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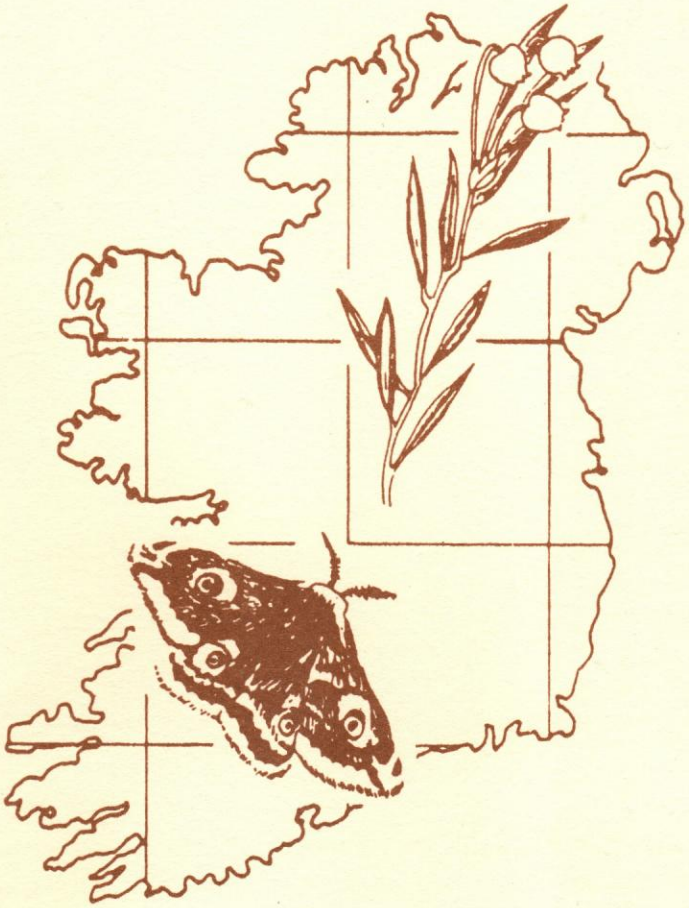

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THIS BULLETIN IS DEDICATED TO THE MEMORY OF PROFESSOR JOHN (JACK) GRAINGER (1925-1995) IN RECOGNITION OF HIS CONTRIBUTION TO IRISH ZOOLOGY.

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BULLETIN OF THE IRISH BIOGEOGRAPHICAL SOCIETY

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EDITORIAL

The year 2000 is another successful one for the Society which is once again privileged to publish a marvellous mix of papers in its *Bulletin* No 24. The hard work of the authors and the referees is greatly appreciated. Our membership numbers remain constant and we are very grateful to the members for their loyalty to the Society. Although inflation is a problem for us, thanks to new sponsors, the Society continues to successfully cover its costs. As a result, the subscription rate (IR£10) will remain unchanged for next year.

Bulletin No. 24 is dedicated to the memory of Professor J. N. R. Grainger of Trinity College, Dublin. The Society is indebted to Dr Julian Reynolds for writing the interesting obituary which appears in the journal.

As sometimes happens with the Society, this year is an unusual one for in addition to the *Bulletin*, current subscribers will receive free of charge *Occasional Publication* No. 5. Entitled *A review of the distribution of the Ephemeroptera in Ireland*, this marvellous work is a comprehensive account by Dr Mary Kelly-Quinn and Professor John Bracken of our mayfly fauna. The publication was kindly sponsored by the Heritage Council and University College Dublin.

Finally, I wish to thank Dr Pat Wallace, Director of the National Museum of Ireland, for his support of the work of the Society; Mr J. M. C. Holmes for his kindness and expertise in producing the camera-ready copy; our printers (especially Mr Jim Carwood) for their skill and unfailing co-operation; and the Committe members for their unstinting support and friendship.

J. P. O'Connor
Editor
18 October 1999

Bull. Ir. biogeog. Soc. No. 24 (2000)

A CHECKLIST OF THE CYCLOPOIDA (CRUSTACEA: COPEPODA) OF IRELAND

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Introduction

The Cyclopoida constitutes an Order of the Subclass Copepoda, occurring in marine, brackish and freshwater habitats. All the species have mandibles which are designed for biting.

Ecologically, the species can be divided conveniently into two groups; free-living forms, and invertebrate associates. The free-living group tends to be relatively unmodified and includes the familiar freshwater "Cyclops" and also some marine families. The invertebrate associates are all marine and live with ascidians or, in one case, with echinoderms. The body form can be drastically modified, particularly in the female.

This paper is an attempt to gather together a comprehensive annotated checklist of the cyclopoid copepods of Ireland. It is based primarily on a re-assessment of the published records in the scientific literature, augmented by some new data. The last complete checklist of the marine copepods was by Pearson (1905, 1906), who recorded 16 species belonging to the present order. There have been many studies done since Pearson, and a significant number of species added to the Irish fauna. A new list is therefore now appropriate.

The species list is laid out in a similar format to that of the harpacticoid copepods (Holmes and O'Connor, 1990), poecilostomatoid copepods (Holmes and Gotto, 1992) and siphonostomatoid copepods (Holmes, 1998). The genera and species are listed in alphabetical order within families. Synonyms which appear in the Irish literature are given under the relevant modern names. Where a species has been recorded in the literature under a name which is not a synonym, i.e., misidentified, the original name is included for reference purposes. Material lodged in the National Museum of Ireland is indicated by NMI. For each species, the records are listed county by county in alphabetical order. Offshore records or

records where the county is in doubt are categorised as 'Ireland'. For each county, the records are listed chronologically with the published records first and then the new unpublished data. For the published material, usually only the original record is cited, as some papers repeat previous data. For example, the enigmatic *Enterocola beaumonti* was originally described and recorded from Valentia, Co. Kerry, by Scott and Scott (1895). This was repeated by Anon (1896), Gamble (1896), Beaumont (1900) and Pearson (1905), in each without adding any new information.

Ecological information is kept to a minimum. For each species, data are given, *inter alia*, on whether it is (a) marine, brackish or freshwater; (b) associated with a particular habitat or animal group; (c) attracted to a light-trap (Holmes and O'Connor, 1988). Where relevant, a brief discussion on taxonomic problems or other matters follows. Material collected by the senior author is indicated by the abbreviation 'JMCH'.

The present checklist reports 88 species in five families. All the previous records of Irish cyclopoid species, both marine and freshwater, are cited. In addition, there are 116 new records. Seven species are new to Ireland. These are indicated by *.

Baird (1850, p. 346) mentioned a variety of *Cyclops quadricornis* which Haliday had informed him occurred in Ireland. While this is the earliest record of a "Cyclops" in Ireland, from the meagre information given, it could be almost any freshwater cyclopid. Similarly, records of *C. quadricornis* from the Belfast area in Thompson (1856) cannot be assigned to any species with certainty.

CYCLOPOIDA

Oithonidae

***Oithona helgolandica* Claus, 1863**

(*Oithona spinifrons* Boeck, *sensu* Brady, 1878)

(*Oithona similis* Claus, 1866)

CLARE: Carrigaholt and Scattery Island (Herdman, 1891).

CLARE/GALWAY: Galway Bay (Herdman, 1891; Boyd, 1973a).

CORK: Kinsale Harbour (Brady and Robertson, 1873; Brady, 1878; Bourne, 1890b); Templenoe, Kenmare River, Berehaven and Glengar(r)iff (Herdman, 1891); Fastnet Rock

(Gough, 1906); off Fastnet (Farran, 1911, map); Cork Harbour (Boyd, 1972); Lough Hyne (Holmes, 1980, 1983; Thain *et al.*, 1981; Holmes and O'Connor, 1991); 4♀♀, Castlehaven (W175293), light-trap, 5m, mud near *Zostera*, 17 August 1985, JMCH; 5 specimens, Courtmacsherry Bay, light-trap, 40m, 13 August 1986, JMCH.

DONEGAL: off Pladda, Lough Foyle, Lough Swilly and Gola Island (Herdman, 1891; I. C. Thompson, 1896); off Moville (MacDonald, 1951).

DOWN: Skulmartin Lightship (Gough, 1906); Strangford Lough (Boyd, 1973b); 2 specimens, Portaferry (J5950), light-trap, 12 March and 10 October 1987, F. Jeal.

DUBLIN: Dalkey (O'Riordan, 1966); 7 specimens, Kelly's Rock (O3050), Lambay Island, light-trap, 15m, 20 June 1991, JMCH (NMI); 3 specimens, Tayleur Bay (O3251), Lambay Island, light-trap, 15m, 20 June 1991, JMCH; 5 specimens, Sunk Island (O321499), Lambay Island, light-trap, 10m, 20 June 1991, JMCH.

GALWAY: Killeany Bay, Aran Islands (Herdman, 1891); High Island and Inishbofin (Farran, 1903); off Cleggan and off Inishshark (Farran, 1903, 1914); Ballynakill Harbour (Farran, 1914); Mutton Island (Fives, 1969); Little Killary (Keegan and Mercer, 1986); ♀, Spiddal (M1221), light-trap, 5m, 17 June 1991, JMCH.

GALWAY/MAYO: Killary Bay (Herdman, 1891; Farran, 1914; Keegan and Mercer, 1986; Ryan *et al.*, 1986); 6 specimens, Killary Harbour, light-trap, 1m, 19 July 1989, D. Minchin.

KERRY: near Valentia and off the Skelligs (Brady and Robertson, 1873); Valentia (I. C. Thompson, 1896, 1897, 1900); off County Kerry (I. C. Thompson, 1903).

MAYO: Westport Bay (Brady and Robertson, 1873); Inishturk and off Clare Island (Farran, 1903); Clare Island area (Farran, 1913, 1914); Blacksod Bay (Farran, 1914, 1915).

WEXFORD: Coningbeg Lightship (Gough, 1906).

WICKLOW: South Arklow Lightship (Gough, 1906).

IRELAND: off west of Ireland (I. C. Thompson, 1903; Farran, 1908a); Porcupine Bank (Farran, 1905); Irish Sea, south and west of Ireland (Farran, 1911, map).

Marine, surface plankton, light-trap.

***Oithona nana* Giesbrecht, 1892**

CORK: Lough Hyne (Thain *et al.*, 1981; Holmes, 1983; Kitching, 1987; Holmes and

O'Connor, 1991).

DONEGAL: several specimens, Mulroy Bay, 22 May 1980, D. Minchin.

DOWN: Skulmartin Lightship (Gough, 1906).

DUBLIN: off County Dublin (Farran, 1911, map).

GALWAY: off Cleggan (Farran, 1903); Ballynakill Harbour (Farran, 1903, 1913, 1914).

GALWAY/MAYO: Killary Harbour (Farran, 1903, 1914; Ryan *et al.*, 1986); 6 specimens, Killary Harbour, light-trap, 1m, 19 July 1989, D. Minchin.

WEXFORD: Coningbeg Lightship (Gough, 1906).

Marine, inshore plankton, light-trap.

***Oithona plumifera* Baird, 1843**

(*Oithona spinirostris* (Claus, 1863))

(*Oithona atlantica* Farran, 1908)

CORK: Long Island Bay, Sherkin (Cook and Jones, 1980).

GALWAY: High Island, Inishbofin and off Inishshark (Farran, 1903); Killeany Bay, Aran Islands, Mutton Island, Kilkieran Bay (Fives, 1969, 1971).

GALWAY/MAYO: Killary Harbour (Keegan and Mercer, 1986; Ryan *et al.*, 1986).

KERRY: off Tearaght (Farran, 1911, map).

MAYO: Inishturk and off Clare Island (Farran, 1903); several specimens, Station 74(7A), off County Mayo, 53°50'N. 10°40'W., 85 fathoms, 8 November 1988, D. Minchin (NMI).

WEXFORD: off south-east Ireland (Farran, 1911, map).

IRELAND: south-west Ireland (Bourne, 1890a); Porcupine Bank (Farran, 1905); off west of Ireland (Farran, 1908a); off west and south-west of Ireland (Farran, 1908b); Irish Sea (Farran, 1911, map).

Marine, plankton.

***Oithona setigera* Dana, 1849**

(*Oithona pelagica* Farran, 1908)

GALWAY: off Cleggan (Farran, 1913).

MAYO: 2 specimens, Station 11, off County Mayo, 54°00'N. 11°00'W., 190m, 24 April

1990, D. Minchin (NMI).

IRELAND: off south-west coast of Ireland (Farran, 1908b).

Marine, plankton.

***Paroithona parvula* Farran, 1908**

IRELAND: off west of Ireland (I. C. Thompson, 1903, as *Oithona nana*; Farran, 1908a; Sars, 1918).

Marine, plankton.

Cyclopinidae

***Cyclopina brachystylis* G. O. Sars, 1921**

CORK: Barloge Creek, near Lough Hyne (Holmes, 1996).

Marine, gravel.

***Cyclopina esilis* Brian, 1958**

CORK: Lough Hyne (Holmes, 1991); 1 specimen, Barloge (W100280), near Lough Hyne, gravel, 7 July 1994, JMCH.

Marine to brackish, gravel.

***Cyclopina gracilis* Claus, 1863**

CORK: Lough Hyne (Holmes, 1987).

GALWAY: Ballynakill Harbour (Farran, 1913, 1914); Spiddal (Holmes, 1986).

GALWAY/MAYO: Killary Harbour (Farran, 1914).

Marine.

***Cyclopina norvegica* Boeck, 1864**

(*Cyclopina gracilis* Claus, *sensu* Brady, 1878)

CORK: Lough Hyne (Holmes, 1985; Holmes and O'Connor, 1991).

DONEGAL: Rathmullen, Lough Swilly (Brady, 1878).

DOWN: Rock Angus, Strangford Lough (Wells, 1963).

GALWAY: several specimens, Salt Lake (L6649), Clifden, *Serpula* reef, July 1980, B. O'Connor (NMI).

IRELAND: Ireland (Harding and Smith, 1960).

Marine to brackish, fine sand to mud, light-trap.

***Cyclopinella* sp.**

CORK: several specimens, Lough Hyne, light-traps, JMCH.

Marine, shallow-water weed, light-trap. From time to time, specimens of an enigmatic cyclopinid turns up in light-trap samples taken in Lough Hyne. While they do not match *Cyclopinella tumidula* Sars, they do seem to belong to this genus. *Cyclopinella* has not been recorded previously in Ireland.

***Cyclopinodes elegans* (T. Scott, 1894)**

CORK: Lough Hyne (Holmes, 1983; Holmes and O'Connor, 1991); one or two specimens occasionally in light-traps, Lough Hyne (W0928), JMCH; several specimens, Barloge (W100280), coarse gravel, 7 July 1994, JMCH.

Marine, gravel, light-trap.

***Cyclopinoides littoralis* (Brady, 1872)**

(*Cyclopina littoralis* (Brady, 1872))

ANTRIM: Larne (Pearson, 1905).

CLARE: Scattery Island (Herdman, 1891).

CORK: Berehaven and Glengar(r)iff (Herdman, 1891); Lough Hyne (Holmes, 1985; Holmes and O'Connor, 1991); 2 specimens, Sherkin Island (W006259), light-trap, 7m, 2 August 1987, JMCH.

DONEGAL: Lough Swilly and Mulroy Lough (Brady, 1878); Killybegs (Herdman, 1891).

DUBLIN: Dalkey (O'Riordan, 1966, as *Cyclopina longicornis*); several specimens, the '40-Foot', Sandycove (O259281), light-trap, 10m, 5 September 1982 and 9 January 1983, JMCH.

GALWAY: Ballynakill Harbour (Farran, 1913, 1914).

GALWAY/MAYO: Killary Harbour (Farran, 1913, 1914).

KERRY: Valentia (I. C. Thompson, 1897, 1900).

Marine, littoral to shallow sub-littoral, light-trap.

***Cyclopinoides longicornis* (Boeck, 1872)**

(*Cyclopina longicornis* Boeck, 1872)

CORK: Lough Hyne (Holmes, 1985); several specimens, Castlehaven (W175293), light-trap, 5m, mud near *Zostera*, 17 August 1985, JMCH (NMI).

MAYO: Elly Bay, Blacksod Bay (Farran, 1915).

Marine, sub-littoral silt and mud, light-trap.

***Muceddina multispinosa* Jaume and Boxshall, 1996**

CORK: 2♀♀, North Basin (W092288), Lough Hyne, 5m, 7 July 1982, JMCH; ♀, off Codium Bay (W099282), Lough Hyne, 20m, 11 July 1982, JMCH; 10 specimens, North Quay (W094288), Lough Hyne, 2m, 23 August 1983, JMCH; 1 specimen, North Quay (W095289), Lough Hyne, 2m, 26 July 1985, JMCH; ♀, North Quay (W095289), Lough Hyne, 3m, 1 August 1985, JMCH; ♀, South Basin (W097280), Lough Hyne, 5m, 11 July 1990, JMCH; 9♀♀, North Basin (W097285), Lough Hyne, 3m, 21 July 1991, JMCH.

Marine to brackish, benthic algae, light-trap. This recently described species is otherwise known only from anchihaline caves in Sardinia, the Balearic Islands and the Canary Islands (Jaume and Boxshall, 1996). Its occurrence in Lough Hyne is unexpected, but the nearby Barloge Creek is a well-known anchorage for large yachts, which could easily provide a means of dispersal for these shallow-water copepods.

The morphology of the Lough Hyne specimens conforms to the description in Jaume and Boxshall (1996) and the key to the Cyclopinidae (Jaume and Boxshall, 1997), except that the inner margin of the basis of swimming leg 1 bears three to five long slender setules rather than the thick spine-like processes described. However, these slender setules can, when they cross at the tips, give an impression of thick spine-like processes.

Cyclopidae

***Acanthocyclops robustus* (G. O. Sars, 1863)**

CORK: 2♀♀, Shreelane Lake (W169354), near Skibbereen, light-trap, 3m, 5 August 1988, JMCH.

DUBLIN: several specimens, Blackrock (O2427), back-garden pond, 25 February, 19 March and 2 April 1986, D. Murphy; ♀, Knockannavea Mountain (O0523), near Brittas, bog-pool, 3 January 1988, JMCH; 9♀♀, Killiney, spring 1991, S. Jacob.

MAYO: turlough near Balla (M250813), 16 March 1987, JMCH (NMI).

IRELAND: Ireland (Kiefer, 1978).

Freshwater, lakes, light-trap. In all probability, all Irish records of *A. vernalis* can be ascribed to *A. robustus*.

***Acanthocyclops venustus* (Norman and T. Scott, 1906)**

(*Cyclops venustus* Norman and T. Scott, 1906)

CLARE: Poulnagollum-Poulelva Cave System (Hazelton, 1974a, 1974b, 1974c).

CORK: Schull (O'Riordan, 1971).

DUBLIN: County Dublin (McCall, 1983).

KILDARE: Bog of Allen at Newbridge (Gurney, 1921, 1933).

LAOIS: Coolnamona and Rossmore bogs (McCall, 1983).

MAYO: Glenamoy bog (McCall, 1975).

WICKLOW: 2♀♀, Upper Reservoir, Glencree, 21 January 1964, J. D. Reynolds (NMI).

Freshwater, *Sphagnum* pools and groundwater.

***Acanthocyclops vernalis* (Fischer, 1853)**

(*Cyclops vernalis* Fischer, 1853)

(*Cyclops lucidulus* Koch, *sensu* Sars, 1913)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

DONEGAL: Glenties and Teelin (O'Riordan, 1971).

KERRY: River Laune, Killorglin (O'Riordan, 1971).

KILDARE: Straffan (Frost, 1942).

LAOIS: County Laois (Feehan, 1983).

MAYO: Clare Island, and Westport and Castlebar area (Scourfield, 1912); Glenamoy Bog (McCall, 1975).

WICKLOW: King's River at Lockstown (O'Riordan, 1971).

Freshwater to brackish. Fryer (1984) described the confusion in the past between *A. robustus* and *A. vernalis*, and all Irish records of *A. vernalis* can probably be assigned to *A. robustus*.

***Cryptocyclops bicolor* (G. O. Sars, 1863)**

(*Cyclops bicolor* G. O. Sars, 1863)

CLARE/GALWAY/TIPPERARY: Lough Derg (Gurney, 1933).

MAYO: Barley Hill Lough, Westport (Scourfield, 1912).

Freshwater.

***Cyclops abyssorum* G. O. Sars, 1863**

(*Cyclops strenuus abyssorum* Sars, 1863)

CLARE/GALWAY/TIPPERARY: Lough Derg (Gurney, 1933).

DONEGAL: Lough Agh, Lough Unna, Dunfanaghy Salt Lake and Sessiagh Lough (O'Riordan, 1971).

DUBLIN: several specimens, Glenageary (O2427), tap water, April 1984 (NMI); ♀, Raheny (O2138), tap water, May 1985 (NMI); several specimens, Herbert Park (O1732), Ballsbridge, Dublin, 25 May 1980, 27 September 1980, 17 May 1987, JMCH; 2 specimens, Blackrock (O2-2-), tap water, December 1984; 2♀♀, Blackrock (O2427), back-garden pond, 2 April 1986, D. Murphy.

FERMANAGH: Lough Erne (Gurney, 1933; Battarbee, 1986).

GALWAY: Mutton Island, Inner Galway Bay (Fives, 1969, as *C. furcifer* Claus, probably this species); Lough Anaserd, Ballyconneely, Ballynakill Lough and Athry Lough Upper (O'Riordan, 1971).

KERRY: Killarney (Gurney, 1933); Lough Curran (O'Riordan, 1971); several specimens, Lough Currane, 17 July 1969, A. B. West.

LEITRIM: Lough Melvin (O'Riordan, 1971).

MAYO: Doo Lough (O'Riordan, 1971).

SLIGO: Lough Arrow (Gurney, 1933); Lough Easky and Lough Talt (O'Riordan, 1971).

WESTMEATH: Lough Ennell (O'Riordan, 1971); several specimens, Fennor (N538582), pond, 29 May 1988, JMCH.

WICKLOW: Poulaphouca Reservoir (O'Riordan, 1971); several specimens, Roundwood Reservoir, filter-beds, 23 May 1991, A. McNally.

IRELAND: Lough Neagh (Graham, 1970).

Freshwater, abundant and widespread in lakes and reservoirs.

***Cyclops strenuus* Fischer, 1851**

(*Cyclops helleri* Brady, 1878)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926, 1932; Grainger, 1957).

DUBLIN: Howth (Gurney, 1921); Kilbarrack (Gurney, 1933).

GALWAY: Lough Cam, Connemara (Brady, 1878 - the precise location of this lake cannot be found, but it might well be a misprint for Lough Conn); Ballinahinch (Kane, 1907); Mutton Island (Fives, 1969); Lough Shindilla (O'Riordan, 1971).

GALWAY/MAYO: Lough Mask and Lough Corrib (Kane, 1907).

KILDARE: Straffan (Frost, 1942).

LAOIS: Ballinclea and Ballycoolan (McCall, 1983).

MAYO: Achill Island, and Westport and Castlebar area (Scourfield, 1912).

WICKLOW: Poulaphouca (O'Riordan, 1971).

IRELAND: Lough Neagh (Kane, 1907; Dakin and Latarche, 1913).

Freshwater, small ponds and ditches.

***Cyclops vicinus* Uljanin, 1875**

WICKLOW: Roundwood Reservoir (Dauod *et al.*, 1986).

IRELAND: Lough Neagh (Graham, 1970).

Freshwater.

***Diacyclops bicuspidatus* (Claus, 1857)**

(*Cyclops bicuspidatus* Claus, 1857)

(*Cyclops pulchellus* Koch, *sensu* Sars, 1913)

(*Cyclops bicuspidatus lubbocki* Brady, 1868)

(*Diacyclops odessanus* (Schmankewitch, 1875))

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

DONEGAL: Redcastle River, Moville (O'Riordan, 1971).

DUBLIN: Clontarf (O'Riordan, 1971).

GALWAY: Kylemore Lough and Ballynahinch (Popple, 1912); Gort (O'Riordan, 1971).

KERRY: Killarney, and River Laune at Killorglin (O'Riordan, 1971).

MAYO: Clare Island (Scourfield, 1912); 4♀♀, turlough near Balla (M250813), 16 March 1987, JMCH (NMI).

MONAGHAN: Cornacassa (Kane, 1907; Poppie, 1912).

WICKLOW: 2♀♀, the Murrough, near Newcastle, 17 February 1987, JMCH (NMI).

Freshwater to brackish, small ponds and ditches.

***Diacyclops bisetosus* (Rehberg, 1880)**

(*Cyclops bisetosus* Rehberg, 1880)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

DUBLIN: Howth (Gurney, 1921); Knocklyon (O'Riordan, 1971).

GALWAY: Scrahilla, Cashel (O'Riordan, 1971).

KERRY: River Laune, Killorglin (O'Riordan, 1971).

LAOIS: Drumneen (McCall, 1983).

MAYO: Kinnacorra Marsh, Clare Island (Scourfield, 1912).

WICKLOW: 3♀♀, the Murrough, near Newcastle, 17 February 1987, JMCH (NMI).

Freshwater to brackish.

***Diacyclops crassicaudis* (G. O. Sars, 1863)**

(*Cyclops crassicaudis* G. O. Sars, 1863)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

KERRY: Farrantooreen Lough, Killorglin (O'Riordan, 1971).

Freshwater.

***Diacyclops languidoides* (Lilljeborg, 1901)**

(*Cyclops languidoides* Lilljeborg, 1901)

(*Cyclops languidus hiberniae* Gurney, 1927)

(*Cyclops languidoides hiberniae* Gurney)

DUBLIN: near Malahide Estuary (Gurney, 1921, as *C. languidus* var., 1927, 1933); juvenile ♀, North Bull Island (O2337), temporary pool, 5 May 1991, J. P. O'Connor (NMI).

Freshwater to brackish.

***Diacyclops languidus* (G. O. Sars, 1863)**

(*Cyclops languidus* G. O. Sars, 1863)

(*Acanthocyclops languidus* (G. O. Sars, 1863))

DUBLIN: Howth (Gurney, 1921).

KILDARE: Newbridge (Gurney, 1921).

MAYO: Clare Island and Achill Island (Scourfield, 1912).

WICKLOW: Ballysmuttan (Frost, 1942).

Freshwater.

***Diacyclops nanus* (G. O. Sars, 1863)**

(*Cyclops nanus* G. O. Sars, 1863)

(*Acanthoyclops nanus* (G. O. Sars, 1863))

KILDARE: Bog of Allen at Newbridge (Gurney, 1921, 1933).

LAOIS: Monettia Bog (McCall, 1983).

MAYO: Achill Island (Scourfield, 1912); Glenamoy Bog (McCall, 1975).

SLIGO: Hollybrook demesne, Lough Arrow (Gurney, 1933).

Freshwater, *Sphagnum*.

***Ectocyclops phaleratus* (Koch, 1838)**

(*Cyclops phaleratus* Koch, 1838)

(*Platycyclops phaleratus* (Koch, 1838))

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

DONEGAL: Kinny Lough (Brady, 1878).

LAOIS: County Laois (Feehan, 1983).

LEITRIM/SLIGO: Lough Glencar (Kane, 1904).

MAYO: near Westport (Brady, 1878).

MONAGHAN: Cornacassa and Bragan (Popple, 1912).

KERRY: County Kerry (O'Riordan, 1971).

Freshwater.

***Eucyclops macruroides* (Lilljeborg, 1901)**

(*Cyclops macruroides* Lilljeborg, 1901)

CORK: Schull (O'Riordan, 1971).

DONEGAL: Lough Agh (O'Riordan, 1971).

GALWAY: Mutton Island, Inner Galway Bay (Fives, 1969, as *C. macruroides denticulatus* Graeter but probably not that sub-species); River Corrib at Galway, and Shanakeever Lough (O'Riordan, 1971).

MAYO: Clare Island, and Clew Bay district (Scourfield, 1912).

Freshwater, lakes and rivers. The record of a single female specimen of *Cyclops macruroides denticulatus* from Mutton Island is regarded as very doubtful and probably can be ascribed to *Eucyclops macruroides*, *s. str.* The entry of *E. denticulatus* for Ireland in *Limnofauna Europaea* (Kiefer, 1978) is probably based on Fives (1969).

***Eucyclops macrurus* (G. O. Sars, 1863)**

(*Cyclops macrurus* G. O. Sars, 1863)

(*Leptocyclops macrurus* (G. O. Sars, 1863))

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

CORK: Lough More, Lough Avaul and Drombrow Lake (O'Riordan, 1971).

FERMANAGH: Lough Erne (Gurney, 1933).

Freshwater.

***Eucyclops serrulatus* (Fischer, 1851)**

(*Cyclops serrulatus* Fischer, 1851)

(*Leptocyclops agilis* (Koch), *sensu* Sars, 1914)

(*Cyclops agilis* Koch, *sensu* Gurney, 1933)

CLARE: Doolin and Poulnagollum-Poulelva Cave Systems (Hazelton, 1974b, 1974c).

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

DONEGAL: Glenties (O'Riordan, 1971).

DUBLIN: Dublin (Grainger, 1974); 3♀♀, Killiney, spring 1991, S. Jacob.

GALWAY: Clifden and Kylemore (Kane, 1907); Mutton Island (Fives, 1969); Lough Inagh, River Corrib at Galway, Lough Rea and Gort (O'Riordan, 1971); Roo West turlough and Poulroe fen and turlough (Reynolds and Marnell, 2000).

LAOIS: County Laois (Feehan, 1983).

LEITRIM: Lough Melvin (O'Riordan, 1971).

MEATH: near Rathmore (Grainger and Davies, 1966).

MAYO: Clare Island, and Clew Bay district (Scourfield, 1912, as *varius* form); Lough Conn and Westport Reservoir (O'Riordan, 1971); Glenamoy Bog (McCall, 1975).

MONAGHAN: Rossmore and Cornacassa (Kane, 1907); Bragan (Kane, 1907; Popple, 1912).

SLIGO: the Rosses (Kane, 1907, as var. *varius*); Lough Easky (O'Riordan, 1971).

Freshwater.

***Eucyclops speratus* (Lilljeborg, 1901)**

(*Cyclops speratus* (Lilljeborg, 1901))

(*Cyclops agilis speratus* (Lilljeborg, 1901))

DUBLIN: Royal Canal, Ashtown (Holmes, 1984).

GALWAY: Lough Inagh (O'Riordan, 1971).

KILDARE: Newbridge (Gurney, 1921).

LAOIS: County Laois (Feehan, 1983).

WESTMEATH: Lough Derravaragh (O'Riordan, 1971).

WICKLOW: Avoca (O'Riordan, 1971).

Freshwater.

***Euryte longicauda* Philippi, 1843 emend. Giesbrecht, 1900**

(*Thorellia brunnea* Boeck, 1864)

CORK: Kinsale Harbour (Brady and Robertson, 1873); Lough Hyne (Holmes, 1983); several specimens, Lough Hyne (W099282), 10 August 1989, JMCH (NMI); several specimens, Lough Hyne (W099283), 12 July 1993, JMCH (NMI).

DONEGAL: Mulroy Bay (Brady, 1878); 1 specimen, Moross Channel (C1838-9), Mulroy Bay, 2-4m, 11 July 1985, D. Minchin.

GALWAY: Clifden Bay (Brady and Robertson, 1873); 1 ♀ on slide, labelled 'Lichomolgus sp.', Station L. 123b, Fahy Bay (L6658), 1-2 fathoms, 7 July 1902, Fisheries (NMI); several specimens, Salt Lake (L6649), near Clifden, *Serpula* reef, July 1980, B. O'Connor (NMI); several specimens, Salt Lake (L6649), near Clifden, *Serpula* reef, July 1982, D. Minchin.

KERRY: Ventry Bay (Brady and Robertson, 1873); off County Kerry (I. C. Thompson, 1903).

MAYO: Westport Bay (Brady and Robertson, 1873).

Marine, shallow-water weed.

***Halicyclops magniceps* (Liljeborg, 1853)**

(*Cyclops aequoreus* Fischer, 1860)

(*Halicyclops aequoreus* (Fischer, 1860))

ANTRIM/DOWN: near Belfast (Brady, 1878).

DOWN: Dundrum (Brady, 1902).

DUBLIN: Malahide Estuary (Gurney, 1921).

GALWAY: south of Clifden (Brady and Robertson, 1873).

KERRY: Killorglin (O'Riordan, 1971).

WEXFORD: 4 specimens, Ballyteige (S935065), light-trap, 1m, 6 June 1988, JMCH (NMI). Brackish, light-trap.

***Halicyclops neglectus* Kiefer, 1935**

(*Halicyclops aequoreus propinqvus* G. O. Sars, 1905)

CORK: Lough Hyne (Holmes, 1987; Holmes and O'Connor, 1991).

DUBLIN: ♀, Dalkey Island, lower gulley, 11 March 1952, K. M. Roe (NMI). Marine, shallow water gravel.

***Macrocyclops albidus* (Jurine, 1820)**

(*Cyclops albidus* (Jurine, 1820))

(*Cyclops tenuicornis* Claus, 1857)

(*Pachycyclops annulicornis* (Koch), *sensu* Sars, 1914)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

CORK: Lough Avaul and Drombrow Lake, Bantry (O'Riordan, 1971); 1♀, Shreelane Lake (W169354), near Skibbereen, light-trap, 3m, 5 August 1988, JMCH (NMI).

DONEGAL: Lough Agh, Lough Unna and Lough Divna (O'Riordan, 1971).

DUBLIN: Royal Canal, Ashtown (Holmes, 1984); ♀, Royal Canal, Castleknock, 3 January 1964, J. D. Reynolds (NMI); ♀, Furry Glen (O0935), Phoenix Park, Dublin, 10 February 1964, J. D. Reynolds (NMI); 2♀♀, People's Garden (O132348), Phoenix Park, 8 July 1970, JMCH; 2♀♀, Glenageary (O2427), tap water, April 1984 (NMI); 2♀♀ Blackrock (O2427), back-garden pond, 25 February 1986, D. Murphy.

GALWAY: Clifden (Kane, 1907); Lough Bola, Lough Inagh and River Corrib at Galway (O'Riordan, 1971).

LAOIS: County Laois (Feehan, 1983).

LEITRIM: several specimens, Kilnamar Lough (H261063), Killegar, light-trap, 2m, 17 August 1991, JMCH (NMI).

MAYO: Clare Island, and Westport and Castlebar area (Scourfield, 1912).

MONAGHAN: Rossmore (Kane, 1907).

SLIGO: the Rosses (Kane, 1907).

WICKLOW: Poulaphouca (O'Riordan, 1971).

IRELAND: Ireland (Brady, 1878).

Freshwater, light-trap.

***Macrocyclops fuscus* (Jurine, 1820)**

(*Cyclops fuscus* (Jurine, 1820))

(*Cyclops coronatus* Claus, 1857)

(*Pachycyclops signatus* (Koch), *sensu* Sars, 1914)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

CORK: Bantry-Durrus Road and Drombrow Lake, Bantry (O'Riordan, 1971).

DUBLIN: Royal Canal, Ashtown (Holmes, 1984); ♀, Royal Canal (O0338), near Lucan, 27 April 1991, JMCH (NMI).

FERMANAGH: Upper Lough Erne (Creighton, 1893).

LAOIS: County Laois (Feehan, 1983).

MAYO: Clew Bay district (Scourfield, 1912).

MONAGHAN: Drumreaske (Kane, 1907).

Freshwater.

***Megacyclops gigas* (Claus, 1857)**

(*Cyclops viridis* (Jurine), var. *gigas* Claus, 1857)

DONEGAL: Lough Unshin, near Lough Columbkille, and Ballyshannon (Kane, 1907).

MONAGHAN: Drumreaske (Kane, 1907).

IRELAND: Lough Neagh (Kane, 1907).

Freshwater.

***Megacyclops latipes* (Lowndes, 1927)**

(*Cyclops latipes* Lowndes, 1927)

(*Cyclops gigas latipes* Lowndes, 1927)

(*Acanthocyclops latipes* (Lowndes, 1927))

DUBLIN: Kilbarrack (Gurney, 1933).

Freshwater.

***Megacyclops viridis* (Jurine, 1820)**

(*Cyclops viridis* (Jurine, 1820))

(*Cyclops vulgaris* Koch, *sensu* Sars, 1913)

(*Acanthocyclops viridis* (Jurine, 1820))

ARMAGH: Kinnegoe Bay, Lough Neagh (Graham, 1970).

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

DONEGAL: Glenties (Southern, 1924).

DUBLIN: Dublin (Khan, 1965); Royal Canal, Ashtown (Holmes, 1984, as *M. latipes*); 2♀♀, Killiney, spring 1991, S. Jacob.

FERMANAGH: Boho Cave (Hazelton, 1974b, 1974c).

GALWAY: Kylemore Lough (Popple, 1912); Glendollagh Lough, Lough Inagh and River Corrib at Galway (O'Riordan, 1971); Pigeon Hole Cave, west of Cong (Hazelton, 1974b, 1974c).

KERRY: Farrantooreen Lough and River Laune, Killorglin and Lough Caragh (O'Riordan, 1971).

KILDARE: Newbridge (Gurney, 1921).

LAOIS: County Laois (Feehan, 1983).

MAYO: Clare Island, and Clew Bay district (Scourfield, 1912); Lough Conn (O'Riordan, 1971); 6♀♀, turlough near Balla (M250813), 16 March 1987, JMCH (NMI).

MONAGHAN: Killyhoman, near Aughnacloy (Kane, 1907); Bragan (Popple, 1912).

OFFALY: Lough Roe (Reynolds, 1986).

IRELAND: Lough Neagh (Dakin and Latarche, 1913); Knockley (Gurney, 1933 - the authors

have been unable to find out precisely where this locality is).

Freshwater, small ponds and lake margins.

***Mesocyclops leuckarti* (Claus, 1857)**

(*Cyclops leuckarti* Claus, 1857)

(*Mesocyclops obsoletus* (Koch), *sensu* G. O. Sars, 1914)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

CORK: Mallow (Gurney, 1933).

LAOIS: County Laois (Feehan, 1983).

IRELAND: Ireland (Scourfield, 1912).

Freshwater, plankton.

***Metacyclops minutus* (Claus, 1863)**

(*Cyclops minutus* Claus, 1863)

WICKLOW: Roundwood Reservoir (Dauod *et al.*, 1986).

Freshwater.

***Microcyclops rubellus* (Lilljeborg, 1901)**

(*Cyclops rubellus* Lilljeborg, 1901)

(*Cyclops varicans rubellus* Lilljeborg, 1901)

MAYO: Clare Island, Castlebar Lough and Islandeady Lough (Scourfield, 1912).

Freshwater.

***Microcyclops varicans* (G. O. Sars, 1863)**

(*Cyclops varicans* G. O. Sars, 1863)

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

MAYO: Westport River and Castlebar Lough (Scourfield, 1912).

Freshwater.

***Paracyclops affinis* (G. O. Sars, 1863)**

(*Cyclops affinis* G. O. Sars, 1863)

(*Platycyclops affinis* (G. O. Sars, 1863))

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

GALWAY: Kylemore Lough (Popple, 1912).

MAYO: Clare Island, Westport and Castlebar Lough (Scourfield, 1912).

MONAGHAN: County Monaghan (Gurney, 1933).

Freshwater. Gurney (1933) cited Popple as the source of the record from County Monaghan, but the record is not in Popple (1912). Possibly Gurney had access to Popple's material.

***Paracyclops fimbriatus* (Fischer, 1853)**

(*Cyclops fimbriatus* Fischer, 1853)

(*Platycyclops fimbriatus* (Fischer, 1853))

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926).

DONEGAL: Sessiagh Lough (O'Riordan, 1971).

DUBLIN: Malahide (Gurney, 1921).

KERRY: Farrantooreen Lough, Killorglin (O'Riordan, 1971).

KILDARE: Newbridge (Gurney, 1921); Straffan (Frost, 1942).

LEITRIM: Lough Melvin (O'Riordan, 1971); several specimens, Kilnamar Lough (H261063), Killegar, light-trap, 2m, 17 August 1991, JMCH (NMI).

MAYO: Clare Island, and Westport and Castlebar area (Scourfield, 1912); several specimens, Inishkea South, 7 April 1970, A. B. West.

MONAGHAN: Rossmore, Cornacassa and Bragan (Kane, 1907).

OFFALY: Lough Roe (Reynolds, 1986).

WESTMEATH: Lough Ennell (O'Riordan, 1971).

WICKLOW: Humphreystown Bridge, King's River, Poulaphouca and Avoca (O'Riordan, 1971).

Freshwater to brackish.

***Paracyclops poppei* (Rehberg, 1880)**

(*Paracyclops fimbriatus poppei* (Rehberg, 1880))

ANTRIM: Lough Neagh off Crumlin River mouth (Graham, 1970).

ANTRIM/DERRY: River Lower Bann, Lough Neagh (Graham, 1970).

DUBLIN: Royal Canal, Ashtown (Holmes, 1984).

KILDARE: Straffan (Frost, 1942).

Freshwater.

***Thermocyclops crassus* (Fischer, 1853)**

CLARE/GALWAY/TIPPERARY: Lough Derg and River Shannon (Southern and Gardiner, 1926, as *Cyclops oithonoides* Sars, probably this species).

GALWAY/MAYO: Galway and Mayo area (Scourfield, 1912, as *Cyclops oithonoides*, probably this species).

IRELAND: Ireland (Kiefer, 1978).

Freshwater, plankton. The entry in *Limnofauna Europaea* (Kiefer, 1978) for *T. crassus* in Ireland appears to be based on the records of *T. oithonoides* by Scourfield (1912) and Southern and Gardiner (1926). *T. oithonoides* is not entered in *Limnofauna Europaea* for Ireland.

***Thermocyclops dybowskii* (Landé, 1890)**

(*Cyclops dybowskii* Landé, 1890)

KERRY: River Laune, Killorglin (O'Riordan, 1971).

Freshwater.

***Tropocyclops prasinus* (Fischer, 1860)**

(*Cyclops prasinus* Fischer, 1860)

CORK: Schull, Bantry-Durrus Road and Lough Avaul (O'Riordan, 1971).

DONEGAL: Lough Finn (O'Riordan, 1971).

DUBLIN: Howth (Gurney, 1921).

GALWAY: River Corrib at Galway (O'Riordan, 1971).

KERRY: River Laune at Killorglin (O'Riordan, 1971).

LAOIS: Glenbarrow River (McCall, 1983).

MAYO: Clare Island, and Clew Bay district (Scourfield, 1912).

MONAGHAN: Rossmore (Kane, 1907).

Freshwater.

Notodelphyidae

***Agnathaner typica* Canu, 1891**

CORK: Lough Hyne (Holmes and O'Connor, 1991, as *Agnathaner* sp.); ♂, Lough Hyne (W100283), light-trap, 20m, 10 July 1982, JMCH (NMI); 3♂♂, Lough Hyne (W095283), light-trap, 20m, 14 July 1990, JMCH (NMI); ♂, Lough Hyne (W097280), light-trap, 21 July 1990, JMCH (NMI); ♂, Lough Hyne (W094284) light-trap, 40m, 14 June 1997, JMCH

Marine, associated with ascidians, light-trap. *Agnathaner* Canu is a genus of male notodelphid copepods. These males are free-swimming and unmodified, and correspond to females which are relatively degenerate and ascidicolous. However, which male matches which female is uncertain in several cases, and the genus is retained provisionally until its nature is understood. There are a number of *Agnathaner* forms which may be found along the western seaboard of Europe. The Lough Hyne specimens have the banded arrangement of cuticular pores on the cephalon found in *Agnathaner typica* Canu, as described by Hipeau-Jacquotte (1980). However, the original description by Canu (1891) is sparse, and the form described under that name by Sars (1921) differs in a number of respects. They do not match *Agnathaner freemani* Hamond, 1968 (female unknown), or *Agnathaner minutus* Canu, 1891, which has been shown by Hippeau-Jacquotte (1980) to be an atypical male form of the notodelpyid *Pachypygus gibber* (Thorell).

***Agnathaner* sp.**

CORK: several ♂♂, Lough Hyne (W100283), light-trap, 20m, 10 July 1982, JMCH (NMI); ♂, Lough Hyne (W095283), light-trap, 20m, 14 July 1990, JMCH (NMI); ♂, Lough Hyne (W094284) light-trap, 40m, 14 June 1997, JMCH.

Marine, light-trap. Occasionally, a different form of *Agnathaner* is found in light-trap samples in Lough Hyne. These are similar in the orange colour and the arrangement of cuticular pores

to *A. typicus*, but differ in the structure of the mouthparts and in the pattern of spinules on the abdomen. The mouthparts have some similarities to *Agnathaner freemani* but the general body shape and the caudal ramus is different.

***Bonnierilla altera* Stock, 1967**

GALWAY: Corranroo Bay, near Kinvara (Holmes and Gotto, 1987).

Marine, with ascidians *Clavelina lepadiformis* (Müller), *Polycarpa rustica* (L.) and *Pyura* spp. (Gotto, 1993).

***Bonnierilla filipes* Stock, 1967**

GALWAY: Pol an Choirre, Mweenish Island, Mutton Island, and Corranroo Bay (Holmes and Gotto, 1987).

Marine, with ascidians such as *Dendrodoa grossularia* (van Beneden) and *Polycarpa rustica* (Holmes and Gotto, 1987).

***Bonnierilla similis* Illg and Dudley, 1961**

DONEGAL: Kindrum Bay, North Water, Mulroy Bay (Holmes and Gotto, 1987).

Marine, with ascidians such as *Pyura squamulosa* (Alder) (Gotto, 1993).

***Botachus cylindratus* Thorell, 1859**

ANTRIM: Larne Lough (Pearson, 1904, 1905).

DOWN: Ballyhenry Bay, Strangford Lough (Gotto and Logan, 1974).

GALWAY: ♀, Roskeeda Bay, *Ascidia mentula* Müller, July 1972, M. White (NMI); 4♀♀, Pol an Choirre, Kilkieran Bay, *Ascidia mentula*, 14 December 1982, M. White (NMI). The listing of this species from 'west Ireland' in Gotto (1993) is based on these specimens from County Galway.

Marine, with solitary ascidians *Ascidia mentula*, *A. conchilega* Müller, *A. obliqua* Alder, *Ascidiella scabra* (Müller) and *Phallusia mammillata* Cuvier (Gotto, 1993).

***Doroixys uncinata* Kerschner, 1879**

DONEGAL: Sheephaven (Gotto, 1961).

DOWN: Strangford Lough (Gotto, 1952).

Marine, in ascidians such as *Polyclinum aurantium* Milne Edwards and *Sidnyum turbinatum* Savigny (Gotto, 1952).

***Doropygella normani* (Brady, 1878)**

(*Doropygus normani* Brady, 1878)

ANTRIM: Larne Lough (Pearson, 1905).

GALWAY: Roundstone (Brady, 1878).

Marine, in ascidians *Ascidia mentula*, *Polycarpa rustica* and *Pyura microcosmus* (Savigny) (Gotto, 1993). This species has never been adequately described by modern standards (Gotto, 1993).

***Doropygella porcicauda* (Brady, 1878)**

(*Doropygus porcicauda* Brady, 1878)

DOWN: Strangford Lough (Gotto, 1960, 1966).

GALWAY: Birtirbuy Bay (Brady, 1878; Pearson, 1905).

Marine, in solitary ascidians *Corella parallelogramma* (Müller) and *Ascidia conchilega* (Gotto, 1993).

***Doropygella psyllus* (Thorell, 1859)**

(*Doropygus psyllus* Thorell, 1859)

CORK: Lough Hyne (Holmes, 1980); ♀, Mulroe Cove (V9240), near Durrus, Dunmanus Bay, *Ascidiella aspersa* (Müller), 13 August 1979, JMCH; several specimens, Lough Hyne, *Ascidiella aspersa*, 3 August and 22 September 1987, JMCH (NMI); several specimens, Lough Hyne, *Ascidiella aspersa*, 18 July 1991, JMCH (NMI).

DOWN: Rock Angus, Strangford Lough (Gotto, 1956).

MAYO: ♀, Clew Bay, *Ascidia virginea*, 5 June 1980, D. Minchin; 8♀♀, Clew Bay, *Ascidia virginea*, 7 June 1980, D. Minchin.

Marine, in solitary ascidians such as *Ascidia virginea* Müller, *A. conchilega* and *Ascidiella aspersa* (Gotto, 1993).

***Doropygus pulex* Thorell, 1859**

CORK: Lough Hyne (Holmes, 1987); 6♀♀, Whiddy Island, Bantry Bay, *Phallusia mammillata*, 24 July 1998, B. Healy (NMI).

DUBLIN: ♀, Dalkey Island (O279261), unnamed ascidian, 20 September 1986, JMCH (NMI).

DONEGAL: Sheephaven (Gotto, 1961); several specimens, Mulroy Bay, from *Pyura squamulosa*, 1985, D. Minchin (NMI).

GALWAY: Roundstone (Brady, 1878, as a variety); Corranroo Bay (Holmes and Gotto, 1987).

Marine, associated with numerous ascidians in addition to those named above, such as *Ascidiella scabra*, *Pyura microcosmus*, *Polycarpa rustica* and *Molgula complanata* Alder and Hancock (Gotto, 1993).

***Gunenotophorus globularis* Buchholz, 1869**

DONEGAL: Sheephaven (Gotto, 1966); ♀, Mulroy Bay, *Pyura squamulosa*, 1985, D. Minchin (NMI); 5♀♀, Mulroy Bay, *Molgula occulta* Kupffer, 1985, D. Minchin (NMI).

DOWN: Strangford Lough (Gotto, 1952).

Marine, in ascidians such as *Pyura squamulosa* and *Polycarpa* spp. (Gotto, 1993).

****Notodelphys agilis* Thorell, 1859**

DONEGAL: 4♀♀, Mulroy Bay, *Molgula occulta*, 1985, D. Minchin (NMI).

Marine, in numerous ascidians such as *Ascidia* spp. and *Molgula* spp. (Gotto, 1993)

***Notodelphys allmani* Thorell, 1859**

(*Notodelphys ascidicola* Allman, 1847 (?))

ANTRIM: Larne (Pearson, 1905; Gotto, 1966); off Whitehead (Brady, 1904; Pearson, 1905).

ANTRIM/DOWN: Belfast Bay (Allman, 1847, as *N. ascidicola*; W. Thompson, 1856).

CORK:: Glandore Harbour (Allman, 1847, as *N. ascidicola*); Lough Hyne (Holmes, 1980).

DOWN: Strangford Lough (Allman, 1847, as *N. ascidicola*; Gotto, 1966); Bangor (Allman,

1847, as *N. ascidicola*; Gotto, 1966).

DUBLIN: Dublin Bay (Allman, 1847, as *N. ascidicola*).

GALWAY/MAYO: Killary Bay (Allman, 1847, as *N. ascidicola*; Farran, 1913, repeated as *N. allmanni*).

MAYO: Blacksod Bay (Farran, 1913, 1915).

Marine, associated with numerous ascidians (Gotto, 1993). The name *N. ascidicola* was discarded by Sars (1921). The adult animals described by Allman (1847) could belong to any of a number of the species of *Notodelphys* described by Thorell, and the juveniles could be *Doropygus pulex*, *Doropgella psyllus* or even *Ascidicola rosea*. Brady (1878) assigned all Irish records of *Notodelphys ascidicola* to *N. allmani*. This was followed by Pearson (1905). More recently, Lejeune and Monniot (1965) attempted to revive *N. ascidicola* in order to cover the entire confusing "Notodelphys" complex. In later papers, Monniot (1981, 1982) revised this opinion.

***Notodelphys caerulea* Thorell, 1859**

CORK: Lough Hyne (Holmes, 1996); 4♀♀, Whiddy Island, Bantry Bay, *Ascidiella aspersa*, 24 July 1998, B. Healy (NMI); ♀, Mulroe Cove (V9240), near Durrus, Dunmanus Bay, *Corella parallelogramma*, 13 August 1979, JMCH (NMI); 3♂♂ 9♀♀, Mulroe Cove (V9240), near Durrus, Dunmanus Bay, *Ascidiella aspersa*, 13 Aug.1979, JMCH (NMI) - basis of 'south Ireland' in Gotto (1993).

GALWAY: Roundstone (Brady, 1878); ♀, Corranroo Bay (M325115), *Ascidiella aspersa*, 20 April 1987, JMCH (NMI).

Marine, ascidians *Ascidia virginea*, *Ascidiella aspersa* and *Corella parallelogramma* (Gotto, 1993).

****Notodelphys canui* Roland, 1963**

DUBLIN: ♀, off Dalkey Island (O3-2-), *Molgula manhattensis* (de Kay), RV 'Celtic Voyager', 17 July 1998, JMCH (NMI).

Marine, ascidians *Molgula echinosiphonica* (Lacaze-Duthiers) (Roland, 1963) and now *Molgula manhattensis*.

***Notodelphys elegans* Thorell, 1859**

CORK: Lough Hyne (Holmes, 1980); ♀, Whiddy Island, Bantry Bay, *Styela clava* Herdman, 6 September 1998, B. Healy (NMI).

DONEGAL: Sheephaven (Gotto, 1961).

DOWN: Ballywhite Bay, Strangford Lough (Williams, 1954, as *N. allmani* in *Ciona intestinalis* (L.), probably this species).

GALWAY: ♀, Pol an Choirre (L7630), Mweenish Island, Kilkieran Bay, *Ciona intestinalis*, 14 Dec.1982, M. White (NMI).

Marine, in ascidian *Ciona intestinalis* (Gotto, 1993).

***Notodelphys prasina* Thorell, 1859**

GALWAY: ♂, Roskeeda, Kilkiean Bay, didemnid colony (*Tridemnum tenerum* (Verrill) or *Leptoclinides faeroensis* Bjerkan), July 1972, M. White (NMI); ♂, Roskeeda Bay, *Ascidia mentula*, July 1972, M. White (NMI) - basis of 'west Ireland' in Gotto (1993).

Marine, associated with ascidians *Ascidia mentula*, *Ascidiella aspersa* and *Phallusia mammillata* (Gotto, 1993).

***Notodelphys rufescens* Thorell, 1859**

DONEGAL: Sheephaven (Gotto, 1961).

Marine, associated with ascidians *Ascidia conchilega*, *A. obliqua*, *Ascidiella aspersa*, *A. scabra* and *Phallusia mammillata* (Gotto, 1993).

***Notodelphys transatlantica* Bocquet and Stock, 1960**

DONEGAL: Sheephaven (Gotto, 1961).

Marine, ascidian *Clavelina lepadiformis* (Gotto, 1993).

***Notopterophorus auritus* (Thorell, 1859)**

GALWAY: ♀, Athola Inlet (L6248), unnamed ascidian, 12 June 1996, B. Healy (NMI).

IRELAND: western Ireland (Gotto, 1960).

Marine, in solitary ascidians *Ascidia mentula*, *A. obliqua*, *A. virginea* and *Ciona intestinalis*

(Gotto, 1993).

***Notopterophorus elongatus* Buchholz, 1869**

MAYO: Blacksod Bay (Farran, 1913, 1915); several specimens, Clew Bay, pink ascidian (probably *Ascidia virginea*), 7 June 1980, D. Minchin.

Marine, ascidian hosts mentioned by Farran (1913) included *Ascidiella aspersa* and *Ascidia mentula*, but its usual host is *Phallusia mammillata* (Illg and Dudley, 1961).

***Notopterophorus papilio* Hesse, 1864**

ANTRIM: Ballygally Bay (Pearson, 1904, 1905).

CORK: Lough Hyne (Holmes, 1991).

DOWN: Strangford Lough (Gotto, 1966); Ballyhenry, Strangford Lough (Gotto and Threadgold, 1980).

GALWAY: Ballynakill (Farran, 1913); 7♀♀, Salt Lake (L6649), Clifden, ascidians on *Serpula* reef, July 1980, B. O'Connor (NMI).

KERRY: several specimens, Parknasilla (V6963), *Ascidia mentula*, July 1962, R. V. Gotto.

Marine, in ascidians such as *Ascidia mentula* (Gotto, 1959b).

***Pachypygus gibber* (Thorell, 1859)**

DONEGAL: Sheephaven (Gotto, 1961).

DOWN: off Chapel Island, Strangford Lough (Gotto, 1955).

Marine, in numerous ascidians, such as *Corella parallelogramma*, *Ciona intestinalis*, *Ascidia conchilega* and *Clavelina lepadiformis* (Gotto, 1993).

Ascidicolidae

Ascidicolinae

***Ascidicola rosea* Thorell, 1859**

ANTRIM/DOWN: Belfast Lough (Riddell, 1909).

CORK: Lough Hyne (Renouf, 1931; Holmes, 1980); North Channel, Cork Harbour (Minchin and Duggan, 1988); ♀, Rapids area (W100281), Lough Hyne, *Ascidiella aspersa*, 20 September

1981, K. Wilson (NMI); 7♀♀, Lough Hyne (W0928), *Ascidiella aspersa*, 3 August 1987, JMCH (NMI); 3♀♀, Lough Hyne (W095279), *Ascidiella aspersa*, 22 September 1987, JMCH (NMI); ♀, Lough Hyne (W095278), *Ascidiella aspersa*, 20 July 1991, JMCH (NMI); 1 juv., Lough Hyne (W095279), *Clavelina lepadiformis*, 22 September 1987, JMCH; ♀, Roaringwater Bay, 5m, maerl bed, *Ascidiella aspersa*, August 1998, S. de Grave; ♀, Whiddy Island, *Ascidiella aspersa*, 24 July 1998, B. Healy.

DONEGAL: ♀, Mulroy Bay, *Molgula occulta*, 1985, D. Minchin (NMI).

DOWN: Strangford Lough (Williams, 1954; Gotto, 1957).

DUBLIN: ♀, north of Balbriggan (O1769), from unnamed ascidian cast up on beach, 5 November 1976, JMCH.

GALWAY: Birtirbuy Bay (Brady, 1878); ♀, Pol an Choirre (L7630), Kilkieran Bay, *Ascidiella aspersa*, 14 December 1982, M. White (NMI).

MAYO: Blacksod Bay (Farran, 1913, 1915).

Marine, with numerous ascidians including *Ascidia virginea*, *Ascidiella aspersa*, *Corella parallelogramma* and *Styela clava* Herdman (Gotto, 1993).

Enterocolinae

***Enterocola fulgens* van Beneden, 1860**

CORK: Lough Hyne (Holmes, 1987, as *Enterocola* sp., probably this species).

DOWN: Strangford Lough (Gotto, 1952, 1954a).

Marine, with colonial ascidians such as *Polyclinum aurantium* (Gotto, 1993), males in light-trap.

***Enterocola megalova* Gotto, 1962**

DOWN: Strangford Lough (Gotto, 1962; Ooishi, 1994).

Marine, in ascidian *Polyclinum aurantium* (Ooishi, 1991).

***Enterocola pterophora* Chatton and Brément, 1909**

DOWN: Strangford Lough (Gotto, 1952, 1954a).

Marine, with colonial didemnid ascidians (Gotto, 1993).

***Enterocola sydnii* Chatton and Harant, 1924**

DONEGAL: Sheephaven (Gotto, 1961).

Marine, with ascidians *Morchellium argus* (Milne Edwards), *Sidnyum turbinatum* and *S. elegans* (Giard) (Gotto, 1993).

Enteropsinae

***Enteropsis chattoni* Monniot, 1961**

GALWAY: several specimens, Omey Island (L5-5-), stranded *Diazona violacea* Savigny collected by K. Linane, 31 January 1993, T. Champ (NMI).

Marine, with ascidians such as *Diazona violacea* (Gotto, 1993).

***Enteropsis roscoffensis* Chatton and Brément, 1909**

GALWAY: Corranroo Bay (Holmes and Gotto, 1987).

Marine, in ascidians such as *Dendrodoa grossularia*, *Pyura microcosmus*, *Phallusia mammillata* (Gotto, 1993).

***Mychophilus roseus* Hesse, 1865**

CLARE: 2♀♀ 1 juv., Muckinish (M254104), *Botrylloides leachi*, 26 August 1991, JMCH.

CORK: Lough Hyne (Gotto *et al.*, 1984; Holmes, 1985); ♂, Lough Hyne (W097280), light-trap, 2m, 25 July 1991, JMCH (NMI).

DONEGAL: Sheephaven (Gotto, 1961).

DOWN: Strangford Lough (Gotto, 1952, 1954a); 6♀♀, the Dorn (J5959), Strangford Lough, *Botrylloides leachi*, February 1988, R. V. Gotto (NMI).

DUBLIN: 'Forty Foot', Sandycove (Gotto *et al.*, 1984); 5♂♂, Sunk Island (O321499), Lambay Island, light-trap, 10m, 20 June 1991, JMCH (NMI).

GALWAY: Spiddal (Gotto *et al.*, 1984; Holmes, 1986).

WATERFORD: Dunmore East (Gotto *et al.*, 1984; Holmes and Jeal, 1987).

Marine, with ascidians *Botryllus schlosseri* (Pallas) and *Botrylloides leachi* (Savigny) (Gotto, 1993), males in light-trap.

Haplostomatinae

***Haplostoma banyulensis* Brément, 1909**

DOWN: Strangford Lough (Gotto, 1952, 1954a, 1954b).

MAYO: 1♂ 18♀♀ 1 juv., Carramore Strand (L795817), near Louisburgh, *Tridemnum tenerum* (Verrill), 27 August 1987, JMCH.

Marine, with ascidians *Didemnum maculosum* (Milne Edwards) and *Tridemnum tenerum* (Gotto, 1993).

***Haplostoma brevicauda* (Canu, 1886)**

(*Haplostoma mizoulei* Monniot, 1962)

CORK: Lough Hyne (Holmes, 1987, as *H. mizoulei*); ♀, Lough Hyne (W0928), South shore, *Sidnyum turbinatum*, 3 August 1987, JMCH (NMI); 1♂ 1♀, Lough Hyne (W100282), 5m, unnamed colonial ascidian, 19 July 1993, JMCH (NMI).

DOWN: Strangford Lough (Gotto, 1952, 1954a).

GALWAY: ♀, Corranroo Bay (M325115), *Sidnyum turbinatum*, 20 April 1987, JMCH (NMI).

Marine, with ascidians such as *Polyclinum aurantium* and *Sidnyum turbinatum* (Gotto, 1993).

H. mizoulei Monniot was regarded as a distinct species until recently synonymised with *H. brevicauda* (Ooishi, 1998).

***Haplostoma eruca* (Norman, 1869)**

DOWN: Strangford Lough (Gotto, 1959a).

Marine, in ascidian *Ciona intestinalis* (Gotto, 1959a).

***Haplostomides hibernicus* (T. Scott and A. Scott, 1895)**

(*(?) Enterocola hibernica* T. Scott and A. Scott, 1895)

(*Aplostoma hibernica* (T. Scott and A. Scott, 1895))

DOWN: Strangford Lough (Gotto, 1952, 1954a).

KERRY: Valentia (Scott and Scott, 1895; Ooishi, 1991).

Marine, with ascidian *Polyclinum aurantium* (Gotto, 1993).

***Haplostomides scotti* Chatton and Harant, 1924**

DOWN: Strangford Lough (Gotto, 1952, 1954a; Ooishi, 1994).

KERRY: Valentia (Scott and Scott, 1895, as *? Enterocola beaumonti*, probably this species).

Marine, with ascidian *Polyclinum aurantium* (Gotto, 1952). Scott and Scott (1895) described an enigmatic copepod under the name "? *Enterocola beaumonti*, sp. n." from an unnamed ascidian. This species is ranked as a *nomen dubium* and is not included in Gotto (1993). It is most probably the same as *Haplostomides scotti*.

Botryllophilinae

***Botryllophilus* spp.**

DONEGAL: Sheephaven (Gotto, 1961, as *B. ruber* Hesse, from *Clavelina*).

DOWN: Strangford Lough (Gotto, 1952, 1954a, 1954b, as *B. ruber*).

MAYO: 2♀♀, Carramore Strand (L795817), near Louisburgh, *Botryllus schlosseri*, 27 August 1987, JMCH.

Marine, ascidians *Botryllus schlosseri* and *Botrylloides leachi* (Gotto, 1952). Gotto (1993) has commented on the taxonomic confusion surrounding the various forms of *Botryllophilus* which have been described from around Europe.

Enterognathinae

***Enterognathus comatulae* Giesbrecht, 1900**

CLARE/GALWAY: ♀, Galway Bay, *Antedon bifida* (Pennant), 3 April 1986, G. O'Donnell (NMI).

DUBLIN: Dalkey Sound (Grainger, 1950).

GALWAY: Ballynakill Harbour (Farran, 1913).

Marine, associated with crinoid *Antedon bifida* (Farran, 1913).

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INVERTEBRATE (ARACHNIDA, INSECTA, MOLLUSCA) RECORDS FROM SOME COUNTY MAYO LOCALITIES, IRELAND

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Introduction

During the period 10-12 August 1999, the authors undertook joint fieldwork activity at three sites in North Mayo, with the objective of gathering invertebrate inventory data. The invertebrate fauna of these sites was virtually unknown, although they were of established botanical interest (Lockhart, 1987, 1989, 1999). The resultant species lists are presented here, together with brief notes on the character of the sites and on the taxonomic groups investigated. Including a few records derived from a reconnaissance visit to the sites (by FM and MS) at the beginning of June 1999, a total of some 240 species was recorded, among them one addition to the Irish fauna.

Nomenclatural sources used are given in the text relating to each taxonomic group. Botanical nomenclature follows Stace (1997). Some additional sites were also visited by one or more of the participants whilst in the vicinity. The records from these sites are included here in the Appendix. Irish National Grid references are given for the sites visited, followed, in brackets, by their corresponding 50km UTM square equivalents.

The sites

Fermoyle, G0522 (MV3).

This is a large calcium-rich flush system in low-lying blanket bog. The nucleus of the flush extends over *circa* 2ha. It comprises a mosaic of small-sedge fen and *Carex* tussocks with scattered patches of small *Betula*, iron-stained shallow pools, moss lawns and *Sphagnum* hummocks with *Vaccinium oxycoccus*. A small stream runs through the system. Botanically, the site is viewed as being close to boreal fen.

Rathavisteen, F9837 (MA4).

A large, mineral-enriched flush and seepage system within blanket bog. The nucleus of the system is *circa* 10ha of transition mire with shallow pools, extensive moss lawns and patches of *Carex paniculata* tussocks. The adjacent blanket bog contains frequent natural bog pools. The plant communities exhibit northern fascies.

Garter Hill, F8040/F8240 (MA2).

An extensive, calcareous, coastal dune system and associated, close-cropped machair plain, traversed by streams and containing calcareous seepages and springs toward its seaward edge. The seepages are marked by patches of taller vegetation, primarily *Iris*.

The taxonomic groups investigated

J. A. Good

Coleoptera: Carabidae, Pselaphidae and Staphylinidae

Carabidae, Staphylinidae and Pselaphidae were collected by sieving, flotation, the use of a suction sampler and pitfall traps. Any members of these groups collected using a pond net, and during the course of general collecting, were also kindly provided by Brian Nelson and Ferdia Marnell. At each of the three sites, typical microhabitats (e.g. floating moss and sedges, unvegetated sand near water) were selected for sampling. There was insufficient time to work any of the sites thoroughly for these groups, but as the objective was to contribute to an overall list for each site, this does not detract from the results obtained.

Species were considered to be indicators of well-developed habitat on the basis of a

combination of two attributes:- (1) that they have a restricted habitat preference, to the types of microhabitat associated with the sites visited; and, (2) that they are reported in the literature as being local or rare, suggesting that they are less likely to survive in historically degraded ecosystems. Species were considered to be typical if they possess the first attribute, but not the second. Nomenclature follows Anderson *et al.* (1997, 1999).

In total, 20 species of Carabidae (including those collected and determined by Martin Speight), 24 species of Staphylinidae and two species of Pselaphidae were recorded (see Table 1), one of which (*Dyschirius impunctipennis* Dawson) was considered to be an indicator species (Good and Butler, 1998). *Quedius boopoides* Munster was recorded from Fermoyle blanket bog flush; this is the second record from Ireland for this species (see Anderson, 1997).

One indicator species (*Dyschirius impunctipennis*) and a number of typical species (*Bembidion pallidipenne* (Illiger), *Bledius fergussoni* Joy and *Bledius fuscipes* agg.) of unvegetated coastal sand maintained by freshwater outflow, occurred at Garter Hill (Carrowteige), indicating that this microhabitat was well-developed at this site.

Distribution data have recently be published for carabids for both Great Britain (Luff, 1998) and Northern Ireland (Anderson *et al.*, 2000). From these accounts, it would appear that *Bembidion pallidipenne* should be classed as an indicator species. However, for coastal lagoons (see Good and Butler, 1998), *B. pallidipenne* was not considered to be an indicator species, because it occurred at most of the machair lake sites visited. It is important to point out, in this case at least, that the term local is being used in terms of the proportion of sites occupied which have apparently suitable habitat, rather than how local a species is geographically. It is assumed that *B. pallidipenne* is not local within the set of sites which contain unvegetated coastal sand with freshwater influence on the north-west coast of Ireland.

Typical species, but no indicator species, were recorded at the Fermoyle flush (*Myllaena intermedia* Erichson, *Ochthephilum fracticorne* (Paykull), *Quedius boopoides* and *Stenus nitens* Stephens) and Rathavisteen flush (*Ericsonius cinerascens* (Gravenhorst), *Gymnusa brevicollis* (Paykull) and *Stenus nitens*), but more intensive sampling, or further sampling at a different time of the year, may reveal indicator species at either or both of these sites. Compared to more nutrient rich peat soils, the results for these groups were poor, and greater sampling effort may be needed for an equivalent species catch from blanket bog sites such as these, as

compared to fens.

E. A. Moorkens

Mollusca

Molluscan species found in the three sites visited are listed below. Nomenclature follows Kerney (1999). Mollusca were sampled at each site in three different ways:- (1) by examining the vegetation and vegetation litter by hand for associated molluscan species; (2) by using a kick net in streams for aquatic Mollusca; (3) by removing 4 to 12 bags (approximately 3kg per bag) of vegetation and litter per site, which were subsequently wet-sieved through two mesh sizes, 3mm and 0.5mm.

The smaller sample was then dried out and examined for smaller species with the aid of an Olympus 40X binocular microscope. Identification of species was confirmed using Kerney and Cameron (1979), Cameron and Redfern (1976), Ellis (1926), Macan (1977) and Ellis (1962). Conditions for finding and collecting snails at each site were reasonable during the course of the site visits.

As with the Diptera, the Mollusca recorded from Fermoyle and Rathavisteen differ considerably. Only six species of snail were found at Rathavisteen, all common species that are tolerant of a wide range of environmental variation, the most important here being low levels of calcium. The majority of the individuals found were from the two species *Pisidium casertanum* (Poli) and *P. personatum* Malm. The former is a highly adaptable species that is ubiquitous in wet places, and the latter is associated with poor habitats that are often stagnant and liable to dry up from time to time (Kerney, 1999). The lack of quality calcareous species at Rathavisteen suggests that this site should indeed be considered as transition mire, and not fen.

By contrast, Fermoyle flush yielded records of quality fen Mollusca, including the rare *Vertigo geyeri* Lindholm, a species scheduled under Annex II of the EU Habitats and Species Directive, which was found to be locally widespread and in good numbers. Some plant species noted where *V. geyeri* was located by hand were *Schoenus nigricans*, *Menyanthes trifoliata*, *Phragmites australis*, *Carex viridula* var. *brachyrrhyncha*, *Carex lasiocarpa*, *Carex dioica* and *Carex limosa*. This site included a range of sub-habitats that provided useful transitions in both

calcareous influence and humidity, from loose vegetation in drier tussocks through saturated vegetation, to areas of open water with stands of *Phragmites*. This is reflected in the range of snails recorded, including four *Vertigo* species. As these minute animals require a stable environment for survival, it suggests that this remote site has enjoyed a lack of disturbance that is rare in modern times.

A total of 25 snail species was found at Garter Hill, and the high biomass of Mollusca, in particular the freshwater species, was striking. Most of the calcareous dune species of Ireland were recorded at this site, notably the species that prefer short grassland, such as *Cernuella virgata* (Da Costa), but wet rather that dry turf (thus the presence of *Vallonia pulchella* (Müller) but not *V. costata* (Müller) or *V. excentrica* Sterki). However, the rare dune species, such as *Vertigo angustior* Jeffreys and *Catinella arenaria* (Bouchard-Chantereaux) were absent. There is no evidence that these species were here in the past, but their absence may be due to the heavy sheep grazing throughout this site, which is reminiscent of other calcareous machair sites in the north west of Ireland which have lost these species. Both species require constantly humid conditions, which are not compatible with the close cropping of turf that is associated with heavy sheep grazing.

B. Nelson and F. Marnell

Coleoptera: Dryopidae, Dytiscidae, Elmindae, Gyrinidae, Haliplidae, Helophoridae, Hydraenidae, Hydrophilidae and Scirtidae

Heteroptera: Corixidae, Gerridae, Hebridae, Hydrometridae, Nepidae, Notonectidae and Saldidae

The aquatic and semi-aquatic Coleoptera and Hemiptera were sampled using two techniques. Open water and marginal pond habitats were sampled by sweeping through the water column with a pond net. In areas of moss carpets and lawns a trampling method was used, in which the moss mat was submerged and insects taken with a pond net from temporarily created pools. Terrestrial Heteroptera and Coleoptera were also collected at all three sites and some spiders were identified from pitfall samples. These are commented on where considered significant.

Totals of 43 species of aquatic Coleoptera and 18 species of aquatic Heteroptera were

collected from all three sites. The individual site totals for Fermoyle, Rathavisteen and Garter Hill were respectively 16, 17 and 24 Coleoptera and 6, 9 and 10 Heteroptera. The first Irish record of the scirtid *Cyphon kongsbergensis* Munster was collected at Rathavisteen (Marnell, in press). *C. kongsbergensis* is a species of bogs where it is found amongst *Sphagnum*. It was first recorded in Britain from Scotland (Skidmore, 1985) and, whilst still considered uncommon, it has since been found at a number of peatland sites in Wales (Garth Foster, pers. comm.; Hyman, 1992).

Fens provide the richest habitat for aquatic Coleoptera in Northern Ireland and individual site totals of 20-35 species are typical (Nelson, 1998). The relatively low totals for Rathavisteen and Fermoyle are considered to be due to a combination of factors including the water chemistry, the degree of isolation of the sites and the perhaps the rather dry weather conditions during the summer. A major factor at Fermoyle was the iron-stained water, an extreme habitat not sampled before, but where few species, and few individuals, were present. At Rathavisteen, whilst individuals were more common in the moss lawns, the species diversity was closer to what would be expected in a poor-fen or acid flush. On the basis of the aquatic Coleoptera this was revealed as an acid flush in a blanket bog system. Species typical of this biotope recorded at Rathavisteen included *Enochrus fuscipennis* (Thomson), *E. affinis* (Thunberg) and *Hydroporus discretus* Fairmaire and Brisout. The few species common to both Rathavisteen and Fermoyle were generalist, widely distributed species.

Whilst it is indicated by other taxonomic groups of invertebrates that Fermoyle is influenced by calcareous or base-rich water, this is not reflected in the records of aquatic Coleoptera and Heteroptera. No species associated with base-rich fens in the rest of Ireland were recorded. *Hydroporus gyllenhalii* Schiödte, *H. obscurus* Sturm and *Graptodytes granularis* (L.) are all species typical of base-poor fens. *H. longicornis* Sharp is a species which is indicative of intact laggs (fen zones at the margin of raised bogs) and shaded poor fens and is found usually with few other species. This is only the third recent Irish record. The low diversity of species and individuals at Fermoyle is thought to be attributable to the unusual water conditions, in particular the iron-staining affecting the pools and moss lawns. The areas of open water on this site had a natural oily appearance, and were noticeably devoid of the targeted groups. For example, no corixids, a characteristic open water group, were recorded from Fermoyle. It is

possible these pools are anoxic at times.

The spring fed pools and streams at Garter Hill supported a fauna typical of mesotrophic open water. Whilst they were located within an area of machair and sand dune the pools lacked species typical of dune slack pools in Donegal.

Amongst the species recorded at the three sites the following were considered of note:-

Fermoyle

Hydroporus longicornis - only three *Hydroporus* species were recorded and all were in low numbers. These small water beetles are usually the most common inhabitants of mossy fens. The presence of this species, unknown from Northern Irish fens and only recorded from two other Irish sites is perhaps indicative of the unusual conditions on this site.

Hebrus ruficeps (Thomson) - whilst this is probably an under-recorded rather than a genuinely rare species, it is in Nelson's experience characteristic of good quality mossy fen, and associated with a suite of notable mesotrophic fen beetles. Not in Nelson's experience associated with *Sphagnum* (Nelson, 1995).

Graptodytes granularis – an uncommon species of poor fens. In Northern Ireland, this is absent from the south-east and only found in base-poor fens in the north and west.

Chartoscirta elegantula (Fallén) – this rare saldid has been found recently in a few saltmarshes and on a cutover raised bog. It was common at Fermoyle.

Pirata tenuitarsis Simon – a wolf spider recorded for the first time in Ireland from Pollardstown Fen (van Helsdingen, 1997). This species is associated with *Sphagnum* bogs, and is probably under-recorded due to previous confusion with *P. piraticus* (Clerck) with which it can occur. However, in the northern fen survey (Nelson, 1998), no *P. tenuitarsis* were found amongst the hundreds of *P. piraticus*.

Rathavisteen

Chartoscirta elegantula - see above.

Cyphon kongsbergensis - see above.

Garter Hill

Laccobius ytenensis Sharp - an uncommon species of stream banks and base-rich flushes.

Paracymus scutellaris (Rosenhaurer) - in Northern Ireland, a scarce species of heathland flushes. How unusual a record this represents is hard to judge. It is very much a western

species in Britain and Ireland and more associated with acid water.

Sigara venusta (Douglas and Scott) - this corixid is very rare in Northern Ireland but seems to be a species of mesotrophic/oligotrophic running water.

Stictonectes lepidus (Olivier) - a typical species of oligotrophic running or still water.

M. C. D. Speight

Diptera

The families of Diptera covered are indicated by records in the species list. In general, nomenclature used follows Soós and Papp (1984-1993), except for Syrphidae, which follows Speight (1999). Literature used for determinations depends on which genera are involved, and also follows the recommendations provided in Speight (1999). Collection was carried out by hand net, which was used for sweeping vegetation, collection from flowers and, in the case of tabanids, collection from members of the survey team! Poor collecting conditions were largely responsible for the paucity of records from the Garter Hill locality, which has to be regarded as under-recorded as a result, in comparison with the other sites.

The Diptera recorded from Fermoyle and Rathavisteen provide a great contrast. Both systems may validly be styled as flush complexes within blanket bog, but the character of the groundwater upwelling in the two sites not only dictates the presence of markedly different vegetation, but associated differences in fauna. Although the fen at Fermoyle occupies but a few hectares, it supports characteristic fen Diptera entirely foreign to the surrounding blanket bog and the less calcareous Rathavisteen flush. Examples are the ptychopterid *Ptychoptera scutellaris* Meigen and the syrphid *Tropidia scita* (Harris). Other crenal elements to the fauna form a subset of acid fen species which extend into both raised and blanket bog situations. The sciomyzid *Dictya umbrarum* (L.) and the syrphid *Melanogaster aerosa* (Loew) would fall into this subset - their occurrence at both Fermoyle and Rathavisteen would be anticipated. Rathavisteen has its share of typical acid flush species that do not occur in fen - the dolichopodid *Campsicnemus compeditus* Loew and the scathophagid *Pogonota barbata* (Zetterstedt) provide examples. It is perhaps worthy of note that sciomyzids are normally entirely absent from general blanket bog surface, since they are predators/parasitoids of snails,

which cannot occur there. Streamsides and flushes would be the only locations within blanket bog that any sciomyzid could be expected to occur.

In its overall character, the Diptera list from the bogland flushes manifests quite clearly a frequently mentioned attribute of such faunas - an almost complete lack of plant feeding species. Out of 70 species recorded, only two have plant feeding larvae. This is perhaps best illustrated by the syrphids, whose 38 representatives on the list include but one plant feeder, *Cheilosia bergenstammi* Becker. In the Irish syrphid list, 15% of the species are plant feeders. Most of the syrphids recorded from the blanket bog flushes visited have aquatic/subaquatic microphagous/detritivore larvae and nearly all the rest have larvae predatory on plant bugs, such as aphids.

Among the Diptera collected, species of restricted range in Ireland do not have any clear role to play in identifying the character or value of these sites - no species particularly restricted geographically were recorded. Granted, there are few published Irish records of some of the flies collected, a good example being the dolichopodid *Argyra elongata* (Zetterstedt). But *A. elongata* is frequent on blanket bog - even degraded blanket bog - in western Ireland, from Kerry to Donegal. Of greater significance are the ecologically-restricted species, which indicate that both bogland flush systems visited support representative faunas, but provide a basis for questioning the wisdom of treating these landscape features simply as flushes. It would seem more practical to classify the flush system at Fermoyle as a fen in its own right, for consideration alongside fens from elsewhere, while the Rathavisteen system would be better regarded as a transition mire.

Arguably, the scarcest Irish fly recorded during this survey is the large, easily distinguishable and brightly-coloured hoverfly *Helophilus trivittatus* (Fabr.). This insect was recorded not only at Fermoyle, but also at roadside locations elsewhere in North Mayo, during the course of the visit. *H. trivittatus* is by no means characteristic of blanket bog and has been recorded in Ireland previously only from part of the Shannon floodplain, near Clonmacnoise (Offaly). It is a predominantly central and southern European insect, replaced in atlantic/northern European peatlands by its closely similar relative *H. affinis* Wahlberg. *H. affinis* is extending its range southwards in Europe and reached both Switzerland and Britain recently - its appearance in Ireland can be expected and occurrence in flushes in blanket bog like the Fermoyle locality

would be most likely. Recording *H. trivittatus* there instead is thus unexpected, and would be worthy of further study.

Discussion

On average, each of the five participants in this inventory exercise added approximately 50 species to the overall list, or some 17 species/site, for the three sites visited, to give a total of nearly 250 species. Perhaps recording 250 species from somewhere might seem a substantial contribution, from the standpoint of someone familiar with similar work on flowering plants or vertebrates. But it is less impressive in terms of inventorising invertebrate faunas, with the wealth of species available. To make the undertaking feasible logistically, the taxonomic groups included in this survey had to be severely restricted. All together, the taxonomic groups covered almost certainly contribute less than 20% of the species to the invertebrate fauna occurring on these sites. They do, however, almost certainly comprise more than 5% of the invertebrate fauna there. That is not to say it can be assumed that for the taxonomic groups surveyed all species occurring on these three sites have been found - it would be most unlikely for that to be so. More importantly, there is no reason to suppose the species lists compiled should be regarded as unrepresentative samples of the site faunas. In essence then, it may be concluded that they provide some basis for comment on the sites and the invertebrates found there.

Individual authors have provided some remarks on both site and fauna, in the text treating their own taxonomic groups. These remarks demonstrate how attributes of one invertebrate group will make possible certain types of comment and attributes of a different group will engender comments of another type. In summary, these remarks indicate that the blanket bog flushes surveyed, whilst not supporting species dramatically different from what is known to occur elsewhere in Ireland, do exhibit very particular faunas, which depend for their constitution not so much on the surrounding blanket bog as on the character of the groundwater supply to the flushes and the type of vegetation that water maintains. Indeed, the blanket bog could realistically be viewed as inactive packing material, of vital importance in protecting these flushes from the depredations of mankind which would normally result in drainage of such features, but otherwise largely irrelevant. It could even be said that the inability of the

general bog surface to support the vast majority of the invertebrates recorded from the flushes makes the bog hostile territory for them, that the flushes are effectively ecological islands. The extent to which this scenario is realistic would depend on the frequency and extent of flushes within any given bog. But it does highlight the importance of extensive flush systems and implies that well-developed flush faunas are unlikely to be maintained on smaller, more isolated flushes. A second observation which might be made of the recorded faunas of the two flushes visited is that they show flush faunas may be very distinct one from another, making "flushes" difficult to assign to some single category of habitat type. Finally, the value of incorporating invertebrates with very different demands of their environment into inventory work is well shown from this brief survey, on all three sites. The authors sampled terrestrial, subaquatic and aquatic groups, predators and detritivores, highly mobile species and very static ones, groups living in the vegetation and on the ground surface (wherever that is in a bog!) and each group had a story to tell.

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TABLE 1. List of species recorded. Abbreviations used: det. = determined by; p = present; FL = Fermoyle; GH = Garter Hill; RN = Rathavisteen; BN = Brian Nelson; EM = Evelyn Moorkens; FM = Ferdia Marnell; JG = Jervis Good; GF = Garth Foster; MS = Martin C. D. Speight.

	det.	FL	GH	RN
ARACHNIDA				
ARANEA				
Linyphiidae				
Lepthyphanthes flavipes (Blackwall)	BN	p		
Lycosidae				
Pardosa pullata (Clerck)	BN	p		
Pirata hygrophilus Thorell	BN	p		
Pirata piraticus (Clerck)	BN	p		
Pirata tenuitarsis Simon	BN	p		
Trochosa terricola Thorell	BN	p		
Thomisidae				
Oxyptila trux (Blackwall)	BN	p		
INSECTA				
COLEOPTERA				
Carabidae				
Agonum fuliginosum (Panzer)	JG			p
Agonum marginatum (L.)	MS		p	
Agonum muelleri (Herbst)	JG		p	
Agonum thoreyi Dejean	JG	p		p
Bembidion pallidipenne (Illiger)	JG/MS		p	
Bembidion tetracolum Say	MS		p	
Broscus cephalotes (L.)	MS		p	
Calathus fuscipes (Goeze)	MS		p	
Calathus micropterus (Duftschmid)	MS		p	
Calathus mollis (Marsham)	JG		p	
Carabus clatratus L.	MS	p		
Dyschirius globosus (Herbst)	JG		p	
Dyschirius impunctipennis Dawson	JG/MS		p	
Dyschirius politus (Dejean)	MS		p	
Elaphrus cupreus Duftschmid	MS		p	
Loricera pilicornis (Fabr.)	MS		p	
Notiophilus substriatus Waterhouse	MS		p	
Pterostichus diligens (Sturm)	JG	p		p
Pterostichus minor (Gyllenhal)	JG			p
Pterostichus nigrita (Paykull)	MS		p	

TABLE 1 (continued)

Chrysomelidae				
Galeruca tanaceti (L.)	BN	p		
Phyllotreta exclamationis (Thunberg)	BN	p		
Plateumaris discolor (Panzer)	MS	p		
Curculionidae				
Otiorhynchus arcticus (Fabr.)	MS		p	
Dryopidae				
Dryops luridus (Erichson)	GF	p	p	
Dytiscidae				
Agabus affinis (Paykull)	BN/FM	p		p
Agabus bipustulatus (L.)	BN/FM	p	p	p
Agabus sturmii (Gyllenhal)	GF			p
Colymbetes fuscus (L.)	BN/FM		p	
Dytiscus semisulcatus Müller	BN		p	
Graptodyes granularis (L.)	BN	p		
Hydroporus discretus Fairmaire & Brisout	BN			p
Hydroporus gyllenhalii Schiödte	GF	p		
Hydroprous longicornis Sharp	BN	p		
Hydroporus longulus Mulsant	BN		p	
Hydroporus obscurus Sturm	BN	p		
Hydroporus pubescens (Gyllenhal)	FM	p		p
Hydroporus tessellatus Drapiez	BN/FM		p	
Hygrotus inaequalis (Fabr.)	BN/FM		p	
Ilybius fuliginosus (Fabr.)	FM		p	
Oreodytes septentrionalis (Gyllenhal)	BN/FM		p	
Rhantus exsoletus (Forster)	BN			p
Stictonectes lepidus (Olivier)	BN/FM		p	
Stictotarsus duodecimpustulatus (Fabr.)	BN/FM		p	
Elmidae				
Elmis aenea (Müller)	BN/FM		p	
Oulimnius tuberculatus (Müller)	GF		p	
Gyrinidae				
Gyrinus minutus Fabr.	BN/FM			p
Gyrinus substriatus Stephens	BN/FM	p	p	
Haliplidae				
Haliplus lineatocollis (Marsham)	BN/FM		p	
Helophoridae				
Helophorus aequalis Thomson	FM/GF		p	p
Helophorus brevipalpis Bedel	BN/FM	p	p	
Helophorus flavipes (Fabr.)	GF		p	p
Hydraenidae				
Limnebius truncatellus (Thunberg)	BN/FM		p	

TABLE 1 (continued)

Hydrophilidae				
Anacaena globulus (Paykull)	BN/FM	p	p	p
Cercyon littoralis (Gyllenhal)	BN		p	
Chaetarthria seminulum (Herbst)	BN/FM	p		p
Coelostoma orbiculare (Fabr.)	BN/FM	p		p
Enochrus affinis (Thunberg)	GF			p
Enochrus coarctatus (Gredler)	FM			p
Enochrus fuscipennis (Thomson)	GF			p
Hydrobius fuscipes (L.)	BN/FM		p	
Laccobius bipunctatus (Fabr.)	FM	p		
Laccobius minutus (L.)	BN	p		
Laccobius ytenensis Sharp	BN/FM		p	
Paracymus scutellaris (Rosenhauer)	BN		p	
Pselaphidae				
Pselaphus heisei Herbst	JG	p		
Reichenbachia juncorum (Leach)	JG	p		
Scirtidae				
Cyphon hilaris Nyholm	GF	p		p
Cyphon kongsbergensis Munster	GF			p
Staphylinidae				
Bledius fergussoni Joy	JG		p	
Bledius fuscipes Rye agg.	JG		p	
Bledius longulus Erichson	JG		p	
Encephalus complicans Kirby	JG	p		
Erichsonius cinerascens (Gravenhorst)	JG			p
Euaesthetus bipunctatus (Ljungh)	JG	p		
Gabrius coxalus (Hochhuth)	JG		p	
Gymnusa brevicollis (Paykull)	JG			p
Lathrobium quadratum (Paykull)	JG	p		
Myllaena intermedia Erichson	JG	p		p
Ochthephilum fracticorne (Paykull)	JG	p		
Polystomota punctatella (Motschulsky)	JG		p	
Quedius boopoides Munster	JG	p		
Quedius curtipennis Bernhauer	JG	p		
Quedius maurorufus (Gravenhorst)	JG	p		
Stenus bifoveolatus Gyllenhal	JG			p
Stenus cicindeloides (Schaller)	JG			p
Stenus fulvicornis Stephens	JG	p		
Stenus impressus Germar	JG	p		
Stenus juno (Paykull)	JG			p
Stenus nitens Stephens	JG	p		p
Stenus nitidiusculus Stephens	JG	p		p

TABLE 1 (continued)

Xantholinus linearis (Olivier)	JG		p	
Xantholinus longiventris Heer	JG		p	
DIPTERA				
Conopidae				
Sicus ferrugineus (L.)	MS	p		
Dolichopodidae				
Argyra elongata (Zetterstedt)	MS			p
Campsicnemus compeditus Loew	MS			p
Campsicnemus curvipes (Fallén)	MS		p	
Dolichopus atratus Meigen	MS			p
Dolichopus atripes Meigen	MS			p
Dolichopus brevipennis Meigen	MS		p	
Dolichopus plumipes (Scopoli)	MS			p
Dolichopus simplex Meigen	MS		p	
Dolichopus ungulatus (L.)	MS		p	
Hydrophorus balticus (Meigen)	MS		p	
Sympycnus pulicarius (Fallén)	MS		p	
Ptychopteridae				
Ptychoptera minuta Tonnoir	MS			p
Ptychoptera scutellaris Meigen	MS	p	p	
Rhagionidae				
Chrysopilus auratus (Fabr.)	MS		p	
Scathophagidae				
Coniosternum decipiens (Haliday in Curtis)	MS			p
Cordylura pudica (Meigen)	MS			p
Pogonota barbata (Zetterstedt)	MS			p
Scathophaga stercoraria (L.)	MS			p
Sciomyzidae				
Dictya umbrarum (L.)	MS	p		p
Hydromya dorsalis (Fabr.)	MS		p	
Ilione lineata (Fallén)	MS			p
Pherbina coryleti (Scopoli)	MS		p	
Renocera striata (Meigen)	MS			p
Tetanocera elata (Fabr.)	MS	p		p
Tetanocera ferruginea Fallén	MS		p	p
Tetanocera fuscinervis (Zetterstedt)	MS	p		
Tetanocera hyalipennis von Roser	MS	p		
Syrphidae				
Anasimyia lunulata (Meigen)	MS	p		p
Cheilosia bergenstammi Becker	MS	p		
Episyrphus balteatus (DeGeer)	MS	p		p

TABLE 1 (continued)

Eristalis abusiva Collin	MS	p		p
Eristalis arbustorum (L.)	MS	p		
Eristalis horticola (DeGeer)	MS	p		
Eristalis interrupta (Poda)	MS	p		
Eristalis intricaria (L.)	MS	p		
Eristalis pertinax (Scopoli)	MS	p		
Helophilus pendulus (L.)	MS	p		
Helophilus trivittatus (Fabr.)	MS	p		
Lejogaster metallina (Fabr.)	MS	p		p
Melanogaster aerosa (Loew)	MS	p		p
Melanogaster hirtella (Loew)	MS			p
Melanostoma mellinum (L.)	MS	p		p
Neoascia geniculata (Meigen)	MS			p
Neoascia meticulosa (Scopoli)	MS			p
Neoascia tenur (Harris)	MS	p		p
Pipizella viduata (L.)	MS			p
Platycheirus angustatus (Zetterstedt)	MS	p		
Platycheirus clypeatus (Meigen)	MS	p		p
Platycheirus granditarsus (Forster)	MS	p		
Platycheirus immarginatus (Zetterstedt)	MS	p		p
Platycheirus manicatus (Meigen)	MS			p
Platycheirus occultus Goeldlin, Maibach & Speight	MS			p
Platycheirus perpallidus (Verrall)	MS	p		p
Platycheirus ramsarensis Goeldlin, Maibach & Speight	MS	p		p
Platycheirus scutatus (Meigen)	MS	p		
Rhingia campestris Meigen	MS		p	p
Sericomyia lappona (L.)	MS			p
Sericomyia silentis (Harris)	MS	p		p
Sphaerophoria philantha (Meigen)	MS			p
Syrphus vitripennis Meigen	MS	p		
Tropidia scita (Harris)	MS	p		
Volucella bombylans (L.)	MS			p
Tabanidae				
Chrysops relictus Meigen	MS	p		p
Haematopota crassicornis Wahlberg	MS			p
Haematopota pluvialis (L.)	MS			p
Hybomitra montana (Meigen)	MS			p
Tachinidae				
Tachina grossa (L.)	MS	p		

TABLE 1 (continued)

HEMIPTERA				
Cercopidae				
Aphrophora alni (Fallén)	BN	p		
Neophilaenus lineatus (L.)	BN	p		
Philaenus spumarius (L.)	BN	p		
Cicadellidae				
Megophthalmus scanicus (Fallén)	BN	p		
Cixiidae				
Cixius nervosus (L.)	BN	p		
Corixidae				
Corixa punctata (Illiger)	BN		p	
Hesperocorixa castanea (Thomson)	BN		p	p
Hesperocorixa linnaei (Fieber)	BN		p	
Hesperocorixa sahlbergi (Fieber)	BN		p	p
Sigara venusta (Douglas and Scott)	BN		p	
Delphacidae				
Delphax pulchellus (Curtis)	BN	p		
Kelisia ribauti Wagner	BN	p		
Megamelus notula (Germar)	BN			p
Gerridae				
Gerris costai (Herrich-Schaeffer)	BN		p	
Gerris lateralis Schummel	BN			p
Gerris odontogaster (Zetterstedt)	BN	p		
Hebridae				
Hebrus ruficeps (Thomson)	BN	p		
Hydrometridae				
Hydrometra stagnorum (L.)	BN		p	p
Miridae				
Closterotomus norwegicus (Gmelin)	BN		p	
Cyrtorhinus caricis (Fallén)	BN	p		p
Stenodema calcarata (Fallén)	BN	p		
Nabidae				
Nabis limbatus Dahlbom	BN			p
Nepidae				
Nepa cinerea L.	BN	p	p	
Notonectidae				
Notonecta glauca L.	BN			p
Notonecta obliqua Thunberg	BN		p	p
Saldidae				
Chartoscirta cincta (Herrich-Schaeffer)	BN	p		
Chartoscirta elegantula (Fallén)	BN	p		p
Saldula saltatoria (L.)	BN		p	

TABLE 1 (continued)

Veliidae				
Microvelia reticulata (Burmeister)	BN	p		p
Velia caprai Tamanini	BN			p
HYMENOPTERA				
Apidae				
Bombus muscorum (L.)	MS/BN			p
Formicidae				
Myrmica ruginodis Nylander	BN	p		
Tenthredinidae				
Selandria serva (Fabr.)	MS			p
Tenthredo ferruginea Schrank	MS	p		
Vespidae				
Vespula rufa (L.)	MS	p		
LEPIDOPTERA				
Nymphalidae				
Aglais urticae (L.)	BN	p		
Vanessa atalanta (L.)	BN	p		
Pieridae				
Pieris napi (L.)	BN	p		p
Sphingidae				
Deilephila elpenor (L.)	BN	p		
ODONATA				
Aeshnidae				
Aeshna juncea (L.)	BN	p		
Coenagriidae				
Enallagma cyathigerum (Charpentier)	MS/BN			p
Ischnura elegans (van der Linden)	MS		p	p
Pyrrhosoma nymphula (Sulzer)	MS		p	p
Lestidae				
Lestes sponsa (Hansemann)	MS/BN			p
Libellulidae				
Libellula quadrimaculata L.	MS			p
Sympetrum danae (Sulzer)	BN	p		p
PLECOPTERA				
Leuctridae				
Leuctra fusca (L.)	BN		p	

TABLE 1 (continued)

MOLLUSCA				
Aciculidae				
Acicula fusca (Montagu)	EM	p		
Agriolimacidae				
Deroceras laeve (Müller)	EM		p	
Deroceras panormitanum (Lessona and Pollonera)	EM		p	
Deroceras reticulatum (Müller)	EM	p	p	p
Arionidae				
Arion ater (L.)	EM	p	p	p
Cochlicopidae				
Cochlicopa lubrica (Müller)	EM	p	p	
Cochlicopa lubricella (Porro)	EM	p		
Discidae				
Discus rotundatus (Müller)	EM	p		
Ellobiidae				
Carychium minimum Müller	EM	p	p	
Carychium tridentatum (Risso)	EM	p		
Euconulidae				
Euconulus alderi (Gray)	EM	p		
Helicidae				
Candidula intersecta (Poiret)	EM		p	
Cepaea nemoralis L.	EM	p	p	
Cernuella virgata (da Costa)	EM		p	
Cochlicella acuta (Müller)	EM		p	
Helicella itala (L.)	EM		p	
Helix aspersa Müller	EM		p	
Hydrobiidae				
Potamopyrgus antipodarum (Gray)	EM	p	p	
Lymnaeidae				
Lymnaea palustris (Müller)	EM		p	
Lymnaea peregra (Müller)	EM		p	
Lymnaea truncatula (Müller)	EM	p	p	
Pupillidae				
Leiostyla anglica (Wood)	EM	p		
Sphaeriidae				
Pisidium casertanum (Poli)	EM		p	p
Pisidium nitidum Jenyns	EM			p
Pisidium obtusale (Lamarck)	EM	p		
Pisidium personatum Malm	EM	p	p	p
Succineidae				
Oxyloma pfeifferi (Rossmässler)	EM	p	p	
Succinea putris (L.)	EM		p	

TABLE 1 (continued)

Valloniidae				
Vallonia pulchella (Müller)	EM		p	
Vertiginidae				
Columella aspera Waldén	EM	p		p
Vertigo antivertigo (Draparnaud)	EM	p	p	
Vertigo geyeri Lindholm	EM	p		
Vertigo pygmaea (Draparnaud)	EM	p		
Vertigo substriata (Jeffreys)	EM	p		
Vitrinidae				
Vitrina pellucida (Müller)	EM		p	
Zonitidae				
Aegopinella nitidula (Draparnaud)	EM	p		
Aegopinella pura (Alder)	EM	p		
Nesovitrea hammonis (Ström)	EM	p	p	
Oxychilus alliarius (Miller)	EM	p	p	

APPENDIX. Some miscellaneous records from other sites visited during course of this excursion (det. BN unless indicated otherwise). All of these sites are in 50km UTM square MV3. Three additional sites were visited, two of them on the shores of Lough Conn.

Species recorded

Coolturk G075179

COLEOPTERA: Dytiscidae: *Agabus bipustulatus* (L.) (FM); Gyrinidae: *Gyrinus minutus* Fabr.; Hydrophilidae: *Enochrus fuscipennis* (Thomson) (FM).

DIPTERA: Syrphidae: *Eristalis intricarius* (L.) (MS); *Helophilus hybridus* Loew (MS); *Helophilus pendulus* (L.) (MS); *Helophilus trivittatus* (Fabr.) (MS); *Sericomyia silentis* (Harr.) (MS).

HEMIPTERA: Notonectidae: *Notonecta glauca* L.

HYMENOPTERA: Apidae: *Bombus muscorum* (L.).

ODONATA: Aeschnidae: *Aeshna juncea* (L.); Lestidae: *Lestes sponsa* (Hansemann); Libellulidae: *Sympetrum danae* (Sulzer).

Lough Conn, Knockmore G228081

COLEOPTERA: Chrysomelidae: *Donacia versicolorea* (Brahm); *Prasocuris phellandrii* (L.); Curculionidae: *Cionus hortulanus* (Geoffroy); Dytiscidae: *Hydroporus palustris* (L.); *Hygrotus inaequalis* (Fabr.); Gyrinidae: *Gyrinus caspius* Ménétries; *Gyrinus substriatus* Stephens; *Orectochilus villosus* (Müller); Haliplidae: *Haliplus lineatocollis* (Marsham).

DIPTERA: Stratiomyiidae: *Oplodontha viridula* (Fabr.); Tachinidae: *Tachina grossa* (L.).

HEMIPTERA: Anthocoridae: *Anthocoris nemorum* (L.); Cercopidae: *Philaenus spumarius* (L.); Cicadellidae: *Cicadella viridis* (L.); Corixidae: *Callicorixa praeusta* (Fieber); *Sigara distincta* (Fieber); *Sigara fallenoidea* (Hungerford); *Sigara fossarum* (Leach); Delphacidae: *Megamelus notula* (Germar); *Trigonotylus ruficornis* (Geoffroy); Gerridae: *Gerris lacustris* (L.); *Gerris thoracicus* Schummel; Lygaeidae: *Cymus glandicolor* Hahn; Miridae: *Blepharidopterus angulatus* (Fallén); *Closterostomus norwegicus* (Gmelin); *Cyrtorhinus caricis* (Fallén); *Plesiocoris rugicollis* (Fallén); *Stenodema calcarata* (Fallén); Nepidae: *Nepa cinerea* L.; Notonectidae: *Notonecta glauca* L.; Saldidae: *Salda littoralis* (L.); Veliidae: *Velia saulii*

APPENDIX (continued)

Tamanini.
HYMENOPTERA: Apidae: *Bombus pascuorum* (Scopoli).
ODONATA: Coenagrionidae: *Enallagma cyathigerum* (Charpentier).

Lough Conn, Cloghans G203133

COLEOPTERA: Dryopidae: *Dryops luridus* (Erichson) (FM); Dytiscidae: *Agabus bipustulatus* (L.); *Agabus unguicularis* Thomson (FM); *Colymbetes fuscus* (L.); *Hydroporus memnonius* Nicolai (FM); *Hydroporus palustris* (L.); *Hydroporus pubescens* (Gyllenhal) (FM); *Hygrotus inaequalis* (Fabr.); *Hygrotus quinquelineatus* (Zetterstedt); *Hyphydrus ovatus* (L.); *Nebrioporus assimilis* (Paykull) (FM); *Nebrioporus depressus* (Fabr.); Gyrinidae: *Gyrinus aeratus* Stephens (FM); *Gyrinus marinus* (Gyllenhal) (GF); Haliplidae: *Haliplus confinis* Stephens; *Haliplus obliquus* (Fabr.) (FM); Hydrometridae: *Hydrometra stagnorum* (L.); Hydrophilidae: *Anacaena limbata* (Fabr.) (FM); *Laccobius minutes* (L.) (FM).
HEMIPTERA: Cicadellidae: *Cicadella viridis* (L.); Corixidae: *Sigara distincta* (Fieber); *Sigara fallenoidea* (Hungerford); *Sigara fossarum* (Leach); Gerridae: *Gerris thoracicus* Schummel; Lygaeidae: *Cymus glandicolor* Hahn; Nepidae: *Nepa cinerea* L.; Notonectidae: *Notonecta glauca* L.

Miscellaneous molluscan records (det. EM).

Eight additional sites were visited, along the shores of Lough Conn. These have been labelled C1-C8 in the listed records. The character of these sites may be sketched as follows:-

C1: Cloghan's Pier, G203133

This is an area of fen that has developed between the mainland and Annaghroe Island, containing *Schoenus nigricans*, *Parnassia palustris*, *Mentha aquatica*, *Campanula rotundifolia* and *Ajuga reptans* in a transition of sub-habitats from hummock-rich grassland to saturated *Phragmites* reedbed and muddy patches with *Hydrocotyle*.

APPENDIX (continued)

C2: West of Lisduvoge, G197109

This is an area of lakeshore fen with rocky sand sparsely vegetated with *Schoenus nigricans* and *Parnassia palustris* leading to denser vegetation with *Carex nigra* and then to wet woodland dominated by *Alnus*.

C3: Tawnaghmore, G226076

This is an area of species rich grassland including *Spiranthes romanzoffiana*, with bare substrate with some *Hydrocotyle* towards the lakeshore and some *Alnus* scrub in places, and swards of *Filipendula* in others.

C4: Pontoon Woods (Attiappleton Lough), G195043

This is an area of wet woodland, mostly made up of oak *Quercus* and holly *Ilex*, with a stream leading to a lake within the woodland.

C5: Pontoon Woods (west of Corryosla Bridge), G197046

This is an area of woodland with a stream and good seepage areas, leading to a sandy lake shore.

C6: Pontoon Woods (east of Corryosla Bridge), G202048

This is an area of oak *Quercus* woodland that is relatively undisturbed. There was a good layer of old leaf litter to search through for Mollusca.

C7: Errew, G169119

The lake shores between Errew and the ruins of Errew Abbey were surveyed. This included areas of lakeshore fen with *Schoenus nigricans*, *Parnassia palustris* and *Hydrocotyle vulgaris*. Alder *Alnus* scrub and *Filipendula* is encroaching in places.

C8: Grange, G168175

This is an area of alder *Alnus* scrub and damp grassland with *Parnassia palustris*, *Hydrocotyle vulgaris* and a good bryophyte cover. It was heavily grazed by cattle during the survey period.

APPENDIX (continued)

Species recorded

ARCHEOGASTROPODA: Neritidae: *Theodoxus fluviatilis* (L.): C1.

BASOMMATOPHORA: Ellobiidae: *Carychium minimum* Müller: C2, C4, C5, C6, C7; *Carychium tridentatum* (Risso): C4, C5, C6, C7; Lymnaeidae: *Lymnaea palustris* (Müller): C1, C2, C3, C7, C8; *Lymnaea peregra* (Müller): C1, C2, C5, C7; *Lymnaea stagnalis* (L.): C1, C5, C7; *Lymnaea truncatula* (Müller): C1, C2, C3, C7, C8; Physidae: *Aplexa hypnorum* (L.): C1, C2, C8; Planorbidae: *Planorbis carinatus* Müller: C1, C2.

MESOGASTROPODA: Aciculidae: *Acicula fusca* (Montagu): C4, C5, C6; Hydrobiidae: *Bithynia tentaculata* (L.): C1, C2; *Potamopyrgus antipodarum* (Gray): C1, C3, C7, C8.

STYLOMMATOPHORA: Agriolimacidae: *Deroceras laeve* (Müller): C4, C5, C6; *Deroceras reticulatum* (Müller): C3; Clausilidae: *Balea perversa* (L.): C4, C5, C6; *Clausillia bidentata* (Strom): C5, C6; Cochlicopidae: *Cochlicopa lubrica* (Müller): C2, C3, C4, C5, C6; *Cochlicopa lubricella* (Porro): C2, C4, C5; Discidae: *Discus rotundatus* (Müller): C4, C5, C6; Endodontidae: *Punctum pygmaeum* (Drapernaud): C7; Euconulidae: *Euconulus alderi* (Gray): C1, C2, C4; *Euconulus fulvus* (Müller): C4; Helicidae: *Cepaea nemoralis* L.: C3, C4, C7, C8; *Trichia striolata* (Pfeiffer): C2; Pupillidae: *Lauria cylindrica* (Da Costa): C5; *Leiostyla anglica* (Wood): C4, C5, C6; Sphaeriidae: *Pisidium obtusale* (Lamarck): C1, C2, C8; *Pisidium personatum* Malm: C1, C2, C8; *Sphaerium corneum* (L.): C1; Succineidae: *Oxyloma pfeifferi* (Rossmassler): C1, C2, C3, C7, C8; *Succinea putris* (L.): C2; Valloniidae: *Acanthinula aculeata* (Müller): C4, C5, C6; *Spermodea lamellata* (Jeffreys): C4, C6; *Vallonia pulchella* (Müller): C4, C5, C6, C7, C8; Valvatidae: *Valvata piscinalis* (Müller): C1; Vertiginidae: *Columella aspera* Walden: C4; *Vertigo antivertigo* (Draparnaud): C7; *Vertigo substriata* (Jeffreys): C7; Zonitidae: *Aegopinella nitidula* (Draparnaud): C4; *Aegopinella pura* (Alder): C1, C4, C6; *Nesovitrea hammonis* (Strom): C2, C4, C6, C7; *Oxychilus alliarius* (Miller): C1, C2, C4, C7; *Oxychilus cellarius* (Müller): C4 *Vitrea contracta* (Westerlund): C3, C4, C5, C6; *Vitrea crystallina* (Müller): C4; *Zonitoides excavatus* (Alder): C4; *Zonitoides nitidus* (Müller): C4, C5, C6, C7.

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THE PRESENT STATUS OF THE SLOW-WORM, *ANGUIS FRAGILIS* L., IN IRELAND

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Introduction

Eighty seven years ago, a snippet in *The Irish Naturalist* (Allingham, 1913) referred to the capture (and killing) of a "Blindworm (*Anguis fragilis*)" on the bank of the River Erne near Ballyshannon, Co. Donegal. It was another 60 years before the slow-worm was next reported in Ireland, this time from the Burren, Co. Clare (McCarthy, 1977). Since then a number of further sightings have been reported (e.g. D'Arcy, 1992; *Westmeath Topic*, July 1999), but no attempt has been made to-date to determine the distribution of the slow-worm and there has been no detailed investigation of the status of this reptile in Ireland.

The slow-worm has evolved a legless skeleton to suit its burrowing lifestyle and consequently bears a superficial resemblance to a snake, but it is easily distinguished as a lizard by its closable eyelids and its ability to shed its tail. *Anguis fragilis* L. is a cold-tolerant species; it is found over most of mainland Europe including southern Scandinavia and is widespread in Britain as far north as Northern Scotland. It has been shown that the slow-worm was one of the first reptiles to recolonise Britain after the last Ice Age (Gleed-Owen, 1998), but there are no archaeological data to show that the animal reached Ireland at that time.

This paper presents the results of the first survey of the slow-worm in Ireland. It brings together original data with anecdotal and historical records to examine the current status of this lizard. A preliminary examination of its habitat within the Burren is also included.

Methods

In an attempt to further our understanding of the status of the slow-worm in Ireland, a general survey of eight locations in the Burren was conducted over a three day period (21-23 July) in

1998. This was followed up with intensive surveys of selected sites in 1999. Furthermore, landowners and naturalists who have reported seeing the animal in the area over the past 25 years were interviewed.

The areas surveyed in 1998 were:- Finavarra (M2612) on the north coast of Clare; Glenslade (M2302) and Carran (R2999) in the mid-Burren; and five sites in the east Burren: Cappaghmore (M3406), Tulla (M3602), Turloughmore (R3499), south of Lough Gealáin at Mullaghmore (R3295) and Glenquin west of Mullaghmore (R3196). Surveying consisted of labour-intensive examination of potential basking spots in vegetation and in the open; investigating likely hiding places i.e. turning over stones, logs, rocks and looking under suitable artificial substrates where present e.g. carpet, lino, felt, tiles.

A more intensive and methodical survey was initiated in 1999. In response to an appeal for slow-worm records *via* Clare and Galway local radio and newspapers, 20 slow-worm sightings were reported. These sites, and other sites where recent anecdotal information suggested that slow-worms occurred, were surveyed between March and October 1999. The sites that were surveyed during 1999 are shown (Fig. 1).

At certain sites, artificial refuges were employed to facilitate the survey effort. Artificial refuges are extensively used as a tool to survey for the presence of reptiles (e.g. Foster and Gent, 1996). Different materials appear to suit different thermal conditions and consequently, in the present study, we employed both roofing felt and galvanised corrugated iron. Refuges were placed at ten survey sites in March 1999. At each site, three pieces of black roofing felt ($1m^2$, $0.5m^2$ and $0.25m^2$) and a $0.5m^2$ of carpet tile were laid down. From August to October 1999, a further 12 sites were surveyed using a mixture of galvanised corrugated iron and felt refuges. Again four refuges were used at each site. The refugia were placed in areas of good ground cover where the habitat graduated from one type to another e.g. from scrub-covered limestone pavement to open calcareous grassland. All sites were checked for slow-worms on the same day or within two consecutive days. In addition, random walks and searches were completed, in areas where slow-worms were expected to occur. Likewise many of the householders in these areas were asked had they ever seen slow-worms on their property. Where animals were encountered regularly at any one site, the number of units of refuges was doubled or trebled to allow more detailed study of the ecology and habitat preferences of these individuals.

Refuges were checked once a month from April to September and weekly from September to mid-October, at which stage temperatures dropped and no further slow-worms were found. Most visits were made in the afternoon and evening. For each animal that was found total length and snout-vent length were recorded to the nearest cm.

Results

During the brief 1998 survey, slow-worms were found at two locations approximately one mile apart to the south-west of Tulla Park. At the first location (M363024) a large female (40cm total length) was found, basking on limestone pavement near hazel *Corylus* scrub. Two juvenile animals were found at the second positive location (M354020), an area of shattered limestone, calcareous grassland and scrub. The animals were under loose rocks. All other locations proved negative for the slow-worm, although the viviparous lizard (*Lacerta vivipara* Jacquin) was observed at Turloughmore and Glenslade.

In 1999, slow-worms were found from 28 May to 14 October and up to 160m a.s.l. In total, 89 records of slow-worms of all sizes were gathered from eight locations. Table 1 summarises the lengths of the animals encountered. This reptile appeared to be present in high densities in some areas where it was found, but sparsely distributed elsewhere. All of these confirmed records suggest an established breeding population in an area north of the Burren National Park, from Glencolumbkille in the south-west (M3200) to Cappacasheen in the north-east (M3704) just over the Galway border. This represents an area of approximately 17 square kilometres (Fig. 1). Other records have been reported from outside this zone (e.g. Gleninagh in the north-west Burren and Carran in the mid-Burren) and undoubtedly the slow-worm is not confined to this area. The figure also shows areas where refugia were installed but no slow-worms were found.

Slow-worms were recorded in a number of habitat types, including limestone pavement, hazel scrub and calcareous grassland, but areas found to be positive for this reptile usually contained a mosaic of two or three of these habitat types.

TABLE 1. Mean snout-vent length (SVL) and total length (+/- Standard Deviation) in cm for animals caught in 1999.

	No.	SVL	Total Length
Males	18	13.2 (+/- 1.3)	26.7 (+/- 4.1)
Females	31	17.0 (+/- 3.1)	31.9 (+/- 6.0)
Juveniles	39	9.2 (+/- 1.9)	17.8 (+/- 2.9)

Discussion

It is generally believed that the slow-worm was introduced into the east Burren approximately 30 years ago, perhaps by the New Age Travellers who arrived in the area around that time, but there is no documentary evidence to support this. Its arrival may equally be connected with the introduction of the green lizard (*Lacerta viridis* (Laurenti)) to the same area in 1958 (Cabot, 1965). The area highlighted in Fig. 1 appears to represent a stronghold for the slow-worm within the Burren. Breeding has been confirmed at a number of locations inside this zone and adults of varying sizes have been recorded demonstrating the presence of a well-established, self-sustaining population. The results of the present survey indicate a relatively discrete focus of population (*circa* 17km^2) which could be regarded as support for the theory that this reptile is a relatively recent introduction to the Burren. However, this situation may equally reflect the concentration of survey effort to date. Survey work is continuing and, with the assistance of several National Parks and Wildlife field staff, a wider area is now under scrutiny.

Despite the occasional records of slow-worms from other parts of the country (e.g. Donegal (Allingham, 1913), Westmeath (*Westmeath Topic*, July 1999) and Cork (R. Hancock pers. comm., 2000)), breeding has never been established outside the Burren area. Consequently it seems most plausible that these individuals had escaped, or been deliberately released, from captivity.

In Britain, *Anguis fragilis* is known to prefer well vegetated areas with extensive ground cover (Arnold *et al.*, 1992). Based on the preliminary findings of the present study, however, it

appears that mosaics of open and well vegetated habitats such as calcareous grassland and scrub with outcrops of limestone pavement, offer the diversity of vegetational structure and of thermal conditions that best suit the slow-worm in the Burren region. Ongoing survey work is attempting to address the issue of habitat preferences in greater detail.

Whatever the origins of the slow-worm in Ireland, it would appear that this reptile is well established in the eastern Burren and is breeding successfully. However, it is by no means common, or widespread. Furthermore, despite occasional anecdotal and even confirmed records, there is no evidence to suggest that the animal is established anywhere else in the country.

Acknowledgements

We would like to thank all the people who provided us with records of the slow-worm. Thanks also to Jim Foster and Tom Langton of *Froglife* for advice on survey methodology.

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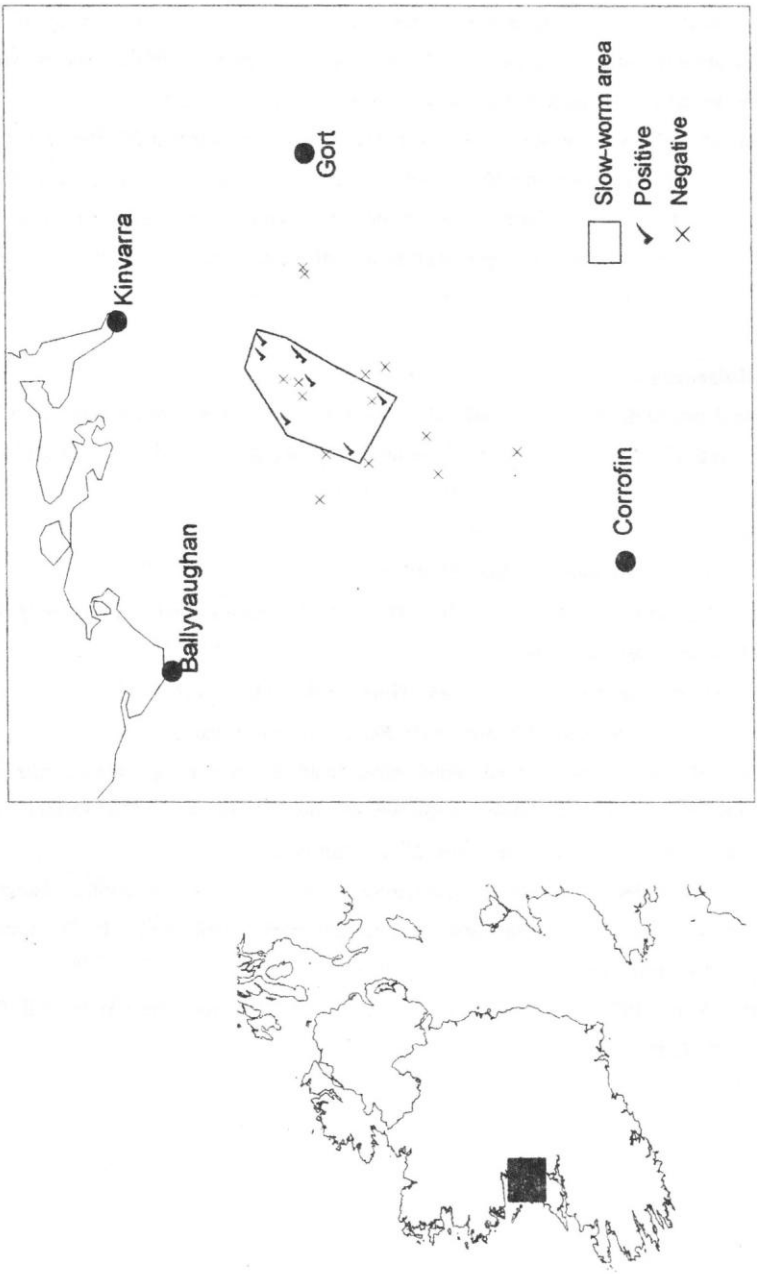
FIGURE 1. The locations surveyed for slow-worms in 1999.



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DISTRIBUTIONAL RECORDS OF IRISH DIPTERA

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Abstract

Irish records are given for twenty-seven families of Diptera *viz.* Anisopodidae, Asilidae, Asteiidae, Bolitophilidae, Campichoetidae, Clusiidae, Coelopidae, Conopidae, Diastatidae, Dolichopodidae, Dryomyzidae, Empididae, Heleomyzidae, Hybotidae, Keroplatidae, Micropezidae, Mycetophilidae, Opetiidae, Pallopteridae, Platypezidae, Platystomatidae, Rhagionidae, Sciaridae, Sciomyzidae, Stratiomyidae, Tabanidae and Ulidiidae.

Introduction

This is the first of a series of papers presenting distributional data on Irish Diptera, both as a contribution towards our knowledge of the biogeography of the group and as an aid to conservation. The records are based on specimens collected by J. P. and M. A. O'Connor in Ireland over the last twenty five years. Unless otherwise stated, they were swept from vegetation using a hand-net. Twenty-seven families are dealt with here *viz.* Anisopodidae, Asilidae, Asteiidae, Bolitophilidae, Campichoetidae, Clusiidae, Coelopidae, Conopidae, Diastatidae, Dolichopodidae, Dryomyzidae, Empididae, Heleomyzidae, Hybotidae, Keroplatidae, Micropezidae, Mycetophilidae, Opetiidae, Pallopteridae, Platypezidae, Platystomatidae, Rhagionidae, Sciaridae, Sciomyzidae, Stratiomyidae, Tabanidae and Ulidiidae. The material was identified by the junior author. Species new to Ireland will be reported elsewhere. Nomenclature follows Chandler (1998) who also lists the Irish species recorded in each family. Voucher specimens are deposited in the National Museum of Ireland. Where existent, Irish check-lists dealing with each family are given under the relevant heading. In addition, other records from the Murrough, Co. Wicklow, will be found in Blackith *et al.* (1991) who carried out an extensive investigation of the dipteran fauna of the area. It was not

possible to review the extensive literature on the Irish Diptera in order to indicate new county or vice-county records. However some important new records are noted. The Irish counties are shown (Fig. 1).

ANISOPODIDAE

Other records for the species below are given by Ashe (1987).

***Sylvicola punctatus* (Fabricius, 1787)**

KILDARE: near Straffan (N9326), in vegetation beside the Grand Canal, ♂ ♀ 14.xi.1981, JPOC and MAOC.

WATERFORD: Ballin Lough (S4403), in lake-side vegetation, ♂ 18.vi.1990, JPOC and MAOC.

WEXFORD: Carnsore Point (T1203), on sand-dunes, 27.viii.1980, JPOC; Curracloe (T1127), old pasture/alder *Alnus* marsh, ♂ 9.v.1982, JPOC; Ferrycarrig (T0122), Heritage Park, ♂ ♀ 19.iv.1987, JPOC; Nethertown (T1205), willow *Salix* marsh, ♂ 6.vi.1986, JPOC and MAOC; Stoneyford (T1009), rough pasture, ♀ 5.ix.1980, JPOC.

ASILIDAE

The Irish fauna is reviewed by Speight (1987).

***Neoitamus cyanurus* (Loew, 1849)**

CARLOW: Bahana Woods (S7239), mixed woodland, 3♂♂ 14.vi.1991, JPOC and MAOC; same locality, ♀ 18.vi.1991, JPOC.

KILKENNY: Woodstock House (S6336), mixed woodland, ♀ 4.vii.1991, JPOC and MAOC.

***Philonicus albiceps* (Meigen, 1820)**

WEXFORD: Fethard (S7905), sand-dunes, ♂ 16.vi.1990, JPOC.

ASTEIIDAE

***Asteia amoena* Meigen, 1830**

CARLOW: Altamont Gardens (S8665), formal gardens, ♂ 31.iii.1991, JPOC.

CLARE: near Ennis (R2979), mixed woodland mainly hazel *Corylus*, ♀ 30.v.1984, JPOC.

KILDARE: Louisa Bridge (N9936), calcareous marshland, ♂ 30.viii.1991, JPOC.

LAOIS: The Derries (N5805), mixed woodland, ♂ 20.ix.1982, JPOC.

WEXFORD: Oaklands (S7125), mixed woodland, ♂ 10.vi.1986, JPOC.

WICKLOW: Glendalough (T1195), lake-shore, ♂ 11.ix.1990, JPOC.

***Leiomyza scatophagina* (Fallén, 1823)**

CORK: Bantry House (V9848), ♂ 3.vii.1985, JPOC.

BOLITOPHILIDAE

Additions to the preliminary account of Irish fungus gnats by Chandler (1976a) have been published in several papers and the Irish list was updated by Chandler (1992).

***Bolitophila saundersii* (Curtis, 1836)**

CLARE: Lisdoonvarna Spa (R1397), beside the river, ♂ 25.v.1992, JPOC and MAOC.

CAMPICHOETIDAE

***Campichoeta obscuripennis* (Meigen, 1830)**

CAVAN: Woodlawn (N4686), Lough Sheelin, lake-side, ♂ 12.ix.1991, JPOC.

WESTMEATH: Ballynafid Lake (N4060), lake-side vegetation, ♂ 22.vi.1989, JPOC.

***Campichoeta punctum* (Meigen, 1830)**

WATERFORD: Woodstock House (S6336), mixed woodland, ♂ 24.vii.1987, JPOC.

CLUSIIDAE

Other records for the species below are given by Chandler (1978a).

***Clusia flava* (Haliday in Curtis, 1837)**

CAVAN: Virginia (N5987), mixed woodland, ♀ 30.v.1982, JPOC and MAOC.

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

COELOPIDAE

***Coelopa frigida* (Fabricius, 1805)**

CLARE: Bridge of Ross (Q7350), coastal moorland, ♀ 10.vii.1981; near Formoyle (M1606), limestone pavement, ♀ 22.v.1985, JPOC and MAOC; Liscannor (R0588), on the headland, ♂ 5.vii.1981, JPOC; River Caher (M1509), The Burren, ♂ 17.vii.1981, JPOC and MAOC.

DUBLIN: Bull Island (O2438), alder *Alnus* marsh, ♂ 14.ix.1985, JPOC.
WEXFORD: Carnsore Point (T1203), sand-dunes, ♂ 1.ix.1980, JPOC; Lady's Island Lake (T1007), lake-side vegetation, ♂ 30.viii.1980, JPOC.

CONOPIDAE

Other records for the species below are given by Smith (1952) and Speight (1978).

***Conops quadrifasciatus* De Geer, 1776**

KERRY: Cloghereen Stream (V9786), Killarney, stream-side vegetation, ♀ 10.ix.1981, JPOC; near Doo Lough, Killarney (V9586), ♂ 11.ix.1981, JPOC; Kenmare Estate (V9490), Killarney, river-side vegetation, 4♂♂ 8.ix.1981, JPOC; Muckross (V9787), Killarney, vegetation along Arthur Young's Walk, ♂ 11.ix.1981, JPOC; O'Sullivan's Cascade (V9188), Killarney, beside the waterfall, ♂ 27.viii.1987, JPOC.
WICKLOW: Russellstown Park (N9610), mixed woodland, ♂ 16.viii.1981, JPOC and MAOC.

DIASTATIDAE

The Irish species are reviewed by Chandler (1986).

***Diastata adusta* Meigen, 1830**

WATERFORD: Woodstown (S6905), mixed woodland, ♂ 3.vii.1990, JPOC.
WEXFORD: Carnsore Point (T1238), sand-dunes, ♀ 27.viii.1980, JPOC.

***Diastata nebulosa* (Fallén, 1823)**

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 22.viii.1988, JPOC.

DOLICHOPODIDAE

The Irish fauna is reviewed by Dyte (1969) with additional data provided by Speight and de Courcy Williams (1992).

***Anepsiomyia flaviventris* (Meigen, 1824)**

CARLOW: St Mullins (S7238), beside a stream, 3♂♂ 17.vi.1991, JPOC.
CORK: Glengarriff (V9057), oak *Quercus* wood, 2♂♂ ♀ 6.vii.1985, JPOC and MAOC; Rahan (W6497), marsh beside a stream, ♂ 6.vii.1989, JPOC.
WATERFORD: Ballin Lough (S4403), lake-side vegetation, 2♂♂ 19.vi.1991, JPOC; Dunhill

Castle (S5000), ♂ 11.vii.1989, JPOC and MAOC; Lismore Castle (X0498), the formal gardens, ♀ 17.vii.1987, JPOC.

***Argyra diaphana* (Fabricius, 1775)**

TIPPERARY: near Ballina (R7172), small wood, ♂ 27.v.1984, JPOC.

***Hercostomus* (*Gymnopternus*) *cupreus* (Fallén, 1823)**

CLARE: Ballyeighter (R3494), mixed woodland, ♂ 29.v.1984, JPOC and MAOC.

TIPPERARY: near Ballina (R7172), small wood, ♂ 27.v.1984, JPOC.

WATERFORD: Mahon Falls (S3009), moorland, ♂ 20.vi.1991, JPOC and MAOC.

WICKLOW: Avondale (T1985), mixed woodland, ♂ 27.v.1988, JPOC; Powerscourt Deer Park (O2012), mixed woodland, ♂ 15.vi.1988, JPOC.

***Hydrophorus nebulosus* Fallén, 1823**

OFFALY: Clara Bog (N2629), on the bog, 2♂♂ 30.iv.1984, JPOC.

***Poecilobothrus nobilitatus* (Linnaeus, 1767)**

WATERFORD: Ballin Lough (S4603), lake-side vegetation, ♂ 19.vii.1987, JPOC; near Dunhill (S5304), hedgerows, ♂ 29.vi.1988, JPOC.

WEXFORD: near Killowen (S7121), pond, ♂ 19.vi.1990, JPOC and MAOC.

***Sciapus platypterus* (Fabricius, 1805)**

CORK: Glengarriff (V9157), mixed woodland mainly oak *Quercus*, 3♂♂ 4.vii.1985, JPOC and MAOC.

GALWAY: Coole Park Woods (M4304), mixed woodland, ♂ 1.vi.1992, JPOC and MAOC.

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♂ 19.vi.1991, JPOC.

WICKLOW: Powerscourt Deer Park (O2012), mixed woodland, ♂ 15.vi.1988, JPOC.

***Syntormon bicolorellum* (Zetterstedt, 1843)**

WEXFORD: Ferrycarrig (T0023), ♀ 15.vi.1991, JPOC.

DRYOMYZIDAE

***Dryomyza flaveola* (Fabricius, 1794)**

CLARE: Ballynalackan (M1000), vegetation beside the cliff-face, ♀ 31.v.1984, JPOC.

LAOIS: Emo (N5305), mixed woodland, ♀ 3.x.1982, JPOC and MAOC.

WEXFORD: Ballyhighland (S8840), mixed woodland, ♂ 14.vi.1982, JPOC and MAOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♀ 27.ix.1987, JPOC.

***Helcomyza ustulata* Curtis, 1825**

CORK: Barley Cove (V7625), ♂ 2.vii.1985, JPOC.

***Neuroctena anilis* (Fallén, 1820)**

CARLOW: Cloughristick (S7069), mixed woodland, ♂ 24.x.1982, JPOC and MAOC.

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 22.ix.1985, JPOC and MAOC.

CLARE: Ennistymon (R1288), in the grounds of the Falls Hotel, ♀ 9.vii.1981, JPOC; Lisdoonvarna (R1397), near the Spa, ♂ 8.vii.1981, JPOC; Rathborney River (M2004), The Burren, ♀ 2.vi.1992, JPOC.

CORK: Glengarriff (V9057), oak *Quercus* wood, ♂ ♀ 6.vii.1985, JPOC and MAOC; Glengarriff (V9256), oak *Quercus* wood, ♂ 7.vii.1985, JPOC and MAOC.

DUBLIN: Malahide Castle (O2245), vegetation along a pathway, ♂ 13.x.1985, JPOC and MAOC.

KERRY: Killarney (V9586), mixed woodland, ♂ 11.ix.1981, JPOC; Tomies Wood (V9188), Killarney, found inside a tree trunk, ♂ 15.ix.1981, JPOC.

KILDARE: near Straffan (N9326), Grand Canal bank, ♀ 12.ix.1982, JPOC and MAOC.

LAOIS: Emo (N5305), mixed woodland, ♂ 3.x.1982, JPOC and MAOC.

WEXFORD: Ballyhighland (S8840), mixed woodland, ♀ 14.vi.1982, JPOC and MAOC.

EMPIDIDAE

The Irish fauna is reviewed by Chandler (1978b) and Lavery *et al.* (1993).

***Chelifera precatoria* (Fallén, 1816)**

CAVAN: Virginia (N5888), alder *Alnus* fen, ♀ 30.v.1982, JPOC and MAOC.

CLARE: Cooleabeg (M1602), damaged blanket bog in The Burren, ♂ 22.v.1985, JPOC and MAOC; Lough Bunny (R3696), limestone pavement, ♂ 28.v.1992, JPOC; Rathborney River (M2004), The Burren, ♂ 2.vi.1992, JPOC.

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♂ 19.vi.1991, JPOC.

WEXFORD: Killoughrim (S8941), oak *Quercus* forest, ♂ 27.v.1987, JPOC; Oaklands (S7125), mixed woodland, ♂ 29.v.1987, JPOC.

***Chelifera trapezina* (Zetterstedt, [1838])**

WATERFORD: Glasha River (S3022), 2♂♂ 8.vii.1989, JPOC and MAOC.

***Clinocera fontinalis* (Haliday, 1833)**

CORK: Glengarriff (V9256), oak *Quercus* wood, ♂ 7.vii.1985, JPOC and MAOC.

WATERFORD: Mahon Falls (S3009), mountain waterfall, ♂ 20.vi.1991, JPOC and MAOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 27.viii.1981, JPOC; Glendalough (T1195), mixed woodland, ♂ 24.iv.1989, JPOC and MAOC.

***Clinocera stagnalis* (Haliday, 1833)**

KILDARE: Rye Water (O0036), vegetation on river-bank, ♂ ♀ 9.viii.1981, JPOC and MAOC.

WATERFORD: Mahon Falls (S3009), mountain moorland, ♂ 3.vii.1988, JPOC; Portally Cove (X6798), vegetation near the sea-shore, ♀ 8.vii.1990, JPOC.

WEXFORD: Nethertown (T1205), willow *Salix* marsh, ♂ 9.vi.1986, JPOC and MAOC.

***Empis* (*Anacrostichus*) *verralli* Collin, 1927**

CLARE: Cooleabeg (M1602), damaged blanket bog in The Burren, 2♂♂ 22.v.1985, JPOC and MAOC.

OFFALY: Clara Bog (N2629), on the bog, 2♂♂ 30.iv.1984, JPOC.

***Empis* (*Coptophlebis*) *albinervis* Meigen, 1822**

WATERFORD: near Passage East (S6811), hill-side vegetation, ♂ 13.vii.1989, JPOC and MAOC.

Confirmed as an Irish species by Lavery *et al.* (1993) based on a ♂ taken at Dunhill, Co. Waterford.

***Empis* (*Empis*) *aestiva* Loew, 1867**

CARLOW: St Mullins (S7238), vegetation beside the river, ♂ 1.vii.1991, JPOC and MAOC.

CORK: Garnish (V9356), Glengarriff, wild area, ♂ 1.vii.1985, JPOC and MAOC.

KILKENNY: Woodstock House (S6336), mixed woodland, ♂ 4.vii.1991, JPOC and MAOC.

WATERFORD: Dunhill Castle (S5000), ♂ 11.vii.1989, JPOC and MAOC.

***Empis* (*Empis*) *chioptera* Meigen, 1804**

DUBLIN: Phoenix Park (O0935), mixed wood of ash *Fraxinus*/hawthorn *Crataegus*, ♂ 17.iv.1982, JPOC and MAOC.

WEXFORD: Oaklands (S7125), mixed woodland, ♂ 10.vi.1986, JPOC.

***Empis* (*Empis*) *nigripes* Fabricius, 1794**

CLARE: near Formoyle (M1606), The Burren, green road, ♂ 29.v.1992, JPOC.

MEATH: Batterjohn Big (N8953), abandoned sand-pit, ♂ 31.v.1989, JPOC.

***Empis* (*Empis*) *nuntia* Meigen, 1838**

CARLOW: St Mullins (S7238), vegetation beside the river, ♂ 17.vi.1991, JPOC.

CLARE: near Ballyvaghan (M2207), The Burren, ♂ 30.v.1992, JPOC.

DUBLIN: Clondalkin (O0631), malaise trap in a suburban garden, ♂ 1-9.ix.1982, JPOC; Dartry (O1530), Botanic Gardens, Trinity College Dublin, ♂ 13.v.1982, JPOC; Naul (O1461), wild area on a farm, ♂ 18.v.1991, JPOC.

MEATH: Batterjohn Big (N8953), abandoned sand-pit, ♂ 31.v.1989, JPOC.

WEXFORD: Killoughrim (S8941), oak *Quercus* forest, ♂ 27.v.1987, JPOC; Oaklands (S7125), mixed woodland, ♂ 10.vi.1986, JPOC; same locality, ♂ 29.v.1987, JPOC.

***Empis* (*Empis*) *planetica* Collin, 1927**

CLARE: near Ennis (R2979), mixed wood mainly hazel *Corylus*, 2♂♂ ♀ 30.v.1984, JPOC.

***Empis* (*Euempis*) *tessellata* Fabricius, 1794**

CARLOW: Cloughristick (S7069), mixed woodland, 2♂♂ 19.vi.1992, JPOC and MAOC.

CLARE: Ballyeighter (R3494), mixed woodland, ♂ 29.v.1984, JPOC and MAOC; Fanore, sand-dunes, ♂ 26.v.1992, JPOC; Lough Bunny (R3696), limestone pavement, ♂ 21.v.1985, JPOC and MAOC.

WEXFORD: Killoughrim (S8941), oak *Quercus* forest, ♂ 16.vi.1982, JPOC and MAOC; Oaklands (S7125), mixed woodland, ♂ 18.vi.1982, JPOC and MAOC.

***Empis* (*Pachymeria*) *femorata* Fabricius, 1798**

WEXFORD: Ballyteige (S9504), sand-dunes, ♂ 12.vi.1982, JPOC and MAOC; same locality, sand-dunes, ♂ 5.vi.1986, JPOC and MAOC; the same locality, ♂ 26.v.1987, JPOC; The Raven (T1026), conifers on sand-dunes, 2♂♂ ♀ 4.vi.1986, JPOC.

***Empis* (*Kritempis*) *livida* Linnaeus, 1758**

CORK: Bantry House (V9848), in the gardens, ♂ 3.vii.1985, JPOC.

WATERFORD: near Passage East (S6811), hill-side vegetation, ♂ 3.vii.1983, JPOC and MAOC.

WEXFORD: Tintern Abbey (S7810), mixed woodland, ♂ 15.vi.1990, JPOC.

WICKLOW: near Calary Lower (O2311), marshy area, ♀ 12.vii.1983, JPOC; Kilmacanoge (O2514), alder *Alnus* marsh and stream, ♀ 15.viii.1982, JPOC and MAOC.

***Empis* (*Xanthempis*) *digramma* Meigen in Gistl, 1835**

CLARE: Lough Bunny (R3696), limestone pavement, ♂ 21.v.1985, JPOC and MAOC.

TIPPERARY: near Ballina (R7172), mixed woodland, ♂ 20.v.1985, JPOC and MAOC.

***Empis* (*Xanthempis*) *stercorea* Linnaeus, 1761**

CAVAN: Virginia (N5888), alder *Alnus* fen, ♂ 30.v.1982, JPOC.

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♂ 18.vi.1990, JPOC and MAOC.

WEXFORD: Curracloe (T1127), alder *Alnus* marsh, ♂ 9.vi.1982, JPOC; Ferrycarrig (T0022), marsh/birch *Betula*/hazel *Corylus*, ♂ 3.vi.1986, JPOC and MAOC; Oaklands (S7125), mixed woodland, ♂ 18.vi.1982, JPOC and MAOC.

***Empis* (*Xanthempis*) *trigramma* Wiedemann in Meigen, 1822**

CLARE: near Formoyle (M1606), green road in The Burren, ♂ 22.v.1985, JPOC and MAOC; Lisdoonvarna Spa (R1397), river-side vegetation, 3♂♂ 25.v.1992, JPOC and MAOC.

***Heleodromia immaculata* Haliday, 1833**

KERRY: Killarney (V9188), Tomies Wood, mixed woodland, ♀ 15.ix.1981, JPOC.

Previously only known from Holywood, Co. Down and Glencar, Co. Kerry (Lavery *et al.* (1993).

***Hemerodromia unilineata* Zetterstedt, 1842**

CARLOW: Altamont Gardens (S8665), mixed woodland near the river, ♂ ♀ 9.vi.1991, JPOC and MAOC; Bahana Woods (S7239), mixed woodland, ♂ 14.vi.1991, JPOC and MAOC; St Mullins (S7238), river-side vegetation, ♂ 17.vi.1991, JPOC.

KILDARE: Rye Water (O0036), river-side vegetation, ♀ 9.viii.1981, JPOC and MAOC.

WATERFORD: Glasha River (S3022), river-side vegetation, ♂ 8.vii.1989, JPOC and MAOC.

***Hilara anglodanica* Lundbeck, 1913**

WEXFORD: Tintern Abbey (S7810), mixed woodland, ♂ 15.vi.1990, JPOC.

WICKLOW: Russellstown Park (N9610), mixed woodland/marsh, ♀ 16.viii.1981, JPOC and MAOC.

***Hilara chorica* (Fallén, 1816)**

WATERFORD: Mahon Falls (S3009), mountain moorland, 2♂♂ 3.vii.1989, JPOC and

MAOC.

***Hilara intermedia* (Fallén, 1816)**

CARLOW: Bahana Woods (S7239), mixed woodland, ♂ 18.vi.1991, JPOC.

WEXFORD: Coolbawn House (S8317), mixed woodland, ♂ 8.vi.1991, JPOC and MAOC.

***Hilara litorea* (Fallén, 1816)**

CORK: Coill Ghleann (R8404), ♀ 31.vi.1985, JPOC.

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♂ 7.viii.1981, JPOC.

KERRY: Rossdohan Island (V7162), exotic gardens, ♂ 9.vii.1985, JPOC and MAOC.

KILDARE: Castletown (N9734), mixed woodland, ♂ 8.viii.1982, JPOC and MAOC.

KILKENNY: Clonassy Wood (S5622), mixed woodland, ♂ 20.vi.1990, JPOC and MAOC; Harristown (S5127), near the dolmen, ♂ 4.vii.1990, JPOC.

LIMERICK: Lough Gur (R6241), lake-side marshy area, ♀ 7.vii.1981, JPOC.

WATERFORD: Ballin Lough (S4403), 2♂♂ 18.vi.1990, JPOC and MAOC; near Dunhill (S5304), hedgerows, ♂ ♀ 29.vi.1988, JPOC; Dunmore East (S6800), seepages at the kittiwake colony, 2♀♀ 11.vi.1991, JPOC; Glasha River (S3022), river-side vegetation, 2♂♂ 8.vii.1989, JPOC and MAOC.

WEXFORD: Slieve Coiltia (S7221), hill-side vegetation, ♀ 14.vi.1990, JPOC.

WICKLOW: Avondale (T1985), mixed woodland, ♂ 5.vi.1989, JPOC.

***Hilara lundbecki* Frey, 1913**

WATERFORD: Tramore (S5901), back strand, 2♂♂ 14.vii.1989, JPOC and MAOC.

WEXFORD: Curracloe (T1127), sand-dunes/marsh, ♂ 28.v.1987, JPOC; Fethard (S7905), near the beach, ♂ 5.vii.1991, JPOC.

***Hilara maura* (Fabricius, 1776)**

CARLOW: Cloughristick (S7069), mixed woodland, ♂ 19.vi.1982, JPOC and MAOC.

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

CLARE: Burren (M2711), The Burren, marsh, ♂ 4.vi.1992, JPOC and MAOC; Gragan Castle (M2003), The Burren, gardens of the hotel, 2♂♂ 2.vi.1992, JPOC; Lisdoonvarna Spa (R1397), river-side vegetation, ♂ 25.v.1992, JPOC and MAOC; Lough Bunny (R3696), limestone pavement, ♂ 28.v.1984, JPOC and MAOC; same locality, ♂ 28.v.1992, JPOC.

DUBLIN: St Catherines Wood (O0136), mixed woodland, ♂ 12.v.1991, JPOC and MAOC.

WEXFORD: Killoughrim (S8941), oak *Quercus* forest, ♂ 27.v.1987, JPOC.

***Hilara monedula* Collin, 1927**

KILKENNY: Woodstock House (S6337), Inistioge, mixed woodland, ♂ 16.vi.1991, JPOC.

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♂ 11.vi.1991, JPOC.

***Hilara obscura* Meigen, 1822**

CAVAN: Woodlawn (N4686), Lough Sheelin, lake-side vegetation, ♂ 6.viii.1990, JPOC and MAOC.

WATERFORD: Rye River (O0036), river-side vegetation, ♀ 9.viii.1981, JPOC and MAOC.

***Hilara rejecta* Collin, 1927**

WATERFORD: Mount Congreve (S5310), formal gardens, ♂ 10.vii.1989, JPOC.

***Hilara thoracica* Macquart, 1827**

CARLOW: Cloughristick (S7069), mixed woodland, ♂ 19.vi.1982, JPOC and MAOC; St Mullins (S7238), stream, ♂ 17.vi.1991, JPOC.

***Hilara quadrivittata* Meigen, 1822**

CLARE: near Formoyle (M1606), The Burren, green road, ♂ 22.v.1985, JPOC and MAOC; same locality, ♂ 29.v.1992, JPOC.

GALWAY: Coole Park Woods (M4304), ♂ 1.vi.1992, JPOC and MAOC.

WATERFORD: Woodstown (S6905), ♂ 3.vii.1990, JPOC.

WESTMEATH: Coosan Lough (N0554), ♂ 2.vii.1980, JPOC.

***Phyllodromia melanocephala* (Fabricius, 1794)**

CARLOW: Bahana Wood (S7239), mixed woodland, ♂ 18.vi.1991, JPOC.

CLARE: Lisdoonvarna (R1397), near the Spa, 2♀♀ 8.vii.1981, JPOC.

CORK: Glengarriff (V9057), oak *Quercus* wood, ♂ 6.vii.1985, JPOC and MAOC.

KILKENNY: Clonassy Wood (S5622), mixed woodland, ♂ 20.vi.1990, JPOC and MAOC.

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♂ 11.vi.1991, JPOC; Portlaw (S4415), mixed woodland, 2♀♀ 16.vii.1987, JPOC and MAOC.

WEXFORD: Urrin River (S8743), woods, ♂ 9.vi.1991, JPOC and MAOC.

***Rhamphomyia* (*Aclonempis*) *albohirta* Collin, 1926**

CLARE: Creagh (M2005), the dry bed of a stream, ♀ 21.iv.1982, JPOC.

TIPPERARY: near Ballina (R7172), small wood, ♂ 27.v.1984, JPOC.

WESTMEATH: Derravaragh Lough (N4762), lake-side vegetation, ♂ 30.v.1990, JPOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 26-27.iv.1986, JPOC and MAOC.

***Rhamphomyia* (*Aclonempis*) *longipes* (Meigen, 1804)**

CORK: Glengarriff (V9057), mixed woodland, ♂ 6.vii.1985, JPOC and MAOC.

WATERFORD: Dunhill Castle (S5000), ♂ 11.vii.1989, JPOC and MAOC.

WEXFORD: Oaklands (S7125), mixed woodland, ♂ 18.vi.1982, JPOC and MAOC; same locality, ♂ 10.vi.1986, JPOC.

***Rhamphomyia* (*Amydroneura*) *erythrophthalma* Meigen, 1830**

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♀ i.xi.1981, JPOC.

***Rhamphomyia* (*Amydroneura*) *hirsutipes* Collin, 1926**

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 3.x.1986, JPOC and MAOC.

***Rhamphomyia* (*Holoclera*) *flava* (Fallén, 1816)**

WEXFORD: Urrin River (S8743), woods, ♂ 9.vi.1991, JPOC and MAOC.

***Rhamphomyia* (*Holoclera*) *umbripennis* Meigen, 1822**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 21.v.1989, JPOC and MAOC.

WEXFORD: Killoughrim (S9041), oak *Quercus* forest, ♂ 19.iv.1990, JPOC; Oaklands (S7125), mixed woodland, ♂ 31.iii.1989, JPOC.

***Rhamphomyia* (*Holoclera*) *variabilis* (Fallén, 1816)**

WEXFORD: Carnsore Point (T1238), sand-dunes, ♂ 26.viii.1980, JPOC.

***Rhamphomyia* (*Megacyttarus*) *crassirostris* (Fallén, 1816)**

CAVAN: Virginia (N5888), alder *Alnus* fen, ♂ 30.v.1982, JPOC and MAOC.

CLARE: Rathborney River (M2004), The Burren, ♂ 2.vi.1992, JPOC.

***Rhamphomyia* (*Pararhamphomyia*) *geniculata* Meigen, 1830**

CLARE: Lough Bunny (R3696), limestone pavement, ♂ 21.v.1985, JPOC and MAOC.

***Rhamphomyia* (*Pararhamphomyia*) *tarsata* Meigen, 1822**

CAVAN: Virginia (N5888), alder *Alnus* fen, ♂ 30.v.1982, JPOC.

CLARE: Cratloe Woods (R5061), conifers, ♂ 5.vi.1992, JPOC; Gragan Castle (M2003), gardens of the hotel, ♂ 2.vi.1992, JPOC.

WICKLOW: Avondale (T1985), mixed woodland, ♂ 27.v.1988, JPOC; Knocksink (O2117),

mixed woodland, ♂ 28.v.1989, JPOC.

***Rhamphomyia (Pararhamphomyia) tibiella* Zetterstedt, 1842**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 4.vi.1990, JPOC and MAOC.

***Rhamphomyia (Rhamphomyia) subcinerascens* Collin, 1926**

DUBLIN: Bull Island (O2438), alder *Alnus* marsh, ♀ 9.v.1982, JPOC and MAOC.

OFFALY: Clara Bog (N2629), on the bog, ♀ 30.iv.1984, JPOC.

***Rhamphomyia (Rhamphomyia) sulcata* (Meigen, 1804)**

CLARE: Lough Bunny (R3696), limestone pavement, ♂ 21.v.1985, JPOC and MAOC.

***Trichopeza longicornis* (Meigen, 1822)**

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♀ 7.viii.1981, JPOC.

WATERFORD: Glasha River (S3022), ♂ ♀ 8.vii.1989, JPOC and MAOC; Portlaw (S4415), mixed woodland, ♂ ♀ 16.vii.1987, JPOC and MAOC.

HELEOMYZIDAE

***Suillia variegata* (Loew, 1862)**

CLARE: near Ennis (R2979), mixed woodland mainly of hazel *Corylus*, ♀ 30.v.1984, JPOC; Lisdoonvarna Spa (R1397), river-side vegetation, ♀ 21.iv.1982, JPOC and MAOC.

DUBLIN: Malahide Castle (O2253), vegetation along pathway, ♀ 6.x.1985, JPOC and MAOC.

KERRY: Kenmare Estate (V9490), Killarney, ♀ 8.ix.1981, JPOC.

KILDARE: Carton (N9638), mixed woodland mainly *Acer*, ♀ 29.iv.1987, JPOC.

LAOIS: The Derries (N5805), ♂ 20.ix.1982, JPOC; same locality, ♂ 11.vi.1983, JPOC and MAOC.

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♀ 5.vii.1990, JPOC.

WEXFORD: John F. Kennedy Park (S7319), arboretum, ♂ 26.iii.1989, JPOC and MAOC; Lady's Island Lake (T1007), lake-side vegetation, ♀ 25.v.1987, JPOC; Rosslare Strand (T0917), ♀ 15.vi.1991, JPOC; Tintern (S7810), mixed woodland along a stream, ♂ 3.iv.1988, JPOC.

***Trixoscelis obscurella* (Fallén, 1823)**

WEXFORD: Fethard (S7905), sand-dunes, ♀ 10.vi.1990 and ♂ ♀ 16.vi.1990, JPOC; Nethertown (T1205), willow *Salix* marsh, ♀ 6.vi.1986, JPOC and MAOC.

HYBOTIDAE

The Irish fauna is reviewed by Chandler (1978b) and Lavery *et al.* (1993).

***Dolichocephala irrorata* (Fallén, 1815)**

WATERFORD: Portlaw (S4415), mixed woodland, ♀ 16.vii.1987, JPOC and MAOC.

WICKLOW: Russellstown Park (N9610), mixed woodland/marsh, ♂ 16.viii.1981, JPOC and MAOC.

***Hybos culiciformis* (Fabricius, 1775)**

CLARE: Ailladie, (M0802), The Burren, limestone pavement, ♀ 15.vii.1981, JPOC.

CORK: Garnish Island (V9356), Glengarriff, mixed woodland, ♀ 1.vii.1985, JPOC and MAOC.

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♀ 7.viii.1981, JPOC.

GALWAY: Cleggan (L6158), ♂ ♀ 20.vii.1982, JPOC; Rossleague House (L6857), Letterfrack, ♂ 24.vii.1982, JPOC and MAOC.

WATERFORD: near Passage East (S6811), hill-side vegetation, ♀ 3.vii.1991, JPOC and MAOC.

WEXFORD: Ballyteige (S9504), sand-dunes, ♀ 12.vi.1982, JPOC and MAOC; John F. Kennedy Park (S7319), arboretum, ♂ 21.vi.1991, JPOC and MAOC.

WICKLOW: Russellstown (N9610), mixed woodland/marsh, 2♀♀ 16.viii.1981, JPOC.

***Hybos femoratus* (Müller, 1776)**

CORK: Glengarriff (V9059), near the Tunnel, mountain moorland, 4♂♂ ♀ 10.vii.1985, JPOC and MAOC.

GALWAY: Letterfrack (L7257), National Park, ♂ 22.vii.1982, JPOC and MAOC.

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♀ 30.viii.1991, JPOC; Newbridge Fen (N7616), ♂ 11.ix.1985, JPOC.

KILKENNY: Woodstock House (S6336), mixed woodland, ♂ 4.vii.1991, JPOC and MAOC.

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♂ 19.vi.1991, JPOC; Glasha River (S3022), ♂ 8.vii.1989, JPOC and MAOC.

WICKLOW: Devil's Glen (T2399), mixed woodland, ♀ 7.viii.1990, JPOC and MAOC.

***Leptopeza flavipes* (Meigen, 1820)**

KILKENNY: Clonassy Wood (S5622), mixed woodland, ♂ ♀ 20.vi.1990, JPOC and MAOC.

MEATH: Kilmessan (N8857), hedgerow, ♂ 27.v.1990, JPOC and MAOC.

***Ocydromia glabricula* (Fallén, 1816)**

CAVAN: Woodlawn (N4686), Lough Sheelin, lake-side vegetation, ♂ 12.ix.1991, JPOC.

CLARE: Ballyeighter (R3494), mixed woodland, ♂ 29.v.1984, JPOC and MAOC.

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♀ 7.viii.1981, JPOC.

KILDARE: Rye Water (O0036), river-side vegetation, 2♀♀ 9.viii.1981, JPOC and MAOC.

KILKENNY: Clonassy Wood (S5622), mixed woodland, ♀ 20.vi.1990, JPOC and MAOC.

LAOIS: Emo (N5305), mixed woodland, ♀ 3.x.1982, JPOC and MAOC.

TIPPERARY: near Ballina (R7172), small wood, ♂ 27.v.1984, JPOC.

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♂ 18.vi.1990, JPOC and MAOC; Glasha River (S3022), ♀ 8.vii.1989, JPOC and MAOC; near Passage East (S6811), hill-side vegetation, ♂ ♀ 3.vii.1991, JPOC and MAOC.

WEXFORD: Urrin River (S8743), woods, 2♂♂ 9.vi.1991, JPOC and MAOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 27.viii.1981, JPOC; same locality, ♂ 22.viii.1988, JPOC; Mount Usher (T2796), Ashford, the gardens, ♂ 27.v.1991, JPOC and MAOC; Russellstown Park (N9610), mixed woodland, ♀ 23.viii.1981, MAOC.

***Oedalea stigmatella* Zetterstedt, 1842**

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♂ 11.vi.1991, JPOC; Glasha River (S3022), ♂ 8.vii.1989, JPOC and MAOC.

***Symballophthalmus fuscitarsis* (Zetterstedt, 1859)**

CLARE: Rathborney River (M2004), The Burren, ♀ 2.vi.1992, JPOC.

WEXFORD: Ferrycarrig (T0022), marsh/birch *Betula*/hazel *Corylus*, ♂ 3.vi.1986, JPOC and MAOC.

***Tachydromia umbrarum* Haliday, 1833**

DUBLIN: Phoenix Park (O0935), hawthorn *Crataegus* wood near the Furry Glen, ♂ 11.vi.1983, JPOC.

***Trachypeza nubila* (Meigen, 1804)**

CORK: Glengarriff (V9256), oak *Quercus* wood, ♂ 7.vii.1985, JPOC and MAOC.

KILDARE: Donadea Forest (N8332), mixed woodland, ♂ 14.vi.1987, JPOC.

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

***Trichina clavipes* Meigen, 1830**

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♂ 19.vi.1991, JPOC; Mahon Falls (S3009), mountain moorland, ♂ 3.vii.1989, JPOC and MAOC.

***Trichina elongata* Haliday, 1833**

WICKLOW: Knocksink (O2117), mixed woodland, ♂ 28.v.1989, JPOC.

***Trichinomyia flavipes* (Meigen, 1830)**

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♀ 1.xi.1981, JPOC and MAOC.

KEROPLATIDAE

Additions to the preliminary account of Irish fungus gnats by Chandler (1976a) have been published in several papers and the Irish list was updated by Chandler (1992).

***Macrocera centralis* Meigen, 1818**

WEXFORD: Ballylane (S7324), New Ross, ♂ 12.vii.1991 JPOC.

***Macrocera fasciata* Meigen, 1804**

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

***Macrocera phalerata* Meigen, 1818**

KILKENNY: Clonassy Wood (S5622), mixed woodland, ♂ 20.vi.1990, JPOC and MAOC.

***Macrocera stigma* Curtis, 1837**

CLARE: Kilshanny (R1293), hedgerows, ♂ 31.vi.1992, JPOC.

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♂ 2♀♀ 11.vi.1991, JPOC.

***Macrocera stigmoides* Edwards, 1925**

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

WATERFORD: Dunmore East (S6800), Malcolmson's Wood, ♂ 8.vii.1988, JPOC.

***Macrocera vittata* Meigen, 1830**

CLARE: Lisdoonvarna Spa (R1397), river-side vegetation, ♀ 25.v.1992, JPOC and MAOC.

***Neoplatyura flava* (Macquart, 1826)**

WICKLOW: Devil's Glen (T2399), mixed woodland, ♂ 7.viii.1990, JPOC and MAOC.

***Orfelia nemoralis* (Meigen, 1818)**

MEATH: Mornington (O1575), sand-dunes, ♂ 15.vi.1989, JPOC.

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♂ 19.vi.1991, JPOC; Mahon Falls

(S3009), mountain moorland, ♀ 3.vii.1989, JPOC and MAOC.

WICKLOW: Powerscourt Deer Park (O2012), mixed woodland, ♂ 15.vi.1988, JPOC.

***Orfelia unicolor* (Staeger, 1840)**

WATERFORD: Glasha River (S3022), ♀ 8.vii.1989, JPOC and MAOC.

WEXFORD: Ballylane (S7324), New Ross, ♂ 12.vii.1991, JPOC.

***Urytalpa ochracea* (Meigen, 1818)**

WEXFORD: near Glenbough (T0929), kettle hole, ♀ 28.v.1989, JPOC.

MICROPEZIDAE

***Calobata petronella* (Linnaeus, 1761)**

CAVAN: Virginia (N5888), alder *Alnus* fen, ♀ 30.v.1982, JPOC.

WATERFORD: Duncannon (S7308), ♀ 8-13.vi.1982, JPOC.

WEXFORD: Ballyteige (S9504), sand-dunes, ♂ 11.vi.1982, JPOC; same locality, sand-dunes, ♂ 12.vi.1982, JPOC and MAOC; Oaklands (S7125), mixed woodland, ♀ 18.vi.1982, JPOC and MAOC.

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

***Neria cibaria* (Linnaeus, 1761)**

CARLOW: Cloughristick (S7069), mixed woodland, 2♀♀ 19.vi.1982, JPOC and MAOC.

CAVAN: Virginia (N5888), alder *Alnus* fen, ♀ 30.v.1982, JPOC.

CLARE: Ballyeighter (R3494), mixed woodland, ♂ 29.v.1984, JPOC and MAOC; Burren (M2711), The Burren, marsh, ♂ 4.vi.1992, JPOC and MAOC.

CORK: Bantry House (V9848), the gardens, ♀ 3.vii.1985, JPOC.

KILDARE: near Straffan (N9326), Grand Canal, along the bank, ♀ 23.v.1982, JPOC and MAOC.

TIPPERARY: near Ballina (R7172), small wood, ♂ 27.v.1984, JPOC.

WEXFORD: Curracloe (T1127), alder *Alnus* marsh, ♂ 9.vi.1982, JPOC; same locality, ♂ 28.v.1987, JPOC; Curracloe (T1020), sand-dunes/marsh, 2♀♀ 3.vi.1984, JPOC and MAOC; Oaklands (S7125), mixed woodland, ♀ 18.vi.1982, JPOC.

MYCETOPHILIDAE

Additions to the preliminary account of Irish fungus gnats by Chandler (1976a) have been published in several papers and the Irish list was updated by Chandler (1992).

***Acnemia nitidicollis* (Meigen, 1818)**

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♂ 11.vi.1991, JPOC; Mahon Falls (S3009), mountain moorland, ♂ 5.vii.1988, JPOC.

WICKLOW: Powerscourt Deer Park (O2012), near the waterfall, ♂ 15.vi.1988, JPOC.

***Allocotocera pulchella* (Curtis, 1837)**

WICKLOW: Devil's Glen (T2399), mixed woodland, ♀ 7.viii.1990, JPOC and MAOC.

***Allodia lugens* (Wiedemann, 1817)**

CAVAN: Virginia Woods (N5987), mixed woodland, 2♂♂ 20.iii.1988, JPOC and MAOC.

WEXFORD: Killoughrim (S9041), oak *Quercus* forest, ♂ 4.iv.1988, JPOC.

***Allodia ornaticollis* (Meigen, 1818)**

WICKLOW: Knocksink Wood (O2118), mixed woodland, ♂ 19.x.1989, JPOC and MAOC.

***Allodia truncata* Edwards, 1921**

WICKLOW: Knocksink Wood (O2118), mixed woodland, ♂ 19.x.1989, JPOC and MAOC.

***Allodiopsis rustica* (Edwards, 1941)**

WEXFORD: Ballylane (S7324), New Ross, ♂ 12.vii.1991, JPOC; River Fethard (S7806), ♀ 17.vi.1990, JPOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, 2♀♀ 22.viii.1988, JPOC.

***Apolephthisa subincana* (Curtis, 1837)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♀ 2.x.1989, JPOC and MAOC.

***Boletina basalis* (Meigen, 1818)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 21.v.1989, JPOC and MAOC.

WICKLOW: Powerscourt Deer Park (O2012), waterfall area, ♀ 15.vi.1988, JPOC.

***Boletina gripha* Dziedzicki, 1885**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 20.iii.1988, JPOC and MAOC.

KILKENNY: Woodstock House (S6336), mixed woodland, ♀ 16.iv.1990, JPOC and MAOC.

WEXFORD: Killoughrim (S9041), oak *Quercus* forest, ♂ 27.iii.1989, JPOC; Rosslare Harbour (T1312), ♀ 2.iv.1991, JPOC.

WICKLOW: Devil's Glen (T2399), mixed woodland, ♀ 17.iii.1988, JPOC and MAOC; Glen of the Downs (O2611), mixed woodland, 3♂♂ 2♀♀ 26-27.iv.1986, JPOC and MAOC.

***Boletina plana* Walker, 1856**

TIPPERARY: near Ballina (R7172), small wood, ♂ 27.v.1984, JPOC.

***Boletina trivittata* (Meigen, 1818)**

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

***Brevicornu fuscipenne* (Staeger, 1840)**

WICKLOW: Devil's Glen (T2399), mixed woodland, ♂ 7.viii.1990, JPOC and MAOC.

***Brevicornu griseicolle* (Staeger, 1840)**

MEATH: Ballivor (N6554), cutover bog, ♂ 20.x.1989, JPOC and MAOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 22.viii.1988, JPOC.

***Cordyla crassicornis* Meigen, 1818**

CARLOW: St Mullins (S7238), river-side vegetation, ♂ 17.vi.1991, JPOC.

WESTMEATH: Belvidere House (N4247), pathway in mixed woodland, ♂ 28.viii.1990, JPOC and MAOC.

***Cordyla fissa* Edwards, 1925**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 20.iii.1988, JPOC and MAOC.

GALWAY: Coole Park Woods (M4304), mixed woodland, ♂ 1.vi.1992, JPOC and MAOC.

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♂ 10.iv.1989, JPOC.

***Docosia gilvipes* (Haliday in Walker, 1856)**

WEXFORD: Ferrycarrig (T0122), Heritage Park, 19.iv.1987, JPOC.

***Exechia fusca* (Meigen, 1804)**

WEXFORD: Killoughrim (S9041), oak *Quercus* forest, ♀ 19.iv.1990, JPOC.

WICKLOW: Devil's Glen (T2399), mixed woodland, ♀ 17.iii.1988, JPOC and MAOC.

***Exechia parva* Lundström, 1909**

MEATH: Ballivor (N6554), cutover bog, ♂ 20.x.1989, JPOC and MAOC.

***Exechia seriata* (Meigen, 1830)**

KERRY: O'Sullivan's Cascade (V9188), Killarney, ♀ 27.viii.1987, JPOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 27.ix.1987, JPOC.

***Exechiopsis subulata* (Winnertz, 1863)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 2.x.1989, JPOC and MAOC.

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

***Leia fascipennis* Meigen, 1818**

DUBLIN: Malahide Castle (O2253), ♀ 6.x.1985, JPOC and MAOC.

KILKENNY: Clonassy Wood (S5622), ♀ 20.vi.1990, JPOC and MAOC.

WATERFORD: Passage East (S6811), hill-side vegetation, ♂ 13.vi.1990, JPOC.

WEXFORD: Urrin River (S8743), woods, ♀ 9.vi.1991, JPOC and MAOC.

WICKLOW: near Calary Lower (O2311), marshy area, ♂ 23.ix.1989, JPOC and MAOC.

***Megophthalmidia crassicornis* (Curtis, 1837)**

WEXFORD: Curracloe (T1127), marshy area, ♂ 10.vi.1991, JPOC.

***Monoclona rufilatera* (Walker, 1837)**

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

KILDARE: Carton (N9638), mixed woodland mainly *Acer*, ♂ 29.iv.1987, JPOC.

***Mycetophila adumbrata* Mik, 1884**

WICKLOW: Devil's Glen (T2399), mixed woodland, ♂ 7.viii.1990, JPOC and MAOC.

***Mycetophila britannica* Laštovka and Kidd, 1975**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 2.x.1989, JPOC and MAOC.

DUBLIN: Malahide Castle (O2253), ♀ 6.x.1985, JPOC and MAOC.

***Mycetophila curviseta* Lundström, 1911**

WEXFORD: Oaklands (S7125), mixed woodland, ♂ 20.iv.1990, JPOC.

WICKLOW: Knocksink (O2117), ♂ 28.v.1989, JPOC; Knocksink Wood (O2118), mixed woodland, ♂ 19.x.1989, JPOC and MAOC.

***Mycetophila edwardsi* Lundström, 1913**

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♀ 11.vi.1991, JPOC.

WEXFORD: Ferrycarrig (T0122), Heritage Park, ♂ 19.iv.1987, JPOC.

***Mycetophila forcipata* Lundström, 1913**

WICKLOW: Glendalough (T1195), mixed woodland, ♀ 24.iv.1989, JPOC and MAOC.

***Mycetophila formosa* Lundström, 1911**

WICKLOW: Devil's Glen (T2399), mixed woodland, ♂ 7.viii.1990, JPOC and MAOC;

Glendalough (T1195), mixed woodland, ♀ 24.iv.1989, JPOC and MAOC.

***Mycetophila fungorum* (De Geer, 1776)**

DUBLIN: Castleknock (O0837), under conifer needles in a suburban garden, ♂ 19.iii.1986, JPOC and MAOC.

***Mycetophila hetschkoi* Landrock, 1918**

WICKLOW: Knocksink Wood (O2118), mixed woodland, ♂ 19.x.1989, JPOC and MAOC.

***Mycetophila marginata* Winnertz, 1863**

CARLOW: Altamont Gardens (S8665), ♂ 31.iii.1991, JPOC.

***Mycetophila ocellus* Walker, 1848**

WATERFORD: Glasha River (S3022), ♂ 8.vii.1989, JPOC and MAOC.

WEXFORD: Killoughrim (S9041), oak *Quercus* forest, ♀ 27.iii.1989, JPOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 26-27.iv.1986, JPOC and MAOC.

***Mycetophila ornata* Stephens, 1846**

WATERFORD: Glasha River (S3022), ♀ 8.vii.198, JPOC and MAOC.

WEXFORD: Tintern Abbey (S7810), mixed woodland beside a stream, ♂ ♀ 15.vi.1990, JPOC; Urrin River (S8743), woods, ♂ 9.vi.1991, JPOC and MAOC.

WICKLOW: Knocksink Wood (O2118), mixed woodland, ♀ 19.x.1989, JPOC and MAOC.

***Mycetophila pumila* Winnertz, 1863**

KILKENNY: Harristown (S5127), near the dolmen, ♀ 4.vii.1990, JPOC.

***Mycetophila signatoides* Dziedzicki, 1884**

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♂ 5.vii.1990, JPOC.

WEXFORD: Killoughrim (S9041), oak *Quercus* forest, ♀ 4.iv.1988, JPOC; Oaklands (S7125), mixed woodland, ♀ 20.iv.1990, JPOC.

***Mycetophila vittipes* Zetterstedt, 1852**

CAVAN: Virginia Woods (N5987), mixed woodland, 2♀♀ 20.iii.1988, JPOC and MAOC.

WICKLOW: Devil's Glen (T2399), mixed woodland, ♂ 17.iii.1988, JPOC and MAOC.

***Mycomya annulata* (Meigen, 1818)**

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

CLARE: Lisdoonvarna Spa (R1397), river-side vegetation, ♂ 25.v.1992, JPOC and MAOC.

WATERFORD: near Passage East (S6811), hill-side vegetation, ♀ 1.vi.1991, JPOC.

WEXFORD: Killoughrim (S8941), oak *Quercus* forest, ♂ 27.v.1987, JPOC; same locality, ♂ 27.iii.1989, JPOC.

WICKLOW: Glendalough (T1195), mixed woodland, ♂ 24.iv.1989, JPOC and MAOC.

***Mycomya cinerascens* (Macquart, 1826)**

CLARE: Lisdoonvarna Spa (R1397), river-side vegetation, ♀ 25.v.1992, JPOC and MAOC.

WATERFORD: near Passage East (S6811), hill-side vegetation, ♂ 12.vi.1991, JPOC; Portlaw Woods (S4415), mixed woodland, ♀ 1.iv.1991, JPOC and MAOC.

WICKLOW: Devil's Glen (T2399), mixed woodland, ♂ 17.iii.1988, JPOC and MAOC; same locality, ♀ 7.viii.1990, JPOC and MAOC.

***Mycomya winnertzii* (Dziedzicki, 1885)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 20.iii.1988, JPOC and MAOC.

WESTMEATH: Belvidere House (N4247), pathway in mixed woodland, ♂ 28.viii.1990, JPOC and MAOC.

***Neuratelia nemoralis* (Meigen, 1818)**

WICKLOW: Avondale (T1985), mixed woodland, 2♂♂ 27.v.1988, JPOC.

***Phronia biarcuata* (Becker, 1908)**

CARLOW: Bahana Woods (S7239), mixed woodland, ♂ 18.vi.1991, JPOC.

WEXFORD: John F. Kennedy Park (S7319), arboretum, ♂ 29.iii.1989, JPOC and MAOC.

***Phronia forcipata* Winnertz, 1863**

WICKLOW: Glendalough (T1195), mixed woodland, ♂ 24.iv.1989, JPOC and MAOC.

***Phronia humeralis* Winnertz, 1863**

KILDARE: Carton (N9638), mixed woodland mainly *Acer*, ♀ 29.iv.1987, JPOC.

WEXFORD: Oaklands (S7125), mixed woodland, ♂ 31.iii.1989, JPOC.

WICKLOW: Avondale (T1985), mixed woodland, ♀ 27.v.1988, JPOC; Glendalough (T1195), mixed woodland, ♂ 2♀♀ 24.iv.1989, JPOC and MAOC.

***Phronia nigricornis* (Zetterstedt, 1852)**

WICKLOW: Devil's Glen (T2399), mixed woodland, 2♂♂ 7.viii.1990, JPOC and MAOC.

***Phthinia winnertzi* Mik, 1869**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 2.x.1989, JPOC and MAOC.

***Platurocypta punctum* (Stannius, 1831)**

WATERFORD: Glasha River (S3022), ♀ 8.vii.1989, JPOC and MAOC.

WEXFORD: Ferrycarrig (T0023), ♂ 30.iii.1989, JPOC; River Fethard (S7806), ♂ 17.vi.1990, JPOC.

***Platurocypta testata* (Edwards, 1924)**

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♀ 22.viii.1988, JPOC.

***Polylepta guttiventris* (Zetterstedt, 1852)**

KILKENNY: Woodstock House (S6336), mixed woodland, ♂ 4.vii.1991, JPOC and MAOC.

***Rymosia fasciata* (Meigen, 1804)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♀ 27.x.1990, JPOC and MAOC.

***Stigmatomeria crassicornis* (Stannius, 1831)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 20.iii.1988, JPOC and MAOC; same locality, ♀ 15.v.1989, JPOC.

WICKLOW: Knocksink Wood (O2118), mixed woodland, ♀ 19.x.1989, JPOC and MAOC.

***Synapha vitripennis* (Meigen, 1818)**

CARLOW: St Mullins (S7238), river-side vegetation, ♀ 1.vii.1991, JPOC and MAOC.

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 27.x.1990, JPOC and MAOC.

WICKLOW: Powerscourt Deer Park (O2012), waterfall area, 2♂♂ 15.vi.1988, JPOC.

***Tetragoneura sylvatica* (Curtis, 1837)**

KILKENNY: Clonassy Wood (S5622), ♀ 20.vi.1990, JPOC and MAOC.

WATERFORD: Belle Lake (S6605), lake-side vegetation, 2♂♂ 11.vi.1991, JPOC; near Passage East (S6811), 2km north-west of, hill-side vegetation, 2♂♂ 12.vi.1981, JPOC.

WICKLOW: Mount Usher (T2796), Ashford, the gardens, ♂ 27.v.1991, JPOC and MAOC.

***Zygomyia humeralis* (Wiedemann, 1817)**

WEXFORD: Ballylane (S7324), New Ross, ♂ 12.vii.1991, JPOC.

***Zygomyia pictipennis* (Staeger, 1840)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♀ 20.iii.1988, JPOC and MAOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 3.x.1986, JPOC and MAOC; same locality, ♀ 22.viii.1988, JPOC.

***Zygomyia vara* (Staeger, 1840)**

MEATH: Ballivor (N6554), cutover bog, ♂ 20.x.1989, JPOC and MAOC.

WICKLOW: Knocksink Wood (O2118), mixed woodland, ♂ 19.x.1989, JPOC and MAOC.

OPETIIDAE

***Opetia nigra* Meigen, 1830**

CARLOW: Bahana Woods (S7239), mixed woodland, ♂ 18.vi.1991, JPOC.

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 20.iii.1988, JPOC and MAOC.

CORK: Glengarriff (V9256), oak *Quercus* wood, ♂ 7.vii.1985, JPOC and MAOC.

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♂ 10.iv.1989, JPOC.

WATERFORD: near Passage East (S6811), hill-side vegetation, ♂ 13.vi.1990, JPOC.

WEXFORD: Ferrycarrig (T002), ♂ 30.iii.1989, JPOC; near Glenbough (T0929), kettlehole, ♂ 28.v.1987, JPOC; Lady's Island Lake (T1007), lake-side vegetation, ♂ 25.v.1987, JPOC; Oaklands (S7125), mixed woodland, ♂ 20.iv.1990, JPOC; Tintern Abbey (S7810), mixed woodland alongside stream, ♂ 15.vi.1990, JPOC.

PALLOPTERIDAE

Speight (1979a) has reviewed the Irish species.

***Palloptera muliebris* (Harris, 1780)**

DUBLIN: Castleknock (O0837), suburban garden, ♀ 28.ix.1985, JPOC and MAOC.

WATERFORD: Lismore Castle (X0498), formal gardens, ♀ 17.vii.1987, JPOC; near Passage East (S6811), hill-side vegetation, 2♀♀ 3.vii.1991, JPOC and MAOC.

WEXFORD: Lady's Island Lake (T1007), lake-side vegetation, ♀ 28.viii.1980, JPOC.

***Palloptera quinquemaculata* (Macquart, 1835)**

CAVAN: Virginia (N5987), mixed woodland, ♀ 30.v.1982, JPOC and MAOC.

CLARE: Cratloe Woods (R5061), conifers, ♂ 5.vi.1992, JPOC.

WEXFORD: Curracloe (T1129), marshy area, ♀ 10.vi.1991, JPOC; Nethertown (T1205), ♂ 6.vi.1986, JPOC and MAOC; Oaklands (S7125), mixed woodland, ♀ 18.vi.1982, JPOC and MAOC.

***Palloptera saltuum* (Linnaeus, 1758)**

WATERFORD: near Passage East (S6811), hill-side vegetation, ♂ 13.vii.1989, JPOC and MAOC.

WEXFORD: Stoneyford (T1009), rough pasture, ♂ 13.vi.1986, JPOC.

***Palloptera scutellata* (Macquart, 1835)**

KERRY: Tomies Wood (V9188), Killarney, mixed woodland, ♂ 15.ix.1981, JPOC.

WICKLOW: Russellstown Park (N9610), mixed woodland/marsh, ♂ 10.iii.1984, JPOC.

***Palloptera trimacula* (Meigen, 1826)**

KERRY: Killarney (V9391), lake-side vegetation, ♀ 15.ix.1981, JPOC.

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♀ 27.viii.1981, JPOC.

***Palloptera umbellatarum* (Fabricius, 1775)**

CARLOW: Bahana Wood (S7239), mixed woodland, ♀ 14.vi.1991. JPOC and MAOC; Cloughristick (S7069), mixed woodland, ♂ 19.vi.1982, JPOC and MAOC; St Mullins (S7238), river-side vegetation, ♀ 1.vii.1991, JPOC and MAOC.

CLARE: Rathborney River (M2004), The Burren, ♂ ♀ 2.vi.1992, JPOC.

WATERFORD: Lismore Castle (X0498), formal gardens, ♂ 17.vii.1987, JPOC.

***Palloptera ustulata* Fallén, 1820**

DUBLIN: Castleknock (O0837), on the window of a suburban house, ♀ 23.ix.1985, JPOC and MAOC; Malahide Castle (O2253), path-side vegetation, ♀ 6.x.1985, JPOC and MAOC.

GALWAY: Rossleague House, Letterfrack (L6857), ♂ 24.vii.1982, JPOC and MAOC.

KERRY: Torc Stream (V9684), Killarney, stream-side vegetation, ♀ 10.ix.1981, JPOC.

MEATH: Kilmessan (N8858), hedgerows, ♀ 18.viii.1991, JPOC and MAOC.

WATERFORD: Mount Congreve (S5319), formal gardens, ♀ 4.vii.1988, JPOC; near Passage East (S6811), hill-side vegetation, ♂ 13.vii.1989, JPOC and MAOC.

WESTMEATH: Belvidere House (N4247), pathway in mixed woodland, ♀ 28.viii.1990, JPOC and MAOC.

PLATYPEZIDAE

The Irish fauna is reviewed by Chandler (1976b).

***Agathomyia viduella* (Zetterstedt, [1838])**

WICKLOW: Knocksink (O2117), mixed woodland, ♀ 15.v.1991, JPOC.

***Paraplatypeza atra* (Meigen, 1804)**

CORK: Bantry House (V9848), gardens, ♂ 3.vii.1985, JPOC.

WATERFORD: near Passage East (S6811), hill-side vegetation, ♀ 3.vii.1991, JPOC and MAOC.

PLATYSTOMATIDAE

The Irish fauna is reviewed by Speight and Chandler (1983).

***Rivellia syngenesiae* (Fabricius, 1781)**

CORK: Glengarriff (V9057), oak *Quercus* wood, ♂ 6.vii.1985, JPOC and MAOC.

RHAGIONIDAE

The Irish fauna is reviewed by Chandler (1975).

***Chrysopilus cristatus* (Fabricius, 1775)**

CLARE: Ailladie (M0802), The Burren, limestone pavement, 3♂♂ 15.vii.1981, JPOC.

CORK: Bantry House (V9848), gardens, ♂ ♀ 3.vii.1985, JPOC; Glengarriff (V9256), oak *Quercus* wood, ♀ 12.vii.1985, JPOC and MAOC; Sheep's Head (V7334), ♂ 3.vii.1985, JPOC.

KILDARE: Newbridge Fen (N7616), ♀ 11.vii.1982, JPOC and MAOC.

LIMERICK: Lough Gur (R6241), lake-side marshy area, ♂ 7.vii.1981, JPOC.

WATERFORD: Dunmore East (S6800), 2♀♀ 25.vi.1984, JPOC.

***Rhagio lineola* Fabricius, 1794**

CLARE: Black Head (M1512), The Burren, limestone pavement, ♂ 2.viii.1988, JPOC and MAOC; Ballynalackan (M1000), The Burren, ♂ 15.vii.1981, JPOC.

CORK: Glengarriff (V9157), oak *Quercus* wood, ♀ 4.vii.1985, JPOC and MAOC; Glengarriff (V9256), oak *Quercus* wood, ♂ ♀ 12.vii.1985, JPOC and MAOC.

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♂ 7.viii.1981, JPOC.

KERRY: Muckross House (V9686), Killarney, ♂ 10.ix.1981, JPOC; Tomies Wood (V9188), Killarney, mixed woodland ♀ 15.ix.1981, JPOC; Torc Stream (V9684), Killarney, ♂ 10.ix.1981, JPOC.

WATERFORD: Nier Valley (S2417), small streams on moorland, 4♂♂ 13.vii.1987, JPOC.

***Rhagio scolopaceus* (Linnaeus, 1758)**

CAVAN: Virginia (N5987), mixed woodland, ♂ 30.v.1982, JPOC and MAOC.

CLARE: Cliffs of Moher (R0392), ♂ 8.vii.1981, JPOC; near Formoyle (M1606), green road in The Burren, ♂ 22.v.1985, JPOC and MAOC.

CORK: Glengarriff (V9059), mountain moorland near the Tunnel, 3♂♂ 10.vii.1985, JPOC and MAOC.

WATERFORD: Mahon Falls (S3009), mountain moorland, ♂ 20.vi.1991, JPOC and MAOC.

WEXFORD: Ballyhighland (S8840), mixed woodland, ♀ 14.vi.1982, JPOC and MAOC; Curracloe (T1127), alder *Alnus* marsh, 2♂♂ 9.vi.1982, JPOC; Ferrycarrig (T0022), marsh birch *Betula*/hazel *Corylus*, ♂ 3.vi.1986, JPOC and MAOC; Nethertown (T1204), marsh, ♂ 2.vi.1987, JPOC.

WICKLOW: near Calary Lower (O2311), marshy area, ♀ 12.vii.1983, JPOC; Powerscourt Deer Park (O2012), waterfall area, ♂ 15.vi.1988, JPOC.

***Rhagio tringarius* (Linnaeus, 1758)**

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♀ 7.viii.1981, JPOC.

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♂ 2.viii.1982, JPOC and MAOC.

WICKLOW: Kilmacanoge (O2514), alder *Alnus* marsh and stream, ♂ 15.viii.1982, JPOC and MAOC.

WATERFORD: Glasha River (S3022), ♀ 8.vii.1989, JPOC and MAOC.

SCIARIDAE

***Phytosciara flavipes* (Meigen, 1804)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 22.ix.1985, JPOC and MAOC; same locality, ♂ 20.iii.1988, JPOC and MAOC.

CLARE: Lisdoonvarna Spa (R1397), river-side vegetation, ♀ 25.v.1992, JPOC and MAOC.

CORK: Bantry House (V9848), gardens, ♂ 3.vii.1985, JPOC; Glengarriff (V9157), oak *Quercus* wood, ♂ 4.vii.1985, JPOC and MAOC.

DUBLIN: Malahide Castle (O2253), path-side vegetation, ♂ ♀ 6.x.1985, JPOC and MAOC; Slade of Saggart (O0324), stream-side vegetation, 2♂♂ 7.viii.1981, JPOC.

KILDARE: Carton (N9638), mixed woodland mainly *Acer*, ♂ ♀ 29.iv.1987, JPOC; Donadee (N8332), mixed woodland, ♂ 11.x.1985, JPOC.

KILKENNY: Woodstock House (S6336), Inistioge, mixed woodland, ♂ 2.iv.1988, JPOC; same locality, ♂ ♀ 16.iv.1990, JPOC and MAOC.

LAOIS: The Derries (N5805), ♀ 11.vi.1983, JPOC and MAOC.

OFFALY: Charleville Wood (N3222), mixed woodland, ♂ 28.iv.1987, JPOC.

WEXFORD: Ferrycarrig (T0122), Heritage Park, ♂ 19.iv.1987, JPOC; Ferrycarrig (T0023), 2♀♀ 30.iii.1989, JPOC; Killoughrim (S9041), oak *Quercus* forest, ♂ 4.iv.1988, JPOC; Tintern (S7810), mixed woodland along stream, ♂ ♀ 3.iv.1988, JPOC.

WICKLOW: Coolattin Wood (T0169), mixed woodland, ♂ 14.ix.1984, JPOC; Glen of the Downs (O2611), mixed woodland, 3♂♂ 26-27.iv.1986, JPOC and MAOC; Knocksink (O2117), mixed woodland, ♂ 2♀♀ 27.iii.1987, JPOC; Tintern (S7810), mixed woodland along stream, ♂ 28.iii.1989, JPOC.

***Schwenckfeldina carbonaria* (Meigen, 1830)**

CAVAN: Virginia Woods (N5987), mixed woodland, ♂ 22.ix.1985, JPOC and MAOC.

CLARE: near Corker Pass (M3010), green road in The Burren, ♂ 23.v.1985, JPOC and MAOC; near Fanore (M1307), green road in The Burren, ♂ 24.v.1985, JPOC and MAOC.

DUBLIN: Bull Island (O2438), alder *Alnus* marsh, ♂ 14.ix.1985, JPOC.

GALWAY: Rossleague House (L6857), ♂ 24.vii.1982, JPOC and MAOC.

KERRY: near Doo Lough (V9586), Killarney, ♀ 11.ix.1981, JPOC; beside the Long Range (V9384), Killarney, ♂ 14.ix.1981, JPOC.

KILDARE: Newbridge Fen (N7616), ♂ 11.ix.1985, JPOC.

***Trichosia splendens* Winnertz, 1867**

WEXFORD: near Killowen (S7121), pond, ♂ 19.vi.1990, JPOC and MAOC.

Previously only known in Ireland from a ♂ taken at Ballynafid, Co. Westmeath (Menzel and Mohrig, 1997).

SCIOMYZIDAE

The Irish fauna is reviewed by Speight (1979).

***Dictya umbrarum* (Linnaeus, 1758)**

CARLOW: St Mullins (S7238), stream, ♀ 17.vi.1991, JPOC.

***Hydromya dorsalis* (Fabricius, 1775)**

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♂ 10.iv.1989, JPOC.

WEXFORD: near Killowen (S7121), pond, 2♂♂ 19.vi.1990, JPOC and MAOC; Tintern Abbey (S7810), mixed woodland along stream, ♂ 3.iv.1988, JPOC.

***Ilione albiseta* (Scopoli, 1763)**

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♀ 19.vii.1987, JPOC; Woodstown (S6905), mixed woodland, ♂ 2.vii.1983, JPOC and MAOC.

WEXFORD: Curracloe (T1127), sand-dunes/marsh, ♂ 10.vi.1991, JPOC.

***Ilione lineata* (Fallén, 1820)**

WATERFORD: Ballin Lough (S4403), lake-side vegetation, ♀ 5.vii.1988, JPOC; same locality, ♂ ♀ 18.vi.1990, JPOC and MAOC.

***Pherbellia albocostata* (Fallén, 1820)**

CORK: Glengarriff (V9057), mixed woodland mainly oak *Quercus*, ♀ 6.vii.1985, JPOC and MAOC.

***Pherbellia cinerella* (Fallén, 1820)**

CLARE: near Corker Pass (M3010), The Burren, ♀ 27.v.1992, JPOC; Fanore (M1308), sand-dunes, ♀ 1.vi.1984, JPOC and MAOC; same locality, ♂ ♀ 26.v.1992, JPOC; near Formoyle (M1606), The Burren, green road, ♂ 29.v.1992, JPOC; Liscannor (R0688), light-trap on hill, ♀ 9-11.vii.1980, JPOC; Lough Bunny (R3696), limestone pavement, ♂ 28.v.1992, JPOC.

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♂ 30.viii.1991, JPOC.

MEATH: Batterjohn Big (N8953), disused sand-pit, 2♂♂ 31.v.1989, JPOC; same locality, ♂ 7.v.1991, JPOC.

WEXFORD: Fethard (S7905), sand-dunes, ♀ 10.vi.1990, JPOC.

WEXFORD: Ballyteige (S9504), sand-dunes, 2♂♂ ♀ 26.v.1987, JPOC; same locality, ♂ 2.vii.1991, JPOC.

***Pherbellia dubia* (Fallén, 1820)**

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

CLARE: Corkscrew Hill (M2020), The Burren, limestone pavement, ♂ 29.v.1992, JPOC;

Lisdoonvarna Spa (R1397), river-side vegetation, 2♂♂ 25.v.1992, JPOC and MAOC; Rathborney River (M2004), The Burren, ♂ 2.vi.1992, JPOC.

***Pherbellia nana* (Fallén, 1820)**

CLARE: Burren (M2711), The Burren, marsh, ♀ 4.vi.1992, JPOC and MAOC.

***Pherbellia schoenherri* (Fallén, 1826)**

CLARE: Lough Bunny (R3696), limestone pavement, ♂ 22.iv.1984, JPOC and MAOC.

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♂ 10.iv.1989, JPOC; same locality, ♀ 30.viii.1991, JPOC.

***Sepedon sphegea* (Fabricius, 1775)**

CAVAN: Woodlawn (N4686), Lough Sheelin, lake-side vegetation, ♀ 12.ix.1991, JPOC.

WEXFORD: near Killowen (S7121), pond, ♀ 19.vi.1990, JPOC and MAOC.

***Sepedon spinipes* (Scopoli, 1763)**

CLARE: Burren (M2711), The Burren, marsh, 2♂♂ 4.vi.1992, JPOC and MAOC.

***Tetanura pallidiventris* Fallén, 1820**

WATERFORD: Belle Lake (S6605), lake-side vegetation, ♂ 11.vi.1991, JPOC; Glasha River (S3022), ♀ 8.vii.1989, JPOC and MAOC; near Passage East (S6811), hill-side vegetation, ♀ 3.vii.1983, JPOC and MAOC.

WEXFORD: Carnsore Point (T1203), sand-dunes, ♀ 26.viii.1980, JPOC.

***Trypetoptera punctulata* (Scopoli, 1763)**

CORK: Glengarriff (V9057), oak *Quercus* wood, ♂ ♀ 6.vii.1985, JPOC and MAOC; Glengarriff (V9256), oak *Quercus* wood, ♂ ♀ 7.vii.1985, JPOC and MAOC; Glengarriff (V9157), ♀ 4.vii.1985, JPOC and MAOC.

GALWAY: Coole Park Woods (M4304), mixed woodland, 2♀♀ 1.vi.1992, JPOC and MAOC.

WESTMEATH: Derravaragh (N4762), lake-side vegetation, ♀ 30.v.1990, JPOC.

STRATIOMYIDAE

The Irish fauna is reviewed by Chandler (1975).

***Beris chalybata* (Forster, 1771)**

CAVAN: Virginia (N5888), alder *Alnus* fen, ♀ 30.v.1981, JPOC and MAOC.

***Beris clavipes* (Linnaeus, 1767)**

MEATH: Kilmessan (N8857), hedgerows, ♂ 19.v.1991, JPOC and MAOC.

***Beris fuscipes* Meigen, 1820**

CLARE: near Formoyle (M1606), The Burren, green road, ♂ 29.v.1992, JPOC.

GALWAY: Rossleague House (L6857), Letterfrack, ♀ 24.vii.1982, JPOC and MAOC.

KERRY: Kenmare Estate (V9490), Killarney, 2♀♀ 8.ix.1981, JPOC.

KILDARE: Carton (N9638), mixed woodland mainly *Acer*, ♂ 29.iv.1987, JPOC.

LIMERICK: Lough Gur (R6241), lake-side marshy area, ♀ 7.vii.1981, JPOC.

MEATH: Kilmessan (N8857), hedgerows, ♂ 19.v.1991, JPOC and MAOC.

TIPPERARY: near Ballina (R7072), River Shannon, ♀ 4.vii.1981, JPOC and MAOC.

***Beris vallata* (Forster, 1771)**

CLARE: Corkscrew Hill (M2003), The Burren, hedgerow, ♂ 14.vii.1981, JPOC.

KILDARE: Rye Water (O0036), river-side vegetation, ♀ 9.viii.1981, JPOC and MAOC.

LIMERICK: Lough Gur (R6241), lake-side marshy area, 2♀♀ 7.vii.1981, JPOC.

TIPPERARY: near Ballina (R7072), River Shannon, ♂ 4.vii.1981, JPOC and MAOC.

WATERFORD: near Dunhill (S5304), hedgerow, ♂ 29.vi.1988, JPOC; Knockaderry (S4905), reservoir, ♂ 19.vii.1987, JPOC.

***Chloromyia formosa* (Scopoli, 1763)**

WEXFORD: Ballyhighland (S8840), mixed woodland, ♀ 4.vi.1982, JPOC and MAOC; Curracloe (T1127), old pasture and alder *Alnus* marsh, ♂ 9.vi.1982, JPOC; Duncannon (S7308), new pasture, ♂ 11.vi.1982, MAOC.

***Microchrysa cyaneiventris* (Zetterstedt, 1842)**

CARLOW: Cloughristick (S7069), mixed woodland, ♂ 19.vi.1982, JPOC and MAOC.

CAVAN: Virginia (N5888), alder *Alnus* fen, ♀ 30.v.1982, JPOC and MAOC.

GALWAY: Rossleague House (L6857), Letterfrack, ♂ 24.vii.1982, JPOC and MAOC.

KILDARE: Rye Water (O0036), river-side vegetation, ♀ 9.viii.1981, JPOC and MAOC.

WATERFORD: near Dunhill (S5304), hedgerows, ♂ 29.vi.1988, JPOC.

WEXFORD: Mount Garrett (S7230), mixed woodland, ♂ 17.vi.1982, JPOC and MAOC.

***Microchrysa flavicornis* (Meigen, 1822)**

LIMERICK: Lough Gur (R6241), lake-side marshy area, ♂ 7.vii.1981, JPOC.

WEXFORD: Nethertown (T1204), marsh, ♂ 2.vi.1987, JPOC.

***Microchrysa polita* (Linnaeus, 1758)**

CAVAN: Virginia (N5987), mixed woodland, ♀ 30.v.1982, JPOC and MAOC.

WATERFORD: Tramore (5901), back strand, ♀ 14.vii.1989, JPOC and MAOC.

***Nemotelus nigrinus* Fallén, 1817**

WEXFORD: Curracloe (T1127), marshy area, 3♂♂ ♀ 10.vi.1991, JPOC.

***Pachygaster leachii* Stephens in Curtis, 1824**

CORK: Fota Island (W7871), ♀ 8.vii.1985, JPOC and MAOC.

KILDARE: Louisa Bridge (N9936), marsh, ♀ 2.viii.1982, JPOC and MAOC.

WATERFORD: near Passage East (S6811), hill-side vegetation, ♂ 13.vii.1989, JPOC and MAOC.

***Sargus bipunctatus* (Scopoli, 1763)**

DUBLIN: Slade of Saggart (O0324), stream-side vegetation, ♂ 18.vii.1982, JPOC and MAOC.

WICKLOW: Russellstown Park (N9610), mixed woodland/marsh, ♂ 16.viii.1981, JPOC and MAOC.

***Sargus flavipes* Meigen, 1822**

WICKLOW: Glen of the Downs (O2611), mixed woodland, ♂ 27.viii.1981, JPOC.

***Sargus iridatus* (Scopoli, 1763)**

KILDARE: Castletown (N9734), mixed woodland, ♀ 8.viii.1982, JPOC and MAOC.

TABANIDAE

The Irish fauna is reviewed by Chandler (1975).

***Chrysops relictus* Meigen, 1820**

WEXFORD: near Killowen (S7121), pond, ♂ ♀ 19.vi.1990, JPOC and MAOC.

WICKLOW: Russellstown Park (N9610), mixed woodland/marsh, 3♀♀ 16.viii.1981, JPOC and MAOC.

***Haematopota crassicornis* Wahlberg, 1848**

CORK: Glengarriff (V9057), oak *Quercus* wood, ♀ 6.vii.1985, JPOC and MAOC.

WICKLOW: near Calary Lower (O2311), marshy area, ♀ 12.vii.1983, JPOC.

***Haematopota pluvialis* (Linnaeus, 1758)**

CLARE: Cliffs of Moher (R0392), ♂ 8.vii.1981, JPOC.

GALWAY: Letterfrack (L7257), National Park, ♀ 22.vii.1982, JPOC and MAOC.

LIMERICK: Lough Gur (R6241), lake-side marshy area, ♀ 7.vii.1981, JPOC.

***Hybomitra montana* (Meigen, 1820)**

GALWAY: Cleggan (L6158), ♀ 20.vii.1982, JPOC.

ULIDIIDAE

Previously known as the Otitidae, the species are reviewed by Speight and Chandler (1983).

***Herina frondescentiae* (Linnaeus, 1758)**

CLARE: Lisdoonvarna Spa (R1397), ♂ 25.v.1992, river-side vegetation, JPOC and MAOC; River Caher, The Burren (M1509), ♀ 17.vii.1981, JPOC and MAOC.

KILDARE: Louisa Bridge (N9936), calcareous marsh, ♀ 2.viii.1982, JPOC and MAOC.

***Seioptera vibrans* (Linnaeus, 1758)**

WATERFORD: near Passage East (S6811), hill-side vegetation, ♂ 12.vi.1991, JPOC.

WEXFORD: Mount Garrett (S7230), mixed woodland, ♂ 17.vi.1982, JPOC and MAOC.

***Tetanops myopinus* Fallén, 1820**

WEXFORD: Fethard (S7905) ♂ 2♀♀ 10.vi.1990, JPOC.

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Bull. Ir. biogeog. Soc. No. 24

FIGURE 1. The counties of Ireland.

Bull. Ir. biogeog. Soc. No. 24 (2000)

COASTAL LAGOON AND SALINE LAKE SHORES AS A HABITAT FOR STAPHYLINIDAE, CARABIDAE AND PSELAPHIDAE (COLEOPTERA) IN IRELAND: PART 2

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Abstract

Fifteen coastal lagoons or saline lakes, and one reclaimed polder channel with saline springs, were sampled for Staphylinidae, Carabidae and Pselaphidae on the south and west coasts of Ireland during 1998, continuing an earlier survey of twenty sites in 1996. In total, 104 species of staphylinid, 41 species of carabid and five species of pselaphid were recorded, of which four staphylinid and four carabid species were considered indicators of ecologically well-developed shoreline habitats. Sites where such habitats were indicated as occurring were Loch Phort Chorrúch (Aran Is, Co. Galway) and Inch Lough (Co. Donegal). Nine microenvironments (of conservation importance) were identified at nine of the 36 sites sampled, based on the occurrence of indicator species: stagnant saline shores, sandy coastal lake shores, bird loafing shores, beach outflow sand, lake shore sedge marshes, coastal reed-beds, vegetated decomposed seaweed, bog-saline water ecotones and unexposed intertidal stony sand/silt.

Introduction

Coastal lagoons are a priority habitat for conservation in Europe (CEC, 1992), and also provide several characteristic ecotonal habitats for invertebrates in Ireland (Good and Butler, 1998). This paper reports on a further survey of the staphylinid and carabid fauna of coastal lagoon and saline lake sites on the south and west coasts of Ireland. Twenty sites were previously studied (Good and Butler, 1998); this survey adds a further sixteen.

Methods

Sixteen coastal lagoons or saline lakes were sampled in 1998. Detailed descriptions of the lagoon sites mentioned in this paper are given in Healy *et al.* (1999), including data on salinity

and hydrology. The sampled areas were generally those most influenced by seawater, because the emphasis of the survey was marine. These areas were mostly associated with the barrier and outer parts of the lagoon or lake shores; the inflow marshes were not sampled.

Details of sites and sampling are summarized in Tables 1 and 3. Four sampling methods were used: (1) Suction sampling using a Stihl® BR 400 suction apparatus, mounted on the operator's back. This machine (referred to as an 'S-vac' to distinguish it from the 'D-vac' suction sampler) has a suction pipe of 58mm diameter (0.0026m^2 surface area). Six subsamples within a defined vegetation type of 100 x 1.5 sec. 'sucks' per subsample were taken at each site, resulting in a total area of 1.56m^2 covered. Because the hand-held pipe was shaken when the apex of the pipe was in the vegetation, a larger area (c. 2m^2) was effectively sampled; (2) Six plastic cup pitfall traps with undiluted ethylene glycol (commercial anti-freeze) as preservative; (3) Ground search turning cobbles (n = 30 / sample); (4) Flotation of beetles in sand or soil in a bucket of water, in areas of potentially suitable *Bledius* habitat (16 samples of *circa* 1000mm^2 x 80mm depth) (see Good, 1998). An equivalent sampling effort was used at each site, except where suitable microhabitats were not available for ground search or flotation.

Species were selected as indicators of well-developed habitat if: (1) they have a restricted habitat preference to the types of microhabitat associated with the lagoon shores; **and** (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems. 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 stenotopic species. The presence of two or more indicator species, likely to breed in the shoreline habitats sampled, is considered an indication of habitat quality (see Good and Speight, 1991).

Nomenclature of Coleoptera follows Anderson *et al.* (1997). Plant nomenclature follows Stace (1997). Voucher specimens of several indicator species have been deposited in the National Museum of Ireland, and other species have been retained in the senior author's collection.

Salinity measurements were taken using a portable salinity refractometer, calibrated using distilled water.

Results

In total, 104 species of staphylinid, 41 species of carabid and five species of pselaphid were recorded from the sixteen sites sampled. Four species of staphylinid, and four species of carabid were considered indicators of well-developed habitat (Table 2). Sites were divided into seven types of lagoon or saline lake, based on the geomorphology of the barrier and the type of shore substrate (Table 3; see also Good and Butler, 1998). These were: (1) sand barrier lagoons (only one site in 1998, which was represented by drainage channels); (2) shingle barrier lagoons; (3) peat shore saline lakes; (4) karst lagoons and (7) estuary impoundments. (Categories (5) and (6) (see Good and Butler, 1998) were not represented in the set of sites investigated in 1998). Results for each site are given under the relevant categories below. Sites considered to have better developed habitats for ecotonal staphylinid, carabid and pselaphid fauna are considered in detail.

1. Sand barrier lagoons

Three sites of the south/south-west coast (Lady's Island Lake, Kilkeran Lake and Lough Gill) were considered to be of conservation importance for their ecotonal fauna by Good and Butler (1998). The site investigated in 1998 (Ballyteige, Co. Wexford) was drained in the 19th century, and was represented by polder channels and a shallow drain system behind a sand dune. It is hydrologically part of a large area (c. 4km^2) of reclaimed agricultural land drained by deep channels with accumulating water pumped over a sea wall. Saline water percolates through the dune barrier at high spring tides. The sampled areas (see Table 1) included sedge flats which flood with brackish water (with *Carex extensa* Gooden. and other sedges, *Glaux maritima* L., *Plantago maritima* L. and a sparse cover of grasses; salinity of adjacent drain: 29‰), the margin of a drain-pool with salt-marsh vegetation (*Bolboschoenus maritimus* (L.) Palla, *Schoenoplectus tabernaemontani* (C.C. Gmel.) Palla and *Ruppia* sp. in standing water; salinity 11‰ after rain), and a drain bank with *Juncus maritimus* Lam., *J. gerardii* Loisel., *Plantago maritima*, sparse *B. maritimus*, *Triglochin maritimum* L., *Agrostis stolonifera* L. and *Centuarium* sp. (water salinity: 24‰). An additional sample was taken from a drain margin with a dense stand of *B. maritimus* (see Table 1; salinity 4‰ on 22 July 1998).

In total, 22 species of staphylinid and eight species of carabid were recorded from the main

set of samples, with a further 13 staphylinids and three carabids from the additional sample (Tables 4 and 5). However, none of these species was considered to be an indicator species.

The *Pogonus* species could not be satisfactorily determined as either *chalceus* (Marsham) or *littoralis* (Duftschmid). Until further specimens are collected from this site, it is assumed to be the more common species (*chalceus*) which, although stenotopic and halobiont, has been relatively frequently recorded in Ireland and has not therefore been regarded as an indicator species.

2. Shingle barrier lagoons

Two shingle barrier lagoons were sampled, both on islands: Kilmore Lake (Whiddy Island, Co. Cork) and Lough Bofin (Inisbofin, Co. Galway).

Kilmore Lake has a wide central inflow channel, which allows seawater entry at most tides. The shores are narrow, with rocky shore, eroded clay loam with cobbles, and narrow clay loam banks with grasses and sedges, as well as small narrow areas of reeds (*Phragmites australis* (Cav.) Trin. ex Steud). In total, 11 species of staphylinid and three species of carabid were recorded (Tables 6 and 7), one of which (*Aepus marinus* (Ström)) is regarded as an indicator species. Ten of the 14 species are typical marine littoral species, and many may have originated as colonists from the surrounding open coast (numbers of dispersing individuals were found floating on open water near the shore).

Aepus marinus is a local halobiont species with a predominantly westerly distribution in Great Britain (Luff, 1988). Its range is limited to the coast from Norway to Brittany (Luff, 1998), and it is absent from Denmark, Germany and the Benelux coasts (Lucht, 1987; Hansen, 1996). It is probably local in Ireland (Luff, 1998); Johnson and Halbert (1902) described it as locally common at the beginning of the century. *A. marinus* is a stenotopic species of intertidal rocky seashores (Lindroth, 1974), occurring in coarse sand or gravel (Hyman and Parsons, 1992).

Myrmecopora sulcata (Kiesenwetter) was represented at Kilmore Lake by a single specimen taken on clay-loam substrate under a stone. It keyed out as *M. lohmanderi* Bernhauer, using Scheerpeltz (1972). *M. lohmanderi* is restricted to the Baltic Sea and south-eastern North Sea. However, the external characteristics of these two species overlap, the genitalia are indistinguishable, and they are probably one species (Lohse, 1989).

Nine species of staphylinid, two species of carabid, and one species of pselaphid were recorded from Lough Bofin (Tables 6 and 7), none of which are regarded as indicator species.

3. Peat shore saline lakes

This was the most frequent type of site sampled in 1998. Sites in Connemara (Co. Galway) included Loch an tSaile, Loch Athola, and a complex of sites north of Casla (Loch an Aibhnín, Loch Cara Fionnla, the bayhead inlet to Loch Cara Fionnla (referred to here as the Cara na gCaorach inlet; see map in Robinson (1990)), and Loch Fhada). There were also four sites in Co. Donegal: Kincas Lough, Maghery Lough, Moorlagh, and Sally's Lough.

Taking all the Connemara sites together, there was a total recorded of 34 species of staphylinid, 17 species of carabid, and three species of pselaphid (Tables 8, 9 and 10), none of which are considered indicator species. Similarly, taking all the Donegal sites together, there was a total of 57 species of staphylinid, 24 species of carabid, and four species of pselaphid (Tables 11 and 12), one of which (*Atheta aquatilis* (Thomson) at Maghery Lough) was considered an indicator species.

Atheta aquatilis was only recently recorded as Irish, from Lynn Lagoon, Larne Lough in Co. Antrim (Anderson *et al.*, 1997). It is local in Britain (Hyman and Parsons, 1994), and uncommon in Central Europe and Scandanavia (Palm, 1970; Benick and Lohse, 1974). It is a stenotopic species restricted to moss and litter in flooded shaded habitats, springs, flushes and wet woodland (Palm, 1970; Koch, 1989; Hyman and Parsons, 1994). Three individuals were recorded at Maghery Lough from pitfall traps on peaty soil in probable otter (*Lutra lutra* (L.)) tunnel tracks in dense reeds (*Phragmites australis*), where the salinity of the water in the outer part of the reed-bed was 22‰ (2 July 1998).

The presence of a single indicator species at Maghery Lough is insufficient to indicate well-developed habitat at this site, although more extensive sampling of the extensive reed-bed may reveal further indicator species.

4. Karst lagoons

Lough Murree is the most well-known and, for staphylinids at least, the best example of this type of lagoon. Karst lagoons occur in the karst limestone area of north Clare and south-east

Galway (see Good and Butler (1998) for other sampled sites), including the Aran Islands. Two further sites, both on Inishmore (Aran Islands) were examined in 1998: Loch Phort Chorrúch and Loch An Chara. Note that the Aran Islands are administratively in Co. Galway, but for biological recording purposes are placed in Co. Clare (Webb *et al.*, 1996).

4.1. Loch Phort Chorrúch (Aran Islands)

This lagoon is similar to Lough Murree in that it possesses both a shingle barrier and subterranean or subaquatic karst channel connections to and from the sea. However, the barrier is much larger, and overtopping appears to be more important as a source of saline water, with both sand and seaweed being deposited on the inside slope of the barrier. This material provides a substrate for Chenopodiaceae, in an environment more sheltered (by the barrier) than would be the case on an exposed shingle shore. The microenvironment can be characterised as a free-draining 'raw soil' which nevertheless maintains moisture for long periods due to the depth of the deposit and the cover (50-100%) of vigorously growing plants. It is questionable whether this type of microenvironment is so well developed on the upper part of non-lagoon shingle shores because the deposits are in contact with established soils with different drainage and vegetation. In consequence, although not directly associated with the lagoonal water-body, the overwash seaweed/sand microhabitat is a direct result of lagoonal processes associated with the barrier, and was sampled for this reason. It must also be mentioned that overwash seaweed was much less extensive on the smaller barrier at Lough Murree.

The behaviour of the water-body at Loch Phort Chorrúch was similar to Lough Murree, with little apparent tidal response, and the water level fluctuating seasonally. The lake shore had organic-rich silty and sandy margins, and pasture shores grazed by cattle. Much of the barrier shore consisted of swards dominated by *Agrostis stolonifera* and *Potentilla anserina* L., again a reflection of the extent of shingle barrier in comparison to the more loamy soils on the seaward shore of Lough Murree. However, there were some areas of *Bolboschoenus maritimus* on silty and sandy substrates, but this was mostly in standing water, or if *B. maritimus* occurred on non-flooded soil it was accompanied by *A. stolonifera*, *P. anserina*, *Carex obtrubae* Podp., etc. Extensive beds of *Phragmites australis* also occurred. The offshore water salinity (0.5m from barrier shore) at the time of sampling was 2‰ (27 July 1998; L856111), and varied from 2-

4.5‰ during the summer (Healy *et al.*, 1999). Sampling areas are given in Table 1.

In total, 28 species of staphylinid and four species of carabid were recorded from Loch Phort Chorrúch (Tables 13 and 14), two of which are considered indicators of well-developed habitat: *Brundinia meridionalis* (Mulsant and Rey) and *Heterothops binotatus* (Gravenhorst). A single male of *B. meridionalis* was recorded under a cobble on sand/silt near a *Bolboschoenus* stand in water at the south-western apex of the lagoon. This species is only known in Ireland from three lagoons/saline lakes, including Lough Murree, where it was present in large numbers (see Good and Butler, 1998). The microhabitat of which it is characteristic (silty shores of stagnant water bodies, with dense filamentous algal growth) was less extensive at Loch Phort Chorrúch due to the proximity of the barrier, and a grassy sward growing on a more sandy soil.

Heterothops binotatus was recorded from the overwash seaweed/sand on the interior slope of the shingle barrier. It is mostly halobiont throughout its range on coasts of the northern Palaearctic, and occurs locally in the North and Baltic Seas (Horion, 1965). It was not recorded from France by Coiffait (1974), but is not listed as notable in Great Britain by Hyman and Parsons (1994), and has been recorded from a number of sites in Ireland (Johnson and Halbert, 1902; Owen, 1997). It is a stenotopic species (Koch, 1989), occurring in decomposing wrack and shoreline detritus with weed and grass growth (Fowler, 1888; Horion, 1965).

Ten species of staphylinid and five species of carabid were recorded from Loch an Chara (Tables 13 and 14), none of which are regarded as indicator species.

7. Estuary Impoundments

Only one site in this category (Inch Lough, Co. Donegal) was surveyed (in both 1996 and 1998) (Note that the category number (7) follows the series in Good and Butler (1998), to which the reader is referred for categories 5 and 6).

7.1. Inch Lough (Co. Donegal)

Inch Lough is a large artificial saline lake formed between two causeways linking an island (Inch) in Lough Swilly to the mainland. Sluice doors in one of the causeways allow water exchange with the estuary, and water is pumped from a large area of reclaimed agricultural land on the mainland. The site supports large numbers of breeding and wintering waterfowl, and forms part of Lough Swilly Special Protection Area (SPA), designated under the Bird's

Directive (see Hickie, 1997).

Two areas of shore were sampled at this site (see Table 1). The main sampling area was a lightly-grazed pasture shore used as a loafing site by swans and waterfowl, with *Agrostis stolonifera*, *Potentilla anserina*, *Juncus gerardii*, *Plantago major* L. and *Glaux maritima*. The area was rich in swan dung, and was flooded at high water (offshore salinity was 8‰ on 5 July 1998). A second area of shelly sandy beach with a sparse (<50%) cover of *Agrostis stolonifera*, *Poa* sp., and *Juncus bufonius* L., grading into a complete cover of *A. stolonifera*, *Potentilla anserina*, *Plantago major*, *Senecio aquaticus* Hill, etc., was also sampled. The bare soil at this area was organic-rich, and the offshore salinity was 4‰ on 5 July 1998.

A total of 37 species of staphylinid and 13 species of carabid were recorded, four of which are regarded as indicator species (Tables 15 and 16): *Bembidion bipunctatum* (L.), *B. aeneum* Germar, *Pelophila borealis* (Paykull) and *Philonthus furcifer* Renkonen. Relevant details for each of these species, with the exception of *P. borealis*, are given in Good and Butler (1998).

Pelophila borealis has been recorded from several sites in Ireland (Luff, 1998), but is only recently recorded in Britain from north-eastern Scotland, Orkney and Shetland (Hyman and Parsons, 1992). It is a northern Holarctic species and is not known as being native in Central Europe (Freude, 1976). It is restricted to wet silty substrates on lentic water margins (Hyman and Parsons, 1992). Lott and Bilton (1991) only recorded it in Ireland from turloughs and Lough Gash (Co. Clare).

The presence of four indicator species indicates a well-developed ecotonal fauna at Inch Lough.

Pselaphidae from Coastal Lagoons

The family Pselaphidae, now regarded by some (see Hansen, 1996) as a subfamily of the Staphylinidae, were stored from the 1996 samples, but not identified by Good and Butler (1998). The results from those sites where they occurred are given in Table 17. Taking 1996 and 1998 together, there were seven pselaphid species recorded from coastal lagoons, but only one, *Trissemus impressa* (Panzer) from Durnesh Lake (Co. Donegal) could be regarded as an indicator species.

T. impressa is recorded from three sites in south-west Ireland (Pearce, 1957), at four fen sites

in Northern Ireland (Nelson, 1998) and at Scragh Bog, Co. Westmeath (Owen, 1997). Although it is not listed as notable in Great Britain by Hyman and Parsons (1994), it is much rarer than the closely related *Reichenbachia juncorum* (Leach), according to Pearce (1957). It is widely distributed throughout most of Europe (Jeannel, 1950), and is restricted to marshes and marshy shores including those on inland saline soils (Koch, 1989). *T. impressa* was considered to be an indicator species on the grounds that its habitat requirements are very similar to *R. juncorum*, but that it is much more local and halotolerant.

Discussion

In terms of their staphylinid and carabid fauna, lagoons do not exist as clearly defined habitats like deciduous woodlands or fen peatlands. But then neither do raised bogs, in the sense that they contain invertebrate communities characteristic of, for instance, *Sphagnum* mosses rather than of raised bog *per se*. The conservation value of lagoons and saline lakes, for ecotonal soil biota, must therefore be seen in the context of coastal wetland habitat rather than coastal lagoonal habitat. Inch Lough provides a good illustration. It is a recently formed site, where no previous lagoon or saline lake occurred. Lough Swilly estuary doubtless provided the original source populations of the indicator species recorded in 1998 (two of these species were recorded in the Lough Foyle/Lough Swilly area by Buckle (1900)). Inch Lough must therefore be viewed as a particularly good example of the type of coastal wetland/shore habitat occurring in Lough Swilly, rather than as a well-defined site in itself. Similarly, at small sites with a strong marine influence (e.g. Kilmore Lake), the ecotonal fauna of the lagoon appears to be represented by a subset of larger populations from the more extensive marine shore habitat outside of the lagoon.

Where a site is being managed for its conservation value, it is useful to identify which habitat features are particularly important for its invertebrate communities (Kirby, 1992) so that these can be protected during the long-term management of the site. Lists of indicator species will have little practical value, after site designation, if they are not 'translated' into recognisable management features (see Speight *et al.*, 1997). In the case of coastal lagoons, the main processes which maintain the microhabitats of the ecotonal indicator assemblages, identified in this survey, are geomorphological. Indeed, 'microhabitat' is perhaps not the best word to

describe what are in effect soil 'microenvironments', i.e. combinations of soil texture, soil chemistry, amplitude of water fluctuation, microclimate and types of soil organic matter and/or microbiota.

An example is provided by Lough Murree (see Good and Butler, 1998). The notable microenvironment at this site is defined (Table 18) as 'silty shores of stagnant saline water-bodies, with dense filamentous algal growth', instead of 'karst lagoon shore'. The former, seemingly tedious, definition is necessary to distinguish the microenvironment from, for instance, the sampled shore of Lough Furnace, which, while being silty and with dense filamentous algal growth, was not stagnant, but regularly tidally flooded. Equally, by using 'saline water-bodies', it is recognised that this microenvironment is not a property of lagoons *per se*, although particularly well-developed in these karst lagoons. This definition incorporates the five parameters mentioned above: soil texture (silty), soil chemistry (saline), amplitude of water fluctuation (stagnant), microclimate (dense algal growth), and type of soil organic matter and/or microbiota (filamentous algal growth). All these components are recognisable in the field without resort to detailed physicochemical sampling.

A list of the important microenviroments from all 36 sites surveyed in 1996 and 1998 is given in Table 18. Taking the best examples of these microenvironments (based on the occurrence of indicator species and the extent of the microenvironment), the best lagoon and saline lake sites were Durnesh Lake, Inch Lough, Lady's Island Lake, Loch Phort Chorrúch, Loch Tanaí, Lough Gill and Lough Murree. For one of these categories (beach outflow sand), in the case of the two sites from which indicator species were recorded (one at each; Doovilra (Co. Mayo) and Durnesh Lake (Co. Donegal)), it is likely that better examples exist in sandy beach outflows from freshwater lakes, since at both sites the extent of suitable microenvironment was small. Similarly, better examples of unexposed intertidal stony sand/silt probably exist at larger sites than Kilmore Lake (Whiddy Island). Three of the indicator species (*Agonum nigrum* Dejean, *Carabus clatratus* L. and *Cypha punctum* (Motschulsky)) were also excluded from Table 18, since their habitat requirements appear to relate more to habitat associated with, but outside, the lagoon itself (estuarine shores, peaty soils, and flushes and stream banks, respectively).

None of these microenvironments can be regarded as exclusively 'lagoonal', and will occur in

other coastal habitat types. Four types were associated with freshwater lakes (lake-shore sedge marshes, bird loafing areas, sandy coastal lake shores, coastal reed-beds), three were associated with coastal environments (vegetated decomposed seaweed, beach outflow sand, unexposed intertidal stony sand/silt) and two were associated with upper salt-marsh zones (bog-saline water ecotone, stagnant saline shores). It is likely that lagoonal processes provide the best examples of many of these microenvironments, but only comparative surveys of other coastal habitats can verify this.

The high proportion of peat shore saline lakes in the 1998 survey must partly account for the relatively poor set of indicator species for sites sampled in that year, when compared to 1996 (Table 2, cf. Good and Butler, 1998: Table 2). The 1998 survey also included proportionally more sites with high salinities, approaching fully marine conditions, but only three halobiont or halophilous indicator species (*Aepus marinus*, *Brundinia meridionalis*, *Heterothops binotatus*; Table 2) were recorded. While weather conditions were considerably wetter than in 1996, this did not affect relative trap catches at sandy sites (Inch, Ballyteige, etc.). Whether it affected samples on peat shores can only be tested by sampling the same area(s) in a different year. Nevertheless, it is to be expected that more than one indicator species would have occurred in the total combined sample from all 1998 peat shore sites.

In total, no local stenotopic species were recorded from peat shore *Juncus maritimus*-dominated swards in the five Camus Bay sites (Cara na gCaorach inlet, Loch an Aibhnín, Loch an tSáile, Loch Cara Fionnla, Loch Fhada) in 1998, although two were recorded from Lough Tanaí in 1996 (Good and Butler, 1998). *Philonthus fumarius* is a coastal marsh species, but it was represented by only a single individual at L. Tanaí. *Stenus opticus* Gravenhorst is a bog species, and occurred where the lake shore graded into well-developed intact ungrazed blanket bog at Lough Tanaí. This was the likely source of indviduals of *S. opticus* and the abundant *S. incrassatus* Erichson (and other bog species; see Table 10 in Good and Butler (1998)) which may have subsequently bred in the *J. maritimus* and *A. stolonifera* swards. These swards were flooded during the summer of 1998, and may therefore be an accessory habitat for these species, which are exploited during years of little disturbance by flooding or drying out of the peat surface. This suggestion raises the possibility that ecotonal habitats can provide very successful breeding opportunities for several stenotopic species in years when environmental

conditions are suitable, but the opposite in years when conditions are unsuitable. Whether this is an important factor in the maintenance of long-term populations of *S. opticus* and similar species remains to be investigated.

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TABLE 1. Details of sites and sampling of coastal lagoons and saline lakes in 1998. Vegetation refers to species dominant in the areas sampled, or to sediment type if no vegetation was present. Generic abbreviations: *A. mar.* - *Armeria maritima* Willd.; *A. stol.* - *Agrostis stolonifera*; *B.* - *Bolboschoenus*; *J. mar.* - *Juncus maritimus*; *J. ger.* - *Juncus gerardii*; *P. ans.* - *Potentilla anserina*; *Pucc.* - *Puccinellia* sp.

Site	Grid ref.	Vegetation	Method	Sampling date
Ballyteige Channels	S953048	*Carex* spp/*Glaux*	S-vac	22 August 1998
(Co. Wexford)			Pitfall traps	23 July - 22 August 1998
	S937064	*A. stol./J. mar.*	Pitfall traps	22 July - 22 August 1998
	S953049	*Schoenoplectus*	Ground search	22 August 1998
	S950053	*B.maritimus*	Pitfall traps	22 July - 22 August 1998
Cara na gCaorach inlet	L957317	*A. stol./J. mar.*	S-vac	18 August 1998
(Co. Galway)			Pitfall traps	16 September - 7 October 1998
	L962313	*A. stol./J. mar.*	Pitfall traps	26 September - 7 October 1998
Inch Lough	C342226	*A. stol./J.ger.*	S-vac	19 September 1998
(Co. Donegal)			Pitfall traps	5 July - 6 August 1998
	C351229	Sparse *A. stol.*	Pitfall traps	5 July - 6 August 1998
Kilmore Lake (Whiddy Is.)	V956488	Salt marsh bank	Pitfall traps	24 August - 11 September 1998
(Co. Cork)			Sieve samples	24 August 1998
	V957481	*A. mar./Pucc.*	Pitfall traps	24 August - 11 September 1998
	V957489	*Phragmites* shore	Ground search	24 August 1998
	V959490	Storm wrack	Sieve samples	11 September 1998
Kincas Lough	B750197	Sedge shore	S-vac	4 August 1998
(Co. Donegal)			Pitfall traps	3 July - 5 August 1998
	B751196	*J. gerardii*	Pitfall traps	3 July - 5 August 1998
Loch an tSáile	L951383	*A. stol./J. mar.*	S-vac	2 September 1998
(Co. Galway)			Pitfall traps	17 September - 17 October 1998
	L951383	*A. stol./J. mar.*	Pitfall traps	17 September - 17 October 1998
	L951384	Shore wrack	Ground search	7 July 1998
	L962394	Cobble shore	Ground search	17 September 1998
Lough Athola	L628483	*A. stol./J. mar.*	S-vac	3 September 1998
(Co. Galway)			Pitfall traps	3 - 25 September 1998
	L626482	*Blysmus*	Pitfall traps	3 - 25 September 1998
	L626483	Peat creek cliffs	Flotation	25 September 1998
	L623483	Peat pool cliffs	Flotation	25 September 1998

TABLE 1 (continued)

	L629482	Rock crevices	Ground search	25 September 1998
Loch an Aibhnín	L949308	*A. stol./J. mar.*	S-vac	17 August 1998
(Co. Galway)			Pitfall traps	17 August - 16 September 1998
	L945321	*A. stol./J. mar.*	Pitfall traps	12 August - 3 September 1998
	L944320	*Zostera* wrack	Sieve samples	12 August 1998
Lough Bofin (Inisbofin)	L523656	*J. gerardii*	S-vac	29 August 1998
(Co. Galway)			Pitfall traps	29 August - 19 September 1998
			Pitfall traps	29 August - 19 September 1998
Loch Cara Fionnla	L963292	*A. stol./Festuca*	S-vac	18 August 1998
(Co. Galway)			Pitfall traps	18 August - 16 September 1998
	L963285	Peat pool shore	Pitfall traps	18 August - 16 September 1998
Loch an Chara	L885100	*A. stol./J. ger.*	S-vac	26 August 1998
(Inishmore, Aran Is.)			Pitfall traps	26 August - 16 September 1998
(Co. Galway)	L884099	*A. stol./J. ger.*	Pitfall traps	26 August - 16 September 1998
Loch Fhada	L944310	*A. stol./J. mar.*	S-vac	11 August 1998
(Co. Galway)			Pitfall traps	11 August - 3 September 1998
	L945311	*A. stol./J. mar.*	Pitfall traps	11 August - 3 September 1998
Loch Phort Chorrúch	L856111	*A. stol./P. ans.*	S-vac	27 August 1998
(Inishmore, Aran Is.)	-857112		Pitfall traps	24 June - 27 August 1998
(Co. Galway)	L856110	*B. maritimus*	Pitfall traps	24 June - 27 August 1998
		Cobble/silt shore	Ground search	23 June 1998
	L855110	Overwash wrack	Sieve samples	27 August 1998
Sally's Lough	B714164	*J. gerardii*/grass	S-vac	4 August 1998
(Co. Donegal)			Pitfall traps	3 July - 4 August 1998
	B715165	*Phragmites/J. ger.*	Pitfall traps	3 July - 4 August 1998
Maghery Lough	B722095	*J. ger.*/grasses	S-vac	4 August 1998
(Co. Donegal)			Pitfall traps	2 July - 4 August 1998
	B721092	*Phragmites*	Pitfall traps	2 July - 4 August 1998
			Sieve samples	4 August 1998
	B723096	Reed flood debris	Sieve samples	2 July 1998
Moorlagh	B788186	*J. mar.*/grasses	S-vac	16 August 1998
(Co. Donegal)			Pitfall traps	4 July - 4 August 1998
		Peat cliff	Flotation	3 August 1998
	B791186	*A. stol./J. mar.*	Pitfall traps	4 July - 4 August 1998

TABLE 2. Indicator species recorded from coastal lagoons and saline lakes in 1998. Soil salinity preference/tolerance derived from Horion (1963-67), Koch (1989) and Hyman and Parsons (1994); see text also. 'Freshwater' refers to habitat in association with freshwater; 'halotolerant' to species which occur on both saline and non-saline soils; 'halophilous' to species which show a preference for saline soils; 'halobiont' to species which are restricted solely to saline habitats.

Species	**Total**	**Sites**	**Soil salinity preference/tolerance**
STAPHYLINIDAE			
Atheta aquatilis (Thomson)	3	Maghery L.	Freshwater
Brundinia meridionalis (Mulsant & Rey)	1	L. Phort Chorrúch	Halophilous
Heterothops binotatus (Gravenhorst)	2	L. Phort Chorrúch	Halobiont
Philonthus furcifer Renkonen	1	Inch Lough	Freshwater
CARABIDAE			
Aepus marinus (Ström)	2	Kilmore L.	Halobiont
Bembidion aeneum Germar	27	Inch Lough	Freshwater, halophilous
Bembidion bipunctatum (L.)	2	Inch Lough	Freshwater, halotolerant
Pelophila borealis (Paykull)	2	Inch Lough	Freshwater

TABLE 3. Types of coastal lagoon and saline lake based on barrier and shore substrate characteristics. See Healy and Oliver (1998) for general classification and definitions of lagoons and saline lakes. Shore substrate refers to representative substrate sampled, and does not cover all substrates present at a site.

Site	Barrier	Shore substrate	Lagoon shore class
Ballyteige Channels	Sand (drained)	Sand	Sand barrier lagoon
Cara na gCaorach inlet	Narrow inlet	Peat	Peat shore saline lake
Inch Lough	Causeway/sluice	Sand/loam	Estuary impoundment
Kilmore Lake	Shingle	Clay loam/cobbles	Shingle barrier lagoon
Kincas Lough	Narrow inlet	Peat	Peat shore saline lake
Loch an tSaile	Narrow inlet	Peat	Peat shore saline lake
Lough Athola	Narrow inlet	Peat	Peat shore saline lake
Loch an Aibhnín	Narrow inlet	Peat	Peat shore saline lake
Lough Bofin	Shingle	Peat	Shingle barrier lagoon
Loch Cara Fionnla	Narrow inlet	Peat	Peat shore saline lake
Loch an Chara	Shingle/karst	Silt/sand	Karst lagoon
Lough Fhada	Narrow inlet	Peat	Peat shore saline lake
Loch Phort Chorrúch	Shingle/karst	Silt/sand	Karst lagoon
Maghery Lough	Causeway/sluice	Peat	Peat shore saline lake
Moorlagh	Causeway/sluice	Peat	Peat shore saline lake
Sally's Lough	Narrow inlet	Peat	Peat shore saline lake

TABLE 4. Staphylinidae from a sand barrier polder channel/drain system at Ballyteige Channels (Co. Wexford). Indicator species are marked with an asterisk. The same sampling techniques and effort were used at each site. The *Bolboschoenus* column represents the additional sample referred to in the text.

	Carex/Glaux	*Juncus/Agrostis*	*Bolboschoenus*	*Schoenoplectus*
Astenus lyonessius (Joy)	1	-	-	-
Atheta amplicollis (Mulsant & Rey)	1	1	145	-
Mycetoporus splendidus (Gravenhorst)	2	-	3	-
Paederus fuscipes Curtis	2	1	-	-
Philonthus cognatus Stephens	2	-	1	-
Quedius schatzmayri Gridelli	1	-	-	-
Sepedophilus nigripennis (Stephens)	2	-	1	-
Staphylinus dimidiaticornis Gemminger	1	-	149	-
Stenus brunnipes Stephens	5	-	7	-
Stenus canaliculatus Gyllenhal	1	7	3	-
Stenus clavicornis (Scopoli)	3	-	20	-
Stenus fulvicornis Stephens	3	-	5	-
Stenus juno (Paykull)	1	-	2	-
Stenus ossium Stephens	1	-	-	-
Tachyporus dispar (Paykull)	4	-	2	-
Tachyporus hypnorum (Fabricius)	1	-	-	-
Tachyporus pusillus Gravenhorst	1	-	-	-
Anotylus rugosus (Fabricius)	-	2	2	-
Bledius limicola Tottenham	-	1	-	17
Philonthus laminatus (Creutzer)	-	1	2	-
Xantholinus longiventris Heer	-	1	3	-
Atheta fungi (Gravenhorst)	-	-	2	-
Atheta graminicola (Gravenhorst)	-	-	15	-
Atheta laticollis (Stephens)	-	-	1	-
Calodera aethiops (Gravenhorst)	-	-	2	-
Carpelimus corticinus (Gravenhorst)	-	-	3	-
Falagrioma thoracica (Stephens)	-	-	1	-
Geostiba circellaris (Gravenhorst)	-	-	13	-
Oxypoda elongatula Aubé	-	-	3	-
Philhygra elongatula (Gravenhorst)	-	-	5	-
Philhygra melanocera (Thomson)	-	-	1	-
Philhygra volans (Scriba)	-	-	2	-
Stenus nanus Stephens	-	-	1	-
Tachinus signatus Gravenhorst	-	-	33	-
Oxypoda umbrata (Gyllenhal)	-	-	-	1

TABLE 5. Carabidae from a sand barrier polder channel/drain system at Ballyteige Channels (Co. Wexford). Indicator species are marked with an asterisk. The same sampling techniques and effort were used at each site. The *Bolboschoenus* column represents the additional sample referred to in the text.

	Carex/Glaux	*Juncus/Agrostis*	*Bolboschoenus*	*Schoenoplectus*
Dyschirius globosus (Herbst)	11	-		-
Pterostichus melanarius (Illiger)	1	-	36	-
Pterostichus niger (Schaller)	14	3	64	-
Agonum marginatum (Linnaeus)	-	1	-	-
Elaphrus cupreus Duftschmid	-	1	-	-
Loricera pilicornis (Fabricius)	-	2	-	-
Amara plebeja (Gyllenhal)	-	-	1	-
Bembidion mannerheimi Sahlberg	-	-	25	-
Carabus granulatus Linnaeus	-	-	26	-
Dyschirius leudersi Wagner	-	-	-	1
Pogonus chalceus (Marsham)	-	-	-	1

TABLE 6. Staphylinidae and Pselaphidae from shingle barrier lagoon shores at Kilmore Lake (Whiddy Island, Co. Cork), and Lough Bofin (Inisbofin, Co. Galway). The same sampling techniques and effort were used at each site. Indicator species are marked with an asterisk.

	Kilmore L.			L. Bofin
	Cliff	Reeds	Wrack	
Atheta vestita (Gravenhorst)	1	-	7	-
Bledius limicola Tottenham	23	-	-	-
Cafius fucicola Curtis	-	-	3	-
Cafius xantholoma (Gravenhorst)	-	5	1	-
Dinaraea angustula (Gyllenhal)	1	-	-	-
Emplenota obscurella (Gravenhorst)	-	2	-	-
Gabrius trossulus (Nordmann)	-	-	2	-
Halobrecta flavipes Thomson	-	4	14	-
Myrmecopora sulcata (Kiesenwetter)	-	1	2	-
Omalium laeviusculum Gyllenhal	-	4	8	-
Xantholinus glabratus (Gravenhorst)	-	1	-	-
Atheta amplicollis (Mulsant & Rey)	-	-	-	3
Cordalia obscura (Gravenhorst)	-	-	-	1
Euaesthetus bipunctatus (Ljungh)	-	-	-	3
Reichenbachia juncorum (Leach)	-	-	-	5
Stenus boops Ljungh	-	-	-	1
Stenus brunnipes Stephens	-	-	-	2
Stenus canaliculatus Gyllenhal	-	-	-	8
Stenus cicindeloides (Schaller)	-	-	-	4
Stenus juno (Paykull)	-	-	-	23
Stenus tarsalis Ljungh	-	-	-	8

TABLE 7. Carabidae from shingle barrier lagoon shores at Kilmore Lake (Whiddy Island, Co. Cork), and Lough Bofin (Inisbofin, Co. Galway). Indicator species are marked with an asterisk.

	Kilmore L.			L. Bofin
	Cliff	Reeds	Wrack	
Aepus marinus (Ström) *	-	2	-	-
Cillenus lateralis Samouelle	-	-	1	-
Trechus obtusus Erichson	1	-	-	-
Pterostichus niger (Schaller)	-	-	-	1
Pterostichus diligens (Sturm)	-	-	-	1

TABLE 8. Staphylinidae and Pselaphidae from saline lake peat shores with *Juncus maritimus* and grasses in Connemara (Co. Galway): Loch an Aibhnín; L. Fhada; Cara na gCaorach inlet; L. Cara Fionnla; Loch an tSaile and Lough Athola. The same sampling techniques and effort were used at each site. Indicator species are marked with an asterisk.

	Aibhnín	Fhada	Caor.	Fionn.	Saile	Athola
Atheta aquatica (Thomson)	1	-	-	-	-	-
Brachygluta helferi (Schmidt-Göbl)	21	7	24	1	138	129
Drusilla canaliculata (Fabricius)	3	-	-	2	-	4
Paederus fuscipes Curtis	9	-	8	-	-	-
Sepedophilus nigripennis (Stephens)	1	1	1	-	12	8
Stenus brunnipes Stephens	1	1	-	1	1	3
Stenus juno (Paykull)	3	1	-	-	9	-
Stenus ossium Stephens	1	-	-	-	-	-
Euaesthetus bipunctatus (Ljungh)	-	5	-	7	-	-
Reichenbachia juncorum (Leach)	-	3	-	43	44	4
Stenus clavicornis (Scopoli)	-	2	-	-	4	1
Stenus fulvicornis Stephens	-	1	-	5	3	2
Stenus fuscipes Gravenhorst	-	2	-	-	-	1
Stenus lustrator Erichson	-	2	2	2	19	19
Stenus nitidiusculus Stephens	-	1	-	1	1	-
Atheta vestita (Gravenhorst)	-	-	2	-	-	-
Cordalia obscura (Gravenhorst)	-	-	1	7	1	-
Tachyporus dispar (Paykull)	-	-	1	1	-	-
Xantholinus longiventris Heer	-	-	1	-	-	-
Atheta amplicollis (Mulsant & Rey)	-	-	-	1	-	-
Oxypoda elongatula Aubé	-	-	-	3	1	-
Quedius fulginosus (Gravenhorst)	-	-	-	1	-	-
Quedius molochinus (Gravenhorst)	-	-	-	1	-	-
Stenus tarsalis Ljungh	-	-	-	2	-	-
Tachyporus nitidulus (Fabricius)	-	-	-	1	-	-
Aleochara brevipennis Gravenhorst	-	-	-	-	1	-
Atheta fungi (Gravenhorst)	-	-	-	-	1	-
Brachygluta fossulata (Reichenbach)	-	-	-	-	31	-
Encephalus complicans Kirby	-	-	-	-	6	-
Lesteva sicula Erichson	-	-	-	-	2	-
Ocypus olens (Müller)	-	-	-	-	1	1
Olophrum fuscum (Gravenhorst)	-	-	-	-	1	-
Rugilus erichsoni (Fauvel)	-	-	-	-	1	-
Stenus bimaculatus Gyllenhal	-	-	-	-	5	-
Stenus impressus Germar	-	-	-	-	10	2
Bledius limicola Tottenham	-	-	-	-	-	9

TABLE 9. Staphylinidae from *Zostera* debris on the seaward shore of Loch an Aibhnín, Connemara (Co. Galway).

Atheta vestita (Gravenhorst)	25
Omalium laevisuculum Gyllenhal	27

TABLE 10. Carabidae and Heteroceridae from saline lake peat shores with *Juncus maritimus* and grasses in Connemara (Co. Galway): Loch an Aibhnín; L. Fhada; Cara na gCaorach inlet; L. Cara Fionnla; Loch an tSaile and Lough Athola. The same sampling techniques and effort were used at each site. Indicator species are marked with an asterisk.

	Aibhnín	Fhada	Caor.	Fionn.	Saile	Athola
Bradycellus harpalinus (Serville)	1	-	-	-	-	-
Dyschirius globosus (Herbst)	3	-	-	-	-	-
Bembidion mannerheimi Sahlberg	-	1	-	-	7	9
Pterostichus niger (Schaller)	-	1	-	5	40	3
Bembidion assimile Gyllenhal	-	-	1	-	1	-
Loricera pilicornis (Fabricius)	-	-	-	1	-	-
Notiophilus palustris (Duftschmid)	-	-	-	1	-	-
Agonum albipes (Fabricius)	-	-	-	-	1	-
Agonum fuliginosum (Panzer)	-	-	-	-	2	-
Carabus granulatus Linnaeus	-	-	-	-	1	-
Dromius linearis (Olivier)	-	-	-	-	3	1
Elaphrus cupreus Duftschmid	-	-	-	-	1	-
Ocys harpaloides (Audinet-Serville)	-	-	-	-	1	-
Pterostichus strenuus (Panzer)	-	-	-	-	1	-
Pterostichus melanarius (Illiger)	-	-	-	-	6	-
Carabus problematicus Herbst	-	-	-	-	-	1
Heterocerus fossor Kiesenwetter	-	-	-	-	-	7

TABLE 11. Staphylinidae and Pselaphidae from saline lake peaty shores at Maghery Lough, Sally's Lough, Kincas Lough and Moorlagh (Co. Donegal). The same sampling techniques and effort were used at each site, with the exception of Maghery L. where shore debris and *Phragmites* litter was sieved. Indicator species are marked with an asterisk. See Table 1 for Maghery Lough subsites.

	Maghery			Sally's	Kincas	Moorlagh
	Reeds	*J. ger.*	Debris			
Aleochara lanuginosa Gravenhorst	-	1	-	-	-	-
Anotylus rugosus (Fabricius)	1	-	-	-	-	-
Atheta aquatilis (Thomson) *	3	-	-	-	-	-
Atheta fungi (Gravenhorst)	1	-	-	-	-	7
Atheta graminicola (Gravenhorst)	1	-	-	-	-	-
Bryaxis bulbifer (Reichenbach)	-	1	-	-	-	-
Cordalia obscura (Gravenhorst)	-	-	1	1	-	-
Gyrohypnus angustatus Stephens	-	-	1	-	-	-
Lathrobium boreale Hochhuth	-	-	1	-	1	-
Lathrobium terminatum Gravenhorst	-	-	5	-	2	-
Lesteva sicula Erichson	7	7	3	-	-	-
Myllaena brevicornis (Matthews)	1	2	-	-	-	-
Myllaena infuscata (Kraatz)	1	-	-	-	-	-
Olophrum fuscum (Gravenhorst)	1	-	-	-	-	3
Olophrum piceum (Gyllenhal)	-	1	-	-	-	-
Oxypoda elongatula Aubé	-	1	-	-	-	1
Philonthus varians (Paykull)	-	1	-	-	-	-
Quedius maurorufus (Gravenhorst)	3	-	7	-	-	-
Quedius nitipennis (Stephens)	-	-	3	-	-	-
Rugilus erichsoni (Fauvel)	-	-	1	-	-	-
Staphylinus dimidiaticornis Gemminger	-	16	-	18	8	-
Stenus bimaculatus Gyllenhal	6	-	-	-	-	-
Stenus brunnipes Stephens	-	3	-	-	6	1
Stenus clavicornis (Scopoli)	-	5	-	6	-	-
Stenus juno (Paykull)	-	1	-	-	2	3
Tachinus marginellus (Fabricius)	1	-	-	-	-	-
Tachinus signatus Gravenhorst	5	-	-	27	-	4
Xantholinus linearis (Olivier)	-	1	-	-	-	-
Aloconota gregaria (Erichson)	-	-	-	1	-	-
Amischa analis (Gravenhorst)	-	-	-	1	-	-
Atheta amplicollis (Mulsant & Rey)	-	-	-	3	-	13
Atheta celata (Erichson)	-	-	-	1	-	-
Ocypus aeneocephalus (DeGeer)	-	-	-	2	-	-
Philonthus cognatus Stephens	-	-	-	2	-	-
Philonthus laminatus (Creutzer)	-	-	-	5	-	-
Pselaphus heisei Herbst	-	-	-	1	-	1
Quedius fuliginosus (Gravenhorst)	-	-	-	2	1	-
Reichenbachia juncorum (Leach)	-	-	-	1	-	3
Xantholinus longiventris Heer	-	-	-	2	-	-

TABLE 11 (continued)

	Maghery			Sally's	Kincas	Moorlagh
	Reeds	*J. ger.*	Debris			
Bryaxis bulbifer (Reichenbach)	-	-	-	-	2	23
Carpelimus corticinus (Gravenhorst)	-	-	-	-	1	-
Dinaraea angustula (Gyllenhal)	-	-	-	-	1	-
Euaesthetus bipunctatus (Ljungh)	-	-	-	-	1	-
Gabrius coxalus (Hochhuth)	-	-	-	-	1	-
Mycetoporus splendidus (Gravenhorst) agg.	-	-	-	-	1	-
Lathrobium brunnipes (Fabricius)	-	-	-	-	1	-
Ocypus olens (Müller)	-	-	-	-	1	-
Othius punctulatus (Goeze)	-	-	-	-	1	-
Stenus canaliculatus Gyllenhal	-	-	-	-	7	-
Stenus fulvicornis Stephens	-	-	-	-	3	8
Stenus impressus Germar	-	-	-	-	1	21
Stenus nitens Stephens	-	-	-	-	1	-
Stenus nitidiusculus Stephens	-	-	-	-	1	7
Tachyporus dispar (Paykull)	-	-	-	-	1	9
Gabrius trossulus (Nordmann)	-	-	-	-	-	1
Geostiba circellaris (Gravenhorst)	-	-	-	-	-	2
Othius angustus Stephens	-	-	-	-	-	1
Quedius nemoralis Baudi	-	-	-	-	-	1
Stenus cicindeloides (Schaller)	-	-	-	-	-	1
Stenus pusillus Stephens	-	-	-	-	-	1
Tachyporus nitidulus (Fabricius)	-	-	-	-	-	1

TABLE 12. Carabidae from saline lake peat shores with *Juncus* spp and grasses at Maghery Lough, Sally's Lough, Kincas Lough and Moorlagh (Co. Donegal). The same sampling techniques and effort were used at each site, with the exception of Maghery L. where shore debris occurred. Indicator species are marked with an asterisk. See Table 1 for Maghery Lough subsites.

	Maghery			Sally's	Kincas	Moorlagh
	Reeds	*J. ger.*	Debris			
Agonum thoreyi Dejean	70	1	3	2	1	-
Bembidion mannerheimi Sahlberg	-	2	1	2	6	2
Elaphrus cupreus Duftschmid	-	1	-	-	5	1
Leistus fulvibarbis Dejean	1	-	-	-	-	-
Leistus terminatus (Hellwig)	1	-	-	-	-	-
Loricera pilicornis (Fabricius)	1	-	-	-	-	-
Pterostichus diligens (Sturm)	1	3	2	-	1	3
Pterostichus niger (Schaller)	-	1	-	-	-	-
Pterostichus nigrita (Paykull)	-	2	-	-	1	-
Agonum fuliginosum (Panzer)	-	-	-	5	2	-
Harpalus rufipes (DeGeer)	-	-	-	1	-	-
Notiophilus palustris (Duftschmid)	-	-	-	1	1	-
Pterostichus crenatus (Duftschmid)	-	-	-	5	3	-
Pterostichus strenuus (Panzer)	-	-	-	1	-	4
Pterostichus versicolor (Sturm)	-	-	-	1	-	-
Abax parallelepipedus (Piller & Mitterp.)	-	-	-	-	1	-
Carabus granulatus Linnaeus	-	-	-	-	4	-
Dromius linearis (Olivier)	-	-	-	-	6	-
Pterostichus melanarius (Illiger)	-	-	-	-	1	-
Pterostichus minor (Gyllenhal)	-	-	-	-	1	-
Agonum albipes (Fabricius)	-	-	-	-	-	6
Dromius melanocephalus Dejean	-	-	-	-	-	1
Nebria brevicollis (Fabricius)	-	-	-	-	-	1
Ocys harpaloides (Audinet-Serville)	-	-	-	-	-	3

TABLE 13. Staphylinidae from karst lagoon shores at Loch an Chara and Loch Phort Chorrúch, Inishmore (Aran Islands). The same sampling techniques and effort were used at each site, with the exception of L. Phort Chorrúch where barrier overwash litter was sieved. Indicator species are marked with an asterisk. See Table 1 for Loch Phort Chorrúch subsites.

	L. Phort Chorrúch				L. an Chara
	Agros.	*B. mar.*	Silt	Wrack	
Amischa analis (Gravenhorst)	-	-	-	1	-
Anotylus rugosus (Fabricius)	4	-	-	-	-
Atheta amplicollis (Mulsant & Rey)	6	11	-	-	1
Atheta clientula (Erichson)	5	-	-	2	-
Atheta fungi (Gravenhorst)	-	-	-	1	-
Atheta graminicola (Gravenhorst)	13	9	-	1	
Atheta orbata (Erichson)	-	1	-	-	-
Atheta vestita (Gravenhorst)	-	-	1	-	-
Brundinia meridionalis (Mulsant & Rey) *	-	-	1	-	-
Carpelimus corticinus (Gravenhorst)	-	1	-	-	3
Cordalia obscura (Gravenhorst)	-	5	-	10	-
Gabrius nigritulus (Gravenhorst)	-	-	-	23	-
Gyrohypnus fracticornis (Müller)	-	-	-	5	-
Heterothops binotatus (Gravenhorst) *	-	-	-	2	-
Mycetoporus splendidus (Gravenhorst)	-	-	-	5	-
Quedius maurorufus (Gravenhorst)	1	-	-	6	-
Rugilus orbiculatus (Paykull)	-	-	-	1	-
Sepedophilus nigripennis (Stephens)	2	-	-	-	1
Stenus brunnipes Stephens	-	-	-	1	3
Stenus canaliculatus Gyllenhal	24	-	1	-	131
Stenus clavicornis (Scopoli)	11	2	-	3	4
Stenus fulvicornis Stephens	9	-	-	-	3
Stenus juno (Paykull)	8	-	-	-	1
Stenus ossium Stephens	8	-	-	4	-
Tachinus signatus Gravenhorst	11	38	-	-	-
Tachyporus nitidulus (Fabricius)	1	-	-	-	-
Xantholinus jarrigei Coiffait	-	-	-	3	-
Xantholinus longiventris Heer	1	1	-	-	-
Stenus cicindeloides (Schaller)	-	-	-	-	5
Stenus nanus Stephens	-	-	-	-	1

TABLE 14. Carabidae from karst lagoon shores at Loch an Chara and Loch Phort Chorrúch, Inishmore (Aran Islands). The same sampling techniques and effort were used at each site, with the exception of L. Phort Chorrúch where barrier overwash litter was sieved. Indicator species are marked with an asterisk.

	L. Phort Chorrúch				L. an Chara
	Agros.	*B. mar.*	Silt	Wrack	
Bembidion assimile Gyllenhal	5	-	-	-	-
Bembidion mannerheimi Sahlberg	3	-	-	-	-
Demetrias atricapillus (Linnaeus)	1	-	-	-	-
Pterostichus strenuus (Panzer)	1	1	-	-	-
Dyschirius globosus (Herbst)	-	-	-	-	1
Elaphrus cupreus Duftschmid	-	-	-	-	1
Pterostichus niger (Schaller)	-	-	-	-	3
Pterostichus nigrita (Paykull)	-	-	-	-	1
Pterostichus crenatus (Duftschmid)	-	-	-	-	1

TABLE 15. Staphylinidae from an impounded estuarine inlet lagoon shore at Inch Lough (Lough Swilly, Co. Donegal). Indicator species are marked with an asterisk.

Aloconota gregaria (Erichson)	3	*Staphylinus dimidiaticornis* Gemminger	1
Amischa analis (Gravenhorst)	1	*Stenus boops* Ljungh	1
Anotylus rugosus (Fabricius)	2	*Stenus brunnipes* Stephens	7
Atheta amplicollis (Mulsant & Rey)	5	*Stenus canaliculatus* Gyllenhal	7
Atheta graminicola (Gravenhorst)	6	*Stenus cicindeloides* (Schaller)	12
Atheta zosterae (Thomson)	1	*Stenus clavicornis* (Scopoli)	1
Encephalus complicans Kirby	1	*Stenus formicetorum* Mannerheim	3
Gabrius coxalus (Hochhuth)	1	*Stenus fulvicornis* Stephens	22
Lesteva sicula Erichson	1	*Stenus juno* (Paykull)	4
Omalium laeviusculum Gyllenhal	1	*Stenus melanopus* (Marsham)	4
Oxypoda exoleta Erichson	1	*Stenus nanus* Stephens	4
Philhygra elongatula (Gravenhorst)	1	*Stenus picipes* Stephens	16
Philhygra melanocera (Thomson)	1	*Stenus similis* (Herbst)	4
Philonthus carbonarius (Gravenhorst)	6	*Tachinus laticollis* Gravenhorst	1
Philonthus cognatus Stephens	13	*Tachinus signatus* Gravenhorst	15
Philonthus concinnus (Gravenhorst)	1	*Tachyporus dispar* (Paykull)	1
Philonthus furcifer Renkonen *	1	*Tachyporus obtusus* (Linnaeus)	1
Philonthus laminatus (Creutzer)	19	*Tachyporus tersus* Erichson	3
Sepedophilus nigripennis (Stephens)	1		

TABLE 16. Carabidae from an impounded estuarine inlet lagoon shore at Inch Lough (Lough Swilly, Co. Donegal). Indicator species are marked with an asterisk.

Agonum dorsale (Pontoppidan)	1	*Bembidion tetracolum* Say	4
Agonum marginatum (Linnaeus)	13	*Carabus granulatus* Linnaeus	4
Agonum muelleri (Herbst)	6	*Loricera pilicornis* (Fabricius)	3
Amara plebeja (Gyllenhal)	1	*Pelophila borealis* (Paykull) *	2
Bembidion aeneum Germar *	27	*Pterostichus diligens* (Sturm)	1
Bembidion bipunctatum (Linnaeus) *	2	*Pterostichus nigrita* (Paykull)	11
Bembidion mannerheimi Sahlberg	1		

TABLE 17. Pselaphidae from sites surveyed in 1996. Indicator species are marked with an asterisk. Site abbreviations: Acon. - L. Aconeera; Cloon. - Cloonconeen; Dron. - Drongawn L.; Durn. - Durnesh L.; Farra. - Farranamanagh L.; Kilk. - Kilkeran L.; Lady's - Lady's Is. L.; Liss. - Lissagriffin L.; Tacum. - Tacumshin L.; Tanaí - L. Tanaí. Indicator species are marked with an asterisk.

	Acon.	Cloon.	Dron.	Durn.	Farra.	Kilk.	Lady's	Liss.	Tacum.	Tanaí
Brachygluta helferi (Schmidt-Göbl)	27	1	3	9	-	-	-	-	-	1
Bryaxis bulbifer (Reichenbach)	-	-	-	-	2	-	-	-	-	1
Pselaphus heisei Herbst	-	-	-	5	-	-	-	-	-	1
Trissemus impressa (Panzer) *	-	-	-	11	-	-	-	-	-	-
Reichenbachia juncorum (Leach)	7	-	-	-	4	-	-	1	-	1
Rybaxis longicornis (Leach)	-	-	-	-	-	26	3	-	4	-

TABLE 18. Microenvironments of conservation importance (identified by the presence of indicator species), created by lagoonal processes, occurring in Irish coastal lagoons and saline lakes. Best examples of the microenvironment refer to those recorded during 1996 and 1998, and are not definitive (e.g. bird loafing shores were not adequately sampled at Lady's Island Lake).

Stagnant saline shores

Silty shores of stagnant saline water-bodies, with dense filamentous algal growth. Indicator species: *Brundinia meridionalis*, *Stenus nigritulus*. Best example recorded at Lough Murree (Co. Clare).

Sandy coastal lake shores

Sparsely vegetated sandy shores of coastal lakes and pools. Indicator species: *Gabrius keysianus*. Best example recorded at Lady's Island Lake (Co. Wexford).

Bird loafing shores

Shores used for loafing by swans and waterbirds with faecal enriched sandy soils and grass. Indicator species: *Atheta liliputana*, *Bembidion aeneum*, *B. bipunctatum*, *Pelophila borealis*. Best example recorded at Inch Lough (Co. Donegal).

Beach outflow sand

Unvegetated aerobic beach sand, maintained by water outflow from a coastal lake. Indicator species: *Diglotta sinuaticollis*, *Dyschirius impunctipennis*. Best examples at Doovilra (Co. Mayo) and Durnesh Lake (Co. Donegal), but better examples may exist at freshwater coastal lakes.

Lake-shore sedge marshes

Leaf-litter and moss in sedge marshes adjoining lake-shore swamps. Indicator species: *Schistoglossa gemina*, *Philonthus furcifer*, *Philhygra* (=*Atheta*) *gyllenhali*, *Trissemus impressus*. Best example recorded at Durnesh Lake (Co. Donegal).

TABLE 18 (continued)

Coastal reed-beds

Deep leaf-litter layer in coastal reed-beds. Indicator species: *Atheta aquatilis*, *Philonthus fumarius*. Best example recorded at Lough Gill (Co. Kerry).

Vegetated decomposed seaweed

Decomposed seaweed with vegetation cover on shingle or sand. Indicator species: *Heterothops binotatus*. Best example recorded at Loch Phort Chorrúch (Aran Islands).

Bog-saline water ecotone

Sheltered peat shores with ungrazed relatively sparse *Agrostis stolonifera* and *Juncus maritimus*, ecotonal between intact blanket bog and saline water bodies, and seasonally flooded at high spring tides. Indicator species: *Stenus opticus*. Best example recorded at Lough Tanaí (Co. Galway).

Unexposed intertidal stony sand/silt

Eroded stones on unexposed sandy/silty intertidal substrates. Indicator species: *Aepus marinus*. Best example recorded at Kilmore Lake (Co. Cork), but better examples may exist at larger non-lagoonal shores.

Bull. Ir. biogeog. Soc. No. 24 (2000)

THE BIOGEOGRAPHY AND CURRENT STATUS OF *GAMMARUS DUEBENI* LILJEBORG AND *GAMMARUS PULEX* (L.) (CRUSTACEA, AMPHIPODA) IN FRESHWATER IN THE REPUBLIC OF IRELAND

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Introduction

Gammarus duebeni celticus Stock and Pinkster, 1970, is a sub-species of one of the four native freshwater amphipod species in Ireland - the others being *Gammarus lacustris* Sars, 1864 and the subterranean species *Niphargus kochianus irlandicus* Schellenberg, 1932 and *Niphargus wexfordensis* Karaman, Gledhill and Holmes, 1994. *G. duebeni* Liljeborg is the common brackish and freshwater amphipod in Ireland (Holmes, 1978). The distribution of *G. lacustris* is more restricted however, being confined to hard calcareous lakes and their outflows (Costello, 1993). *Niphargus kochianus* is confined to subterranean waters, and is recorded only from the southern half of Ireland (Costello, 1993), while *Niphargus wexfordensis* has only recently been described from groundwater in the southeast of Ireland (Karaman *et al.*, 1994).

The ecology of *G. duebeni* is interesting and it has been well documented by authors such as Pinkster *et al.* (1970) and Sutcliffe (1978, 2000). It was first described as a new, brackish water species by Liljeborg in 1852. The freshwater form of *G. duebeni* was first recognised in the rivers and lakes of Ireland by Reid (1939). He failed to find any morphological differences between the freshwater form and the brackish water form. However, he did notice that the brackish water form failed to breed in freshwater. He presumed this was due to a failure in the functioning of the ovaries under a different osmotic pressure. Subsequently, he suggested that the two forms were distinct and went on to describe them as the α form in freshwater and the β form in brackish water.

It was not until 1970 that these two forms were separated on a subspecific level (Stock and Pinkster, 1970). This was based on the length / width ratio of the merus of the fifth walking leg - the freshwater forms from Ireland having a merus length that was greater than twice its width, whilst the brackish water forms have a merus length that was less than twice its width. Based on these relative dimensions, two subspecies of *G. duebeni* were proposed - namely *G. duebeni celticus* from freshwater habitats in Ireland and Brittany and *G. duebeni duebeni* from brackish water habitats.

These two forms are also physiologically different. *G. duebeni celticus* from fresh water in Ireland and Brittany is distinguished by a suite of osmoregulatory features conferring improved survival at lower sodium concentrations (Sutcliffe, 1971). Both Reid (1939) and Hynes (1954) found that whilst *G. duebeni duebeni* was able to survive in fresh water, it was unable to breed. However, Sutcliffe (1970) successfully managed to breed brackish water animals from Kintyre in fresh water that was pumped from Lake Windermere. He found that after a period of two years, the sodium regulatory mechanism in the experimental animals closely resembled that of the Irish freshwater populations. In another two years it was discovered that the length / width ratio of the merus of the walking leg had changed - becoming 3% narrower than that of the parent population (Sutcliffe, 2000). It was postulated by Sutcliffe, in this same paper, that the development of narrower limbs in freshwater is directly associated to the adaptive changes required for osmoregulation in freshwater. Sutcliffe also opposes the idea that brackish and freshwater forms are subspecies, and says that any differences between the two forms are differential phenotypic expressions of a common genotype (Sutcliffe, 2000).

Possible ideas on the origin of *G. duebeni* in freshwater were discussed by Pinkster *et al.* (1970). It was assumed that, in pre-glacial periods, *G. duebeni* was a marine, cold temperate species that occurred along the coasts of Northern Europe and Eastern North America. During the Mindel glacial period (some 425,000 BP), no inland waters would have been present, but occasionally larger coastal waterbodies would have been dammed up against icewalls. These waters were presumably saline and in these lakes, *G. duebeni* would have had a wide distribution. During the subsequent interglacial periods, the melting of this ice would have lowered the sodium concentration of these lakes, allowing suitable conditions for *G. duebeni* to adapt morphologically and physiologically to these increasingly dilute waters. These adapted *G.*

duebeni could easily have invaded fresh, inland waters in areas such as southern Ireland and the Atlantic coast of France, which seem to have remained relatively ice free during subsequent glacial periods. Elsewhere they were expelled due to the ice of the Riss and Wurm glacial periods. The fact that parts of Ireland were unglaciated during these periods is significant, as it has allowed at least 10,000 years, and possibly up to 425,000 years for acquisition of subspecific characters.

G. duebeni is believed to be widespread throughout Ireland, but its distribution has been discussed by few authors (Reid, 1939; Holmes, 1978; Macan and Lund, 1954). No work has been published on its distribution for the last 22 years. Given the changes seen in freshwater amphipod distribution in Northern Ireland with the spread of the introduced *Gammarus pulex* (L., 1758) (Dick *et al.*, 1990), an opportunity was seen to produce a comprehensive map of the current freshwater distribution of *G. duebeni* throughout the Republic of Ireland.

Materials and Methods

In initial stages of this study, records were obtained from the National Museum of Ireland, through the help of Mr Mark Holmes, and a literature search was made for any papers concerning *G. duebeni* in fresh water habitats in Ireland. These papers included those exclusively on *G. duebeni* (e.g. Reid, 1939), on macroinvertebrates in general (e.g. Macan and Lund, 1954) or on the analysis of fish diets (e.g. Kennedy and Fitzmaurice, 1968, 1970, 1971). Any records obtained in this way were noted and recorded.

Some of these records were quite old and in most cases no National Grid Reference accompanied any records for *G. duebeni*. This made records quite difficult to map accurately and the distribution obtained was patchy. To solve this problem, recent records (1996 onwards) on gammarids were obtained from the biological monitoring programme of the Environmental Protection Agency (EPA). The data came from their annual assessments of the biological status of Ireland's rivers and streams, based on macroinvertebrate fauna. The database concerns rivers in the Republic of Ireland, hence information for Northern Ireland was not obtained from this source.

The EPA information included the presence or absence of *G. duebeni* from each river station inspected. The National Grid Reference (five digit Easting and Northing co-ordinates) for each

station was obtained by a hand-held GPS (Geographic Positioning System). Specimens with elongated or kidney-shaped eyes were assumed to be *G. duebeni*, as those of *G. pulex* and *G. lacustris* are more rounded, and to date this has proved the case by confirmatory microscopic examination of representative samples taken. Selected specimens of *G. duebeni* checked by Noreen McLoughlin were assigned to the sub species *celticus*. Identification to species level was made using the keys and characters of Gledhill *et al.* (1976), and subspecies verification was based on the length / width ratio of the merus of the fifth leg.

A computer package called DMAP (copyright Alan Morton) was used to map the Irish distribution of *G. duebeni* based on 10km squares. This is a program that is especially designed for the mapping of biological data. To add to the basic outline of Ireland provided, the DMAP Digitizer package was used to add the 40 hydrometric areas (based on river catchments) onto the basic map. Catchments are considered to be more appropriate when mapping a freshwater species than county boundaries or terrestrial features.

Each positive record for *G. duebeni* was plotted using the National Grid Reference of the EPA monitoring station in which the gammarids occurred. Each point on the map was set to correspond to an area of 10km. Positive records concerning *G. duebeni* are represented by a closed symbol. Areas in the Republic of Ireland where the introduced amphipod *G. pulex* is known to occur are noted by open symbols.

Results

The initial literature survey on the distribution of *G. duebeni* showed it to be present in all catchments, although records for some catchments were sparse.

The results of the distribution study based on the EPA data can be seen in the accompanying map (Fig. 1). The map demonstrates that *G. duebeni* has a wide distribution in fresh water in the Republic of Ireland and that it is almost ubiquitous in every catchment. However, it can be seen that there are some areas that do have sparser records for *G. duebeni*, e.g., hydrometric areas 9 (Liffey and Dublin Bay), 10 (Avoca - Vartry) and 25 (Lower Shannon). These catchments have been numbered in Fig. 1.

The introduced *G. pulex* is seen to occur in hydrometric areas 7 (Boyne) and 9 (Liffey). Boyne specimens were confirmed by Mr Mark Holmes (NMI). It now seems to be the

dominant amphipod along the Leinster Blackwater and the lower reaches of the Boyne - from the point where the Blackwater River meets the Boyne River at Navan, Co. Meath.

Where *G. duebeni* and *G. pulex* occur in the same 10km square, the latter's presence is indicated. This is based on the presumption that *G. pulex* is the exception rather than the rule and that it is important to be aware of its current distribution.

Discussion

It does not seem that there are widespread losses of *G. duebeni* in fresh waters in the Republic of Ireland, unlike the situation in Northern Ireland (Costello, 1993). Results from the literature as well as the records of the EPA show that it occurs abundantly in most of the hydrometric areas that have been studied. Information on the distribution of *G. duebeni* in Northern Ireland can be seen in a paper by Strange and Glass (1979).

The lack of findings of *G. duebeni* in hydrometric areas 9 and 10 is probably owing to the acidic nature of the rivers and streams in this area, having a bedrock of granite and also low calcium levels. Calcium is an important factor in the lifecycle of crustaceans, as it is essential for the reformation of the exoskeleton after moulting. Although *G. duebeni* is classed as a calcicole species, it was recorded during biological surveys from some sites with low ionic strength, e.g. Rivers Behy (pH 5.71; conductivity 54μS/cm) and Finnow (pH 6.96; conductivity 48μS/cm) in Co. Kerry.

G. pulex has only recently been recorded in the Boyne catchment (McLoughlin and Reynolds, in prep.). It is now the dominant amphipod along the Blackwater River and in the lower Boyne River from its confluence with the Blackwater River at Navan. *G. duebeni* is found in the Boyne above Navan - before its confluence with the Blackwater River.

G. pulex has been known to occur in the Liffey catchment for the past 12 years (Keatinge, 1989). However, since its initial discovery in the Brittas River and its tributaries it has now been discovered in areas along the shore of Blessington Reservoir and in small streams flowing into the reservoir (McLoughlin and Reynolds, in prep.).

G. pulex has not yet been recorded from any other sites in the Republic of Ireland. However, its presence in Northern Ireland is well documented. It was introduced in 1958 and 1959 to several areas in Northern Ireland in an attempt to increase fish stocks in angling waters by

increasing the food availability (Strange and Glass, 1979). Since then, it has displaced *G. duebeni celticus* in several river systems, including the River Lagan (Dick *et al.*, 1990). The methods of displacement of *G. duebeni celticus* by *G. pulex* have been well documented (Dick *et al.*, 1989, 1990, 1993) and they are believed to be in the form of interference competition with reproductive mechanisms. It has been suggested that differential predation of *G. pulex* males on moulted *G. duebeni celticus* females is the primary method of displacement (Dick *et al.*, 1989). In some situations, *G. duebeni celticus* is able to survive upstream of the *G. pulex* populations - this can be observed currently in the Boyne River above Navan.

From evidence presented here and from the ongoing displacement of *G. duebeni celticus* in Northern Ireland, there is no doubt that in the future *G. duebeni* in the Republic of Ireland will gradually be replaced by *G. pulex* in many river systems. A similar situation has been seen in Brittany, France, where *G. duebeni* has been replaced in many areas by *G. pulex* (Dunn, 1995). Also, *G. duebeni* once occurred in Normandy (Chevreux and Fage, 1925; Pacaud, 1952), but it has now been entirely replaced by *G. pulex* migrating from the East (Pinkster *et al.*, 1970).

Another freshwater amphipod introduced to Ireland may expand its range at the expense of *G. duebeni*. *Crangonyx pseudogracilis* Bousfield, 1958, was discovered by Holmes in 1969 in a pond in the Phoenix Park, Dublin (Holmes, 1975). It has since been reported from many areas across the country, including the Liffey, Boyne, Erne and Bann basins as well as the lakes of Clare and Galway (Reynolds, 1998). However, there is no evidence that *C. pseudogracilis* is displacing *G. duebeni* through biotic interactions. It seems that *C. pseudogracilis* can tolerate water of lesser quality with lower oxygen in which other gammarid species cannot survive (MacNeil *et al.*, 2000). It is also known to tolerate a wide salinity range and polluted water (Conlon, 1994). Its spread to water of good quality seems to be limited by its successful predation by other gammarid species (Dick, 1996; MacNeil *et al.*, 1999). There is no doubt however, that *C. pseudogracilis* is thriving in shallow, eutrophic waters (Dick *et al.*, 2000), helped by high fecundity (Hynes, 1955) as well as its ease of dispersal with ornamental aquatic plants and on the feet of birds (O'Connor *et al.*, 1991).

The preferred habitat for *G. duebeni* in fresh waters is relatively clean, unpolluted and well oxygenated waters. Decreasing water quality in Ireland may lead to replacement of *G. duebeni*

by *C. pseudogracilis*. In the latest national overview of water quality in the Republic of Ireland (1995 - 1997) some 33% of the 13,200km of river channel surveyed was to some degree affected by organic pollution (Lucey *et al.*, 1999). A survey on the river quality in Northern Ireland, carried out in 1995, showed eutrophication to be a significant problem in some catchments (Environment and Heritage Service, no date). Eutrophication through diffuse enrichment from agricultural runoff is seen as the biggest threat to freshwater habitats and to communities of sensitive freshwater organisms (Toner *et al.*, 2000).

Ireland's early separation from the rest of Europe has resulted in a restricted flora and fauna, of which there are few indigenous crustaceans. If we regard *G. duebeni celticus* as an indigenous Irish and Breton subspecies, then it is important to realise the need for an effective conservation method when it seems threatened. Attempts are being made to elucidate the degree of genetic variation of populations of *G. duebeni celticus* from geographically distant parts of Ireland, using allozyme electrophoresis and DNA analysis. An understanding of the genetic relationships between Irish populations of *G. duebeni celticus* may facilitate in the understanding of the possible origins of this subspecies and guide in its conservation management.

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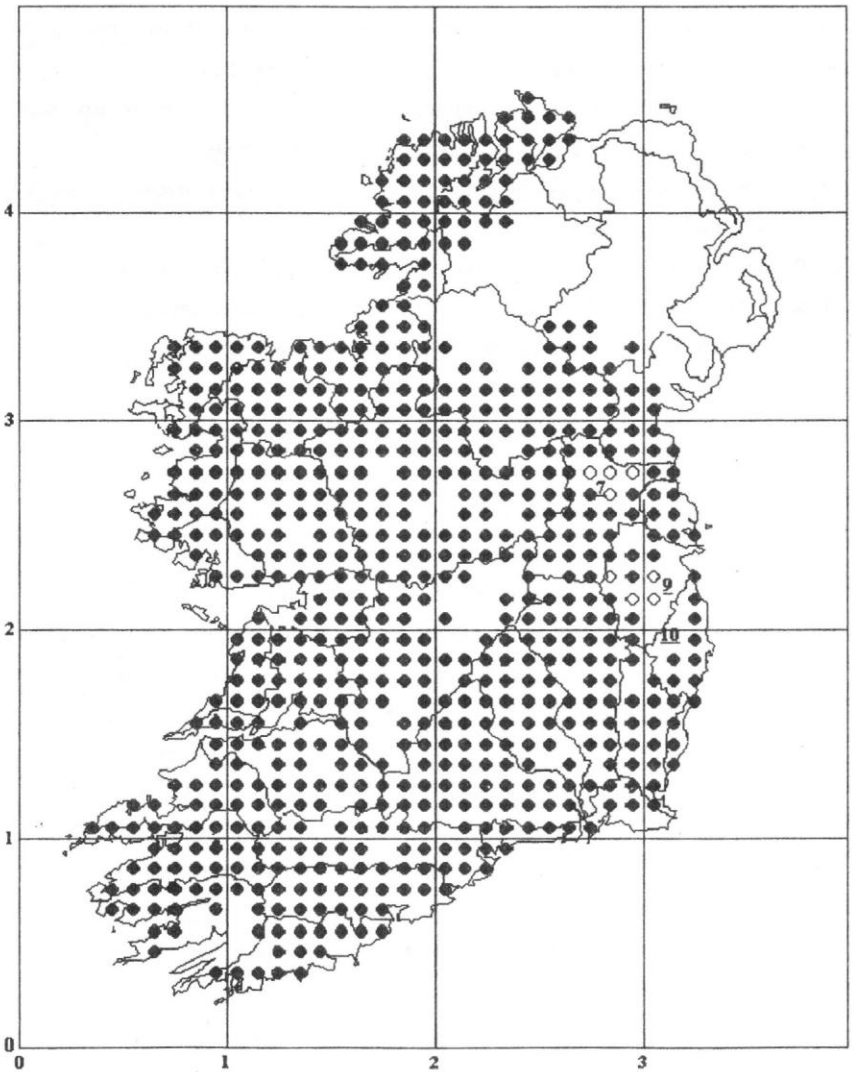
FIGURE 1. The distribution of *Gammarus duebeni* (closed circles) and *Gammarus pulex* (open circles) in freshwater in the Republic of Ireland based on presence in 10km squares (Hydrometric areas in the background).



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THE STATUS OF THE FRESHWATER PEARL MUSSEL *MARGARITIFERA MARGARITIFERA* (L.) IN EAST CORK AND PART OF WATERFORD, IRELAND

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The freshwater pearl mussel (*Margaritifera margaritifera* (L.)) has declined in many parts of its European range (Young, 1991). Although widespread in southern Irish rivers and streams, it has apparently declined in some areas also (Lucey, 1993). The species is listed in Annex II and Annex V of the EU Habitats Directive (92/43). Annex II describes the species as "of community interest whose conservation requires the designation of Special Areas of Conservation", while Annex V describes the species as "of community interest whose taking in the wild and exploitation may be subject to management measures". In Ireland, *Margaritifera* is one of only two aquatic invertebrates afforded legal protection under the Wildlife Act, 1976 (Statutory Instrument No. 112, 1990). Because of its protected status and the importance placed on its conservation at EU level, a survey was conducted to establish its status and distribution in rivers and streams in east Cork and part of Waterford (see Table 1 for list).

Lucey (1993) published the most recent information on the status of *Margaritifera* in this study area using data collected between 1987 and 1992. He showed that it was present in the rivers Blackwater, Licky, Tay and Mahon. One other river in this study area, the Glashaboy, was reported to hold a population in the past. Thompson (1856) reported "Mr. Humphreys of Cork notes it as abundant at Inchigeela, and as inhabiting the small rivers which run through Blarney and Glanmire". The reference to Glanmire is to the Glashaboy. Although Lucey (1993) showed a positive record in 10km square W68 (Glashaboy), he reported to me (J. Lucey, pers. comm.) that this record was a mapping error, and that he did not find *Margaritifera* in the Glashaboy.

Study area and methods

The study area consists of a group of rivers and streams in east Cork and Waterford. These are listed below and in Table 1, as follows: Glashaboy and tributaries Butlerstown and Black

Brook, Owennacurra and tributaries Leamlara and Templeboden, Dungourney, Kiltha, Womanagh, Dissour, Tourig, Glendine, Licky, Goish, Finisk, Bricky, Colligan, Dalligan, Tay, Mahon, Glenshelane, Owenashad, Bride and tributaries Flesk, Knoppogue, Douglas and Glenaboy. The Blackwater was also surveyed between Lismore and Killavullen.

Survey sites were selected at approximately evenly spaced intervals along each river. Access to the river was usually gained at bridges. A minimum of 200m (often up to 500m) of river was surveyed in detail at each site. Survey methods consisted of a search for empty shells along river edges and on gravel and sandy shoals, and a search of the river bed for live mussels using a black plastic bucket with a transparent bottom. Surveying was carried out only when visibility in the water was good. Most fieldwork was conducted between February and November 1999. Some preliminary work was done in August and September 1998 and a few areas not surveyed in 1999 were completed in March, April and June 2000.

Results

A total of 150 sites were surveyed in the small rivers of east Cork and Waterford and seven in the Blackwater. Live *Margaritifera* were found in four rivers, the Blackwater, Licky, Tay and Mahon (Table 1), and these are described below. In view of the fact that *Margaritifera* formerly occurred in the Glashaboy, a particularly detailed survey was undertaken there, with negative results. All rivers in which *Margaritifera* were found were known to hold the species before the survey began (Lucey, 1993).

Blackwater: this river was by far the largest one included in the survey. Most of the river channel within the study area is too deep for wading. Therefore, the survey results are considered inadequate and do not reflect the real status of *Margaritifera* there. It is not possible to give an estimate of population size for the part of this river surveyed.

Licky: *Margaritifera* occur in the Licky at two sites, although all but one mussel was found at a single site. Most of the population is located in about 1km of river. The minimum total population is probably in the region of 300 mussels.

Tay: *Margaritifera* occur along about 4km of river and the minimum total population is probably in the region of 300 mussels.

Mahon: the Mahon holds a small population, apparently restricted to less than 1km of river.

Only 28 live mussels were found, as well as one empty shell. The minimum total population probably does not exceed 100 mussels.

Empty shells were collected during the fieldwork on the rivers and the length of each was measured (mean 100.6mm; sd 8.1; range 83–120; n 71). Seventy-nine per cent of these measured between 91–110mm. Most live *Margaritifera* seen were in a similar size range although only two were measured at 95 and 100mm. Salmonid fish, which act as hosts to the larval (glochidial) stage of *Margaritifera* (Lucey, 1993), were noted in all rivers where the species was present.

Additional record: a single large live *Margaritifera* was found in May 1998 by Cyril Saich and the author in the River Allow (north west Cork) (R31).

Discussion

The methods employed in this survey are considered adequate for all rivers except the Blackwater. No estimate of the population can be given and the distribution of the species along this river remains unclear. Riverbank protection works to prevent erosion and fisheries related developments have recently occurred on the Blackwater, some of them involving interference with the riverbed. In view of this and the protected status of the species, a detailed survey using diving equipment is urgently needed in order to establish distribution and population size. The Blackwater is now a proposed candidate Special Area of Conservation. Part of the Tay is within a proposed Natural Heritage Area but no habitat protective measures are in place (or proposed) for the other two rivers containing *Margaritifera*.

Water quality in the small rivers is good with the Tay and Mahon considered unpolluted (Lucey *et al.*, 1999). However, 13% of the Licky is considered slightly polluted/eutrophic and nearly 30% of the Blackwater is classified in the same condition (Lucey *et al.*, 1999). Intensive agriculture takes place in the catchment of all rivers and slurry and artificial fertilizers are regularly spread in adjoining fields. Water for human consumption is abstracted from all three small rivers close to the point of mussel habitation.

It is noteworthy that no juvenile mussels were found at any site, although small specimens may be overlooked if submerged in the substratum (Moorkens, 1995). However, several of those found in the Licky were noted to be somewhat smaller than the average given above. It

appears from this survey that the populations in the Licky, Tay and Mahon are at a critically low level. Moorkens and Costello (1994) considered that the hardwater form of the freshwater pearl mussel (*Margaritifera m. durrovensis* Phillips) in the river Nore, with an estimated population of 420 in 1994, would need a population twenty times greater for successful recruitment. If the same applies to the softwater form (the subject here) then its long-term survival is in doubt in the three small rivers in this study area.

It appears that the Glashaboy population is long since extinct. Although water for human consumption is abstracted near Glanmire, 15% of the river is considered slightly polluted/eutrophic (Lucey *et al.*, 1999). During the survey I noted raw sewage discharging directly to the river from three different industries above the water intake point. Slurry from a farmyard was also seen entering the river. There is a high and expanding human population in the area around Glanmire, Riverstown and Sallybrook. The river here is very badly clogged with household litter and rubbish from local industries and building sites. Considerable alteration of the natural riverbank has taken place due to rubble dumping as a result of past and current house building and industrial development. Overall, this part of the Glashaboy is now an unsuitable habitat for *Margaritifera*.

Acknowledgements

I wish to thank Cyril Saich who assisted with the survey in the Blackwater, Tom Ryan who provided transport for part of the survey and John Lucey, Ferdia Marnell and Evelyn Moorkens for references and comments on an earlier draft.

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TABLE 1. List of east Cork and Waterford rivers and streams surveyed for *Margaritifera margaritifera* in 1999, with details of sites surveyed, sites positive and numbers of live and empty shells found.

River	No. of sites surveyed	No. of sites positive live/empty	No. of mussels live/empty
Glashaboy	12	0/0	0/0
Butlerstown	5	0/0	0/0
Black Brook	2	0/0	0/0
Owennacurra	11	0/0	0/0
Leamlara	2	0/0	0/0
Templeboden	1	0/0	0/0
Dungourney	4	0/0	0/0
Kiltha	5	0/0	0/0
Womanagh	5	0/0	0/0
Dissour	5	0/0	0/0
Tourig	7	0/0	0/0
Glendine	3	0/0	0/0
Licky	13	2/3	187/11
Goish	5	0/0	0/0
Finisk	6	0/0	0/0
Bricky	2	0/0	0/0
Colligan	7	0/0	0/0
Dalligan	4	0/0	0/0
Tay	10	3/1	93/27
Mahon	10	2/1	28/1
Glenshelane	4	0/0	0/0
Owenashad	5	0/0	0/0
Bride	13	0/0	0/0
Flesk	3	0/0	0/0
Knoppogue	3	0/0	0/0
Douglas	2	0/0	0/0
Glenaboy	1	0/0	0/0
Blackwater	7	2/3	2/38

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A PROVISIONAL LIST OF SPIDERS (ARANEAE) FROM LESLEY GIBSON'S SURVEY (1979-1982) OF CARNSORE POINT, CO. WEXFORD, INCLUDING ONE SPECIES NEW TO IRELAND, *MARO MINUTUS* (O. P.-CAMBRIDGE, 1906) (LINYPHIIDAE)

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The following is a provisional list of spider species gathered by Leslie Gibson between 1979 and 1982 while carrying out a baseline survey of terrestrial invertebrates at Carnsore Point (T1000), Co. Wexford. The area is bounded to the south and east by the sea-shore, to the west by Lady's Island Lake and to the north by a line drawn from the northernmost point of the lake to the east coast. The work was conducted from Trinity College Dublin and was commissioned by the Irish Electricity Supply Board (E.S.B.) as part of an environmental study in preparation for the then mooted construction of a nuclear power station at Carnsore Point. A copy of Gibson's thesis (1982), written in association with the survey, is held in the Natural History Museum, Dublin. It contains a wealth of information pertaining to the ecology and seasonal distribution of spiders in the area and must constitute one of the most intensive studies of spiders carried out in Ireland.

The material collected by Gibson is also housed in the Natural History Museum, Dublin (register number NMI 16: 1987). The number of specimens is very large (some 7000 spiders alone), representing many groups of invertebrates. Much of it has not been examined in significant detail.

During 1998 and 1999, the present author undertook to examine the spiders. The material is generally in very good condition. Data labels are largely intact though interpreting some of the details on these necessitates careful correlation with Gibson's thesis. The identity of all specimens upon which the present list is based was checked by the author. Identifications were made using Roberts (1993) with occasional reference to Locket and Millidge (1951-1953). The list has been compiled from an examination of specimens for which there is a locality and date of capture. It is possible that a small number of other species may be contained in the

unexamined material (of which there is a significant amount).

Taxonomic note

Nomenclature is based primarily on Roberts (*op. cit.*) including the revisions noted in the supplement to this work. Since the assignation of New County Record or New Irish Record status to any species is based on van Helsdingen (1996), it seems necessary to note a number of differences in taxonomy to that used in his literature survey, an important work for anyone engaged in studying spiders in Ireland. He placed the genus *Philodromus* in the family Philodromidae and the genus *Meta* (*Metellina*) in the family Metidae. Roberts retained them in the Thomisidae and the Tetragnathidae respectively. Van Helsdingen raised the subfamily Liocraninae to family status Liocranidae, a change which Roberts adopted in a later work (1995) and this is accepted here. Van Helsdingen probably omitted a note explaining that *Dicymbium brevisetosum* (Locket, 1962) (Linyphiidae) is not a separate species but a forma of *Dicymbium nigrum* (Blackwall, 1834) c.f. his entry for *Toxochrus cirrifrons* (O. P.-Cambridge, 1871). He placed *Theridion bimaculatum* (Linnaeus, 1767) (Theridiidae) in the genus *Neottiura* and *Zelotes pusillus* (C. L. Koch, 1833) (Gnaphosidae) in *Drassylus*. Van Helsdingen listed *Pardosa purbeckensis* F. O. P.-Cambridge, 1895 (Lycosidae) as an Irish species but not *Pardosa agrestis* (Westring, 1861). Roberts interpreted these to be members of a single highly polytypic species, the latter name having priority. For this reason, the record of *P. agrestis* on the present list is not treated as a new Irish record. The species *Micrargus subaequalis* (Westring, 1851) is misplaced on p. 74 when it should be on p. 73.

The Species List

New county records are indicated by *, the new Irish record **. A total of 126 species were identified, 59 of which are new county records. There is one new Irish record.

Family Amaurobiidae

Amaurobius similis (Blackwall, 1861)

Amaurobius ferox (Walckenaer, 1825)

Family Dysderidae

Dysdera crocata C. L. Koch, 1838

Harpactea hombergi (Scopoli, 1763)

Family Segestriidae

Segestria senoculata (Linnaeus, 1758)

Family Gnaphosidae

**Drassodes cupreus* (Blackwall, 1834)

Haplodrassus signifer (C. L. Koch, 1839)

**Zelotes (Drassylus) pusillus* (C. L. Koch, 1833)

**Zelotes electus* (C. L. Koch, 1839)

Zelotes latreillei (Simon, 1878)

Micaria pulicaria (Sundevall, 1832)

Family Clubonidae

Clubiona reclusa O. P.-Cambridge, 1863

**Clubiona stagnatilis* Kulczynski, 1897

**Clubiona neglecta* O. P.-Cambridge, 1862

Clubiona lutescens Westring, 1851

Clubiona compta C. L. Koch, 1839

**Clubiona subtilis* L. Koch, 1867

Family Liocranidae

**Agroeca proxima* (O. P.-Cambridge, 1871)

Family Thomisidae

Subfamily Misumeninae

Xysticus cristatus (Clerck, 1757)

**Xysticus erraticus* (Blackwall, 1834)

Ozyptila trux (Blackwall, 1846)

Ozyptila brevipes (Hahn, 1826)

Subfamily Philodrominae

**Philodromus cespitum* (Walckenaer, 1802)

Family Salticidae

Marpissa nivoyi (Lucas, 1846)

**Euophrys frontalis* (Walckenaer, 1802)

Family Lycosidae

**Pardosa agrestis* (Westring, 1861)

**Pardosa monticola* (Clerck, 1757)

**Pardosa palustris* (Linnaeus, 1758)

**Pardosa pullata* (Clerck, 1757)

Pardosa amentata (Clerck, 1757)

Pardosa nigriceps (Thorell, 1856)

**Alopecosa pulverulenta* (Clerck, 1757)

**Alopecosa cuneata* (Clerck, 1757)

Trochosa ruricola (Degeer, 1778)

Trochosa terricola Thorell, 1856

Arctosa perita (Latreille, 1799)

Pirata piraticus (Clerck, 1757)

Family Agelenidae

Agelena labyrinthica (Clerck, 1757)

Family Hahniidae

**Antistea elegans* (Blackwall, 1841)

Family Mimetidae

Ero cambridgei Kulczynski, 1911

Ero furcata (Villers, 1789)

Family Theridiidae

Theridion sisyphium (Clerck, 1757)

**Theridion bimaculatum* (Linnaeus, 1767)

Enoplognatha ovata (Clerck, 1757)

**Enoplognatha thoracica* (Hahn, 1831)

Robertus lividus (Blackwall, 1836)

**Pholcomma gibbum* (Westring, 1851)

Family Tetragnathidae

Tetragnatha extensa (Linnaeus, 1785)

Tetragnatha montana Simon, 1874

Pachygnatha clercki Sundevall, 1823

Pachygnatha degeeri Sundevall, 1830

**Meta* (*Metellina*) *segmentata* (Clerck, 1757)

**Meta* (*Metellina*) *mengei* (Blackwall, 1869)

**Meta* (*Metellina*) *merianae* (Scopoli, 1763)

Family Araneidae

Araneus diadematus Clerck, 1757

Larinioides cornutus (Clerck, 1757)

Agalenatea redii Archer, 1951

Araniella cucurbitina (Clerck, 1757)

Zygiella atrica (C. L. Koch, 1845)

Family Linyphiidae

Ceratinella brevipes (Westring, 1851)

**Walckenaeria nudipalpis* (Westring, 1851)
**Walckenaeria vigilax* (Blackwall, 1853)
**Walckenaeria antica* (Wider, 1834)
Walckenaeria unicornis O. P.-Cambridge, 1861
**Walckenaeria acuminata* Blackwall, 1833
**Dicymbium nigrum* f. *brevisetosum* Locket, 1962
Hylyphantes graminicola (Sundevall, 1830)
Gnathonarium dentatum (Wider, 1834)
Gongylidium rufipes (Linnaeus, 1758)
**Dismodicus bifrons* (Blackwall, 1841)
Hypomma bituberculatum (Wider, 1834)
Baryphyma trifrons (O. P.-Cambridge, 1863)
Gonatium rubens (Blackwall, 1833)
**Peponocranium ludicrum* (O. P.-Cambridge, 1861)
**Pocadicnemis pumila* (Blackwall, 1841)
**Oedothorax gibbosus* (Blackwall, 1841)
Oedothorax fuscus (Blackwall, 1834)
Oedothorax retusus (Westring, 1851)
**Trichopterna thorelli* (Westring, 1862)
**Pelecopsis nemoralis* (Blackwall, 1841)
Silometopus elegans (O. P.-Cambrdge, 1872)
Tiso vagans (Blackwall, 1834)
**Troxochrus scabriculus* f. *cirrifrons* (O. P.-Cambridge, 1871)
**Tapinocyba praecox* (O. P.-Cambridge, 1873)
Monocephalus fuscipes (Blackwall, 1836)
**Lophomma punctatum* (Blackwall, 1841)
**Gongylidiellum vivum* (O. P.-Cambridge, 1875)
**Micrargus subaequalis* (Westring, 1851)
Savignia frontata (Blackwall, 1833)
Diplocephalus permixtus (O. P.-Cambridge, 1871)

**Araeoncus humilis* (Blackwall, 1841)
**Araeoncus crassiceps* (Westring, 1861)
Erigone dentipalpis (Wider, 1834)
Erigone atra Blackwall, 1833
Erigone longipalpis (Sundevall, 1830)
**Drepanotylus uncatus* (O. P.-Cambridge, 1873)
**Aphileta misera* (O. P.-Cambridge, 1882)
**Porrhomma pygmaeum* (Blackwall, 1834)
**Agyneta subtilis* (O. P.-Cambridge, 1863)
**Agyneta decora* (O. P.-Cambridge, 1871)
**Agyneta conigera* (O. P.-Cambridge, 1863)
**Meioneta saxatilis* (Blackwall, 1844)
***Maro minutus* O. P.-Cambridge, 1906
**Centromerus prudens* (O. P.-Cambridge, 1873)
**Centromerus dilutus* (O. P.-Cambridge, 1875)
Tallusia experta (O. P.-Cambridge, 1871)
Centromerita bicolor (Blackwall, 1833)
**Centromerita concinna* (Thorell, 1875)
**Bathyphantes approximatus* (O. P.-Cambridge, 1871)
Bathyphantes gracilis (Blackwall, 1841)
**Bathyphantes parvulus* (Westring, 1851)
Kaestneria pullata (O. P.-Cambridge, 1863)
Diplostyla concolor (Wider, 1834)
Tapinopa longidens (Wider, 1834)
**Floronia bucculenta* (Clerck, 1757)
**Taranucnus setosus* (O. P.-Cambridge, 1863)
Stemonyphantes lineatus (Linnaeus, 1758)
**Lepthyphantes obscurus* (Blackwall, 1841)
Lepthyphantes tenuis (Blackwall, 1852)
**Lepthyphantes zimmermanni* Bertkau, 1890

Lepthyphantes mengei Kulczynski, 1887
Lepthyphantes ericaeus (Blackwall, 1853)
**Neriene montana* (Clerck, 1757)
Neriene clathrata (Sundevall, 1830)
Neriene peltata (Wider, 1834)
**Allomengea vidua* (L.Koch, 1879)

Comment

The following species are worthy of note. *Zelotes electus* (Gnaphosidae) has been found in only one other Irish county. *Clubiona subtilis* (Clubionidae) is known from only two other Irish counties and apparently relatively few in Britain. Roberts describes the salticid *Marpissa nivoyi* as rare, though it is known from four other Irish counties, always in coastal sites. *Alopecosa cuneata* (Lycosidae) has been found in only one other Irish county, as have the linyphiids *Floronia bucculenta* and *Taranucnus setosus*. The linyphiid *Aphileta misera* is known from only two Irish counties.

***Maro minutus* O. P.-Cambridge, 1906, a new Irish record.**

This species is a very small (1.1-1.5mm) pale spider with an uncommon but probably widespread distribution in Britain. A total of ten (8♂♂2♀♀) specimens were identified from the Gibson material. One of the females was collected in January 1979 but as yet the author has not been able to correlate it with information from the thesis. It was probably captured in a preliminary survey of the area. All the other specimens were from pitfall traps between 11 May and 5 July 1980. All specimens were taken in an area of damp-impeded grassland that runs along the south coast behind the area of active dune. This area of grassland retains a lot of moisture during the summer months and some areas are permanently inundated. The vegetation is characterised by *Ulex europaeus* L., *Juncus*, *Rubus*, *Ranunculus* and *Potamogeton* spp. Gibson mentioned the grid reference T105039 for the site where the *Maro* specimens were caught and T114039 as a general reference for the Pullingtown townland in which she placed these traps.

Acknowledgements

I would like to thank Dr J. P. O'Connor of the Natural History Museum, Dublin, who first suggested I look at the Gibson spiders. I am very grateful to Mark Holmes and Pat O'Sullivan, also of the Natural History Museum, for their assistance while I was examining this material.

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FURTHER RECORDS OF STINKHORN (*PHALLUS IMPUDICUS* PERS.) AND DOG STINKHORN (*MUTINUS CANINUS* (PERS.)) FUNGI FROM ENGLAND, IRELAND, LUXEMBOURG AND SCOTLAND

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Introduction

Records of stinkhorn fungi, the majority of which were from badger (*Meles meles* (L.)) setts, were listed by Sleeman *et al.* (1996). Here further records are reported, mainly those that arose from an appeal for information in the *B.B.C. Wildlife Magazine* (Croft, 1997). The area, map reference and the number of fungi are listed. The recorder is named after the record, unless it is the authors.

Records of the stinkhorn (*Phallus impudicus* (Pers.)) and dog stinkhorn (*Mutinus caninus* (Pers.))

ENGLAND

Devon

Heathercombe Brake, Dartmoor (SX719808): stinkhorn fruits regularly, badgers plentiful.

Kent

West Wood (TR140435): stinkhorns present throughout the wood where there are badger setts, most numerous around larch (*Larix*), Tim Dougall.

Salop

Kinsley Wood (SO287732): twenty stinkhorn fruits and eggs in mixed conifers and hardwoods, badgers present, October 1997, Stuart Moore.

West Midlands

Birmingham (SP0787): two stinkhorn fruits in a suburban garden, Wendy Schilling.

Worestershire

Wossel Wood (SO797772): a stinkhorn fruit, near badger sett (and stinkhorns have been seen at setts regularly over many years), September 1997.

IRELAND

County Cork

Ballincollig Military Cemetery (W7161): one stinkhorn fruit, November 1999.

Fota Estate (W7971): stinkhorn fruits at badger main sett, one on a spoil heap, October and November 1999.

Lough Hyne, Kelly's Garden (W0828): a dog stinkhorn found near badger path and a stinkhorn near badger latrine, November 1998, Georg Dose.

County Waterford

Little Island (S6511): one stinkhorn fruit and eggs, June 1999, at a large main sett in woods.

Little Island (S6411): one stinkhorn fruit and eggs, June 1999, at a main sett in woods.

Rincrew Wood (X0980): many stinkhorn fruits in June and July 1999, and four more fruits growing within 0.5m of a badger sett (non-main sett), Pat Smiddy.

LUXEMBOURG

A stinkhorn fruit in a deciduous wood near badger sett in July 1999, Tim Roper.

SCOTLAND

Grampian

Paddockhaugh (NJ214600): stinkhorn fruit on 27 September 1997, John Smith.

Conclusion

When all the records of stinkhorns, both here and in our previous publication (Sleeman *et al.*, 1996), are taken together, over 70% are from areas close to badgers' setts. This confirms the suggested relationship between stinkhorns and badgers' setts (Sleeman *et al.*, 1997).

Acknowledgements

We wish to thank the *B.B.C. Wildlife Magazine* for running our appeal and those who sent in the records, in particular Pat Smiddy and Georg Dose. We also wish to thank Ken Bond for working out some of the map references.

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THE CHANGING STATUS OF *HELOPHILUS TRIVITTATUS* (FABR.) (DIPTERA: SYRPHIDAE) IN IRELAND

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Earlier in these pages (Speight *et al.*, 2000), the hoverfly *Helophilus trivittatus* (Fabr.) is recorded for the first time from north-west Mayo, and it is mentioned there that the only previous, published, Irish records of this fly are from beside the River Shannon, in the vicinity of Clonmacnoise (Co. Offaly). Here, we add records of this species from Fermanagh and South Cork:-

Cork: W6658 (NT2), Glinny, Riverstick, 11 June 2000, male and female, lightly grazed grassland edged by *Rubus* thickets and *Ulmus* scrub, MS.

Fermanagh: H0852 (NA4), Monawilkin, 23 June 1999, male with attached orchid pollinia (of *Platanthera*?) on face, *Hieracium* flowers, limestone grassland, BN.

As was stated when *H. trivittatus* was added to the Irish list (Speight and Nash, 1993), this is a large, conspicuous insect, unlikely to be either overlooked or confused with other known Irish syrphids. Further, attention had been drawn to the potential occurrence of this syrphid in Ireland, both by Speight *et al.* (1975) and Speight (1985). Indeed, in the latter article, the apparent absence of *H. trivittatus* from Ireland was described as "decidedly odd". Although it had probably been seen in the vicinity of Clonmacnoise a few years prior to its presence in Ireland being confirmed (see Speight and Nash, 1993), the only other - and uncertain - evidence for the occurrence of this insect here dates from early in the 19th century (Speight *et al.*, 1975). During the last 100 years there has been a significant focus of attention on the Irish syrphid fauna, from the time of Yerbury's activities at the turn of the century onwards (see Speight *et al.*, 1975), and it is almost impossible that the presence of *H. trivittatus* would have gone unnoticed, were it to any extent generally distributed in Ireland. Yet now, suddenly, the species has been recorded from four widely separated parts of the island, within the last 10

years (see fig. 1).

In the case of the Co. Cork locality, syrphid collecting was carried out at the same time of the year (and in better weather conditions!) two years previously, but *H. trivittatus* was not found there then. More-or-less the same could be said of the general area of Co. Mayo from which *H. trivittatus* has now been found. It is difficult to believe other than that *H. trivittatus* is, for one reason or another, undergoing an extremely rapid expansion of its range within Ireland at the moment. From what has been seen so far of its pattern of habitat occupancy in Ireland, and to judge from its occurrence in continental Europe, this species could now be expected to turn up almost anywhere in the island, except perhaps the north-west. On the continent it is a recognised "migrant", undergoing long-distance population movements, so occurrences do not necessarily relate to location of breeding sites. It would be interesting to know if this species is exhibiting an apparent range expansion trend in Britain. Since *H. trivittatus* is more of a southern European insect than either of the other two *Helophilus* species known to occur in Ireland (*H. hybridus* Loew and *H. pendulus* (L.)), it might be postulated that its sudden, apparent expansion here has something to do with the much-discussed phenomenon of climatic warming. However, other Irish syrphids which might be expected to evidence some equally rapid response to such an influence, in particular *Sphaerophoria scripta* (L.), show no sign of any range expansion here yet. Further, another *Helophilus* species, *H. affinis* Wahlberg, is currently evidencing a general range expansion southwards in Europe, from its origins in Scandinavia. Its advent in Britain was anticipated in a paper published in 1988 (Speight, 1988) and first records from both Britain (Stuke, 1996) and the Alps (Maibach *et al.*, 1992) were published within 10 years. Its range expansion could be equally convincingly cited as evidence for climatic deterioration! *H. affinis* can be expected to reach Ireland very soon. It may be distinguished from the species known in Ireland at present using the key in Speight (1988).

Acknowledgement

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FIGURE 1. Known distribution of *Helophilus trivittatus* in Ireland (plotted on UTM grid, using 50km grid units), July 2000.

Bull. Ir. biogeog. Soc. No. 24 (2000)

JOHN NOEL ROBERT GRAINGER (1925-1995)

Jack Grainger was appointed Professor of Zoology and Comparative Anatomy in the University of Dublin, Trinity College, at the age of 34, and held this position for almost 30 years. Until his retirement in 1992, he had been a presence in several very different areas of biology, from the problem of liver fluke in Irish livestock to the biological effects of climatic change. He also worked on exercise and muscle physiology and produced a much-cited model for cell growth. However, a common thread runs through most of his varied interests and research fields - the adaptations and responses of poikilotherm invertebrates to their environment. He was a very active field biologist, although not primarily a naturalist. From early investigations into migration patterns in the plankton of Gouganebarra Lake, Co. Cork, he went on to study the ecophysiology of aquatic organisms confined to temporary water bodies - their development, how they withstood desiccation and the signals by which they emerged from diapause. This also led him to investigate the measurement of environmental factors, in particular moisture, and his mathematical and computer models formed, until recently, part of the training of many ecology graduates. He was an adept computer programmer, adapting early portable computers to many functions, including their linkage to automatic recording of environmental variables.

One line of enquiry concerned the Irish turloughs, in which he and colleagues discovered several entomostracan species not previously known in Ireland (for example, the fairy shrimp *Tanymastix stagnalis* (L.) and the copepod *Diaptomus cyaneus* Gurney). These shallow water bodies, with intimate connections to epikarstic groundwater, appear to flood and dry out unpredictably, in response to periods of substantial rainfall, but there is an overlying rhythm associated with seasonal differences in temperature and evaporation rates between summer and winter. Vital strategies for the fauna adapted to life there involve both rapid development rates and a secure way to avoid dessication. The study of turlough organisms is linked to that of temperature acclimation and thermal tolerance, studied in organisms as disparate as snails and copepods.

Jack Grainger was also an expert in helminth parasitology, both of fishes and mammals, and he brought his understanding of environmental stresses experienced by aquatic organisms, and their responses to climatic variations, to collaborations with the Agricultural Institute, into the

conditions in which liver fluke flourishes. His involvement in climate study developed towards the end of his research career, when he was able to model the details of life-history variation with temperature and humidity, and hence predict the broad sweep of effects of modern features such as global warming and climatic change.

Brought up in West Cork in the rectory at Bantry, Jack Grainger had a charming, slightly abstracted air about him, usually when he was thinking about his subject, or some apparatus he was devising, rather than the conversation. He was ahead of his time in the Irish academic context. He also presided over a period of immense change in Irish higher education - during which Trinity came gradually into the state funded system and Biology finally took its place on the Leaving Certificate syllabus. Not all changes of the time would today be approved of - just before he took over, the historic Zoology Museum in Trinity College was divided up to provide a home for newer diciplines such as Genetics and Pharmacology and Trinity's first Electron microscope. His honours included council member and senior vice-president of the Royal Irish Academy; he served on the Higher Education Authority and, after his retirement, he was particularly active on the National Council for Education Awards, on behalf of the then Regional Technical Colleges. He will be remembered as a leading scientist and polymath, but above all as a modest, unassuming and delightful person.

JULIAN REYNOLDS

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BOOK REVIEWS

ATLAS OF THE LAND AND FRESHWATER MOLLUSCS OF BRITAIN AND IRELAND by Michael Kerney. Harley Books, Martins, Great Horkesley, Colchester, Essex CO6 4AH, England. Published in association with the Conchological Society of Great Britain and Ireland. 1999. ISBN 0 946589 48 8. Hardback. 244 x 172mm. 264 pp. Price £25.00 Sterling net.

The new *Atlas* of non-marine Mollusca updates the first such atlas published in 1976 and also edited by Michael Kerney. Michael has been Non-marine Recorder for the Conchological Society of Great Britain and Ireland for an amazing 30+ years.

Both *Atlases* have been a labour of love which have comprehensively documented the changing fortunes of our native snails and slugs over a critical phase in their history. The first *Atlas* was published in the van of a wave of recording schemes initiated after the B.S.B.I. *Atlas* appeared in 1962. Recording coverage of Ireland was actually quite good even in this first *Atlas*, thanks largely due to the present author and generous support from the Conchological Society in mounting several major field expeditions to Ireland to map under-recorded areas. The main advances since then have been dependent upon the efforts of one or two homegrown recorders, who, though having done well, have limited resources. Present coverage has therefore not advanced as much as one would have liked in the intervening 33 years, except in very localized areas of the north and north-west of Ireland and in the recording of some of the rarer species such as *Assiminea grayana* and *Tandonia rustica*.

The 1976 *Atlas* was softback, in large format (approximately A4) and contained only dot maps showing distribution patterns. The new *Atlas* is hardback, more compact and follows the modern trend for interpretation, so the maps have accompanying information on history, biogeography and ecology. Each species map has a monochrome drawing of the shell concerned and size is indicated in the text. Interestingly, an English name is included under the Latin name which may help those who find Latin names tedious or hard to remember. It may also do something to popularise study of the group. The accompanying text gives a summary of known ecological requirements followed by current status, history in the British Isles, details of wider distribution and allusions (though not always literature references) to recent taxonomic research.

The latter seems to have been included to avoid criticism as the names used in the text are conservative by modern standards, Admittedly, there are cases where little research has been conducted within the British Isles and any suggested change of names is perhaps premature. Nevertheless, I would have liked more detail on current thinking and research. While references to further reading have been included in some cases e.g. that of *Pyramidula umbilicata* (p. 84), nothing is given in others (e.g. the split of *Lymnaea ovata* from *L. peregra* (p. 56)).

I was also a bit disappointed that hothouse introductions were excluded from the *Atlas* (also from the 1976 *Atlas*). Several of these (*Limax valentianus* is an example) are now well acclimatised in outdoor conditions, one supposes as a response to global warming. If we are to track introductions as well as extinctions, knowledge of these aliens seems fairly important. As the author mentions in one of the introductory chapters, a substantial number of molluscan species have been introduced to the British Isles by human activity (thirty in Britain; approximately the same number in Ireland though the list is different). There appear to be more coming in all of the time. An Irish example is the North American freshwater pulmonate, *Physa gyrina*, recently established on Lough Neagh. Other species of *Physa* are regularly imported with tropical fish and plants, and these too may become naturalised in time. Some faunal imports can have economic repercussions - note the spread of the Zebra mussel (*Dreissena polymorpha*) in Ireland since the date of the 1976 *Atlas* (p. 236). This species has just reached Lough Erne from the Shannon System and threatens lakeland biodiversity in an ever-widening geographical area.

I have dwelt at some length on personal caveats to the book. This may give an unfair impression of the work as a whole. For anyone interested in Irish biogeography in general, not just molluscs, this volume is indispensable and gives a fascinating insight into the relationships between the Irish fauna and that of the neighbouring island of Britain. Faunas are not static things and the molluscan fauna has changed more than most within the short span of scientific observation. Here again, the book provides valuable insight to the possible effects of anthropic intervention, climate change and so on. It is remarkable that the Irish molluscan fauna has not suffered a single extinction, with the possible exception of *Truncatellina cylindrica*, in the period of direct observation. A number of wetland species (notably *Vertigo* spp.) are, however,

declining and threatened, a fact drawn attention to in the *Atlas*. As well as threats to biodiversity, there are other pointers in the book to future research needs. Some taxonomic issues have already been referred to, but there are a number of others, in particular the identity and actual distribution of slug species within critical groups (*Arion* (*Kobeltia*), certain *Deroceras*). Plenty, indeed, to keep aspiring conchologists in business for some time to come! But first, buy the book!

R. ANDERSON

THE GROUND BEETLES OF NORTHERN IRELAND (COLEOPTERA - CARABIDAE) by Roy Anderson, Damien McFerran and Alastair Cameron. Atlases of the Northern Ireland Flora and Fauna Volume 1. 256 pp; 166 maps. Ulster Museum, Botanic Gardens, Belfast BT9 5AB, Northern Ireland. 2000. ISBN 0 900761 37 7. Price £14.99 Sterling.

This is a spectacular book, presenting regional entomology in a richly illustrated, up-to-date, hardback format, and also incorporating a considerable amount of new ecological and environmental information, far beyond that usually associated with distribution atlases. The book leads a series of publications from the Centre for Environmental Data and Recording (CEDaR) in Northern Ireland, to be followed by volumes on Macrolepidoptera, mammals and non-marine molluscs. The authors have been successful in drawing on funds from a number of sources (Department of Agriculture for Northern Ireland, Worldwide Fund for Nature, The Queen's University of Belfast, and the Environment and Heritage Service). That there are sufficient data to merit the publication of maps is due to the dedication of Dr Anderson and his colleagues, and also to the inclusion of carabids as part of ecological monitoring of the Environmentally Sensitive Areas (ESA) Scheme in Northern Ireland. The maps use a 5km, not a 10km, square grid, which increases the amount of information presented.

A particularly welcome aspect of the selection of carabids, and indeed the theme of one of the chapters, is the focus given to soils and their fauna. Many carabids specialise in soils in ecotonal habitats of a particular texture and geomorphological origin, a component of ecosystems often ignored since they occur between plant communities, and can be impacted without changes being detected by phytosociological indicators. The sandy shores of Lough Neagh, with their characteristic fauna, are one of the best examples of this ecotonal

microenvironment.

There is much of interest due to the juxtaposition of text and maps. I was intrigued to learn that *Bembidion aeneum* Germar was so widespread. A comparison of its map with that for the recognised common species *Bembidion lampros* (Herbst) shows this clearly. Also useful were the data on *Carabus clatratus* L., demonstrating both its localised distribution (mainly in Fermanagh), but widespread occurrence on mineral soils. I have also found the colour plates (of 55 species) helpful for students struggling with Lindroth's (1974) generic key.

One difficulty I had with the book related to citation. Three chapters are authored, but are the authors of the book to be cited as editors, and if so, who wrote Chapter 3? Similarly, the plates are copyrighted by Anderson and Thomson, but their names do not appear on the section on plates.

The final chapter (by McAdam and Montgomery) presents a summary of a number of projects using carabids as indicators of land-use impacts in the well-organised and extensive agri-environmental monitoring system adopted in Northern Ireland. There is also much of interest here, such as the maintenance of carabid biodiversity on meadows of farms participating in the ESA (Environmentally Sensitive Areas) scheme, compared to its decline in non-participating farm meadows. However, it is rather surprising that this chapter does not refer to the preceding chapters, even where one might expect the source of autecological information to be cited, as in the case of *Pterostichus oblongopunctatus* (Fabr.) (p. 191). The systematic, natural history approach of the core chapter contrasts with the more quantitative ecological approach of the final chapter, although it is one of the notable features of this book that it begins to integrate both traditions. If the relative abundances and numbers of dominant and subdominant species alone were to provide a sufficient basis to understand and monitor ecosystems, it would beg the question as to what the application is of the systematic distributional and ecological information presented elsewhere in the book. Perhaps the authors of the final chapter could have made more reference to the species listed as notable, in the systematic section, as good habitat indicators. Clearly, there is a need for all of us to find ways in which the traditions of natural history and quantitative ecology can be effectively integrated to understand changes in biodiversity.

In many ways the book is a classic, and it is recommended to anyone interested in Irish

natural history, soil ecology, and the carabid fauna of Britain and Ireland.

JERVIS GOOD

INSTRUCTIONS TO CONTRIBUTORS

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. Wordperfect 5.1 is preferred.

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

4. Records: please ensure that, when possible, the following information is incorporated in each record included in a manuscript:-
(a) latin name of organism.
(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, vice-county number 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.

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NOTICES

ROYAL IRISH ACADEMY
PRAEGER COMMITTEE FOR FIELD NATURAL HISTORY

Grant Information

Grants are available for field work relevant to the natural history of Ireland. Grantees need not be based in Ireland.

Applications are particularly welcome from amateur natural historians. Grants could be considered as a contribution to the cost of the project. Awards cannot be made in support of undergraduate or postgraduate student programmes, for school projects or for any part of the applicants' professional work.

Applicants should ensure that the proposed work, or work closely resembling the proposal, has not already been carried out in the same geographical area. A catalogue of previous Praeger reports can be accessed through the Academy Library.

A representative set of any material collected must be deposited in the National Museum, Dublin, or the National Herbarium, Dublin, or the Ulster Museum, Belfast or any other recognised institution in Ireland.

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