wetland*

Part of a conventionally-managed cereal field (drained from *Juncus* flushes and old pasture in 1990), adjoining the drain feeding the pond described under (1) above, was fenced off and excavated during autumn 2002, to form a catenary series of five cells (total area 0.1ha), each of *circa* 2% downhill slope. The excavated topsoil was replaced in the cells after excavation and grading. Water was diverted from the drain to flow through the overland-flow wetland, and at the outflow from the wetland the water was channelled back into the drain, upslope of the point at which the drain discharged into the pond described above. Parts of the created wetland cells were planted with *Glyceria maxima* and *Carex riparia* during Autumn 2003. The fenced off area is shown as Wetland field in Figure 1.

FIGURE 1. Sketch map showing location of introduced overland-flow wetland and pond (shown in black).

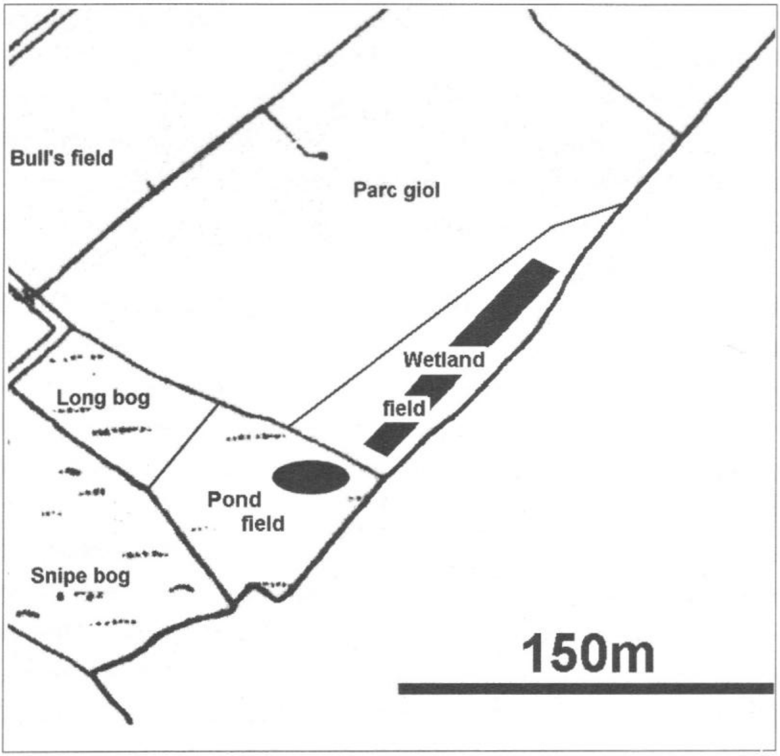
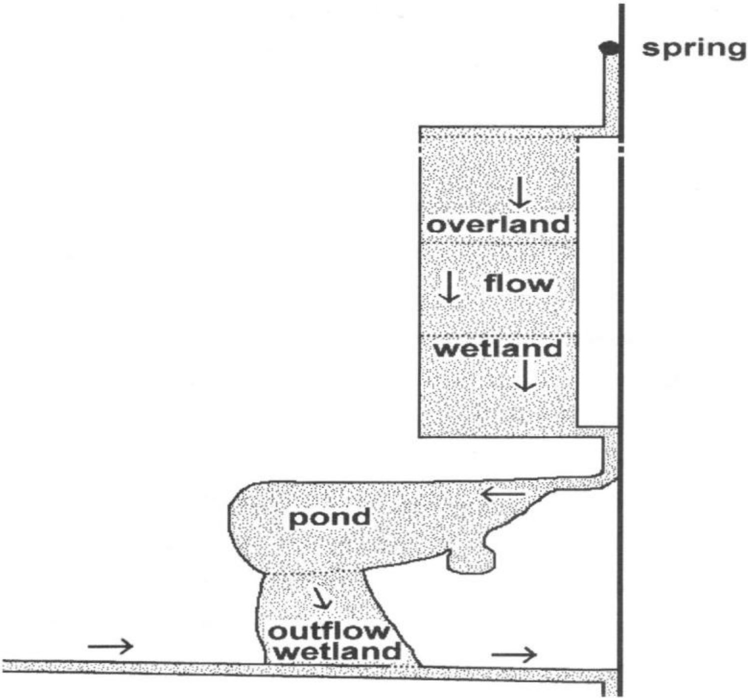


FIGURE 2. Diagrammatic representation of the created overland-flow wetland, plus the created pond and its outflow wetland. Broken lines on the lateral margins of the uppermost overland-flow wetland cell indicate that the overland-flow wetland is not shown to scale: each wetland cell is approximately 10m wide and the five cells are together approximately 100m long. Dotted transverse lines indicate spillways. Arrows indicate direction of water flow: downslope from the spring to the pond, *via* the cells of the overland flow wetland and thence continuing downslope through the outflow wetland to the axial ditch transporting water out of the farm. Inundated ground is shown stippled.



Sampling regime

Following its installation in late summer of 2000, the pond and its dependent outflow wetland have been visited in spring and summer each year for direct observation of the dragonfly fauna. The overland-flow wetland has been visited for the same purpose, each spring and summer since its installation. Adult dragonflies observed were collected by hand-net and determinations verified under the microscope. In addition, emergence traps were installed around the edge of the pond and on its outflow wetland, in 2002 and 2004 and on the overland-flow wetland in 2004. The emergence traps used and their installation are described in Speight (2004). To investigate possible breeding of species seen as adults but not collected by the emergence traps, nymphs were collected using a pond net during April 2005. Determination of nymphs was carried out using, in combination, the keys and figures provided by Carchini (1983), Fraser (1956) and Gerken and Sternberg (1999).

Results

Costs

The cost of pond and outflow wetland creation was €1700. This included an excavator and a Volvo earth-mover to move the excavate off site, plus fencing costs.

The cost of installation of the created overland-flow treatment wetland was €4000, which included site levelling, excavator (25h), a Volvo earthmover and small dumper to move the excavate off site, fencing and planting.

Direct observation

Dragonfly species not seen on the farm previously started to appear round the margins of the new pond in 2001, where *Sympetrum sanguineum* was observed in July. The following year (2002), *S. sanguineum* was joined by *Coenagrion puella* and *Ischnura elegans* round the pond margins, and the presence of mating pairs of both *C. puella* and *I. elegans* was noted. In July 2003, *Lestes sponsa* and *Pyrrhosoma nymphula* were found both around the pond and among the tall vegetation of the thickly-vegetated pond outflow area and *Sympetrum striolatum* also occurred round the pond. At the beginning of October of that year, a female of *Aeschna juncea* was observed ovipositing in the shallow water of one of the bays in the pond margin, where *Typha* was present. These species were also observed round the pond in 2004, with the exception of *S. sanguineum*. Territorial males of *Libellula quadrimaculata* were observed round the pond in the summer of 2004. The presence of nymphs of *A. juncea* and *L. quadrimaculata* was confirmed in the bay planted with *Typha*, during April 2005.

In the case of the overland-flow wetland, *Ischnura elegans* was observed in abundance flying over the two lower cells of the wetland in 2004, with *Pyrrhosoma nymphula* and *Sympetrum striolatum*.

Emergence traps

The product of the emergence-trapping campaign can be seen in Table 1. Six of the species recorded from the farm by direct observation were also collected by the emergence traps, as was *Ischnura pumilio*, whose presence was not noticed by direct observation. It will be noted that although a specimen of *S. sanguineum* was collected by emergence trap in 2003, no specimens were obtained from the more extensive emergence trapping of 2004.

TABLE 1. Species collected by emergence trapping

	Pond & outflow wetland		Overland-flow wetland
SPECIES	2002	2004	2004
Aeschna juncea (L., 1758)			
Coenagrion puella (L., 1758)			
Ischnura elegans (van der Linden, 1823)		8	21
Ischnura pumilio (Charpentier, 1825)			13
Lestes sponsa (Hansemann, 1823)		9	
Libellula quadrimaculata L., 1758			
Pyrrhosoma nymphula (Sulzer, 1776)		4	437
Sympetrum sanguineum (Muller, 1764)	1		
Sympetrum striolatum (Charpentier, 1840)	11	89	57

Discussion

Before introduction of the pond and wetland features described here one dragonfly species, *Sympetrum striolatum*, was known from the farm. Within three years of installation of the pond, nine dragonfly species were observed on the farm, and breeding by six of them was confirmed from either the pond or its outflow wetland. Further, there was also evidence of breeding by two of the other species in the pond, though this was not confirmed by emergence trapping. In the case of *Aeschna juncea*, first observed on the farm in 2003, it is likely that the absence of specimens in the emergence traps in 2004 was due to the long generation time in this species, which is known to require three or more years (development may take up to seven years:

Sternberg and Buchwald, 2000) to complete its life cycle. *A. juncea* nymphs collected from the pond in 2005 were of a size to suggest they might complete development in that year. Similarly, if *Libellula quadrimaculata* began breeding in the pond in 2003, the first generation of adults bred from the pond would not be expected until 2005. The nymphs of *L. quadrimaculata* collected from the pond in the spring of 2005 were nearly mature, suggesting that the pond might indeed produce adults later in that same year. The overland-flow wetland was also shown to support some of these dragonflies, within two years of its installation, and successful breeding of the additional *Ischnura pumilio* was confirmed from there. The only observed species whose presence might have been expected in the emergence traps from either the pond or the overland-flow wetland, or both, during 2004, but which was not recorded from them, is *Coenagrion puella*. The emergence-trapping reported on here was part of a more extensive programme (see Speight, 2004) that embraced all wetland areas of the farm, but there was no evidence that any of the dragonflies were breeding elsewhere on the farm than in the areas of introduced habitat.

Considering the farm dragonfly fauna in relation to the known fauna of surrounding grid squares, 50% of the latter group of species were observed on the farm for the first time, and shown to be either definitely or probably breeding there, within three years of introduction of the habitat features described here. Among them are the three species already recorded from the grid square in which the farm is located, all of which are now known to develop on the farm. There remain eight species known from surrounding grid squares but not from the farm. On the basis of habitat availability, four of these eight species (*Anax imperator, Calopteryx splendens, C. virgo* and *Orthetrum caerulescens*) would not be expected to occur on the farm. The occurrence of two others (*Aeschna mixta* and *Brachytron pratense*) seems feasible, if unlikely, on the same basis. This leaves two species, *Coenagrion pulchellum* and *Enallagma cyathigerum*, whose presence on the farm would be expected, in association with the introduced habitats. In other words, nearly all of the available dragonfly species that might be expected to occupy the habitats introduced to the farm are now present on the farm. The species present represent more than 40% of the known dragonfly fauna of Co. Cork. If either *C. pulchellum* or *E. cyathigerum* also start to use the farm that percentage will rise to almost 50%, and the representation of dragonflies on the farm would be in line with the representation of sciomyzids and syrphids, for which half or more of the Co. Cork fauna have been observed on the farm and would be expected to breed in the habitats present. In the case of the sciomyzids, more than half of the Co. Cork species have been proven to breed on the farm (Speight, 2004).

The rapid appearance of *Sympetrum sanguineum* following installation of the pond, and its equally rapid disappearance, serves as a reminder that, even if installation of the new wetland and freshwater features has resulted in the addition of a number of dragonfly species to the list of invertebrates resident on the farm, evolution of the ecological character of the introduced habitats will initially be rapid and accompanying changes in their fauna are to be expected. Without active habitat management, species associated with largely unvegetated water bodies, in particular, would seem unlikely to persist for long - including *Ischnura pumilio*. Even so, persistence of most of the dragonflies now present on the farm would be expected for a protracted period, unless significant changes occur in the water supply to the pond, or predatory fish were introduced to it. In the latter event, it would be anticipated that most dragonfly species would disappear from the pond, leaving survival of the dragonfly fauna largely dependent on the overland-flow wetland, which would be unlikely to support the full range of species recorded from the farm at the moment.

This small study shows that, in a landscape of enclosed farms, some components of the invertebrate fauna can respond almost immediately to installation of even a small, isolated pond, rapidly establishing breeding populations of the majority of species that would be expected to occur in association with such a habitat. But of potentially critical significance to this result is the character of the pond's outflow. This pond was designed so that its outflow was some metres wide, overflowing across the surface of an area of grassland as large as the pond itself, before meeting the axial drain that transports the water out of the farm. During the period of this study, the thickly-vegetated, aquatic/terrestrial ecotone that developed where the pond outflow water passed through the grassland may have been as important as the pond, in supporting the dragonfly fauna, to judge from the emergence trap results. This relationship might be expected to change as the pond itself becomes more thickly vegetated. But the juxtaposition of pond and dependent wetland (the outflow zone ecotone has become a de facto wetland) has clearly benefited the dragonflies so far. It has similarly benefited other components of the invertebrate fauna of the farm, though these data are yet to be published (Speight and Good, *in litt.*).

The overland-flow wetland installed on the farm in the autumn of 2002, upstream of the pond, had its first full year of existence at a point in time when the pond, and its dependent outflow wetland, had already developed a dragonfly fauna. It is perhaps unsurprising, therefore, that all but one of the dragonflies so far found breeding in the overland-flow wetland are also breeding in the pond/outflow wetland area. Overlap in the fauna of these two areas can only aid in the survival on the farm of the species held in common, reducing, for them at least, their degree of isolation on the farm. But there are also dragonflies found either in the pond/outflow wetland area or the overland-flow wetland area, but not in both. This suggests that, while these habitat resources overlap in their biodiversity support capability, they are not in this respect identical, even for a small taxonomic group like the Odonata.

It is of note that, with the exception of *Sympetrum striolatum*, none of the dragonfly species now recorded from the farm had been seen there during the five years prior to installation of the new habitat features. And this is despite the reality that fieldwork aimed at inventorising the species of various insect groups was conducted on the farm during this period, including a comprehensive Malaise-trapping programme carried out in 2000. It is none-the-less difficult to believe otherwise than that all of the dragonflies now recorded from the farm must have been flying through it/over it during this five-year period but were never sighted, or collected, doing so. At least for the Odonata, it thus seems unjustified to assume that the species that can be recorded from a site provide a basis for deciding which species would be expected to colonise it, were appropriate habitat made available. On the contrary, it would seem that dragonfly species overflying a site can be, to a significant extent, inaccessible to either observation or interception trapping activity, when habitats appropriate to them are absent from that site.

This study shows that, for taxonomic groups like the Odonata, to which the enclosed-farm landscape is still permeable to dispersal activity, introduction or extension of wetland/standing water habitat availability, to aid in maintenance of an existing farm fauna, can also result in a net increase in biodiversity. A progressive increase in the availability of wetland/freshwater habitats within the farmland landscape would, of itself, progressively increase landscape permeability, thus providing more organisms with an opportunity to re-colonise and move through farmland. Certainly, it seems likely that the presence of 50% or more of regional biodiversity could be secured in farmland in Ireland, by pro-active management measures that could be carried out as part of agri-environmental schemes. The Odonata for which habitat can, with apparent facility, be introduced to/maintained on the farm may not include species that would be regarded as threatened in Ireland, which is also the largely the case for both sciomyzids and syrphids, but to secure the future of 50% of the biodiversity of a county would be significant in itself, to whatever extent threatened species were included.

Ponds or pools like the one introduced to this farm are absent from surrounding farms (Speight and Good, 2001b). To that extent, at least, it is thus isolated within the local landscape. Had it been installed as part of a set of agri-environmental measures introduced under a REPS farm plan, no account would have been taken of any agri-environmental measures introduced to surrounding farms. Similarly, introduction of agri-environmental measures to an adjacent farm would not take into account components of any REPS plan introduced to the farm we have studied, or the habitat resources present there. This has significance in relation to installation of standing-water habitat like a pond, since it is recognised that, in terms of biodiversity maintenance, clusters of ponds in the landscape are more effective than a series of isolated ponds (see for example, Oertli *et al.*, 2002). So, as operated at present, agri-environmental schemes would be unlikely to result in introduction to the landscape of strategically placed clusters of ponds that would maximise efficiency of biodiversity maintenance for pond flora and fauna, if this required pond installation in adjacent farms. Such schemes continue to evolve, and it is to be hoped that they might in future be able to take into consideration issues like pond installation at landscape level, rather than only at the level of the individual farm.

Under the current agri-environmental scheme, REPS 3 (Rural Environmental Protection Scheme 3), creation of new habitat, as described in the present text, is one of seven Category 1 options (of which it is obligatory to implement one) for which there is no extra payment. The creation of wetland and freshwater features, such as those described here, would only be provided for under this option. It is reasonable to predict that the €4000 cost of establishing the overland-flow wetland (for excavation, fencing and planting) would be considered excessive by most farmers, in comparison with costs of other Category 1 options, such as hedgerow rejuvenation or green cover establishment. However, whether a pond or an overland-flow wetland was created, a more significant financial deterrent would be the resultant productive devaluation of the land and the number of years for which this devaluation would operate. To judge from the results presented here, even in the case of a taxonomic group that can evidently colonise new wetland/pond habitat almost immediately it becomes available, some of the immigrant species (e.g. *Aeschna juncea*) would be hard-pressed to complete even one generation in created habitat that remained in place for no more than five years - the current duration of a REPS scheme. Loss of ponds or wetlands created under a REPS scheme might occur following termination of the scheme not so much because farmers would then have to carry maintenance costs themselves but more because such features represent land taken out of productive use and providing no financial return once the five-year REPS scheme ends.

The combination of relatively high initial investment and the necessity for a semi-permanent product puts the creation or restoration of such wetland features on farmland beyond the scope of five-year schemes such as REPS. It can only be concluded that few farmers are likely to create wetland habitat under the existing agri-environmental measures. For creation of such habitats within farmland to be worthwhile a funding structure similar to that operating for the Native Woodland Scheme (DMNR, 2002) would be more appropriate. Under the latter scheme, the validated approved costs (under a maximum limit) of establishment are reimbursed to the participating landowner, and a premium is available to compliant participants for more than 20 years (DMNR, 2002). In both cases there are long-lasting non-biodiversity benefits: in woodlands, the provision of wood products, carbon sequestration and landscape enhancement, and for overland-flow wetlands, water purification services (Hammer, 1992), as well as the hydrographic benefits of water storage.

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ACHALCUS BRITANNICUS (DIPTERA: DOLICHOPODIDAE) NEW TO IRELAND

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Since the list of Irish Diptera incorporated into Chandler (1998) was published, one species belonging to the genus *Achalcus* has been added, *A. vaillanti* Brunhes (see Speight, 2004). The present note adds a second species, bringing to five the number of *Achalcus* species known from Ireland. A further three species are known from the island of Great Britain, two of them added only recently, at the time of their description (Pollet, 1996). In Chandler (1998), the date of description of these species is erroneously given as 1997. It would be unsurprising if one or the other of those species remain to be discovered in Ireland - these flies are minute and rarely caught other than by Malaise trap or emergence trap.

Achalcus britannicus Pollet, 1996

Cork: W6685 (NT2), Glinny, Riverstick, 26 June/14 September 2004, males and females, emergence traps, ungrazed *Deschampsia/Molinia* grassland shallowly-flooded in winter, due to seepages activating along spring-line, MCDS/J. A. Good, NMI.

This *circa* 2mm long fly has rarely been seen other than in the catches of emergence traps, Malaise traps or water traps. It was described from material collected in Great Britain and Germany and has not been recorded elsewhere, until now (Marc Pollet, pers. comm.). Males can be determined with confidence using the key provided by Pollet (1996). This dolichopodid has previously been found among tall ground vegetation in wetland (fen and reed beds). In this instance, it occurred in humid, seasonally-flooded, disused grassland. The emergence trap catches from which the Glinny specimens were extracted also contained large numbers of the more frequently encountered, and closely similar, species *A. flavicollis* (Meigen). These emergence traps were situated in *Deschampsia/Molinia* grassland that has not been grazed for some 20 years and is being invaded by *Prunus spinosa/Salix* scrub. On a slight slope, the site does not carry surface water during the summer months, but, with onset of autumnal high groundwater levels seepages become active, producing a slow-moving film of water at the ground surface, that then remains water-logged until late spring. While *A. flavicollis* has been collected in emergence traps elsewhere on this farm, *A. britannicus* has not. In particular, *A. britannicus* has not been collected from either of two overland-flow wetlands created by deliberate alteration to surface drainage patterns, one of them heavily vegetated by a tall herb community in which *Deschampsia* and *Filipendula* predominate, the other at this point in time largely unvegetated, apart from self-established grasses and scattered, sown, clumps of *Glyceria maxima* and *Carex riparia*.

Acknowledgements

I am grateful to Dr Jervis Good for the opportunity to install emergence traps at various locations on Glinny-Boulaling farm, during 2004. Marc Pollet kindly confirmed the range currently known for *A. britannicus* in Europe.

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A REVIEW AND UPDATE OF THE MESOSTIGMATID AND PROSTIGMATID MITES OF THE MARINE LITTORAL AND SUPRALITTORAL IN IRELAND BASED ON THE WORK OF J. N. HALBERT (1872-1948), INCLUDING A CHECKLIST, REVISED NOMENCLATURE, COLLECTING SITES AND RECENT RECORDS OF MITES

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Abstract

The paper considers the biodiversity and biogeography of mesostigmatid and prostigmatid mites (Acari) of the Irish marine littoral and supralittoral based on Halbert's records. Halbert was an important northern European pioneer in the study of mites. The paper lists the mites recorded by him and includes new nomenclature and recent records. Globally, marine records of prostigmatid mites, especially non halacarids, are poorly known and together with the littoral mesostigmatids have been largely ignored in Ireland since Halbert studied them.

Introduction

This paper is associated with an earlier one by the same authors (Baker and Bayliss, in press) which describes Halbert's life and work in the field of acarology. It follows a similar pattern to an earlier paper on Halbert's mites by Luxton (1998) who dealt with the oribatid and parasitiform groups. The present paper deals with the other main mite divisions, but only those found in the marine littoral and supralittoral.

Halbert's name will always be associated with the original Clare Island Survey (Praeger, 1915) where his work was in entomology and acarology. Records suggest he did his main collecting for this on Clare Island itself but also collected on the shores of the adjoining mainland. The Survey, one of the first All Taxa Biodiversity inventories (ATBI) in the world, took place at the end of the first and beginning of the second decades of the twentieth century and was described by Viney (1997) as "the world's first baseline biological study". It has subsequently been realised how important studies like this are in issues such as global warming, pollution and threats to the environment. To preserve and manage existing marine species on the seashore requires detailed knowledge of what is there and information on the meiofauna of the littoral is part of that knowledge. Without this basic biological information, it is not possible to predict, with any certainty, the effects of human impacts. Clare Island has now become a baseline monitoring site for environmental change. Collins (1999) has described the place, the people involved, their results and publications in the first Clare Island survey.

Halbert is perhaps best known for his work on freshwater mites, although he published two seminal papers on the acari of the Irish seashore in 1915 and 1920. These were amongst his most important pioneering papers, have formed the basis for studies on this group in the Eastern Atlantic-Boreal and are still extensively cited.

Although most of his career was spent in museum work, Halbert was an active naturalist before this time, and later after retirement. At the Natural History Museum in Dublin he worked on insects and mites and was described as "small, neat, alert, cultured, well read" and like his close friend Edwin Bullock (note 1), "unassuming and had integrity and humour" (Beirne, 1985). In their bibliography of Irish entomology, Ryan, O' Connor and Beirne (1984) dedicated their book to the memory of Halbert and wrote of his "unfailing cheerfulness and good humour…[and]…the encouragement, assistance and advice" which he was always ready to give. Baker and Bayliss (in press) have recently described Halbert's career and work on the Acari.

Halbert's slides, correspondence and papers (note 2) are deposited in the Natural History Museum, Dublin and are described by O'Connor (1979, 1980) and Baker and Bayliss (in press). They consist of diaries, letters, note-books, printed publications, copies of his papers and the keys and books of other workers.

There have been few comprehensive studies on non-halacarid prostigmatid marine mites in northern Europe. Most have been limited to the British Isles and include King (1914), Evans and Browning (1953), Pugh (1988), Pugh and King (1985, 1988) and to Ireland (Brady, 1875; Farran, 1915; Halbert, 1915, 1920). In Europe, marine Halacarids have been fairly well documented. A list of British species was given by Green (1960) and the group has been studied in detail by Green and Macquitty (1987). In Ireland, recent works have included those of Bartsch (1985) and Somerfield (1988, 1991).

Intertidal or littoral mites do not belong to any one group and include both the true marine mites or Halacaridae and others, essentially terrestrial, a relatively small number of which have colonized the seashore (mainly mesostigmatid, oribatid and prostigmatid mites). The Halacaridae have been more successful in the marine environment and are found both at the littoral level and in deeper water.

The supralittoral, although part of the littoral fringe, is not intertidal, since it is not covered by the tides but sprayed only at high water spring tides. This zone, equivalent to the 'Orange' zone of Halbert (1920), and Evans *et al.* (1961), contains two main habitats, tidal debris (or wrack) consisting mainly of drying seaweed washed up on the shore and patches of lichen on rock surfaces. The prostigmatid mites recorded in Halbert's (1920) table as strictly supralittoral were *Rhyncholophus araneoides* = *Balustium araneoides* Berlese; *Alicus oblongus* = *Pachygnathus oblongus* (Halbert); *Alicus latus* = *Pachygnathus latus* (Halbert) and *Microtrombidium pusillum* (Hermann), although in the same paper he includes the latter in the *Pelvitia* zone "just below high water mark" (Halbert, 1920).

General accounts dealing with global and ecological issues and with the biogeographical distribution of marine prostigmatids are those of Proches and Marshall (2001) and Bartsch, (1989), the former for non-halacarids and the latter for halacarids. Proches and Marshall (2001) also provide a list of the non-halacarid intertidal mites of the world.

Halbert's shore collecting

Halbert collected mainly on the shore at Ardfry in the north-eastern extremity of Galway Bay, at a rocky shore at Malahide in County Dublin, and on Clare Island and the adjoining mainland areas around Clew Bay including Westport, Louisburgh and Mulranny. He divided the shore into zones based upon the lichens and brown algae and his records refer to these vertical subdivisions. Halbert wrote that "much observation is needed with regard to the exact zoning of these littoral forms". He noted the two distinct groups of mites referred to earlier, the "truly maritime forms" found well below the high-tide mark where they survive continual immersion and live in crevices when the tide is out and others which live under stones and seaweed at or about high water mark (Halbert, 1915).

A 'Field Diary' (note 3) of his work on the Clare Island Survey, which included the neighbouring areas of Westport and Achill Island, in County Mayo, provides a vivid description of his daily collecting trips. One note written in September 1913 reads, "Coll. along shore. Many Oribatids and a few Gamasids under stones. In the afternoon visited the shore of Bellacragher Bay, (Blacksod inlet)…Bdella abundant - a fair no. of Oribatids and a few species of Bdella" (note 3). Halbert was assisted by Rowland Southern (note 4) and worked with him collecting in the intertidal area for Halbert's 1920 paper. Some of the material Southern provided was dredged from the sublittoral, during the scientific expeditions of the fisheries cruiser *Helga*, but this is not relevant here.

Halbert's papers and slides in the Natural History Museum, Dublin

Sometime following Halbert's death in 1948, his personal papers and slides became the property of the National Museum and the correspondence relating to this collection has been catalogued and is in the library of the Natural History Museum, Dublin (note 5). The slides are carefully maintained and catalogued, although some are without labels, vary from good to poor condition and others are identified to genus only. On one such slide, identified to genus, there was a note, " *Halacarus* female, Spitsbergen" (note 6). There are two slide cabinets known to contain Halbert mite material, referred to as Acari 1 and 2. The first, a 100 tray cabinet labelled the Bullock/Halbert collection contains material identified by Halbert together with some slides of other workers, like R. D. Mitchell from the 1950's and A. Berlese from the 1890's, the latter believed by staff to have been purchased by the museum. The second cabinet, referred to as the Halbert Collection, includes types of all the species named by Halbert, and contains freshwater mites and type material. This cabinet has an associated unpublished handbook drawn up by J. O' Connor in 1979 which is a "List of Halbert Acarina (Types)". Additional information is provided on some of the slide labels but some of Halbert's slides are missing (note 7). Luxton (1998) has made a detailed study of Halbert's oribatid and parasitiform slides, some of which have been renamed and newly labelled. Keith Hyatt, formerly of the Natural History Museum in London, has also examined, renamed and relabelled others.

The list below is arranged alphabetically with Halbert's name first, followed where appropriate, by current names, authorities and distribution. A = handwritten notes on annotated copy made on the 1915 paper (note 8). C = information on collecting sites from Halbert's papers (1915, 1920). S = information on the slide.

MESOSTIGMATA

The taxonomic information in this section is largely from Halbert (1915, 1920) and Luxton (1998).

***Cyrthydrolaelaps hirtus* Berlese, 1904**

Characteristic shore species occurring from the *Pelvitia* zone to *Fucus serratus*. Malahide and Ardfry (C).

***Episeius grandis* (= *Lasioseius grandis* Berlese, 1916)**

Malahide Island salt marsh and Malahide estuary and open shore (C).

***Gamasolaelaps aurantiacus* Berl. = *Gamasolaelaps excisus* (L. Koch, 1879)**

Westport, Mulranny, and "a little above high-water mark" at Howth, Co. Dublin (C).

***Gamasus (Ologamasus) calcaratus* C. L. Koch. = *Holoparasitus calcaratus* (C. L. Koch, 1839),** see Luxton (1998)

Achill Island and seashore at Westport and Mulranny (C).

***Gamasus coleoptratorum* (L.) = *Parasitus coleoptratorum* (Linnaeus, 1758)**

Orange lichen zone Malahide 1916 and at Westport 1918 (C).

***Gamasus crassipes* var. *longicornis* Berl. = *Pergamasus longicornis* (Berlese, 1906)**

Under stones and decaying seaweed at Ardfry (C).

***Gamasus* (*Eugamasus*) *immanis* Berl. = *Vulgarogamasus immanis* (Berlese, 1904)**

Under stones at high water mark Westport, Howth and Glendore on Cork coast (C).

***Gamasellus inermis* sp. nov. = *Digamasellus inermis* (Halbert, 1920)**

Orange lichen and *Pelvitia* zones at Malahide rocky shore (C) and (S).

***Gamasus kempersi* Oudms. = *Parasitus kempersi* Oudemans, 1902**

Westport under stones on sea shore, Mulranny on the shore of Bellacragher Bay (C).

***Gamasus* (*Gamasus*) *lunaris* Oudms. = *Cornigamasus lunaris* (Berlese, 1882)**

Westport shore (C).

***Gamasus* (*Eugamasus*) *trouessarti* Berl. = *Vulgarogamasus trouessarti* (Berlese, 1892)**

Under stones at high water at Westport, also on the Dublin coast (C).

***Gamasoides spinipes* (C. L. Koch) = *Gamasodes fimbriatus* Karg, 1971,** see Luxton, 1998

Mulranny under stones on sea shore (C).

***Halolaelaps celticus* Halbert, 1915**

Type. Howth seashore 1913 (S). Just below high tide on the shore at Westport and Howth (C).

***Halolaelaps glabriusculus* Berl et Trouess. = *Halolaelaps marinus* (Brady, 1875)**

Between tide marks at Westport, on estuarine and non rocky shores at Ardfry and Westport and at Malahide in *Fucus vesiculosus* and *F. serratus* zones (C).

***Haluropoda interrupta* sp. nov. = *Uropoda (Phaulodinychus) repletus* (Berlese, 1903)**

Shore a little below high tide and on salt marshes at Westport, Mulranny, Howth (C).

***Haluropoda minor* sp. nov. = *Uropoda (Uropoda) halberti* Hirschmann, 1993**

The Bills Rocks (Mayo) old nests of Puffins and gulls 1910 (S). Westport, Mulranny, Dollymount and Howth (C).

***Holostaspis marginatus* (Herm.) var. *littoralis* nov. = *Macrocheles glaber* (Muller, 1860)**

Westport shore (C).

***Hydrogamasus giardii* (Berl. and Trouess.)**

Malahide shore from *Pelvitia* to *Fucus serratus* and at Ardfry in same zones (C).

***Hydrogamasus littoralis* (G. et R. Can.)**

"lower intertidal" in *Fucus vesiculosus* and *F. serratus* zones at Malahide and Ardfry (C).

***Laelaps dentatus* sp. nov. = *Pseudoparasitus ovulatus* (Halbert, 1915)**

Type. Malahide, rocky shore 13. 7. 43 9 (original date 1923) and relabelled on the back as *Pseudoparasitus dentatus* (Halbert, 1920) (det. M. Luxton) (S). "Intertidal species" at Malahide and Ardfry on rocky and estuarine shores (C).

***Lasioseius fucicola* sp. nov. = *Thinoseius fucicola* (Halbert, 1920)**, see Luxton, 1998

Orange lichen zone at Malahide under seaweed. (C).

***Lasioseius salinus* sp. nov. = *Leioseius salinus* (Halbert, 1920)**

Malahide (S). Saltmarsh on Malahide Island (C).

***Macrocheles marginatus* var. *littoralis* (Halbt.) = *Macrocheles glaber* (Muller, 1860)**

Type. Westport shore 1911, also labelled as male paralectotype designated by Emberson and Hyatt, det. KHH 1984. Two slides, one male and one female (S). Westport, Malahide and Ardfry at high water and lichen level (C).

***Phaulocylliba berlesii* sp. nov. = *Uropoda* (*Phaulodinychus*) *littoralis* (Trouessart, 1902)**

Between tide marks Howth harbour (C).

***Phaulocylliba littoralis* (Trouess.) = *Uropoda* (*Phaulodinychus*) *littoralis* (Trouessart, 1902)**

Type. Howth harbour 1913. Now *Phaulodinychus littoralis* (Trouessart, 1902) (M. Luxton) (S). Malahide in *Pelvitia* and *F. spiralis* zones (C).

***Phaulodinychus orchestiidarium* (Barrois) = *Uropda* (*Phaulodinychus*) *orchestiidarium* (Barrois, 1887)**

Ardfry and Malahide from *Pelvitia* to *F. serratus* zones (C).

***Phaulodinychus repletus* Berl. = *Uropoda* (*Phaulodinychus*) *repletus* (Berlese, 1903)**

Type. Westport on shore 1911 (S). A widespread species both in estuaries and salt marshes and on the shore in the lichen zone - Ardfry, Westport, Mulranny and Malahide estuary, Howth, Dollymount (C).

***Rhodacarus roseus* var. *pallidus* Hull = *Rhodacarus pallidus* Hull, 1917**

Malahide, *Fucus spiralis* zone (S). Orange lichen zone at Malahide (C).

***Thinoseius berlesii* sp. nov. = *Thinoseius fucicola* (Halbert, 1920),** see Luxton, 1998

Malahide rocky shore 1915 (S). Malahide in orange lichen zone under decaying seaweed (C).

***Thinozercon michaeli* Halbert, 1915**

Type. Westport shore 1911 (S). Westport and Howth under stones on shore (C).

***Trachyuropoda minor* Halbt. = *Uropoda* (*Uropoda*) *halberti* Hirschmann, 1993**

Ardfry and Malahide in orange lichen and *Pelvitia* zones. Also from old nests of Puffins and gulls on the Bill rocks off Mayo coast (C).

PROSTIGMATA

1. Non-Halacarid mites

Systematics of this group is largely based on Elliott, King, Morgan, Pugh, Smith and Wheeler (1990), Hansson (1998), Pugh (1988), Pugh and King (1985, 1988). Halbert's name first with new nomenclature following.

***Alicus latus* sp. nov. = *Pachygnathus latus* (Halbert, 1920)**

Orange lichen Malahide (C).

***Alicus oblongus* sp. nov. = *Pachygnathus oblongus* (Halbert, 1920)**

"Malahide orange lichen zone 24. 5. 1915" (S).

***Bdella capillata* Kramer**

Clare Island in rock crevices between tides-marks. Mweelaun, Louisborough and Westport.

***Bdella decipiens* Thorell = *Bdella vulgaris* (Henmann) var. *littoralis* Moniez, 1890**

Malahide, Clare Island, Mulranny (Bellacragher Bay) (C).

***Bdella littoralis* (L.) = *Neomolgus littoralis* (Linnaeus, 1758)**

Orange lichen to *Fucus vesiculosus* zones. Malahide and Ardfry (Mweeloon Bay) (C).

***Chromotydaeus ovatus* (C. L. Koch) = *Penthaleus ovatus* C. L. Koch, 1838**

Mulranny under stones, and at Ardfry in *Pelvitia* and *Fucus spiralis* zones.

***Cyta latirostris* (Herm.)**

Under stones, shore of Malahide estuary (C).

***Eupodes variegatus* Koch var. *halophilus* nov. = *Eupodes halophilus* (Halbert, 1920)**

Fucus serratus zone Ardfry (C).

***Halotydeus hydrodromus* (Berl et Trouess) var. *albolineatus* nov. Halbert, 1915**

"West coast of Ireland Sept. 1913" (S). *Pelvitia* to *Fucus serratus* zones, Malahide and Ardfry, Mulranny (C).

***Lasiotydaeus brevistylus* sp. nov. = *Lasiotydeus brevistylus* Halbert, 1920**

Orange lichen and *Pelvitia* zones, Malahide (C).

Microtrombidium pusillum **(Herm.) var.** ***major*** **nov. Halbert 1920**

Under stones *Pelvitia* zone, Ardfry (C).

Nanorchestes amphibius **Top et Trouess.**

Orange lichen, *Pelvitia* and *Fucus spiralis* zones, Malahide (C).

Podothrombium filipes **(Koch)**

Mulranny under stones.

Rhagidia halophila **(Lab.) =** ***Foveacheles canestrini*** **(Berlese and Trouessart, 1889)**

Orange lichen to *Fucus serratus* zones, Malahide, Ardfry, Mulranny.

Rhaphignathus scutatus **sp. nov. =** ***Cheylostigmaeus scutatus*** **Halbert, 1920**

Under stones, saltmarsh, Malahide Island, *Pelvitia* zone, Ardfry (C).

Rhyncholophus araneoides **(Berl.) =** ***Balaustium araneipes*** **Cooreman, 1956**

Synonym *Balaustium araneoides* Berlese, 1910: Halbert, 1920

Orange lichen zone, Malahide (C).

Rhyncholophus passerinii **(Berl.) =** ***Abrolophus halberti*** **(Cooreman, 1936)**

Malahide and Ardfry in *Pelvitia* zone.

Rhyncholophus rubripes **Berl. et Trouess =** ***Abrolophus rubripes*** **(Berlese and Trouessart, 1889)**

Orange lichen, *Pelvitia* to lower zones - 'wide intertidal range'. Westport, Mulranny, Malahide, Ardfry (C).

Rhyncholophus tardus **sp. nov. =** ***Abrolophus tardum*** **(Halbert, 1915)**

Under stones, Mulranny (Bellacragher Bay) (C).

Stigmaeus rhodomelas **var.** ***fissuricola*** **nov. Halbert, 1920**

Orange lichen and *Pelvitia* zones, Malahide (C).

2. Halacarid mites

Irish records as listed by Halbert (1915, 1920). Systematics based on Green and Macquitty

(1987) and Somerfield (1988, 1991). Additional information from Bartsch (1985, 1989).

***Agaue brevipalpis* Trouess. = *Agauopsis brevipalpus* (Trouessart, 1889)**

"Malahide rockpools in the *Pelvitia* zone" 3. 7.1917 (A).

***Halacarus* (*H.*) *areolatus* sp. nov. Halbert, 1915 = *Thalassarachna* (=*Halacarellus*) *capuzina* (Lohmann, 1889)**

The type specimen has been located and synonymized and attributed to Bartsch (1985). See Somerfield and O'Connor (1992).

***Halacarus* (*Halacarus*) *actenus* Trouess = *Halacarus actenos* Trouessart, 1889**

Clew Bay - dredged, Blacksod Bay in weed from shore.

***Halacarus* (*H.*) *basteri* (Johnst.) = *Thalassarachna basteri* (Johnston, 1836)**

Widespread - Clare Island, Blacksod Bay, Ardfry, Howth and Sandycove. "Malahide in *Laminaria* and low *Fucus serratus* zones" May 1915 (A).

***Halacarus* (*H.*) *ctenopus* Gosse, 1855**

"On weeds between tidemarks at Westport and Birterbury Bay and the Isles of Aran" (Halbert, 1915). One species taken by Somerfield (1988) at Dublin, Scotsman's Bay. Now recorded more widely in Ireland by Green and Macquitty (1987).

***Halacarus* (*C.*) *fabricii* (Lohm.) = *Copidognathus fabricii* (Lohmann, 1889)**

Ardfry, Malahide, Howth. Also " in oysters new harbour Ardferry 16. 6.1916 JNH" (S). "Kinsale harbour May 1914 3-5 fms in weeds" (A).

***Halacarus* (*C.*) *gibbus* Trouess = *Copidognathus gibbus* (Trouessart, 1889)**

"Clew Bay adults dredged in 24 fathoms" (Halbert, 1915).

***Halacarus* (*Copidognathus*) *gracilipes* Trouess.=*Arhodeoporus gracilipes* (Trouessart, 1889)**

Blacksod Bay in weed on shore and dredged in four fathoms.

***Halacarus* (*C.*) *lamellosus* var. *septentrionalis* nov. = *Copidognathus septentrionalis* (Halbert, 1915)**

"Clew Bay, Mayo 1923 JNH" Type (in red) (S). Dredged in Clew Bay (C). Bartsch (1985) states that *C. humerosus graveolus* and *C. lubricellus* are synonyms of *C. septentrionalis*.

***Halacarus* (*C.*) *oculatus* Hodge = *Copidognathus oculatus* (Hodge, 1863) sensu Lohmann, 1889**

Blacksod Bay "dredged in four fathoms", Malahide and Kinsale harbour (2 to 5 fathoms) (C).

***Halacarus* (*C.*) *rhodostigma* Gosse = *Copidognathus rhodostigma* (Gosse, 1855)**

Sublittoral at Blacksod Bay - 3 fathoms, Valencia harbour (7 to 9 fathoms), Kinsale harbour (2 to 5 fathoms).

***Halacarus* (*H.*) *southerni* sp. nov. = *Thalassarachna southerni* (Halbert, 1915)**

Sublittoral -"dredged 24 fathoms in Clew Bay 25. 5. 1909" (S).

***Halacarus* (*C.*) *tabellio* Trouess. = *Copidognathus lamellosus* (Lohmann, 1893)**

Found in rock-pools at Malahide and Howth on Dublin coast. A footnote in Green and Macquitty (1987) states that it was first recorded by Halbert as *C. tabellio* and has since been synonymized with *C. lamellosus* by Bartsch, 1979.

***Rhombognathus notops* (Gosse)**

Clare Island amongst coralline seaweeds (C). "Clare Island ?Lukedhamior 25. 7.1910" (S).

***Rhombognathus pascens* (Lohm.) = *Rhombognathides pascens* (Lohmann, 1889)**

"Clare Island coralline July 11" (S). "Malahide rockpools May" (A). "Clare Island, common in coralline seaweeds and *Lithothamnion*... Blacksod Bay...counties Dublin and Cork" (Halbert, 1915)."Widespread and abundant, generally being found on algae" (Somerfield, 1988).

***Rhombognathus seahami* (Hodge) = *Rhombognathides seahami* (Hodge, 1860)**

"Clare Island in weeds" 24. 8. 1911(S). "Malahide 23. 2.1901 and in rockpools May 1915" (A). Blacksod Bay in *Lithothamnion*...Howth and Sandycove (C).

***Rhombognathus setosus* (Lohm.) = *Isobactrus setosus* (Lohmann, 1889)**

"Clare Island coralline weed" July 1911(S). "Malahide rockpools May" (A).

***Simognathus sculptus* (Brady) = *Simognathus minutus* (Hodge, 1863)**

"Clare Island 25. 7.1910" (S). Clare Island ..."on *Lithophyllum incrustans*" and rockpools at Portstewart (C).

***Scaptognathus trouessarti* sp. nov. = *Scaptognathus trouessarti* Halbert, 1915**

"Dingle bay" (S). Single specimen dredged from 19 to 20 fathoms, collected by R. Southern and although not strictly part of this review, is included here. Abe and O'Connor (1991) have given a detailed description of the holotype as Halbert's (1915) description was found to be inadequate.

***Trouessartiella falcata* (Hodge) = *Lohmannella falcata* (Hodge, 1863)**

Blacksod Bay (C).

Irish records of Halacarid mites since the work of Halbert

The non-halacarid prostigmatid mites of the Irish seashore have not been studied since Halbert's time but the halacarids have been examined more thoroughly.

Bartsch (1985) recorded thirty four species from the Strangford Narrows and the adjacent Irish Sea. Although these are not strictly intertidal, many having been collected at depths of 30-42m, twenty six were recorded along the sublittoral fringe at depths of 0.01-0.15m and these are referred to here. This was the first major paper on Irish Halacarid mites since the time of Halbert. The following, which occurred in the sublittoral fringe (Bartsch, 1985), are species not recorded by Halbert - *Halacarus bisulcus* Viets, *Halacarellus balticus* (Lohmann), *Halacarellus procerus* Viets, *Arhodeoporus minor* Bartsch, *Coloboceras drachi* Monniot, *Copidognathus latisetus* Viets, *Copidognathus reticulatus* (Trouessart), *Copidognathus tectirostris* Bartsch, *Simognathus leiomerus* Trouessart, *Metarhombgnathus armatus* (Lohmann), *Rhombognathides merrimani* Newell, *Rhombognathides mucronatus* (Viets).

Bamber, MacQuitty and Connor (1997) list only the Halacarid mites recorded from around the British Isles and surrounding seas and the reader is referred to Green and MacQuitty (1987).

Somerfield (1998, 1991) has provided many new localities for Irish Halacarid mites and the following species have been added to the Irish list as a result of his work - *Isobactrus levis* (Viets), *Isobactrus ungulatus* Bartsch, *Metarhombognathus nudus* (Viets), *Rhombognathides spinipes* (Viets), *Rhombognathus subtilis* Bartsch, *Agauopsis tricuspis* Benard, *Lohmannella kervillei* (Trouessart), *Thalassarachna hexacantha* (Viets), *Thalassarachna longipes* (Angelier), *Thalassarachna subterranea* (Viets) and *Rhombognathides merrimani needleri* Newell.

Discussion

Although there have been several checklists on the mite fauna of the seashore of various parts of Europe, information is still incomplete and fragmentary for some countries. According to Elliott *et al.* (1990) many littoral records are inaccurate. Luxton (1998) describes Ireland as "an acarologically uncharted territory". Although differences in the intensity and season of sampling in different regions will greatly affect the results and the information is still incomplete, several trends are nevertheless apparent.

According to Pugh and King (1985), mesostigmatid mites are adapted to live on the lower shore and they, with other 'terrestrial' acari, have migrated down from the upper supralittoral over time. With regard to this group, Pugh and King (1988) list twenty four species from the British supralittoral about half of which appear in Halbert's (1915, 1920) lists. Pugh (1988), studying the shore dwelling mites of the Scilly Isles records six mesostigmatid mites. These were mainly in tidal debris and are *Macrocheles glaber*, *Macrocheles superbus*, *Thinoseius fucicola*, *Pergamasus crassipes*, *Phaulodinychus orchestiidarum and Phaulodinychus repleta*, five of which were recorded by Halbert. In their work on the vertical distribution of the non-halacarid mites, Pugh and King (1985) list eleven mesostigmatids on the seashore, most of which are in Halbert's lists.

By today's standards, many of Halbert's descriptions were too brief and inadequate. Bartsch

(1985) comments on certain of the halacarid mites described by Halbert, either redescribing or synonymizing them. These are *Halacarellus southerni* (Halbert, 1915), *Halacarellus areolatus* (Halbert, 1915) and *Copidognathus septentrionalis* (Halbert, 1915). Pugh (1988) also refers to the inadequacy of some of the original descriptions with particular regard to the higher Prostigmata.

Being part of the Eastern Atlantic-Boreal, Irish records are very similar to those of the British Isles. However, several species in Pugh and King's (1985, 1988) lists have so far not been recorded from Ireland. Proches and Marshall (2001) include only littoral species and omit the non marine such as those found in tidal debris or amongst supralittoral lichens. On the other hand, Halbert's lists (1915, 1920) include some found only in tidal debris by Pugh and King (1988). Proches and Marshall (2001) noted fourteen species of non-halacarid prostigmatid in the Eastern Atlantic Boreal and of these nine are in Halbert's (1915, 1920) records. Similarly, eight out of the 15 records of non-halacarids given by Pugh (1988) and nine out of 13 (Pugh and King, 1985) were recorded by Halbert. These records suggest that Halbert's work is incomplete since he found only about a half of the species recorded elsewhere in the Eastern Atlantic Boreal. However, it should be noted that many taxa occur in tidal debris which is ephemeral and contains different species on a year to year basis. These are 'non maritime' species of terrestrial origin (Pugh, personal communication).

Unlike the halacarids, non-halacarid mites are restricted to the supra littoral and intertidal zones indicating that they have not fully adapted to the marine environment. Proches and Marshall (2001) believe that prostigmatids have only relatively recently (in the geological time scale) colonized and evolved on the shore and describe some of the marine prostigmatids as having "tenuous marine associations" (Proches and Marshall, 2002). Oribatid and astigmatid mites on the other hand are believed to have been there longer. World wide, 27 species of non-halacarid intertidal prostigmatids were recorded by Proches and Marshall (2001) with nine to genera only and of all the non-halacarid mites, 73% are contained in only four geographical regions with most prostigmatid mite genera restricted to a single geographical region. Proches and Marshall (2002) list a total of 58 prostigmatid species for Southern Africa of which 48 are members of the Halacaridae.

According to Bartsch (1989), there are about 700 described species of Halacarids world-wide. Halbert (1915, 1920) referred to twenty species in Ireland and Bartsch (1985) recorded twenty six species of Halacarid mite along the sublittoral fringe in Strangford Narrows at and just below low water level. More recently, extensive work on the Irish coastline by Somerfield (1988, 1991) has added to the Irish lists. Somerfield (1991) believes that in terms of the Irish Halacaridae at least, most of the commoner littoral species have now been accounted for. Although a good deal of work has been done on the Halacaridae, the non-halacarid mites of the Irish seashore have been neglected. A great deal of further work will be needed "before zoogeographical statements can be made" (Somerfield, 1991) and this applies especially to the non halacarids prostigmatid mites.

Although there is doubt about the validity of some of Halbert's species, especially the prostigmatids, he was the first worker on the mites of the Irish seashore and his pioneering studies laid the foundations for subsequent workers in the Eastern Atlantic-Boreal.

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Notes

1. Edwin Frederick Hall Bullock (1879-1965), friend of Halbert, photographer and later hotelier lived in Ireland for 60 years but was born in London. He had wide interests as an amateur naturalist - botany, bird's eggs, Lepidoptera and especially Coleoptera. He acquired Halbert's mite collection after Halbert died. See obituary under Stelfox (1966).

2. There are two typed manuscript lists in the Natural History library, one prepared in 1986 by M. Doyle and a more recent and detailed "List of Entomological Manuscripts in library" prepared in 1999. The latter is used here for file numbers.

3. Halbert's diary (manuscript file number NMINH/MS/038) of the Clare Island Survey 1909-1911, diary entry for Thursday 25 September 1913.

4. Rowland Southern, a friend of Halbert and co-worker in the field, was born in Lancashire, trained as a chemist and moved to Dublin to work in the laboratory of the city analyist. He gained a BSc London degree, took part in the Clare Island Survey and as a marine zoologist published mainly on annelids. In one paper he was highly critical of the "excessive attention" being paid to geographical distribution and to the "county mania" (Southern, 1917) at the expense of studies on living animals and pleaded for a return to studies on living organisms, their adaptations, habits, and reactions to the environment .

5. Letters received by Halbert are catalogued and in the Library of the Natural History Museum, Dublin -see note 2.

6. Halbert was consulted about mite material from the Oxford University Expedition to Spitsbergen in 1921. The Halacaridae were of special interest. A letter from C. S. Elton dated 7.9.1922 held at the museum, (file number NMINH/MS/56/11), enquires "Mr Hirst of the British Museum, recommended me to write to you and ask whether you could find time to look at them".

7. In part of an obituary to Bullock, Stelfox (1966) indicates that the former acquired Halbert's collection of slides (of land and freshwater mites) after Halbert died. Some of Halbert's slides however were destroyed in the post due to poor packing.

8. In Appendix 3. "List of Entomological Manuscripts in Library 1999", the file numbers NMINH/MS/039/ 1 and 2 refer to hard- backed copies of the Clare Island Survey in which a copy of Halbert's 1915 paper has been annotated with additional records of occurrence, although Appendix 3 incorrectly refers to these as Halbert's 1911 paper. These are in the museum library.

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NOTES AND RECORDS ON SOME IRISH ORTHOPTERA AND DERMAPTERA

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Introduction

Although the Irish Orthoptera/Dermaptera fauna comprises of only 16 species, the group has traditionally achieved little attention from naturalists. No fewer than four species, *Pholidoptera griseoaptera* (De Geer), *Metrioptera roeselii* (Hagenbach), *Conocephalus dorsalis* (Latreille) and *Forficula lesnei* Finot have been added to the list over the last 25 years. One might expect that it would be relatively easy to turn up new sites for some of the more interesting species, given that the maps contained in Haes and Harding (1997) show clearly that very little collecting has been carried out along the south coast, although this part of the country would be expected to have the richest fauna. However much of my recording effort since 1998 has taken place in counties Cork and Waterford, and Orthoptera and Dermaptera finds have hardly been spectacular. In the following account new vice-county records are denoted by an asterisk (*).

Pholidoptera griseoaptera (De Geer)

MID CORK: Ringabella Creek, W769569, 18 October 1998. A substantial colony of these insects occur along the north shore of the creek, where they are associated with bramble *Rubus* patches, through which grow scattered plants of gorse *Ulex europaeus* L. and blackthorn *Prunus spinosa* L. Discovered independently by the author having previously been located here in 1988 by Cooke (1998). Noted on a number of subsequent occasions at this site. On 15 September 2003 an attempt was made to delineate the extent of the colony. Specimens were found to occur in hedgerows as far west as Ahane Cross Roads W739567, from there to the outskirts of Minane Bridge village, and from there along the minor road which lies to the north of Ringabella stream, to Ringabella Creek where the colony extended as far east as W777574. Thus the east-west length of the colony is just under 4km. Some animals were stridulating from isolated *Rubus* patches in rough grassland behind the dyke which bisects Ringabella Creek. No animals were found in Minane Bridge village itself, or indeed anywhere south of Ringabella stream. Apparently suitable habitat along the coast just east of Ringabella was unoccupied.

WATERFORD: Cheekpoint S683129, 19 September 2001. Frequent in hedgerow along a *circa* 750m length of roadverge. Present on coarse vegetation, comprising bracken *Pteridium aquilinium* L., bramble *Rubus*, hawthorn *Crataegus monogyna* Jacq. and blackthorn *Prunus spinosa* L.. Also noted here was a specimen of the speckled bush-cricket *Leptophyes punctatissima* (Bosc). *P. griseoptera* was relocated at this site on 28 September 2003, and the colony found to extend for a further *circa* 1.5km along a path through rank vegetation between Coolbunnia S683119 and Parkswood Upper S689107. Searched for without success between Parkswood Upper and Passage East, and thence along the coast road to Crook. *P. griseoptera* was added to the Irish list when specimens were collected at this site in 1983 (O'Connor and O'Connor, 1985).

Otherwise known in Ireland from two well established and relatively close by colonies on the Clare-Galway border, discovered in 1998 (Speight, 1999). *P. griseoptera* is a relatively easily overlooked animal. It tends to remain hidden in vegetation and the stridulation is not very obvious, unless, as at the above sites, a number of animals are calling at the same time. Nevertheless, it seems strange that this bush-cricket should be confined in Ireland, so far as is known, to a few well-established colonies, separated by large areas containing much apparently suitable habitat. Possibly it has increased at the Waterford site, given that O'Connor and O'Connor (1985) had to mount an intense search to collect nymphs in June and July 1984, whereas it is now common at the site. These authors discuss some of the issues concerning the status of this insect in Ireland, without coming down in favour of it being either a native or a relatively recent introduction, although their arguments tended to favour the latter option. In my view the likelihood must be that this flightless insect has arrived in Ireland relatively recently, and with human assistance. If this is the case one could anticipate further expansion in Ireland, especially in Munster and south Leinster.

***Metrioptera roeselii* (Hagenbach)**

EAST CORK: *Clonard East, X087744, 8 October 1998. About a dozen specimens were located at this site, which would appear to be somewhat atypical for the species, stridulating from a *Rubus* patch bordering sandy grassland. A few individuals stridulating at this site in September 2000.

WATERFORD: Newport, X090842, 20 September 1998. A substantial colony occurs at this site, associated with a rough pasture of rushes *Juncus* and *Scirpus*, on the landward site of a coastal *Phragmites* marsh. A few specimens penetrated into the *Phragmites* marsh and onto a small rough area of *Rubus*/*Urtica* on the landward side of the pasture. Relocated at this site on 30 September 2004, when the colony was found be approximately 500m in length. St Molanas Abbey, X078825, 20 September 1998. A brief search at this site revealed the presence of a few stridulating animals on a grassy bank enclosing a *Phragmites* marsh. D'Loughtane, X100834, 22 September 1998, one specimen stridulating from a narrow band of *Juncus* grassland on the landward side of a coastal *Phragmites* marsh.

M. roeselii was added to the Irish list when specimens were located at the St Molanas Abbey site listed above by Anderson (1977). Dr Anderson estimated that a population of *circa* 1000 animals were present in August 1990. Clearly thoroughly established along the lower reaches of the Blackwater River, although some potential habitat, especially on the northern outskirts of Youghal, appears unoccupied.

***Leptophyes punctatissima* (Bosc)**

WEST CORK: Inchydoney, W406389, 23 July 2000. One specimen beaten from *Pteridium*, rough vegetation behind sand dunes. A second specimen located here in July 2001.

EAST CORK: Marino Point, W777688, 23 July 2004. Six near adults swept from *Urtica* bordering *Rubus* patches in rank grassland, and along adjacent footpath verge. Still unrecorded from Mid Cork, despite a number of specific searches.

WATERFORD: Ballyvoyle Bridge, X335949, 13 September 1998, one mature female on *Rubus*, growing along the verge of a coastal side road. Also six specimens beaten from *Pteridium* and rough vegetation on a nearby coastal bank, 13 July 2000. Ballyvoony Bridge, X380974, 10 July 2000, nymphs beaten from *Pteridium* on south-west facing hillside. Passage East, S699104, 28 September 2003, single male on *Rubus* leaf, roadside cliff top. Ardsallagh, X094814, and Tinnabinna, X101812, 1 October 2003. Two males and one female located on *Rubus* leaves, and additional specimens located here in August 2004. A relatively large population may well be present on this extensive site, which comprises a dry south-facing hillside, with in places much *Pteridium* with *Rubus* understory. Rincrew, X097808, 31 August 2004, female swept from a small patch of *Pteridium* on hillside.

WEXFORD: Ballyhack, S707110, 9 August 1998, one specimen basking on a bramble *Rubus* leaf on a south facing roadside bank. On subsequent visits noted as being well established in the vicinity of Ballyhack.

Irish records for *L. punctatissima* are reviewed by Harding (1981) and Cotton (1982), and additional localities are given by Anderson (1987), Haes (1992), O'Connor and O'Connor (1985) and O'Connor (2002). This is the most frequently recorded bush-cricket in Ireland, however it has still been reported from a grand total of just 17 10km squares. It is however quite a difficult animal to spot, especially when populations are small, as would appear often to be the case in Ireland. Also the stridulation is essentially inaudible and of no use in locating colonies. Bat detectors, which amplify the stridulation, have been used with considerable success to locate colonies in Great Britain, however so far my own attempts at using this technique have been fruitless. Instead I rely on sweeping *Pteridium* and checking *Rubus* patches at apparently suitable and almost invariably coastal sites. Regularly noted as being apparently absent from what seemed ideal sites, even when specifically searched for. However my searches have tended to take place in mid September/October, which is likely to be a shade past the peak season. Also in Autumn 2004 poor weather greatly hampered planned recording. At least along the coasts of Cork and Waterford *L. punctatissima* appears to be a distinctly scarce and unpredictable invertebrate.

***Tetrix undulata* (Sowerby)**

WEST CORK: Dunlough Bay, V7326, 9 May 1996. Singleton swept from grassy area below sea cliff.

Although familiar with both *Tetrix* spp from Co. Sligo, this is the only groundhopper record I have from Cork/Waterford. As with *M. maculatus* they appear to be surprisingly scarce along the south coast, other than in Co. Kerry.

***Myrmeleotettix maculatus* (Thunberg)**

WEST CORK: Present on coastal heath at the following two Cape Clear Island sites: Carriglure, V9621 and Pointabullaun, V9419, 19 August 1996.

WATERFORD: *Ballyscanlan Lake, S5303, 27 July 1999, a small population present on heath-covered hillocks.

WEXFORD: *Ballyteige Burrow, S9306, 15 September 1996, scattered in sand dunes. Colestown, T0020, 3 August 1998, a small colony occurs on heathy ground among gorse *Ulex gallii* Planchon and heather *Calluna vulgaris* (L.).

M. maculatus is known to be widely scattered in Ireland however these are no previous records from the south-east coast.

***Labia minor* (L.)**

MID CORK: Halfway, W5961, 22 May 2001. Frequent in a dung heap, in a field, some distance from the nearest farmyard. Loughbeg, W7863, 25 October 2004, a few specimens sieved from debris collected from an old dungheap in a field

EAST CORK: *Fota, W787714, 23 July 2004. Male collected, and two immatures seen, in a straw/dung heap in a field. Castlemartyr, W972738, 17 October 2004, frequent in an old dung heap.

WATERFORD: Dungarvan, X2794, 15 May 2005, frequent in a dung heap.

WEXFORD: Drinagh, T0518, 26 May 2005, frequent in a dung heap.

LIMERICK: *Kilmallock, R6227, 19 December 2004. A few specimens present in a dung heap.

SOUTH TIPPERARY: *Ferryhouse, Clonmel, S237229, 25 October 2000. Frequent in a large heap of leaves, which was obviously of long standing and acting as a compost heap, at the rear of the Catholic Church. Other interesting invertebrates present included an uncommon pseudoscorpion (Cawley, 2002).

Although relatively widely recorded in the past the only recent Irish records for *L. minor* appear to be those listed by Good (1979) and O'Connor *et al.* (1990). However it is primarily associated with dung heaps and would need to be specifically searched for. Clearly widespread at least in the south, where I have located colonies in about half of the small number of dung heaps searched.

***Forficula lesnei* Finot**

WATERFORD: Ballyvoyle Bridge, X3394, 19 August 2001. Beaten from vegetation on sea bank, and present also in nearby hedgerow umbellifer stems. Abbeyside, X270930, 25 September 2003, a few specimens present in dead umbellifer stems, on a rank patch just behind HWM. Invariably present with, and much outnumbered by *Forficula auricularia* (L.). This earwig, which is said to be easily overlooked, was added to the Irish list by Cawley (2000).

F. lesnei is well established along a *circa* 15km length of Waterford coast, centred on Dungarvan. Surprisingly however I have failed to turn up this flightless insect elsewhere along the south coast, despite a number of specific searches. Although *F. lesnei* is a native species in Great Britain, and was predicted to occur in Ireland by Marshall and Haes (1988), there remains a possibility that it is an introduction in the Irish fauna.

Discussion

It is remarkable that only three of the Irish Orthoptera/Dermaptera, namely *Omocestus viridulus* (L.), *Chorthippus brunneus* (Thunberg) and *Forficula auricularia* L. could be described as being widespread and reasonably common. Most of the remaining species have, at least on present evidence, markedly localised distributions. The likelihood must be that if the present phase of climatic amelioration continues, many of these species could be expected to undergo an expansion of range. It should be borne in mind also that in Great Britain, the horticultural trade has been implicated in the spread of some species, e.g. *L. punctassima*. Additions to the Irish list may still be anticipated, perhaps especially involving accidental introductions. However, some natives could still remain to be detected, for example among the localised and very easily overlooked cockroaches *Ectobius* spp. which are native in Britain.

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THE FIRST RECORDS OF *AMELETUS INOPINATUS* EATON, 1887 (EPHEMEROPTERA: AMELETIDAE) IN UPLAND STREAMS IN CO. KERRY, IRELAND

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The mayfly *Ameletus inopinatus* Eaton (Ameletidae) is known from the mountainous areas of the European Subregion (Brittain, 1974; Santori, 1988; Arnekleiv, 1996) and single records in North America (Zloty, 1996), and has a narrow geographic distribution in Ireland. The majority of the distribution records are confined to the Wicklow Mountains (Fahy, 1973; Clabby and Bracken, 1976; Kelly-Quinn, 1993; Tierney *et al.*, 1998; Kelly-Quinn and Bracken, 2000), where it is reported to be locally abundant (Kelly-Quinn, 1993). The only other distribution records in Ireland are confined to two rivers in Co. Donegal, namely the Derrybeg stream in the Glenveagh National Park (Lynch *et al.*, 1995) and the Deele River (Kelly-Quinn and Bracken, 2000). *A. inopinatus* has been noted as an arctic-alpine species, however records in its northerly range in the British Isles at low elevations (Morgan and Egglishaw, 1963; Elliott *et al.*, 1988), dismiss this classification. This occurrence in relation to elevation suggests that the distribution of this mayfly is influenced by temperature and it may as a result become an important bioindicator of climate change.

In a survey of the macroinvertebrates of headwater streams in Ireland funded by The Heritage Council (Baars *et al.*, 2004), *A. inopinatus* was recorded for the first time in Co. Kerry. This is the most southerly distribution record in the British Isles. Specimens were collected during one minute multi-habitat kick sampling in Kealnafulla stream (V809872), some 0.9km from its source. The stream has a steep slope dominated by a riffle/shoot and pool sequence with a large proportion of boulder, cobble and pebble substrate. It drains moorland with peaty soils and has an underlying Old Red Sandstone geology. Two nymphs were collected at 310m a.s.l. and a single specimen was collected at 340m a.s.l. on 17 April 2004. No further specimens were collected during summer samples taken on 30 July 2004, although previous life history studies suggest that the adult emergence period may have already taken place (Gledhill, 1959).

The Kealnafulla stream is one of several tributaries of the Gaddagh River draining the northern slopes of the MacGillycuddy's Reeks, Co. Kerry. An additional survey in April 2005 resulted in further collections in the nearby Kealmanagh stream (V806869, 360m a.s.l.) within the same catchment. A healthy population was noted on this occasion in both these high altitude streams (>350m a.s.l.), and the mayfly is likely to occur in the other nearby streams in this catchment. Observations made in further high altitude streams in the mountainous areas of Co. Kerry suggest that *A. inopinatus* may be very localized. Further exploration in this area is necessary, as other published surveys in the area seem to have been confined to lower altitudes (Dowling *et al.*, 1981; Wise and O'Connor, 1997).

Current ecological observations on instream microhabitat usage and records from lake habitats indicates that *A. inopinatus* tolerates a variety of environmental conditions and has ecological plasticity. Therefore, the current distribution records may underestimate its distribution in Co. Kerry and it could occur in other high altitude (>300m a.s.l.) cool-water streams in the catchments draining the northern mountain slopes. Additional studies are necessary in order to determine the extent of the mayfly populations in this area as the present confirmed localities are not within the Killarney National Park and may not be afforded appropriate protection. We propose that *A. inopinatus* be considered as a National Notable species in terms of the threat category definitions proposed by Bratton (1990).

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THE CRANEFLIES (DIPTERA) OF IRELAND. PART 3. LIMONIIDAE: DACTYLOLABINAE AND LIMNOPHILINAE

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Abstract

The Irish fauna of Dactylolabinae consists of only a single species, *Dactylolabis sexmaculata* (Macquart, 1826). However, the Limnophilinae are quite speciose and currently consist of 28 Irish species, all of which have been previously recorded except for one, *Idioptera pulchella* (Meigen, 1830), which is recorded here as new to Ireland. The identities of most 19th century Irish Limnophilinae records have been resolved.

Introduction

This is the third of a series of papers, the first and second respectively being Ashe *et al.* (1995, 1998), which aims to provide a detailed review of the records, literature and distribution of all the Irish cranefly species. The most recent checklist of the Irish species of Limoniidae (Ashe, O'Connor and Murray, 1998) lists all the species included in this work except *Idioptera pulchella* (Meigen), reported here as new to Ireland.

The Dactylolabinae, with its single Irish species, *D. sexmaculata*, is a relatively recent addition only being first discovered in Ireland in 1991 (Ashe *et al.*, 1995). However, in Britain a second species, *D. transversa* (Meigen, 1804), is known. It has not yet been found in Ireland.

In the earliest account which includes Irish Limnophilinae, Haliday (1833) recorded nine species, all assigned to the genus *Limnobia* (Table 1). The identity of most of these nine species has been resolved but the identity of two (*Limnobia nitidicollis* and *Limnobia ferruginea*) is uncertain. Three of the named species (*Limnobia fasciata* sensu Haliday, *Limnobia marmorata* and *Limnobia decora*) are all synonymous with *Eloeophila maculata* (Meigen) with the result that there are acceptable records for five species.

Limnobia aegle (Haliday in Curtis, 1837) is a MS name which was never formally described by Haliday but appears in a list of species in Curtis (1837: column 236, as *aegle* Hal.) without any description being given. It is both a nomen nudum and an unavailable junior synonym of *Eloeophila maculata* (Meigen, 1804). Haliday never published it because he subsequently wrongly believed that *aegle* and *trimaculata* Zetterstedt were the same species (Edwards, 1938: 81) - see page 209 (Fig. 2) from Haliday's unpublished MS '*Catalogue of Irish insects*' which shows "*ægle*" and the word "no" with a line through both and replaced above with "*trimaculata* Zett.". Haliday's *aegle* is not included in Savchenko *et al.* (1992) though *aegle* Edwards is. The full entry for *aegle* Haliday, which can be inserted in a future edition of the Palaearctic Catalogue as an unavailable junior synonym of *Eloeophila maculata* (Meigen, 1804), is as follows:-

aegle (HALIDAY in CURTIS, 1837): A Guide to an Arrangement of British Insects: 236 (*Limnobia*). Type-locality: not stated (probably Holywood, County Down, Ireland). **Nomen nudum**.

The only other relevant 19th century reference to Limnophilinae is Walker (1856) which includes 11 Irish species (see Table 1) indicated in his text with a capital I for Ireland in parenthesis, e.g. (I.) or (E.S.I.) where E. and S. respectively mean England and Scotland. On page 268 of Walker (*op. cit.*), Haliday is acknowledged for improving and contributing to the text and is probably responsible for including the 11 Irish Limnophilinae species. Ten of the names given in Walker (*op. cit.*) are satisfactorly resolved, with four of these (numbered 1 to 4 in Table 1) being the same as four given in Haliday (1833). One of the names used is the misidentified *Limnobia trimaculata* referred to in the previous paragraph above. The only uncertain species is *Limnobia punctata* which may be a misidentified species of *Limnophila*, though neither of the two British species of this genus have yet been found in Ireland.

For the period 1900 to 1974 a relatively small number of papers were published (Yerbury, 1902; Carpenter, 1908; Grimshaw, 1912; Edwards, 1938; Coe, 1950; Hazelton, 1974a, b, c) which included records of Irish Limnophilinae. These papers, averaging at about one per decade, mostly contained one to several records only and included common species, first published Irish records and repeat Haliday records. When Mendl (1987) appeared it was then the most significant paper on the Irish Limoniidae ever published and included records of 17 Limnophilinae species from various localities in Counties Clare, Cork, Down, Galway, Kerry, Mayo, Meath, Sligo, Waterford and Wicklow. The 1990s saw considerable activity with papers by Speight (1990), Hancock (1990), Ashe *et al.* (1991), Blackith *et al.* (1991) which included Limnophilinae records and several catalogues (Savchenko *et al.*, 1992; Ashe, O'Connor and Murray, 1998; Chandler, 1998) which included the Irish Limoniidae. In addition, the first two parts (Ashe *et al.*, 1995 on the Subfamily Pediciinae, since elevated to family rank; Ashe *et al.*, 1998 on the Subfamily Limoniinae) of a comprehensive review of all Irish cranefly records were published. The present paper (the third part) and the fourth part (on the Family Cylindrotomidae) are published together in the same journal issue.

Materials and methods

The Irish national grid reference (six, four or two figure reference) is included where possible followed by the Universal Transverse Mercator (UTM) 50 km grid reference in parentheses. The method used to obtain the UTM references is described in Rasmont *et al.* (1986). The UTM data for each species was used to prepare the distribution maps (Fig. 1).

The data included in Mendl's (1987) work on Irish species are not repeated in detail but the relevant UTM grid references have been calculated for each record and incorporated on the distribution maps (Fig. 1). A collection, in alcohol, of most of the species Mendl collected in Ireland is preserved in the National Museum of Ireland though some of the rarest species were not included. In the genus *Neolimnomyia*, Mendl (1987) considered *nemoralis* and *adjuncta* as synonymous with one another (which in not accepted here). Consequently, his records of *nemoralis* from Counties Clare, Cork, Galway, Kerry, Mayo, Sligo and Wicklow, which presumably include a mixture both *adjuncta* and *nemoralis*, have not been included on the maps because all this specimens would need to be re-identified.

A few Irish county records (one Waterford and four Wexford records), all based on J. J. F. X. King specimens collected in 1902, lack specific locality information (with the Waterford record also lacking the collecting date). King's notebooks, which can provide useful information for his later collecting activities, apparently do not exist for 1902. Consequently, the "Waterford" and "Wexford" records cannot be easily plotted on the UTM maps because each of these three counties occupy parts of at least three UTM squares. However, in a catalogue of the Irish Neuroptera by King and Halbert (1910) several different specific localities for both Waterford and Wexford are mentioned, sometimes with King's name in italics as the collector, though the collecting dates are not given. King presented a collection of insects to the National Museum of Ireland in 1909 (registration number N.M.I. 19: 1909) and this includes specimens of various Trichoptera species collected in Waterford and Wexford. By utilising the date collected given on the label of King's Trichoptera specimens and by checking the Wexford locality information given for each Trichoptera species in King and Halbert's (1910) catalogue it has been possible to determine that all four Wexford Limnophilinae records were collected at Edenvale, near Castlebridge. Although the date the Waterford specimen was collected is not yet known a similar examination of King's Trichoptera specimens for Waterford records shows that all specimens have the locality "Cappoquin" on the labels though the localities specified in the catalogue include Cappoquin and several other places mostly within a few kilometres of Cappoquin. The date range of Cappoquin specimens shows that King was collecting in the general area on various dates at least between the 21 July and the 5 August 1902. Therefore the Waterford specimen of *Pseudolimnophila sepium* (Verrall) was collected in July or August 1902 in the vicinity of Cappoquin.

The Irish material collected by the Dutch entomologists (M. Dierks, P. Oosterbroek and G. Verberne) is preserved in the pinned collections of the Institute of Taxonomic Zoology, Amsterdam, The Netherlands. Nomenclature for the Dactylobinae and Limnophilinae follows Savchenko *et al.* (1992) apart from any more recent changes included in Chandler (1998). Species were identified using Coe (1950) and a MS key prepared by Alan Stubbs.

List of collectors and abbreviations used for collectors' names

P. Ashe = PA; B. P. Beirne = BPB; R. E. Blackith = REB; R. M. Blackith = RMB; J. E. Chainey = JEC; P. J. Chandler = PJC; R. L. Coe = RLC; J. H. Cole = JHC; M. Dierks = MD; J. Dixon = JD; F. W. Edwards = FWE; P. H. Grimshaw = PHG; J. N. Halbert = JNH; A. H. Haliday = AHH; E. G. Hancock = EGH; A. G. Irwin = AGI; J. J. F. X. King = JJFXK; R. A. Lass = RAL; R. Moles = RM; R. Nash = RN; J. P. O'Connor = JPOC; J. P. O'Connor and M. A. O'Connor = JMOC; P. Oosterbroek = PO; O. W. Richards = OWR; R. F. Scharff = RFS; K. C. Side = KCS; A. E. Stubbs = AES; A. W. Stelfox = AWS; R. I. Vane-Wright = RIVW; G. Verberne = GV; J. W. Yerbury = JWY.

Irish Checklist of Dactylolabinae and Limnophilinae

• = species new to Ireland

Subfamily Dactylolabinae

Dactylolabis sexmaculata (Macquart, 1826)

Subfamily Limnophilinae

Austrolimnophila ochracea (Meigen, 1804)

Eloeophila apicata (Loew 1871)

Eloeophila maculata (Meigen, 1804)

Eloeophila mundata (Loew, 1871)

Eloeophila submarmorata (Verrall 1887)

Eloeophila trimaculata (Zetterstedt, 1838)

Epiphragma ocellaris (Linnaeus, 1761)

Euphylidorea aperta (Verrall, 1887)

Euphylidorea dispar (Meigen 1818)

Euphylidorea lineola (Meigen 1804)

Euphylidorea meigenii Verrall, 1887

Idioptera linnei Oosterbroek, 1992

• *Idioptera pulchella* (Meigen, 1830)

Neolimnomyia (Brachylimnophila) adjuncta (Walker 1848)

Neolimnomyia (Brachylimnophila) nemoralis (Meigen, 1818)

Neolimnomyia (Neolimnomyia) batava (Edwards 1938)

Neolimnomyia (Neolimnomyia) filata (Walker, 1856)

Paradelphomyia (Oxyrhiza) fuscula (Loew, 1873)

Paradelphomyia (Oxyrhiza) senilis (Haliday, 1833)

Phylidorea (Paraphylidorea) fulvonervosa (Schummel, 1829)

Phylidorea (Phylidorea) abdominalis Staeger 1840

Phylidorea (Phylidorea) ferruginea (Meigen, 1818)

Phylidorea (Phylidorea) squalens (Zetterstedt, 1838)

Pilaria discicollis (Meigen, 1818)

Pilaria fuscipennis (Meigen, 1818)

Pilaria meridiana (Staeger, 1840)

Pseudolimnophila lucorum (Meigen, 1818)

Pseudolimnophila sepium (Verrall, 1886)

Subfamily Dactylolabinae

***Dactylolabis sexmaculata* (Macquart, 1826)**

This species was first recorded from Ireland by Ashe *et al*. (1991) and it is somewhat surprising, since it is a large and distinctive species, that it was not discovered decades ago by entomologists visiting the Burren. It is associated with exposed limestone areas, particularly limestone pavement, where it may be observed sunning itself or running on the rock surface. Almost certainly an underrecorded species which is likely to occur in other western counties, (e.g. Galway, Mayo, Sligo, Leitrim), where natural formations of exposed limestone occur, especially bare rock faces and limestone pavement. In Britain, it is known from about 15 widely scattered post 1960 sites (Falk, 1991).

CLARE: 2.iv.1983, Burren M0904 (MU.3), JPOC (Ashe *et al*., 1991); 21.iv.1984, Ailladie M088029 (MU.3), JMOC.

Subfamily Limnophilinae

***Austrolimnophila ochracea* (Meigen, 1804)**

Recorded by Mendl (1987) from Counties Clare, Cork, Galway, Kerry, Sligo and Wicklow.

CARLOW: 24.vii.1975, Graiguealug S766715 (PU.1), AES; 18.vi.1991, Bahana Woods S7239 (PU.2), JPOC; **CAVAN**: 4.vi.1990, Virginia Woods N5987 (PV.1), JPOC; **CLARE**: 30.v.1984, near Ennis R292796 (MU.3), JPOC; **CORK**: 11.vi.1901, Glengarriff (MT.4), JWY (Yerbury, 1902, sub *Limnophila*); 19-20.vi.1970, Glengarriff State Forest V9157 (MT.4), RIVW; 16.vii.1975, Kildorrery R723106 (NT.1), AES; 16.vii.1975, Mallow W550980 (NT.1), AES; 16.vii.1975, Ballymaquirk Bridge, Banteer W385987 (NT.1), AES; 11.vii.1976, Myross

Wood, Leap W2036 (MT.4), JEC; 11.viii.1977, Myross Wood, Leap W2035 (MT.4), JEC; 4.vii.1985, Glengarriff Forest V915570 (MT.4), JMOC; 6.vii.1985, Glengarriff V907575 (MT.4), JMOC; 7.vii.1985, Glengarriff V920565 (MT.4), JMOC; **DUBLIN**: 27.vi.1975, Howth Woods, Dublin O2-3- (PV.4), PJC; 7.viii.1981, Slade of Saggart O033245 (PV.4), JPOC; **GALWAY**: 26.vii.1958, Toomdeola [= Toombeola] Bridge (MV.2), GV; 22.ix.-3.x.1974, Letterdyfe House, Roundstone (MV.2), PO; 23.vii.1975, Rosturra Wood, Woodford M773020 (NU.1), AES; 1.vi.1992, Coole Woods M4304 (NU.1), JMOC; **KERRY**: 30.vi.1969, Torc Cascade (MT.3), PJC; 16.vii.1975, 1 mile east of Barraduff W102911 (MT.3), AES; 17.vii.1975, Upper Lake area, Killarney V917820 (MT.3), AES; 17.vii.1975, Clonee Loughs, south-west of Kenmare V8264 (MT.4), AES; 17.vii.1975, Reen V870705 (MT.4), AES; 18.vii.1975, Releagh Bridge, south of Kenmare V923603 (MT.4), AES; 18.vii.1975, Sheen V955675 (MT.4), AES; 19.vii.1975, Headley Bridge, Abbeyfeale R074194 (MT.3), AES; 19.vii.1975, Barry's Glen, north of Killarney V954976 (MT.3), AES; **KILDARE**: 23.vi.1975, Ardscull Mote S7-9- (PU.1), PJC; **KILKENNY**: 15.vii.1975, Davidstown S646186 (PT.1), AES; **LOUTH**: 29.vi.1975, Killin Park J0-0- (PV.3), PJC; 29.vi.1975, Thomastown N9-9- (PV.3), PJC; **MAYO**: vii.1910, Clare Island (MV.1), PHG (Grimshaw, 1912, sub *Limnophila*); no date [1909-1910], Westport, at riverside (MV.3), PHG (Grimshaw, 1912, sub *Limnophila*); no date [1909-1910], Brackloon Wood, near Westport (MV.3), PHG (Grimshaw, 1912, sub *Limnophila*); 25.vii.1958, Toermakeady [= Toormakeady] (MV.4), GV; **MEATH**: 28.vi.1975, Hays N9-7- (PV.4), PJC; **TIPPERARY**: 22.vi.1975, wildlife sanctuary, near Dundrum R9-4- (NU.4), PJC; 15.vii.1975, north-west of Caher S030275 (NU.4), AES; 16.vii.1975, Burncourt R937192 (NT.3), AES; **WATERFORD**: 21.vi.1975, Gurteen S2-2- (NU.4), PJC; 15.vii.1975, 4 miles east of Tikineor S304225 (NU.4), AES; 15.vii.1975, Carrickbeg S404216 (PT.1), AES; 31.vi.1983, Malcolmson's Wood S6800 (PT.1); JPOC; 8.vii.1989, Glasha River S3022 (NU.4), JMOC; 1.vi.1991, 11.vi.1991, Belle Lake S6605 (PT.1), JPOC; 3.vii.1991, Passage East S6811 (PT.1), JPOC; **WESTMEATH**: 22.vi.1989, Ballynafid Lough N4060 (PV.2), JPOC;

31.v.1991, Belvedere House N4247 (PV.2), JMOC; **WEXFORD**: 14.vii.1975, Orristown T0413 (PT.3), AES; 15.vii.1975, near Newbawn S856244 (PU.4), AES; 14.vi.1982, Ballyhighland S8840 (PU.4), JMOC; 10.vi.1986, Oaklands S715255 (PU.2), JPOC; 4.vi.1987, Killoughrim Forest Park S8941 (PU.4), JPOC; 17.vi.1990, river at Fethard S7806 (PT.1), JPOC; 15.vi.1990, 6.vii.1990, Tintern Abbey S7810 (PT.1), JPOC; 9.vi.1991, Urrin River woods S8743 (PU.4), JMOC; **WICKLOW**: 27.v.1988, Avondale T1985 (PU.3), JPOC; 22.viii.1988, Glen of the Downs O2611 (PU.3), JPOC; 15.vi.1988, Powerscourt O2012 (PU.3), JPOC; 7.viii.1990, Devil's Glen T2399 (PU.3), JMOC; iv.-x.1988, Blackditch Wood O3103 (PU.3), REB/RMB, Malaise trap sample (Blackith *et al.*, 1991); v.-vi.1989, Blackditch Wood O3103 (PU.3), REB/RMB, bred from mossy woodland litter (Blackith *et al.*, 1991); vi.-vii.1988, Blackditch Wood O3103 (PU.3), REB/RMB, bred from rotten birch (Blackith *et al.*, 1991); v.1988, Killoughter Marsh Field T3199 (PU.3), REB/RMB (Blackith *et al.*, 1991); vi.1988, Clonmannon Wood T3098 (PU.3), REB/RMB (Blackith *et al.*, 1991).

***Eloeophila apicata* (Loew, 1871)**

The "Wexford" record given in Edwards (1938) is based on a single male J. J. F. X. King specimen preserved in the Hunterian Museum, University of Glasgow. For an explanation on how the specific Wexford locality was identified. see the text concerning King in the materials and methods section.

CORK: 19-20.vi.1970, Glengarriff State Forest V9157 (MT.4), RIVW; **KERRY**: 25.viii.1902, Kenmare (MT.4), JJFXK; 16.vii.1975, Aghnanus Bridge, Kilgarvan W046790 (MT.3), AES; 17.vii.1975, Muckross Lake, Killarney V966846 (MT.3), AES; **WATERFORD**: 15.vii.1975, 4 miles east of Tikineor S304225 (NU.4), AES; **WEXFORD**: 11.vii.1902, "Wexford" [= Edenvale, near Castlebridge] (PU.4), JJFXK (Edwards, 1938, sub *Limnophila* (*Elaeophila*)); **WICKLOW**: 10.vii.1971, Powerscourt O1-1- (PU.3), PJC; viii.1988, Blackditch Wood O3103 (PU.3), REB/RMB (Blackith *et al.*, 1991).

***Eloeophila maculata* (Meigen, 1804)**

Limnobia decora Haliday was described by Haliday (1833) from Holywood, Co. Down. In the Haliday collection, in the Natural History Museum in Dublin, there are no Irish specimens of *decora* but there are two British specimens (one male and the second lacking the abdomen), which cannot be the types of *decora* even though Edwards in 1936 wrote the word "Type ?" on the identity label of the male specimen. Haliday did exchange specimens with various contemporaries and it is possible that the types may exist in the collections of some other museum. Although Edwards (1938) recognised *decora* as a distinct variety of *maculata* it is now regarded as a junior synonym of *maculata*.

The species *Limnobia aegle* Haliday in Curtis (1837), which is both a nomen nudum and a synonym of *Eloeophila maculata* (Meigen), was based on Irish specimens but never formally described by Haliday - see additional comments on *aegle* in the introduction. No locality information was published for *aegle* but it was most likely collected around Holywood, Co. Down. Edwards (1938) described *Limnophila* (*Elaeophila*) *aegle* Edwards as a valid taxon and a variety of *maculata* based on two adult female specimens in the Haliday collection in the Natural History Museum in Dublin. These two specimens are therefore the types of both *aegle* Haliday in Curtis (1837) and *aegle* Edwards (1938). The variety *aegle* Edwards is now considered to be a junior synonym of *maculata*.

The "Wexford" record given in Edwards (1938) is based on a single female J.J.F.X. King specimen preserved in the Hunterian Museum, University of Glasgow. For an explanation on how the specific Wexford locality was identified see the text concerning King in the materials and methods section.

Recorded from several localities in Counties Galway and Kerry by Mendl (1987).

ANTRIM: 2.ix.1972, Belfast J3269 (UF.2), RN; 19.v.1975, Masserene J1485 (PA.3), ?AGI; **CLARE**: 2.vi.1992, Rathborney River, Burren M2004 (MU.3), JPOC; **CORK**: 11.vii.1976, Myross Wood, Leap W2036 (MT.4), JEC; **DOWN**: 1827-1831, Holywood (UF.1), AHH

(Haliday, 1833, sub *Limnobia fasciata* (misidentified); Haliday, 1833, sub *Limnobia marmorata*; Haliday, 1833, sub *Limnobia decora*; Walker, 1856, sub *Limnobia fasciata* (Irish record only); Walker, 1856, sub *Limnobia marmorata*; Walker, 1856, sub *Limnobia decora*; Edwards, 1938, sub *Limnophila* (*Elaeophila*) *maculata* var. *decora*); 18.viii.1974, Ballygowan J4163 (UF.2), AGI; **KERRY**: no date [probably 1898], Kenmare (MT.4), JNH; 25.viii.1902, Killarney (MT.3), JJFXK; 4.vi.1905, Mangerton (MT.3), JNH; 4.vii.1969, Owenreagh River Valley, Killarney (MT.3), PJC; 16.vii.1975, 1 mile east of Barraduff W102911 (MT.3), AES; 17.vii.1975, Muckross Lake, Killarney V966846 (MT.3), AES; 17.vii.1975, Reen V870705 (MT.4), AES; 19.vii.1975, Barry's Glen, north of Killarney V954976 (MT.3), AES; 24-31.vii.1978, Loo tribuitary, River Flesk W048790 (MT.3), PA (Mendl, 1987) (two pupae collected on 24th in drift samples in the river, adult males hatched 31st); **KILKENNY**: 15.vii.1975, Davidstown S646186 (PT.1), AES; **MAYO**: no date [1909], Clare Island (MV.1), PHG (Grimshaw, 1912, sub *Ephelia marmorata* Meig.; Edwards 1938, sub *Limnophila* (*Elaeophila*) *maculata* var. *decora*); **TIPPERARY**: 22.vi.1975, wildlife sanctuary, near Dundrum R9-4- (NU.4), PJC; 22.vi.1975, Marl Bog, near Dundrum R9544 (NU.4), PJC; 16.vii.1975, Burncourt R937192 (NT.3), AES; **WEXFORD**: 16.vii.1902, "Wexford" [= Edenvale, near Castlebridge] (PU.4), JJFXK (Edwards 1938, sub *Limnophila* (*Elaeophila*) *maculata* var. *aegle* Edw.); 15.vii.1975, near Newbawn S856244 (PU.4), AES; **WICKLOW**: 21.v.1896, Glenmalur (PU.3), JNH; 9.vii.1969, road down to Lough Dan (PU.3), PJC; 16.ix.1968, wood near Aughrim River (PU.3), PJC; 9.vii.1969, Aughrim (PU.3), PJC; iv.1988, Killoughter Marsh Field T3199 (PU.3), REB/RMB (Blackith *et al.*, 1991 sub *Ilisia*).

***Eloeophila mundata* (Loew, 1871)**

Mendl (1987) has records from Counties Galway, Kerry and Waterford.

TIPPERARY: 15.vii.1975, north-west of Caher S030275 (NU.4), AES; **WATERFORD**: 15.vii.1975, 4 miles east of Tikineor S304225 (NU.4), AES; **WICKLOW:** 26.vi.1975, Bellevue Woods, Glen of the Downs O2-1- (PU.3), PJC.

***Eloeophila submarmorata* (Verrall, 1887)**

CLARE: 28.vii.1966, St Catherine's Island, Doolin Cave System R0898 (MU.3), RAL (Hazelton 1974a, b, c, sub *Limnophila* (*Elaeophila*)); 22.v.1970, Lisdoonvarna (MU.3), PJC; 25.v.1992, Lisdoonvarna Spa R1397 (MU.3), JMOC; **DOWN**: 18.v.1975, Ballygowan Wood J4163 (UF.2), AGI; **FERMANAGH**: 18.vii.1966, Coolarkin Cave H122432 (NA.4), RAL (Hazelton 1974a, b, c, sub *Limnophila* (*Elaeophila*)); **KERRY**: 25-27.v.1929, Killarney (MT.3), FWE (Edwards, 1938, sub *Limnophila* (*Elaeophila*)).

***Eloeophila trimaculata* (Zetterstedt, 1838)**

Recorded by Mendl (1987) from one locality in County Wicklow. The Irish record of *trimaculata* given in Walker (1856: 283, sub *Limnobia*) is a misidentification by Haliday - he believed *trimaculata* was an earlier name for his undescribed species *aegle* which is a synonym of *Eloeophila maculata* (Meigen) - see comments in the introduction.

ANTRIM: 24.v.1975, Slievenance, near Trostan D1621 (PB.4), AGI; **CLARE**: 22.v.1985, Cooleabeg M163020 (MU.3), JMOC.

***Epiphragma ocellaris* (Linnaeus, 1761)**

Recorded by Mendl (1987) from Counties Kerry and Sligo.

CLARE: 30.v.1984, near Ennis R292796 (MU.3), JPOC; **KERRY**: 25-27.v.1929, Killarney (MT.3), FWE; 17.vii.1975, Upper Lake area, Killarney V917820 (MT.3), AES; **WEXFORD**: 14.vi.1982, Ballyhighland S8840 (PU.4), JMOC; **WICKLOW**: 1827-1831, Vale of Clara and/or Glendalough (PU.3), AHH (Haliday, 1833, sub *Limnobia picta* Fabricus; Walker, 1856, sub *Limnobia picta* Fabricus; Carpenter, 1908, sub *E. picta* Fabricius).

***Euphylidorea aperta* Verrall, 1887**

Additional records are given in Mendl (1987) from Counties Kerry, Mayo and Wicklow.

CORK: 19-20.vi.1970, Glengarriff State Forest V9157 (MT.4), RIVW; 6.vii.1989, Rahan W6497 (NT.1), JPOC; **KERRY:** 29.v.1966, Upper Lake, Killarney (MT.3), OWR; 27.v.1974, Abbey Island, Derrynane V5-5- (MT.2), KCS; 17.vii.1975, Clonee Loughs, south-west of

Kenmare V8264 (MT.4), AES; **WEXFORD**: 7.vi.1986, Oaklands S715255 (PU.2), JMOC; **WICKLOW**: 24.vi.1975, Whaley Abbey T1-8- (PU.3), PJC; 24.vi.1975, Glendalough T1-9- (PU.3), PJC.

***Euphylidorea dispar* (Meigen, 1818)**

The Irish records of *Limnobia punctum* and *Limnobia dispar* given in Walker (1856), probably based on information provided by Haliday, are both referable to *Euphylidorea dispar* but unfortunately without any date or locality data being given.

ANTRIM: 19.v.1975, Masserene J1485 (PA.3), AGI; **DERRY**: 22.v.1975, Traad Point, Lough Neagh, near Ballyronan H9587 (PA.3), AGI; **TYRONE**: 22.v.1975, Ardboe, Lough Neagh H9675 (PA.3), AGI; **WEXFORD**: 13.vi.1986, Stoneyford T105098 (PT.3), JPOC; 27.v.1987, Killoughrim Forest Park S8941 (PU.4), JPOC; **WICKLOW**: 24.vi.1975, Whaley Abbey T1-8- (PU.3), PJC; 15.vi.1988, Powerscourt O2012 (PU.3), JPOC.

***Euphylidorea lineola* (Meigen, 1804)**

The records of *lineola* given in Walker (1856: 287), including the Irish record, are according to Verrall (1887) misidentified - these records are referable to *Phylidorea* (*Paraphylidorea*) *fulvonervosa* (Schummel, 1829).

The "Antrim" record refers to County Antrim and no other locality information is given on the labelled specimen, which is preserved in the pinned collections of the Natural History Museum, London. King's notebook in the Hunterian Museum, University of Glasgow (Geoff Hancock pers. comm. to P. Ashe) shows that during a holiday at Newcastle, Co. Down, King went on a three day trip (12-14 July 1912) to Shanes Castle, Co. Antrim, and it is assumed therefore that the specimen was collected in the general vicinity of the castle.

ANTRIM: 12.vii. 1912, "Antrim" [= Shanes Castle, near Randalstown] (PA.3), JJFXK; 17.iv.1974, Masserene, Lough Neagh J1485 (PA.3), AGI; **CLARE**: 9.v.1970, Ballylacken Castle (MU.3), PJC; 9-11.vii.1980, Liscannor R063883 (MU.3), JPOC; 21.v.1985, Lough Bunny R3696 (NU.1)), JMOC; 26.v.1992, Kilshanny R1292 (MU.3), JPOC; **DOWN**: 1827-

1831, Holywood (UF.1), AHH (Haliday, 1833, sub *Limnobia ferruginea*; Walker, 1856, sub *Limnobia ferruginea*); **DUBLIN**: 25.iv.1982, Bull Island O2538 (PV.4), JMOC; **KERRY**: 3.ix.1982, near Ballyheige Q7626 (MU.2), EGH (Hancock, 1990 sub *Limnophila*); 8.ix.1982, Ardfert Q7821 (MT.1), EGH (Hancock, 1990 sub *Limnophila*); **LEITRIM**: 15.v.1970, Glencar, near waterfall (NA.2), PJC; **MONAGHAN**: 20.v.1976, Carrickmacross H8-0- (PV.1), JHC; 21.v.1976, Lough Egish H7813 (PV.1), JHC; **WEXFORD**: 27.viii.1980, Carnsore Point T121038 (PT.3), JPOC; 28.viii.1980, Lady's Island Lake T104071 (PT.3), JPOC.

***Euphylidorea meigenii* Verrall, 1887**

Mendl (1987) records the species from localities in Counties Cork, Donegal, Galway and Kerry.

ANTRIM: 24.v.1975, Slievenance, near Trostan D1621 (PB.4), AGI; 24.v.1975, Glarryford Bog, near Clogh Mills D0515 (PA.3), AGI; **CLARE**: 7.vi.1970, Atorick, 460' R635960 (NU.1), RIVW; 22.v.1985, Cooleabeg M163020 (MU.3), JMOC; **CORK**: 10.vii.1985, tunnel near Glengarriff V909598 (MT.4), JMOC; **DOWN**: 10.vi.1973, Crocknafeola Pine Wood J2722 (PV.3), AGI; **DUBLIN**: 20.vii.1958, Dublin [City] (PV.4), GV; **GALWAY**: 22.ix.1974, near Roundstone (MV.2), MD; 22.ix.-3.x.1974, Roundstone (MV.2), PO; 24.ix.-2.x.1974, Recess (MV.4), PO; 2.x.1974, Twelve Pins (MV.2), MD; **KERRY**: 25.viii.1902, Killarney (MT.3), JJFXK; viii.1940, Killarney (MT.3), BPB; 26.v.1974, Connor Pass Q5-0- (MT.1), KCS; 9.ix.1982, Shevanea Q5005 (MT.1), EGH (Hancock, 1990 sub *Limnophila*); 13.ix.1982, Loch Slat Q601080 (MT.1), EGH (Hancock, 1990 sub *Limnophila*); **KILDARE**: 9.vi.1984, Mouds Bog N771154 (PU.1), JPOC; **LEITRIM**: 10.v.1970, Lough Rinn (NV.3), PJC; **MAYO**: no date [1909-1910], Clare Island (MV.1), PHG (Grimshaw, 1912); **OFFALY**: 30.iv.1984, Clara Bog N265295 (NV.4), JPOC; 8.ix.1988, All Saints Bog N0010 (NU.3), REB/RMB (Speight, 1990 sub *Limonia meigeni*); **WICKLOW**: 3.vi.1970, near Kippure Bog, 1,750' 0140140 (PU.3), RIVW.

***Idioptera linnei* Oosterbroek, 1992**

Idioptera fasciata (Linnaeus, 1767), the old name for this species was found to be preoccupied and the replacement name *linnei* was proposed (Oosterbroek in Savchenko *et al.*, 1992). The record of '*Limnobia fasciata*' from Holywood, Co. Down (Haliday, 1833) is a misidentified *Eloeophila maculata* (see above and Table 1). The Wicklow record detailed below is the only known Irish locality for this endangered Red Data Book species and the record is acceptable because it is such a distinctive species although the original specimen(s) appear to no longer exist.

WICKLOW: viii.1988, Blackditch Wood, (O3103) (PU.3), REB/RMB (Blackith *et al.*, 1991 sub *fasciata*).

***Idioptera pulchella* (Meigen, 1830)**

There is a single preserved Irish male specimen of *I. pulchella* which was collected by Robert and Ruth Blackith and placed in a plastic vial. Apart from the name *"Idioptera pulchella* Mg" written on the lid of the vial there is no other information which indicates the date or the locality where it was collected. However, the vial was in a bag of similar vials, all with similar writing, nearly all of which are associated with their work (Blackith *et al.*, 1991) on the Murrough, Co. Wicklow. This specimen was evidently mislaid and the record was not published by them in their paper. All of their limoniid material from several Murrough localities was collected either in 1988 or 1989 and the most likely specific locality, where most of the material was collected, is Blackditch Wood. This is the first record of this species from Ireland.

The species is listed in Haliday's MS '*Catalogue of Irish insects*' on page 209 as "*Idioptera pulchella* M." (Fig. 2) but the species name is crossed out followed by the word "non" - evidently he considered that his identification was incorrect.

WICKLOW: 1988-1989, The Murrough (probably Blackditch Wood), (O3-0-) (PU.3), REB/RMB.

***Neolimnomyia* (*Brachylimnophila*) *adjuncta* (Walker, 1848)**

See comments under *Neolimnomyia* (*Brachylimnophila*) *nemoralis*.

CAVAN: 12.ix.1991, Woodlawn, Lough Sheelin N4686 (PV.1), JPOC; **CLARE**: 18.v.1970, Cratloe Wood (NU.2), PJC; 19.v.1970, Lahinch, below Moy House (MU.3), PJC; 20.v.1970, near Kilfenora (MU.3), PJC; 9-11.vii.1980, Liscannor R063883 (MU.3), JPOC; 21.v.1985, Lough Bunny R3696 (NU.1), JMOC; **CORK**: 29.v.1974, Dereenacarrin V8-5- (MT.4), KCS; 29.v.1974, Dunboy Castle V6-4- (MT.2), KCS; 29.v.1974, Dunmanus Bay V8-3- (MT.4), KCS; 30.v.1974, Bealad W3-4- (NT.2), KCS; **DUBLIN**: 14.ix.1985, Bull Island O2538 (PV.4); **GALWAY**: 23.v.1974, Maam L9-5- (MV.4), KCS; 22.ix.-3.x.1974, Roundstone (MV.2), PO; **KERRY**: 25-27.v.1929, Killarney (MT.3), FWE (Edwards, 1938, sub *Limnophila* (?*Pilaria*)); 6.ix.1982, Blennerville, near Tralee Q815135 (MT.1), EGH (Hancock, 1990 sub *Limnophila*); 8.ix.1982, Ardfert Q7821 (MT.1), EGH (Hancock, 1990 sub *Limnophila*); 14.ix.1982, near Dreenagh Q715320 (MU.2), EGH (Hancock, 1990 sub *Limnophila*); **KILDARE**: 12.ix.1982, Grand Canal N933263 (PV.4), JMOC; **KILKENNY**: 2.vi.1974, Glenmore S6-2- (PU.2), KCS; 2.vi.1974, south of New Ross S6-2- (PU.2), KCS; **LAOIS:** 20.ix.1982, The Derries N586050 (PU.1), JPOC; **MAYO**: 25-27.ix.1974, Maam Cross, 12 km [error = 12 miles] west of Cong (MV.4), MD; 29.ix.1977, Westport Demesne L9-8- (MV.3), PJC; 30.ix.1977, Lough Conn, north of Pontoon G1-0- (MV.3), PJC; **OFFALY**: 19.ix.1999, Charleville Wood N3222 (NV.4), PJC; **ROSCOMMON**: 28.ix.1977, Lough Ree N0-4- (NV.4), PJC; 28.ix.1977, Castlerea M6-8- (NV.1), PJC; **SLIGO**: 1.x.1977, Ballinacarrow G6-1- (NV.1), PJC; **WEXFORD**: 25.vii.1970, Cahore T2244 (PU.4), RIVW; 9.vi.1986, Nethertown T125050 (PT.3), JMOC; 25.v.1987, Lady's Island Lake T104071 (PT.3), JPOC; 27.v.1987, Killoughrim Forest Park S8941 (PU.4), JPOC; 28.v.1987, Curracloe T1127 (PU.4), JPOC; **WICKLOW**: 1.vi.1970, near Six Mile Point O315050 (PU.3), RIVW; 19.ix.1982, Russellstown Park N9611 (PU.3), JPOC.

***Neolimnomyia* (*Brachylimnophila*) *nemoralis* (Meigen, 1818)**

Most sources recognise two European species of *Brachylimnophila*, *adjuncta* and *nemoralis*, but Mendl (1987) questioned the validity of the main separating character on the wing venation and recognised only *nemoralis* (with *adjuncta* as a junior synonym). In this paper, both species are considered to be valid species. Consequently, Mendl's (1987) records of *nemoralis* from Counties Clare, Cork, Galway, Kerry, Mayo, Sligo and Wicklow, which presumably include a mixture of both *adjuncta* and *nemoralis*, have not been included on the maps.

ANTRIM: 2.ix.1972, Belfast J3269 (UF.2), RN; 16.vi.1974, Belfast J322692 (UF.2), RN; **CARLOW**: 1.vii.1991, St Mullins S7238 (PU.2), JMOC; **CLARE**: 28.vii.1966, St Catherine's Island, Doolin Cave System R0898 (MU.3), RAL (Hazelton 1974a, b, c, sub *Limnophila* (*Pilaria*)); 23.vii.1975, Bridget Lake, Tulla R556810 (NU.1), AES; 25.v.1992, Lisdoonvarna Spa R1397(MU.3), JMOC; 26.v.1992, Kilshanny R1292 (MU.3), JPOC; 2.vi.1992, Rathborney River, Burren M2004 (MU.3), JPOC; **CORK**: 28.vi.1969, Tobar Ghobnatan, near Ballyvourney (MT.3), PJC; 19-20.vi.1970, Glengarriff State Forest V9157 (MT.4), RIVW; 29.v.1974, Adrigole V8-4- (MT.2), KCS; 3.vii.1985, Bantry House V985481 (MT.4), JPOC; **DOWN**: 1827-1831, Holywood (UF.1), AHH (Haliday, 1833, sub *Limnobia*); 18.viii.1974, Ballygowan J4163 (UF.2), AGI; **DUBLIN**: 27.vi.1975, Howth Woods, Dublin O2-3- (PV.4), PJC; **GALWAY**: 22.ix.-3.x.1974, Roundstone (MV.2), PO; 1.vi.1992, Coole Woods M4304 (NU.1), JMOC; **KERRY**: 4.vii.1969, Owenreagh River Valley, Killarney (MT.3), PJC; 8.ix.1982, Ardfert Q7821 (MT.1), (Hancock, 1990 sub *Limnophila*); **KILDARE**: 11.ix.1985, Newbridge Fen N767166 (PU.1), JPOC; **KILKENNY**: 15.vii.1975, Davidstown S646186 (PT.1), AES; **LIMERICK**: 19.vii.1975, Adare Bridge R472466 (NU.2), AES; **LOUTH**: 29.vi.1975, Ballymascanlon Swamp J0-1- (PV.3), PJC; 29.vi.1975, Thomastown N9-9- (PV.3), PJC; **MAYO**: no date [1909-1910], lough near Westport (MV.3), PHG (Grimshaw, 1912); no date [1909-1910], Brackloon Wood (MV.3), PHG (Grimshaw, 1912); **OFFALY**: 26.vi.1987, Slieve Bloom N2204 (NU.3), PJC; **TIPPERARY**: 22.vi.1975, Woodrooff S1-2- (NU.4), PJC; **WATERFORD**: 15.vii.1975, Carrickbeg S404216 (PT.1), AES; **WESTMEATH**: 22.vi.1989, Ballynafid Lake N4060 (PV.2), JPOC; **WEXFORD**: 15.vii.1975, near Newbawn S856244

(PU.4), AES; 4.vi.1987, 27.v.1987, Killoughrim Forest Park S8941 (PU.4), JPOC; **WICKLOW**: 11.vii.1971, near Dunlavin (PU.3), PJC; 24.vi.1975, Whaley Abbey T1-8- (PU.3), PJC; 24.vi.1975, Glendalough T1-9- (PU.3), PJC; 25.vi.1975, Devil's Glen T2-9- (PU.3), PJC; 25.vi.1975, Powerscourt Deer Park O1-1- (PU.3), PJC; 27.v.1988, Avondale T1985 (PU.3), JPOC; v.-vi.1988, Blackditch Wood O3103 (PU.3), REB/RMB, Malaise trap sample (Blackith *et al.*, 1991); v.1989, Blackditch Wood O3103 (PU.3), REB/RMB, bred from mossy woodland litter and mud (Blackith *et al.*, 1991); vi.1989, Killoughter Marsh Field T3199 (PU.3), REB/RMB (Blackith *et al.*, 1991).

***Neolimnomyia* (*Neolimnomyia*) *batava* (Edwards, 1938)**

The type-localities for *N. batava* includes Wexford and several British localities. The main (world) collections in the Natural History Museum (London) contains two syntype specimens collected by King on the 28.vi.1902 with "Wexford" on the label which evidently refers to County Wexford. In the Hunterian Museum, University of Glasgow collections, there is a single female syntype collected on the 11.vii.1902 also with "Wexford" on the label and with an Edwards determination label. The specific Wexford locality where the specimens were collected has been determined as Edenvale, near Castlebridge where a stream and a waterfall are located For an explanation on how the specific Wexford locality was identified see the text concerning King in the materials and methods section.

TIPPERARY: 16.vii.1975, Burncourt R937192 (NT.3), AES; **WEXFORD**: 28.vi.1902, 11.vii.1902, "Wexford" [= Edenvale, near Castlebridge] (PU.4), JJFXK (Edwards, 1938, sub *Limnophila* (?*Pilaria*)).

***Neolimnomyia* (*Neolimnomyia*) *filata* (Walker, 1856)**

Recorded by Mendl (1987) from Counties Galway and Kerry.

CORK: 3.vii.1985, Bantry House V985481 (MT.4), JPOC; 6.vii.1989, Rahan W6497 (NT.1), JPOC; **KERRY**: 29.vi.1969, Rossacroonaloo Wood W0478 (MT.3), PJC; 2.vii.1969, Killarney, by Dinis Road between lakes (MT.3), PJC; **MAYO**: 29.ix.1977, Westport Demesne L9-8-

(MV.3), PJC; **TIPPERARY**: 22.vi.1975, wildlife sanctuary, near Dundrum R9-4- (NU.4), PJC; **WATERFORD**: 1.vi.1991, Belle Lake S6605 (PT.1), JPOC; **WESTMEATH**: 22.vi.1989, Ballynafid Lake N4060 (PV.2), JPOC; **WEXFORD**: 2.vi.1986, Ferrycarrig T005228 (PT.3), JPOC; **WICKLOW**: 7.vii.1969, Glencree, river below barracks (PU.3), PJC; 8.vii.1969, above Poll an Easa Waterfall, Glendalough (PU.3), PJC; 24.vi.1975, Glendalough T1-9- (PU.3), PJC; 20.vi.1991, Kilmacanoge Marsh O2513 (PU.3), PA.

***Paradelphomyia* (*Oxyrhiza*) *fuscula* (Loew, 1873)**

The Enniskerry specimen is preserved in the collections of the Natural History Museum, London.

WICKLOW: vii.1940, Enniskerry (PU.3), BPB (Coe, 1950: 45, "S.E.Ireland", sub *Oxydiscus fusculus*); 16.ix.1968, wood near Aughrim River (PU.3), PJC.

***Paradelphomyia* (*Oxyrhiza*) *senilis* (Haliday, 1833)**

This species was first described by Haliday (1833) from material collected at Holywood, Co. Down. The type, a single pinned adult male (with one wing and five legs missing), bearing three labels: (i) a green label with "Ireland" printed in black; (ii) a white museum accession label with "Haliday, 20.2.'82" printed in black, and (iii) a white identity label with ". senilis, H" handwritten in black ink. This specimen is preserved in the collections of the National Museum of Ireland.

Mendl (1987) recorded this species from Counties Cork and Kerry.

DOWN: 1827-1831, Holywood (UF.1), AHH (Haliday, 1833, sub *Limnobia*; Walker, 1856, sub *Dicranota*); **KERRY**: 14.ix.1982, near Dreenagh Q715320 (MU.2), EGH (Hancock, 1990); **LOUTH**: 29.vi.1975, Ballymascanlon Swamp J0-1- (PV.3), PJC; **TIPPERARY**: 22.vi.1975, wildlife sanctuary, near Dundrum R9-4- (NU.4), PJC; 15.vii.1975, north-west of Caher S030275 (NU.4), AES; **WATERFORD**: 11.vi.1991, Dunmore East S6800 (PT.1), JPOC; **WICKLOW**: iv.-vi.1988, Blackditch Wood O3103 (PU.3), REB/RMB, Malaise trap sample (Blackith *et al.*, 1991); v.1989, Blackditch Wood O3103 (PU.3), REB/RMB, bred from rotten birch (Blackith *et al*., 1991).

***Phylidorea (Paraphylidorea) fulvonervosa* (Schummel, 1829)**

Mendl (1987) records this species from Counties Cork, Galway, Kerry, Mayo and Waterford. Recorded from Ireland, without any locality data, by Walker (1856, sub *lineola* [misidentified = *fulvonervosa*]) - see note on *Euphylidorea lineola*.

CAVAN: 4.vi.1990, Virginia Woods N5987 (PV.1), JMOC; **CLARE**: 7.vi.1970, Atorick, 460' R635960 (NU.1), RIVW; 25.v.1992, Lisdoonvarna Spa R1397 (MU.3), JMOC; 31.v.1992, Kilshanny R1292 (MU.3), JPOC; **CORK**: 28.vi.1969, Tobar Ghobnatan, near Ballyvourney (MT.3), PJC; 19-20.vi.1970, Glengarriff State Forest V9157 (MT.4), RIVW; 10.vii.1985, tunnel near Glengarriff V909598 (MT.4), JMOC; **DUBLIN**: 12.vi.1953, Howth (PV.4), RLC; **GALWAY**: 24.vii.1958, between Moycullen and Spiddle (MV.4), GV; 24.ix.-2.x.1974, Recess (MV.4), PO; **KERRY**: 18.viii.1902, Kenmare (MT.4), JJFXK; 29.vi.1969, Glenflesk (MT.3), PJC; 2.vii.1969, Dinis Road between lakes, Killarney (MT.3), PJC; 16.vi.1970, Lough Accose V750850 (MT.1), RIVW; 17.vii.1975, Clonee Loughs, south-west of Kenmare V8264 (MT.4), AES; 17.vii.1975, Looscaunagh Lake, Derrygarriff V887704 (MT.4), AES; 18.vii.1975, Knockeirka V947666 (MT.4), AES; **LOUTH**: 29.vi.1975, Ballymascanlon Swamp J0-1- (PV.3), PJC; 29.vi.1975, Thomastown N9-9- (PV.3), PJC; **MAYO**: no date [1909-1910], Brackloon Wood (MV.3), PHG (Grimshaw, 1912, sub *lineolella* Verrall); **WATERFORD**: 18.vi.1990, Ballin Lough S4403 (PT.1), JMOC; **WESTMEATH**: 22.vi.1989, Ballynafid Lake N4060 (PV.2), JPOC; **WEXFORD**: 25.vii.1970, Cahore T2244 (PU.4), RIVW; 9.vi.1986, Nethertown T125050 (PT.3), JMOC; 15.vi.1990, Tintern Abbey S7810 (PT.1), JPOC; 19.vi.1990, pond near Killowen S7121 (PU.2), JMOC; **WICKLOW**: 20.vii.1958, Sally Gap, 600 m. (PU.3), GV; 8.vii.1969, above Poll an Easa Waterfall, Glendalough (PU.3), PJC; 23.vi.1975, Wicklow Gap O0-0- (PU.3), PJC; 26.vi.1975, Bellevue Woods, Glen of the Downs O2-1- (PU.3), PJC; 12.vii.1983, 22.viii.1988, near Calary Lower O234119 (PU.3), JPOC; 15.vi.1988, Powerscourt O2012 (PU.3), JPOC; iv.-vi.1988, Blackditch Wood O3103 (PU.3), REB/RMB, Malaise trap sample (Blackith *et al*., 1991 sub *Euphylidorea*); v.1988, Blackditch Wood O3103 (PU.3), REB/RMB, bred from *Phragmites* stem bases (Blackith *et al*., 1991 sub *Euphylidorea*).

***Phylidorea* (*Phylidorea*) *abdominalis* Staeger, 1840**

KERRY: 29.vi.1969, Rossacroonaloo Wood W0478 (MT.3), PJC (Ashe *et al*.,1991).

***Phylidorea* (*Phylidorea*) *ferruginea* (Meigen, 1818)**

Recorded by Mendl (1987) from Counties Cork, Donegal, Galway, Kerry and Mayo. The records of *ferruginea* given in Haliday (1833) and Walker (1856) are misidentifications of *Euphylidorea lineola* (Meigen).

CAVAN: 2.x.1989, Virginia Woods N5987 (PV.1), JMOC; **CLARE**: 26.v.1975, Lough Bunny R3695 (NU.1), AGI; 21.v.1985, 28.v.1985, Lough Bunny R3696 (NU.1), JMOC; 28.v.1992, Lough Bunny R3696 (NU.1), JPOC; 5.vi.1992, Cratloe Wood R5061 (NU.2), JPOC; **CORK**: 29.v.1974, Dromnea V8-3- (MT.4), KCS; **DONEGAL**: no date (?1970's), Carrigan Head, Slieve League G5575 (NA.1), AGI; **DOWN**: 18.v.1975, Ballygowan J4063 (UF.2), AGI; **GALWAY**: 22.ix.-3.x.1974, Roundstone (MV.2), PO; **KERRY**: 25-27.v.1929, Killarney (MT.3), FWE; 29.vi.1969, Glenflesk (MT.3), PJC; 17.vii.1975, south of Killarney V932826 (MT.3), AES; 8.ix.1981, Kenmare Estate, Killarney V945905 (MT.3), JPOC; **KILKENNY**: 2.vi.1974, Glenmore S6-2- (PU.2), KCS; **MAYO**: vi.1909, Clare Island (MV.1), JNH (Grimshaw, 1912); vii.1910, Louisburgh (MV.1), JNH (Grimshaw, 1912); no date [1909-1910], lough near Westport (MV.3), PHG (Grimshaw, 1912); no date [1909-1910], Knappagh (MV.3), PHG (Grimshaw, 1912); **MONAGHAN**: 15.vii.1971, near Lough Muckno (PV.1), PJC; 20.v.1976, Carrickmacross H8-0- (PV.1), JHC; 21.v.1976, Lough Egish H7813 (PV.1), JHC; **ROSCOMMON**: 14.v.1970, Lough Ree shore (NV.4), PJC; **WATERFORD**: 4.vii.1989, Ballin Lough S4403 (PT.1), JMOC; 1.vi.1991, Belle Lake S6605 (PT.1), JPOC; **WESTMEATH**: 7.v.1988, Ballynafid Lake (PV.2), PJC; 30.v.1990, Derravaragh Lough N4762 (PV.2), JPOC; **WEXFORD**: 25.vii.1970, Cahore T2244 (PU.4), RIVW; 15.vii.1975, near Newbawn S856244 (PU.4), AES; 26.viii.1980, Carnsore Point T1103 (PT.3), JPOC; 4.vi.1986, The Raven T110260 (PU.4), JPOC; 6.vi.1986, Nethertown T125050 (PT.3), JMOC; 25.v.1987, Lady's Island Lake T104071 (PT.3), JPOC; 28.v.1987, near Glenbough T0929 (PU.4), JPOC; 10.vi.1991, Curracloe T1127 (PU.4), JPOC; **WICKLOW**: 15.viii.1982, Kilmacanoge Marsh O2514 (PU.3), JMOC; vi.-viii.1988, Blackditch Wood O3103 (PU.3), REB/RMB, Malaise trap sample (Blackith *et al*., 1991); v.1989, Blackditch Wood O3103 (PU.3), REB/RMB, bred from mossy woodland litter (Blackith *et al*., 1991); vi.1988, Killoughter Marsh Field T3199 (PU.3), REB/RMB (Blackith *et al*., 1991).

***Phylidorea* (*Phylidorea*) *squalens* (Zetterstedt, 1838)**

Recorded from Counties Cork, Donegal, Galway and Kerry by Mendl (1987).

CORK: 29.v.1974, Dereenacarrin V8-5- (MT.4), KCS; 10.vii.1985, tunnel near Glengarriff V909598 (MT.4), JMOC; **KERRY**: 25-27.v.1929, Killarney (MT.3), FWE (Edwards, 1938, sub *Limnophila* (*Phylidorea*)); 12.vi.1970, Lough Gal, 400' Q476068 (MT.1), RIVW; **KILDARE**: 9.vi.1984, Mouds Bog N771154 (PU.1), JPOC; **WICKLOW**: 26.vi.1970, Military Road Falls O112030 (PU.3), RIVW.

***Pilaria discicollis* (Meigen, 1818)**

There are two Irish Haliday specimens. The first specimen is a pinned adult female bearing (i) a handwritten ink "*fuscipenn*" [=*fuscipennis*] label, (ii) a green printed "Haliday" label and (iii) a white printed "Haliday 20.2.'82" label. The second specimen is a pinned adult female (with the same latter two labels but no species identity label). Both specimens were re-identified and labelled by R. I. Vane-Wright in 1971 as *Pilaria discicollis*. It is therefore accepted here that Haliday's (1833) record of '*Limnobia fuscipennis*' is erroneous and was based on a misidentification of these two *P. discicollis* specimens.

Mendl (1987) records the species from Counties Cork and Meath.

ANTRIM: 30.vi.1975, Masserene, Lough Neagh J1-8- (PA.3), PJC; **CARLOW**: 24.vii.1975, Graiguealug S766715 (PU.1), AES; **CORK**: 19-20.vi.1970, Glengarriff State Forest V9157

(MT.4), RIVW; **DOWN**: 1827-1831, Holywood (UF.1), AHH (Haliday, 1833, sub *Limnobia fuscipennis* Meigen - misidentified); 18.viii.1974, Ballygowan J4163 (UF.2), AGI; **GALWAY**: 22.ix.-3.x.1974, Roundstone (MV.2), PO; 24.ix.-2.x.1974, Recess (MV.4), PO; **KERRY**: 17.vii.1975, Reen V870705 (MT.4), AES; 8.ix.1982, Ardfert Q7821 (MT.1), EGH (Hancock, 1990); **LOUTH**: 29.vi.1975, Ballymascanlon Swamp J0-1- (PV.3), PJC; **MAYO**: 17.vi.1909, Clare Island (MV.1), PHG (Grimshaw, 1912, sub *Limnophila*); no date [1909-1910], Castlebar (MV.3), anon. (Grimshaw, 1912); **TIPPERARY**: 22.vi.1975, Woodrooff S1-2- (NU.4), PJC; 15.vii.1975, north-west of Caher S030275 (NU.4), AES; **TYRONE**: 22.v.1975, Washing Bay, Lough Neagh H9066 (PA.4), AGI; **WEXFORD**: 14.vii.1975, Orristown T0413 (PT.3), AES; 15.vii.1975, near Newbawn S856244 (PU.4), AES; **WICKLOW**: iv.-viii.1988, Blackditch Wood O3103 (PU.3), REB/RMB, Malaise trap sample (Blackith *et al.*, 1991).

***Pilaria fuscipennis* (Meigen, 1818)**

The only record of this species in Ireland is given in Mendl (1987) who recorded it from the Gap of Dunloe, near Killarney, Co. Kerry.

***Pilaria meridiana* (Staeger, 1840)**

First recorded by Mendl (1987) from a single locality near Ballyconneely in the Connemara region, Co. Galway.

WICKLOW: 22.viii.1988, near Calary Lower O234119 (PU.3), JPOC.

***Pseudolimnophila lucorum* (Meigen, 1818)**

Recorded from one locality in the Connemara region of Co. Galway by Mendl (1987).

CLARE: 20.vii.1975, Aglish R325920 (MU.3), AES; **KERRY**: 3.vii.1969, Lough Caragh (MT.1), PJC; 17.vii.1975, Reen V870705 (MT.4), AES.

***Pseudolimnophila sepium* (Verrall, 1886)**

The Waterford record given in Edwards (1938) is based on a J. J. F. X. King specimen but no such specimen appears to exist in the Natural History Museum (London) collections though the Killarney specimen is in their pinned collections. The specimens are not in the Hunterian

Museum, University of Glasgow, but may be preserved in the Edinburgh Museum whose collections are not currently accessible due to re-location to different premises. At present, no collecting date has been determined but sometime in late July or early August of 1902 is likely and the general vicinity of Cappoquin is where the material was collected (see text concerning King in the materials and methods sections).

KERRY: 25.viii.1902, Killarney (MT.3), JJFXK (Coe, 1950: 43, "S.W.Ireland", sub *Limnophila* (*Pseudolimnophila*)); **WATERFORD**: vii-viii.1902, "Cappoquin" [= vicinity of Cappoquin] (NT.3), JJFXK (Edwards, 1938, sub *Limnophila* (*Pseudolimnophila*)); **WICKLOW**: 11.vii.1971, near Dunlavin (PU.3), PJC.

Discussion

The single Dactylolabinae species, *Dactylolabis sexmaculata*, is so far only known from the limestone pavement areas of the Burren, Co. Clare, but could be expected to occur in similar habitats in a few other western counties. In Britain, a second species of Dactylolabinae, *D. transversa* (Meigen, 1804) is known, which has not yet been found in Ireland.

There are only two Irish counties (Armagh and Longford) out of a total of 32 counties for which there are no Limnophilinae records. The most common and widespread Irish species is *Austrolimnophila ochracea*. From the available records, several other species including *Eloeophila maculata*, *Euphylidorea meigenii*, *Neolimnomyia* (*Brachylimnophila*) *adjuncta*, *Neolimnomyia* (*Brachylimnophila*) *nemoralis*, *Phylidorea* (*Paraphylidorea*) *fulvonervosa* and *Phylidorea* (*Phylidorea*) *ferruginea* are also common and widespread.

The total British Limnophilinae fauna now numbers 45 species (including additional species of *Neolimnomyia* and *Pilaria*), based on Stubbs's MS key, of which 28 occur in Ireland. The additional Limnophilinae found in Britain include two more genera, *Hexatoma* and *Limnophila*, and 17 species. These genera (*Hexatoma* and *Limnophila*) and most of the 17 additional British species are likely to be found in Ireland with more intensive collecting.

Based on Falk's (1991) assessment of the scarce and threatened flies in Britain, there are 16 species (two Dactylolabinae and 14 Limnophilinae) which fit into one of the four main Red Data Book [= RDB] categories which in order of importance are "RDB1 - endangered", "RDB2 - vulnerable", "RDB3 - rare" and "notable". Of these 16 Red Data Book species, there are nine known from Ireland and their identity and ranking based on Falk (1991) are as follows:-.

Dactylolabinae	
Dactylolabis sexmaculata	Notable
Limnophilinae	
Idioptera linnei	RDB1 - Endangered
Eloeophila apicata	Notable
Eloeophila mundata	Notable
Eloeophila trimaculata	Notable
Idioptera pulchella	Notable
Paradelphomyia (Oxyrhiza) fuscula	Notable
Pilaria fuscipennis	Notable
Pilaria meridiana	Notable

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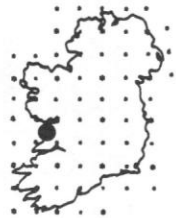
TABLE 1. List of 19th century Limnophilinae recorded from Ireland by Haliday (1833) and Walker (1856) with numbers 1 to 4 in the right column being the same four species found in both publications.

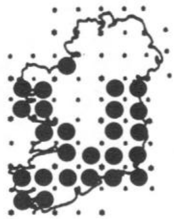
Page	Name used by Haliday	Identity of Name used by Haliday	
148	*Limnobia fasciata*	misidentified = *Eloeophila maculata* (Meigen)	1
148	*Limnobia marmorata*	misidentified = *Eloeophila maculata* (Meigen)	2
148,153	*Limnobia decora*	misidentified = *Eloeophila maculata* (Meigen)	
148	*Limnobia fuscipennis*	misidentified = *Pilaria discicollis* (Meigen)	
148	*Limnobia nitidicollis*	misidentified, possibly a *Pilaria* species	
148	*Limnobia nemoralis*	*Neolimnomyia* (*Brachylimnophila*) *nemoralis* (Meigen)	
148,153	*Limnobia senilis*	*Paradelphimyia* (*Oxyrhiza*) *senilis* (Haliday)	3
148	*Limnobia ferruginea*	? = *Phylidorea* (*Phylidorea*) *ferruginea* (Meigen)	
151	*Limnobia picta*	*Epiphragma ocellaris* (Linnaeus)	4

Page	Name used by Walker	Identity of Name used by Walker	
283	*Limnobia fasciata*	misidentified = *Eloeophila maculata* (Meigen)	1
283	*Limnobia trimaculata*	misidentified = *Eloeophila maculata* (Meigen)	
284	*Limnobia marmorata*	misidentified = *Eloeophila maculata* (Meigen)	2
285	*Limnobia lucorum*	misidentified = *Austrolimnophila ochracea* (Meigen)	
286	*Limnobia ferruginea*	misidentified = *Euphylidorea lineola* (Meigen)	
286	*Limnobia punctum*	*Euphylidorea dispar* (Meigen)	
286-7	*Limnobia dispar*	*Euphylidorea dispar* (Meigen)	
287	*Limnobia lineola*	misidentified = *Phylidorea* (*Paraphylidorea*) *fulvonervosa* (Schummel)	
288	*Limnobia punctata*	possibly a species of *Limnophila*	
288	*Limnobia picta*	*Epiphragma ocellaris* (Linnaeus)	4
306	*Dicranota senilis*	*Paradelphomyia* (*Oxyrhiza*) *senilis* (Haliday)	3

FIGURE 1. Distribution maps, based on the UTM 50km grid, for Dactylolabinae and Limnophilinae cranefly species occurring in Ireland, as well as a coverage map for all records.

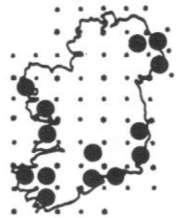


Dactylolabis sexmaculata

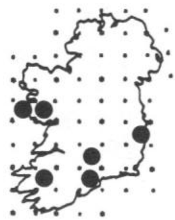


Austrolimnophila ochracea

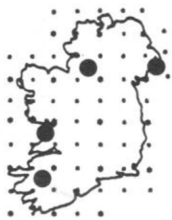
Eloeophila apicata



Eloeophila maculata

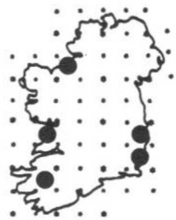


Eloeophila mundata



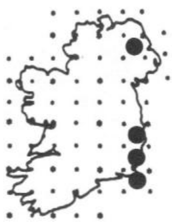
Eloeophila submarmorata

Eloeophila trimaculata

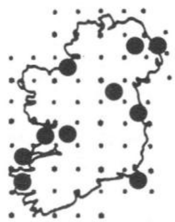


Epiphragma ocellaris

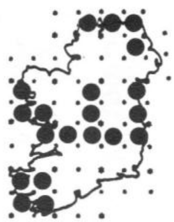
Euphylidorea aperta



Euphylidorea dispar

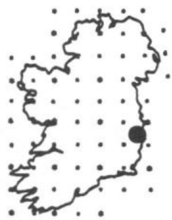


Euphylidorea lineola



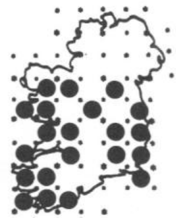
Euphylidorea meigenii

FIGURE 1 (continued).



Idioptera linnei

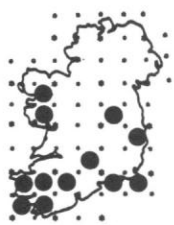
Idioptera pulchella



Neolimnomyia (Brachylimnomyia) adjuncta

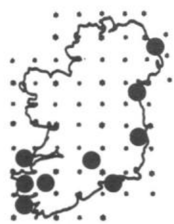
Neolimnomyia (Brachylimnomyia) nemoralis

Neolimnomyia (Neolimnomyia) batava

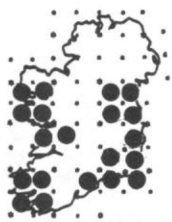


Neolimnomyia (Neolimnomyia) filata

Paradelphomyia (Oxyrhiza) fuscula

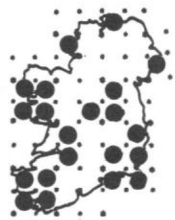


Paradelphomyia (Oxyrhiza) senilis

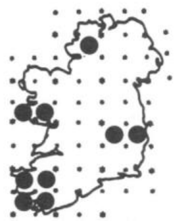


Phylidorea (Paraphylidorea) fulvonervosa

Phylidorea (Phylidorea) abdominalis

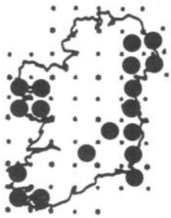


Phylidorea (Phylidorea) ferruginea



Phylidorea (Phylidorea) squalens

FIGURE 1 (continued).

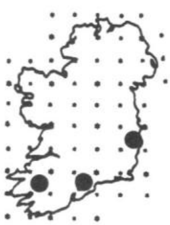


Pilaria discicollis

Pilaria fuscipennis

Pilaria meridiana

Pseudolimnophila lucorum



Pseudolimnophila sepium

Coverage

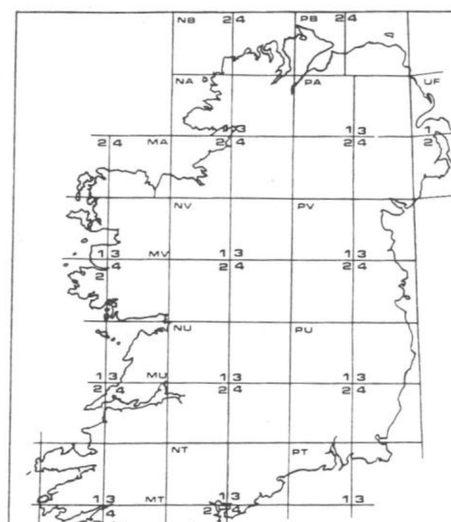


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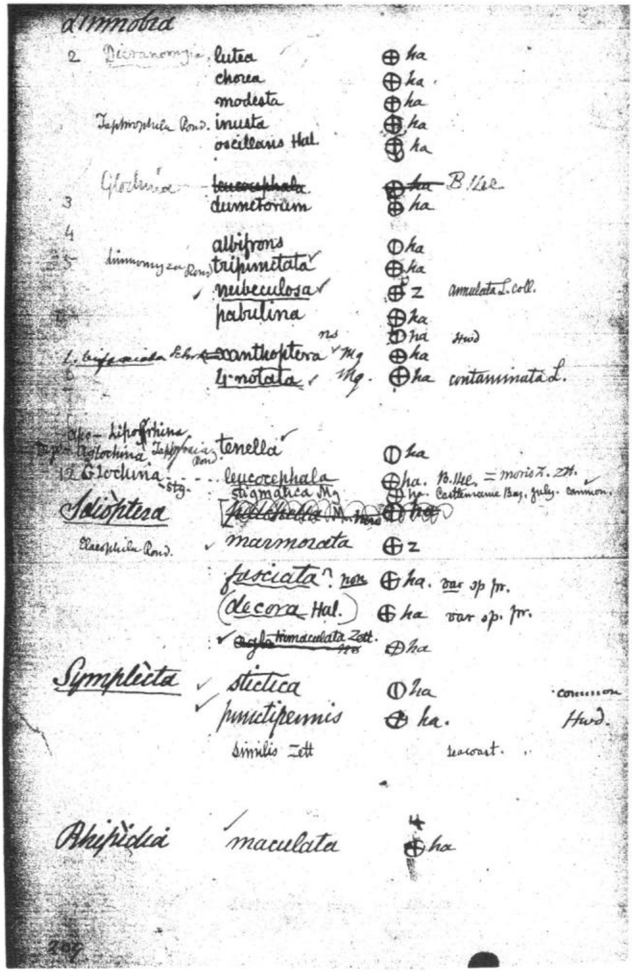
FIGURE 2. Page 209 from Haliday's unpublished MS '*Catalogue of Irish insects*' which shows "*ægle*" and the word "no" with a line through both and replaced above with "*trimaculata* Zett.". Also shown is "*Idioptera pulchella* M." but the species name is crossed out followed by the word "non".



Limnobia

2 Dicranomyia lutea ⊕ ha
chorea ⊕ ha
modesta ⊕ ha
Taphrophila Rond. inusta ⊕ ha
oscillans Hal. ⊕ ha

Glochina ~~leucocephala~~ ⊕ ~~ha~~ B.Mee.
3 dumetorum ⊕ ha

4 albifrons ⊕ ha
5 Limnomyza Rond. tripunctata ⊕ ha
nubeculosa ⊕ z annulata L. coll.
pabulina ⊕ ha
ns ⊕ ha Hwd
xanthoptera Mg ⊕ ha
6 4-notata Mg. ⊕ ha contaminata L.

tenella ⊕ ha
Glochina leucocephala ⊕ ha. B.Mee. = morio Z. ZH.
stigmatica Mg ⊕ ha. Castlemaine Bay, July. common.
Idioptera ~~pulchella~~ M. non
Elaeophila Rond. marmorata ⊕ z

fasciata? non ⊕ ha. var sp pr.
(decora Hal.) ⊕ ha var sp. pr.
~~ægle~~ trimaculata Zett. ~~no~~ ⊕ ha

Symplecta stictica ⊕ ha common
punctipennis ⊕ ha. Hwd.
similis Zett seacoast.

Rhipidia maculata ⊕ ha

209

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THE CRANEFLIES (DIPTERA) OF IRELAND. PART 4. CYLINDROTOMIDAE

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Abstract

The Irish fauna of the small Family Cylindrotomidae consists of only three species whereas in Britain and parts of continental Europe, four species are widely distributed. An additional two species are confined to Northern Europe. It is considered likely that the fourth British species, *Triogma trisulcata* (Schummel, 1829), will eventually be found in Ireland with more intensive collecting or by specifically searching for it.

Introduction

This is the fourth of a series of papers, (the first, second and third respectively being Ashe *et al.* (1995, 1998, 2005)), which aims to provide a detailed review of the records, literature and distribution of all the Irish cranefly species. The most recent checklist (Chandler, 1998) lists all three Irish species of Cylindrotomidae included in this work. *Phalacrocera replicata* (Linnaeus, 1758) was the only species of Cylindrotomidae included in the Irish checklist of aquatic insects (Ashe *et al.,* 1998) because the other two species are terrestrial.

The collections of the National Museum of Ireland contain three pinned British Haliday specimens (without date or locality) of *Cylindrotoma distinctissima* (Meigen, 1818) but no Irish specimens. Haliday (1833) does not list this species or any other Cylindrotomidae occurring in

Ireland. However in Haliday's unpublished MS '*Catalogue of Irish insects*' (pp 208-209), the generic name "(*Cylindrotoma*)" is used in association with several species of the Family Pediciidae. Evidently, Haliday did not know what the true *Cylindrotoma* looked like until he collected the three British specimens or saw the species in other insect collections.

The only published 19th century reference to Cylindrotomidae in Ireland is Walker (1856: 313), for *C. distinctissima*, the distribution of which is given as "(E. S. I.)" where E., S. and I. respectively mean England, Scotland and Ireland. The specimen(s) on which this Irish record is based were most likely collected by Haliday. All that can be said with certainty is that there is a reliable 19th century Irish record in Walker (*op. cit.*) but without any date, county or locality being specified.

Apart from the checklists mentioned above, the only published 20th century records of Cylindrotomidae from Ireland are for *Diogma glabrata* (Meigen, 1818) in Edwards (1938) and Beirne (1951) and for *P. replicata* in Ashe *et al.* (1991).

Materials and methods

The Irish national grid reference (six, four or two figure reference) is included where possible followed by the Universal Transverse Mercator (UTM) 50km grid reference in parentheses. The method used to obtain the UTM references is described in Rasmont *et al.* (1986). The nomenclature for the Cylindrotomidae follows Soós and Oosterbroek (1992). Species were identified using Coe (1950) and an unpublished MS key prepared by Alan Stubbs.

List of collectors and abbreviations used for collectors' names

P. Ashe = PA; B. P. Beirne = BPB; P. J. Chandler = PJC; J. J. F. X. King = JJFXK; J. P. O'Connor = JPOC; J. P. O'Connor and M. A. O'Connor = JMOC; J. Scharff = JS.

A checklist of Irish Cylindrotomidae

Cylindrotoma distinctissima (Meigen, 1818)

Diogma glabrata (Meigen, 1818)

Phalacrocera replicata (Linnaeus, 1758)

***Cylindrotoma distinctissima* (Meigen, 1818)**

There is a reliable 19th century Irish record in Walker (1856) for this species but without any date, county or locality being specified (for more details, see introduction).

ANTRIM: 7.v.1970, Glenariff (PB.4), PJC; **CAVAN**: 30.v.1981, Virginia, in mixed woodland N593877 (PV.1), JMOC; **DUBLIN**: no date [1920's], Dundrum (PV.4), JS; 18.vii.1982, Slade of Saggart, at riverbank O033245 (PV.4), JMOC; **KERRY**: 8.ix.1981, Kenmare Estate, Killarney V945905 (MT.3); JPOC; 29.v.1992, Clydagh Bridge, River Flesk W114826 (MT.3), PA; **GALWAY**: 21.v.1970, Clarinbridge (NU.1), PJC; 21.v.1970, Coole Park (NU.1), PJC; **WATERFORD**: 8.vii.1989, Glasha River S3022 (NU.4), JMOC; **WESTMEATH**: 31.v.1983, Lough Ennell N290468 (PV.2), JPOC; **WEXFORD**: 7.vi.1986, Oaklands, in mixed woodland S715255 (PU.2), JMOC; **WICKLOW**: 27.viii.1981, Glen of the Downs O263110 (PU.3), JPOC.

***Diogma glabrata* (Meigen, 1818)**

ARMAGH: 15.vii.1971, Newry Forest (PA.4), PJC; **WATERFORD**: 27.vii.1902, 28.vii. 1902, 1.viii.1902, Cappoquin (NT.3), JJFXK (Edwards, 1938 as Waterford); **WICKLOW**: vi.1940, Enniskerry (PU.3), BPB (Beirne, 1951).

***Phalacrocera replicata* (Linnaeus, 1758)**

WESTMEATH: 28.vi.1987, Glen Lough N2766 (NV.4), PJC (Ashe *et al.*, 1991).

Discussion

There are 22 Irish counties out of a total of 32 for which there are no Cylindrotomidae records. Based on the available records, the most common and widespread Irish species is *C. distinctissima*.

In Britain a fourth species of Cylindrotomidae, *Triogma trisulcata* (Schummel, 1829), is known. Although it has not yet been found in Ireland, it could be expected to occur here. *T. trisulcata* is a rare species, apparently with a short flight period (month of May) and is associated with aquatic mosses in seepage bog and upland streams (Falk, 1991).

Based on Falk's (1991) assessment of the scarce and threatened flies in Britain, three of the four species of Cylindrotomidae fit into one of the four main Red Data Book [= RDB] categories which are in order of importance:- "RDB1 - endangered", "RDB2 - vulnerable", "RDB3 - rare" and "notable". Of these three Red Data Book species, there are two known from Ireland. Their identity and ranking based on Falk (1991) are as follows:-

Cylindrotomidae

Diogma glabrata	Notable
Phalacrocera replicata	Notable

Acknowledgement

We are grateful to M. A. O'Connor for her help in collecting specimens.

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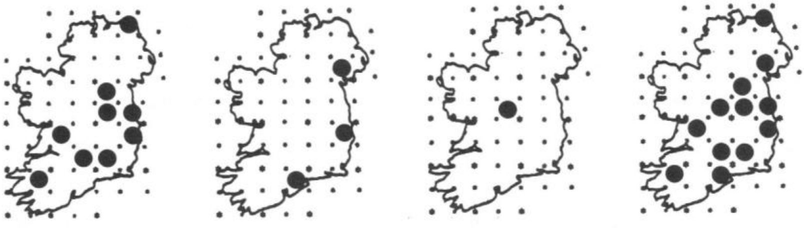
FIGURE 1. Distribution maps, based on the UTM 50km grid, for Cylindrotomidae cranefly species occurring in Ireland, as well as a coverage map for all records.



Cylindrotoma distinctissima | *Diogma glabrata* | *Phalacrocera replicata* | Coverage

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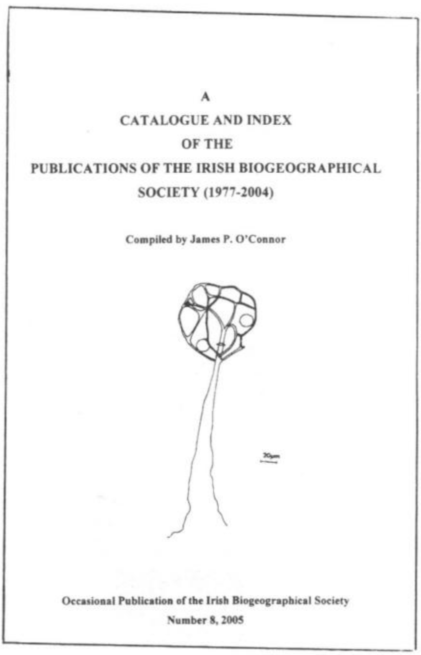
A CATALOGUE AND INDEX OF THE PUBLICATIONS OF THE IRISH BIOGEOGRAPHICAL SOCIETY (1977-2004) Compiled by J. P. O'Connor. *Occasional Publication* **No. 8**. 2005. 74pp. Price €10 or £10.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OF THE
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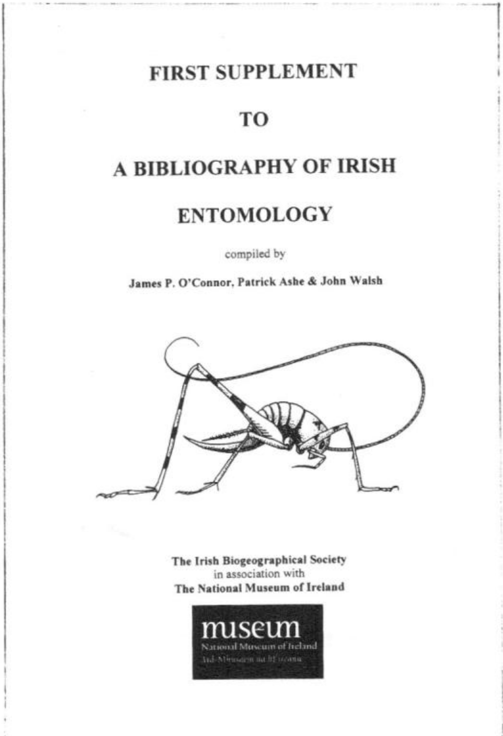
Occasional Publication of the Irish Biogeographical Society
Number 8, 2005

This publication provides an easy method of accessing the information contained in the Society's publications. All articles are listed. The index sections contain details of subjects under the following headings:- "Botany", "General Zoology", "Entomology", "Archaeology, Biogeography, Conservation & Geology", "Biological records, Membership & Obituaries". There is also a comprehensive index to authors.

FIRST SUPPLEMENT TO A BIBLIOGRAPHY OF IRISH ENTOMOLOGY Compiled by James P. O'Connor, Patrick Ashe and John Walsh. Published by the Irish Biogeographical Society in association with the National Museum of Ireland. 2005. 186pp. Price €30 or £25.



The very successful *A Bibliography of Irish Entomology* dealt with entomological papers published up to 1980. Dedicated to the memory of Bryan P. Beirne, this first supplement mainly covers the years 1980-2000. Over 2000 entries are included.

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1. Manuscripts should follow the format of articles in this *Bulletin*.

2. Manuscripts should be submitted as typed copy on A4 paper, using double-spacing and 2.5cm (1 inch) margins. Whenever possible, also submit the text on diskette. **Word is preferred and Times New Roman 13pt should be used.**

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

4. Records: please ensure that, when possible, the following information is incorporated in each record included in a manuscript:-

(a) latin name of organism.

(b) statement of reference work used as the source of nomenclature employed in the text. The describer's name should be also given when a zoological species is first mentioned in the text.

(c) locality details including at least a four figure Irish grid reference (e.g. N3946), county or vice-county and some ecological data about the collection site, plus date of capture.

(d) Collector's name and determiner's name (where different from collector's name), and

(e) altitude data should be included where relevant.

5. Manuscripts should be submitted to the Editor, Dr J. P. O'Connor, at the following address:- National Museum of Ireland, Kildare Street, Dublin 2, Ireland.

NOTICES

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