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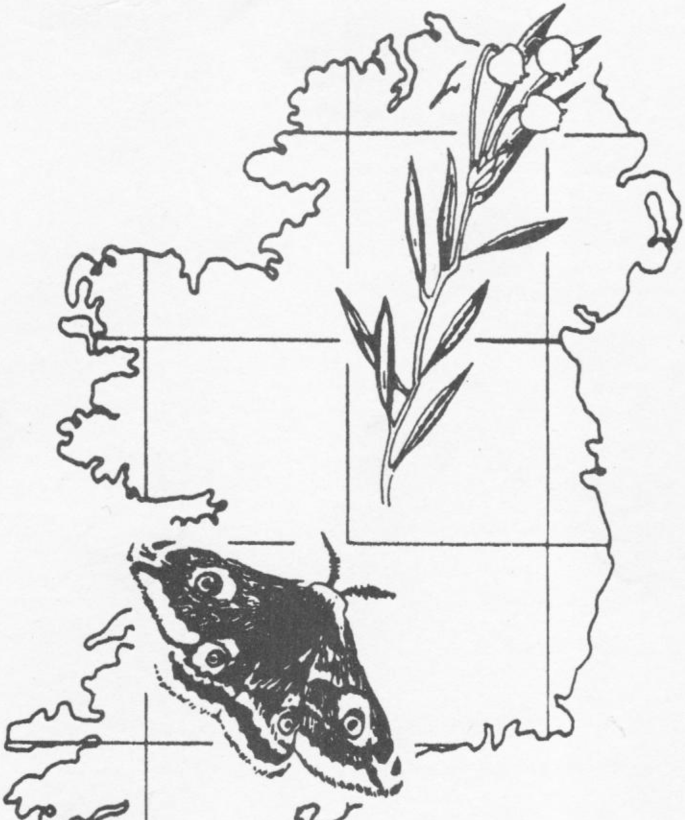

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This Bulletin is dedicated to the memory of Dr Arthur Went (1910-1980) in recognition of his impressive contribution to our knowledge of Irish fishes.

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ENQUIRIES CONCERNING THE BULLETIN (INCLUDING THE PURCHASE OF BACK ISSUES) MAY BE SENT TO THE IRISH BIOGEOGRAPHICAL SOCIETY C/O DR J. P. O'CONNOR, THE NATIONAL MUSEUM OF IRELAND, KILDARE STREET, DUBLIN 2, IRELAND.

BULLETIN OF THE IRISH BIOGEOGRAPHICAL SOCIETY

Number 30

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EDITORIAL

With this issue, the Society attains another landmark – its thirtieth *Bulletin*. It is dedicated to the memory of that remarkable ichthyologist Dr Arthur Went (1910-1980) in recognition of his impressive contribution to our knowledge of Irish fishes. Dr Went was the Inspector and Scientific Advisor in the Department of Agriculture and Fisheries. It is appropriate therefore that the memoir of Dr Went which appears on pages 370-376 was written by one of his colleagues Dr Christopher Moriarty. The Society is very grateful to Dr Moriarty for his marvellous account of the life of this remarkable scientist. The Society also wishes to thank Dr Went's son, Mr David Went, both for his generosity and for supplying the wonderful photograph of his father.

In July 2005, the book *First supplement to A Bibliography of Irish Entomology* was published. This was the first work in the new *Macro Series*. These volumes will be produced in A4 format in limited editions. Printed in 13 or 14 point and stitched bound, the new series is perfect for checklists and bibliographies because of the large format, legibility, durability and ease of notation. The series is complimentary to the *Occasional Publications* and the *Bulletin* which are in A5 format. In July 2006, the second volume, *An annotated checklist of the Irish butterflies and moths (Lepidoptera)*, was published. With details of the 1412 recorded Irish species, the checklist was compiled by K. G. M. Bond, R. Nash and the editor. It is published by the Society in association with the National Museum of Ireland. Further details are given elsewhere in this issue.

On behalf of the Committee of The Irish Biogeographical Society, I wish to thank Dr Pat Wallace, Director of the National Museum, for his support, our sponsors for their essential financial support and our referees for their advice.

J. P. O'Connor

Editor

25 August 2006

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 (one inch) margins. Whenever possible, also submit the text on diskette. **Word is preferred and Times New Roman 13pt should be used.**

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

4. Records: please ensure that, when possible, the following information is incorporated in each record included in a manuscript:-

(a) latin name of organism.

(b) statement of reference work used as the source of nomenclature employed in the text. The describer's name should be also given when a zoological species is first mentioned in the text.

(c) locality details including at least a four figure Irish grid reference (e.g. N3946), county or vice-county and some ecological data about the collection site, plus date of capture.

(d) Collector's name and determiner's name (where different from collector's name), and

(e) altitude data should be included where relevant.

5. Manuscripts should be submitted to the Editor, Dr J. P. O'Connor, at the following address:- National Museum of Ireland, Kildare Street, Dublin 2, Ireland.

Bull. Ir. biogeog. Soc. No. 30 (2006)

RECORDS OF OTTERS (*LUTRA LUTRA* L.) AND BADGERS (*MELES MELES* L.) FROM BUILT-UP AREAS IN IRELAND

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Introduction

There is interest in the occurrence and survival of carnivores in built-up areas as this habitat is increasing both in Ireland and worldwide. The authors list recent records here of otters (*Lutra lutra* L.) and badgers (*Meles meles* L.) in such areas in the south of Ireland. We have included the following information:- how the animal was detected, the date, the location, map reference, the recorder with the relevant initials if one of the authors.

Otter records

County Limerick

Otter dead on a road, 22 April 2005, Limerick City (R5858) on the Clare side of the N18, DPS.

County Clare

Otter spraints under a bridge over the River Rine, 22 April 2005, Dromoland Intersection

(R3872), N18, DPS.

County Cork

There has been a recent account of otters in Cork City (Sleeman and Moore, 2005). Additional records from Co. Cork are presented here.

Otter spraint and tracks, May 2003, Rathcormac (W8191), under a bridge, abundant, DPS.

Otter dead on a road in the village, December 2005, Ballinscarthy (W4046), about 1km from a river, showing that otters can be found well away from main waterways, DPS.

Otter spraints seen several times in 2005 at Fota Estate (W7971). This locality became built up in 2005 due to the development and expansion of the area leased to the Zoological Society for the 'wildlife'- a collection of captive exotic animals. There is a remnant badger population on the Estate (see below), DPS.

County Tipperary

Dead otter, April or May 2004, MS also had a sighting of a live animal in April or May 2005, Carrick on Suir (S3821) near the River Suir, MS.

County Kilkenny

Road casualty otter, adult male on 23 March 2004, New Ross (S7830) near the River Barrow - this animal was collected and taken to Waterford Institute of Technology, MS.

An otter holt, plenty of spraint and tracks in urban Fiddown Island on the River Suir, Kilkenny (S4619), June 2004, MS.

County Waterford

Otter spraint on the banks of the River Suir, at the mouth of St Johns River, 1999, Waterford City (S6112), Declan McGragh.

Otter seen raiding fish scraps from an angling boat then resting on a pontoon, October 2004, St John's River, Waterford City (S6112), MS.

Otter resting place with tracks and spraint, June 2005, Ballyduff (S5211) on the banks of the River Suir, DPS.

An otter holt, with two entrances and lots of spraint, there was also spraint found under the bridge, June 2005, Kilmacthomas (S3905), just above the old road bridge where a mill stream joins the Mahon River, DPS.

Otter spraint, July 2005, Dunmore East (S6800), Dunmore strand, a culverted stream, DPS.

Otter spraint, July 2005, Cappoquin (X1099), under a bridge over the Glenshelane River, DPS.

Otter spraint, July 2005, Tallow (W9992), at Tallow Bridge and at a bridge over the Glanaboy River (W9991), DPS.

Badger records

County Cork

Two badgers, one mature male (11kg) and a mature female (9kg), were trapped under licence and re-located from the site at Ballincollig, (W6971), a former military barracks, CD/DPS.

Badgers still survive in at least three setts seen in 2006 at Fota Estate (W7971) after the estate became built up in 2005, DPS.

County Dublin

A road casualty badger was found at the gate to the Veterinary Research Laboratory in April 2001 at Abbotstown (O0939). There is also an extent population within the Abbotstown estate and there are at least 3 active setts there, DPS.

County Waterford

A badger road traffic victim, unsexed, summer 2004, in the suburb of Grange on the west of Waterford City (S6110), MS. There is a dense population of badgers on the nearby Little Island and on the river bank to the immediate west of the island.

Discussion

Otters are well known in Irish cities and towns (Moriarty, 1997; Sleeman and Moore, 2005). They are also reported from British towns and cities, including London before the Second World War (Fitter, 1945) and again on its other edges in this century. Also known from Glasgow where signs of habitation have been increasing (Green and Green, 1997) and some 80 cities and towns in England (Chanin, 2003). From all these records, it is concluded that otters are not disturbed by urbanisation or buildings. Badgers on the other hand seem to be scarcer in built-up areas, as has been observed in the past (Moriarty, 1997), and only survive at the edges or in very isolated green areas.

Acknowledgements

We wish to thank Declan McGragh, Audrey Hearne and John Doran of Waterford Institute of Technology for records from Waterford and Dave O'Leary of University College Cork for help with work in Ballincollig, and Ger Morgan also of U. C. C. for his encouragement.

References

Chanin, P. (2003) *Ecology of the European otter*. Conserving Natura 2000 Rivers. Ecology Series No **10**. English Nature, Peterborough.

Green, R and Green, J. (1997) *Otter survey of Scotland 1991-1994*. Vincent Wildlife Trust, London

Fitter, R. S. R. (1945) *London's natural history.* Collins New Naturalists Series, London.

Moriarty, C. (1997) *Exploring Dublin, wildlife parks and waterways*. Wolfhound Press, Dublin.

Sleeman, D. P. and Moore, P. (2005) Otters in Cork City. *Irish Naturalists' Journal* **28**: 73-79.

CONCHAPELOPIA HITTMAIRORUM MICHIELS AND SPIES, 2002 (DIPTERA: CHIRONOMIDAE, TANYPODINAE) NEW TO THE IRISH FAUNAL CHECKLIST

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Introduction

In the key to the pupal exuviae of British Chironomidae, Langton (1984) recognised a characteristic exuviae of the genus *Conchapelopia* Fittkau which he designated as *Conchapelopia* sp.?, since it was not possible to associate it with the adult of any of the then recognised species. In a subsequent work, Langton (1991) provided determining features of pupal exuviae of six west Palaearctic species of *Conchapelopia,* while the status of the taxon with the characteristic exuviae remained uncertain and it was designated as "*Conchapelopia* Pe1" pending resolution. Michiels and Spies (2002), resolved the status of "*Conchapelopia* Pe1" by recognising it as the exuviae of a new species, *C. hittmairorum,* which they described in adult male and female, pupa and larval stages from the River Alz, at its outflow from the Chiemsee, South East Bavaria, Germany. Langton and Visser (2003) included *C. hittmairorum* in the updated key to pupal exuviae of the West Palaearctic Region. Although recognisable in the pupal stage for some time from Langton (1984, 1991), adults and pupal exuviae had been confused with several closely related species, including *C. pallidula* (Meigen) and *C. triannulata* (Goetghebuer). Because of this confusion, and some previous mis-determinations in identification, Michaels and Spies (*op. cit.*), based on their comprehensive review and examination of material in existing collections, noted that *C. hittmairorum* has a widespread distribution in Europe including Austria, France, Germany, Great Britain Spain, Sweden and

Switzerland.

Three species of *Conchapelopia* - *C. melanops* (Wiedeman), *C. pallidula* (Meigen) and *C. viator* (Kieffer) are already known from Ireland (Ashe *et al.*, 1998). However, exuviae of *Conchapelopia* Pe1, *sensu* Langton (*op. cit.*) have been recognised in collections of pupal exuviae by the author and former students of the Department of Zoology, University College Dublin since 1973, including some by Ashe (1982) and Hayes (1991). The pupa is distinguished from other known *Conchapelopia* species by the presence of pronounced convex swellings on the inner borders of the anal lobes, as well as on features of the thorax and the respiratory thoracic horn.

While compiling a series of voucher slides of Irish Chironomidae during a project supported by The Heritage Council, a detailed review of preserved chironomid specimens of *Conchapelopia* was undertaken. Re-examination of material of *Conchapelopia* Pe1 and other specimens of *Conchapelopia* in the author's collection, authenticates the presence of *C. hittmairorum* from a number of locations in Ireland. This paper confirms a widespread geographic distribution of the species in Irish lotic waters.

Records of *Conchapelopia hittmairorum* Michiels and Spies, 2002 in Ireland

The following records, by county, are of pupal exuviae unless otherwise stated. Information on the collection locality is provided and Irish National Grid References are given in parentheses, followed by date of collection and name of collector (leg.), original determinator (det.) and identification, if noted. Voucher material of *C. hittmairorum,* is included in the The Heritage Council Collection of Irish Chironomidae (HCCIC) deposited in the National Museum of Ireland (NMI).

CARLOW: River Slaney, Motabower Bridge (S832778), 28.viii.1981, leg./det. B. Hayes as *C. pallidula.* **DONEGAL**: River Keenagh, Umgall, Inishowen (C454543), 16.viii.1982, leg./det. B. Hayes as *C. pallidula*. **KERRY**: River Flesk, 1km upstream Flesk Bridge, Killarney

(V976895), 27.vii.1973, adult male and pupal exuviae, leg. D. Murray (voucher specimen # 19, HCCIC, NMI); River Flesk, White Bridge, Killarney (V987900), 12.vii.1974, leg. D. Murray; July 1976, leg. P. Ashe (Ashe, 1982); Same locality, 23.vii.1979, pharate female, leg. P. Ashe, det. L. Heneghan as *Conchapelopia* sp. **MEATH**: River Boyne, Kilcarn Bridge (N885655), 18.viii.1995, leg. D. and W. Murray. **ROSCOMMON**: River Suck, Ballyforan (M817464), 16.vii.1981 and 28.vii. 1982, leg./det. B. Hayes as *C. pallidula*; River Suck, Castlecoote (M809627), 16.vii.1981, leg./det. B. Hayes as *C. pallidula*. **WATERFORD**: River Blackwater, Ballyduff (W964992), 31.viii.1981, leg./det. B. Hayes as *C. pallidula*. **WEXFORD**: River Slaney, Edernline Bridge (S977345), 29.vii.1982, leg./det. B. Hayes as *Conchapelopia* sp. (voucher specimen #20, HCCIC, NMI).

Acknowledgements

Support from The Heritage Council under the 2005 Wildlife Grant Scheme (project WLD/2005/13985) to compile *The Heritage Council Collection of Irish Chironomidae*, now deposited in the National Museum of Ireland, is gratefully acknowledged. Some of the material on which this paper is based was collected by Patrick Ashe and Brian Hayes between 1976 and 1982. These inputs are acknowledged with gratitude as are provision of facilities in the School of Biology and Environmental Science, University College Dublin by Professor Thomas Bolger, Head of School.

References

Ashe, P. (1982) *Ecological and taxonomic studies on the Chironomidae (Diptera, Nematocera). Part 1- A study of the Chironomidae of the River Flesk, SW Ireland.* Ph.D. thesis, National University of Ireland, University College Dublin. 157pp.

Ashe, P., O'Connor, J. P. and Murray, D. A. (1998) A checklist of Irish aquatic Insects. *Occasional Publication of the Irish Biogeographical Society* No **3:** 1-80.

Hayes, B. (1991) *Studies on the Chironomidae (Diptera: Insecta) of Irish rivers based on collections of Pupal Exuviae*. Ph.D. thesis, National University of Ireland, University College Dublin. 282pp.

Langton, P. H. (1984) *A key to the pupal exuviae of British Chironomidae*. Privately Published.

Langton, P. H. (1991) *A key to the pupal exuviae of West Palaearctic Chironomidae*. Privately Published.

Langton P. H. and Visser, H. (2003) *Chironomidae exuviae - A key to pupal exuviae of the West Palaearctic Region*. Interactive System for the European Limnofauna, Biodiversity Centre of ETI, UNESCO Publishing, Paris.

Michiels, S. and Spies, M. (2002) Description of *Conchapelopia hittmairorum* spec. nov., and redefinition of similar western Palaearctic species. *Spixiana* **25**: 251-272.

Bull. Ir. biogeog. Soc. No. 30 (2006)

MORPHOLOGICAL VARIATION NEAR RANGE ENDS OF LARVAE OF THE NATTERJACK TOAD *BUFO CALAMITA* LAURENTI (ANURA: BUFONIDAE) IN IRELAND AND POLAND

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Abstract

Bufo calamita Laurenti larvae from five different localities in Ireland, n = 20 each, and 28 from a Polish locality were analyzed for 18 external morphometric characters by means of descriptive and multivariate statistical analyses. Descriptive statistics for the pooled Irish and the Polish sample were calculated. Developmental stage 27 larvae, most common in both samples, were tested for significant difference between means and those of Polish larvae were greater for all but two variables. Stepwise discriminant analysis determined that the most important variable for distinguishing Irish from Polish larvae was body length. Principal component analysis generated a first principal component accounting for 74% of the sample variability, and was a function of total, body, and tail length. Irish and Polish larvae differed in pigmentation also. Reasons for differences between the insular Irish and continental Polish samples are discussed.

Key words: natterjack tadpoles, morphometric variables, island biogeography, Ireland, Poland.

Introduction

The biota of islands has long captured the interest of naturalists and biogeographers from Darwin to traders and explorers of ancient times. The insular species often appeared related to those known on nearby continents yet, as noted by A. R. Wallace (1878), were different, sometimes giant or dwarf forms of the mainland populations, or were wingless versions of insects or birds that had lost the very organs that probably had brought them to their respective islands. Attempts to explain these curiosities range from special creation to the classic tome of MacArthur and Wilson (1967) and that of Carlquist (1974), to the more contemporary effort of Whittaker (1998). Principles from these works will be discussed later in this paper.

A classic question in biogeography has involved the scenario that if a given species has a widespread geographic distribution surrounding a single center of origin, would genetic or morphological diversity be greater or less at the periphery of the distribution? Because of its wide distribution, the Scots pine, *Pinus sylvestris* L., is a model plant species for such a genetic analysis (Quencez and Bastien, 2001). The natterjack toad, *Bufo calamita* Laurenti, 1768, also has an ideal geographic distribution for such a study. Boulenger (1898) noted its abundance in France and the Iberian Peninsula, with populations in Ireland and the British Isles, extending eastward across north-central Europe to Poland and the present Czech Republic. Berger and Michałowski (1963, p. 52) provided a map of collection records in Poland and extended the known range into what was at that time western USSR. Frost (2004) also extended the known range into the now western Russian Federation. Beebee and Rowe (2000) used microsatellite analysis to document genetic variation from sites in western Ireland and southern Spain across to eastern Poland with phylogeographic implications, some of which will be cited herein. Since genetic analysis is not within the remit of this study, we confined our analysis to morphological variation of the toad, specifically its larvae.

The purpose of this study was to: (1) document selected, external, morphological characters of larvae by means of descriptive statistics from sites in Co. Kerry, Ireland, representing the western extension of geographical range, and a site in Warsaw, Poland, *circa* 2,100km distant, that approaches the eastern extension of range; (2) determine if larvae could be correctly assigned to location based on selected morphological variables; (3) determine which variables were most critical in determining location by a discriminant function analysis with stepwise selection; (4) determine which variables account for the majority of the variance in the selected morphometric character states using principal component analysis; and (5) evaluate the results relative to ecological principles of island biogeography and the question of diversity at range margins, including prior studies of the natterjack toad.

Materials and methods

A sample of n = 28 tadpoles was collected on 5 June 1994 in Warsaw, Woj. Miasto, 52°12' N 21°02' E, Poland. The site was a permanent, man-made pond on the Vistula River floodplain in the vicinity of the fortified Citadel complex; it often is used for wading by youngsters during summer. Additional tadpoles (n = 20 sample size each site) were collected under license in May 1997 by JKK at five Co. Kerry, Ireland, localities. Irish grid references, maps, altitude, and habitat descriptions are described in Korky and Webb (1999, 2001). The terms "larvae" and "tadpoles" are used interchangeably. All larvae were seined with a fine hand-net and preserved in 10% buffered formalin. Larvae were staged according to Gosner (1960). Descriptive features follow Altig (1970), and McDiarmid and Altig (1999). A total of 18 morphometric variables were measured using calipers and a binocular dissecting microscope and ocular micrometers calibrated to the nearest 0.1mm. Some specimens had missing or damaged characters.

Data analyses

Statistical procedures were performed with SAS for Windows (ver. 6.12). Descriptive statistics of central tendency and variability were calculated for each of 18 various, external, morphological characters. Developmental stage differed significantly between regions (Ireland versus Poland; Fisher exact test, $P > 0.0001$). Therefore, all comparisons between regions were limited to stage 27 specimens, the stage representing the greatest overlap between sample sets. All 18 variables then were tested for normality. Because significant deviations from normality were detected, the nonparametric Wilcoxon rank-sum test was used as the univariate treatment to compare Irish and Polish samples. A Bonferroni procedure was applied to adjust the P values to account for repeated testing of the same sample sets, one variable at a time.

Multivariate statistical treatments also were performed. The 16 variables for which there were no missing values were subjected to a discriminant function analysis with region as the single classification variable in order to determine which variables were most important in distinguishing Irish from Polish larvae. The significance level for a variable's entry into or removal from the model was set at $P < 0.15$.

A principal components analysis was performed to generate a correlation matrix from which new variables (principal components) could be generated. Each principle component is a weighted linear function of all original variables that accounts for the maximum amount of variance not captured by preceding principal components. We expected the first principal component (PC1) to characterize overall body size because each original variable was a morphological measurement. Subsequently, PC1 was tested for normality. Because significant deviations from normality were detected, PC1 values of Irish and Polish samples were compared with the nonparametric Wilcoxon rank-sum test.

Results

Descriptive statistics

Measures of central tendency and variability are presented for all samples from Ireland and Poland. For the Irish sample (Table 1), representing stages 27, 28, and 29, total length ranged from 10.2-17.4mm, with a mean of 12.83mm. For the Polish sample (Table 2), representing stages 26, 27, and 28, total length ranged from 12.0- 23.0mm, with a mean of 17.65mm. These values suggest a size differential between smaller insular Irish and larger continental Polish tadpoles. However, because the stages differ, they cannot easily be compared. Therefore, descriptive statistics limited to developmental stage 27 larvae from Ireland (10 larvae) (Table 3) and Poland (17 larvae) (Table 4) are presented for comparison. With the exception of A-2 gap ratio and P-1 gap, mean values from Polish samples were greater than those from Irish samples, and these differences were significant (Table 5).

Multivariate comparisons

The results of the stepwise discriminant analysis are presented in Table 6. The most important variable in distinguishing Irish from Polish samples was body length. Much less important, but still significant, were ventral fin height, A-2 gap, and A-1 length.

Principle components analysis generated a first principle component that accounted for 74% of the sample variability, and the first four components accounted for 94% of the variability (Table 7). The eigenvectors of PC1 (Table 8) with the greatest values were total length, body length, and tail length. Further, the eigenvectors of all other variables, except A-2 gap, left and right A-2 length, and A-2 gap ratio, were similar to total, body, and tail length. Thus, PC1 effectively represents overall body size. PC1 values of the Polish samples (mean = 2.5 +/- 1.4 SD) were significantly greater than those of the Irish samples (mean = -4.2 +/- 0.5 SD; $Z = 4.24$, $P = 0.0001$).

Discussion

The data from Tables 5-8 clearly indicate total length, and its components of body and tail length and other mensural features with the exception of A-2 gap ratio and P-1 gap width, is the distinguishing feature between stage 27 Irish and Polish tadpoles. This difference is consistent for the size differential that often exists between insular and continental forms, although such a comparison generally involves adults rather than larvae. Island forms may experience reduction in size relative to continental forms for a number of reasons. A land bridge formerly connected Ireland to Britain, which was itself connected to the European continent during the Quaternary Period when minimum global sea level was 130m lower than today (Bell and Walker, 1995; Whittaker, 1998). Immigration from the continent to Britain ended about 8,700-8,000 YBP, and that of Britain to Ireland ended some 2,000-3,000 years earlier when global sea level rose as glaciers melted.

Beebee and Rowe (2000) used microsatellite analysis to quantify various measures of genetic variation of 11 larval and toadlet samples across the present range of natterjack distribution. They concluded all extant populations spread northward from Velez, Spain, as climatic conditions improved during post-glacial times. Their conclusions are consonant with the land bridge scenario mentioned above, and their data show genetic diversity of populations decreased as a function of geographic distance from the refugium of Velez. Their Polish sample from near the Białowieza National Park on the Belarus border showed significantly lower genetic diversity, most likely due to genetic drift and/or directional selection under suboptimal conditions as the range margin was approached. Thus, population differentiation across the distributional range may be due to a combination of genetic drift, founder's effect, and bottlenecking. The Irish samples of our study with their significantly smaller body size may particularly reflect these forces associated with differentiation because of habitat fragmentation that has effectively isolated them into specialized habitat "islands" on the actual island.

Sometimes called the running toad because of its short hind legs that preclude saltation, adult natterjacks are good pioneers and the founder effect may have selected for small immigrants with greater ease of dispersal than larger ones. This dimunition may be reflected in the larvae as well as the adults.

Small size may be a refection of reduced food supply on islands (Carlquist, 1974), since islands with reduced land mass generally have reduced niche spaces, and thus have fewer species at all trophic levels compared to continents. The number of anurans in Ireland reflects this, with only 2 listed by Frost (2004), compared to Poland with various estimates of 14 (Berger and Michalowski, 1963), 13 (Najbar, 1995), and 12 (Frost, 2004). While food availability may be a factor for the nocturnal feeding adults who prey on beetles, spiders, and ants (Banks *et al.*, 1993), and earthworms and slugs (Najbar, 1995), since larvae feed on algae, which normally is superabundant, small larval size likely is not a function of food availability.

The fact that natterjack tadpoles are the smallest of all tadpoles in continental Europe and the Irish tadpoles are yet smaller may be further explained by the model of developmental rate and environmental stability proposed by Wilbur and Collins (1973). This model predicts that animals in unfavorable environments will increase their developmental rate and metamorphose earlier at a species-specific minimum body size, while those in favorable environments that allow rapid growth will slow their developmental rate and metamorphose later at a larger size. Natural Irish natterjack populations in Co. Kerry from which several samples were collected occur in coastal dune slacks where temporary fresh water overlies salt water in a precarious balance of precipitation and desiccation, noted by Korky and Webb (2001), which places a premium on rapid development, thus selecting for small larval size. The other Co. Kerry samples occur in shallow coastal loughs among dunes and isolated loughs and bog pools in heathlands within 2.4km of the coast, and are subject to a variety of destabilizing events, including drainage, acidification, salinization, and anoxia, all of which may promote rapid development and smaller resultant size. Even the translocated populations in Co. Wexford reported by Korky and Webb (1999) are not free of these influences, as more field work and analysis should confirm. The Polish sample from a permanent pond far from the sea represents a more favorable environment that could explain their larger overall size.

Another observed difference between Irish and Polish samples not reported previously is coloration. All 100 pooled larvae from the five Irish localities cited in the materials and methods tadpoles were jet black. Those from Poland reflected the original description of natterjack larvae from France, i.e., red brown in colour with a total length 20-30mm (Angel, 1946). Also, Irish toads have been noted to be darker than their Scottish or English counterparts (Smith, 1964). It is possible that this adult tendency toward melanism also is maintained by the larvae. However, it is more likely related to the influence of higher temperature on developmental rate. While many factors influence developmental and growth rates, temperature is the prime factor since it determines both larval body size and length of the larval period (McDiarmid and Altig, 1999, pp 207-209). Tadpoles in warmer, shallower water, aided by their heat-absorbing dark colour and aggregation behaviour, increase their developmental rate, have reduced gain of mass, and are smaller at any given stage including metamorphosis than those raised at lower temperatures. Our Irish samples conform to this scenario both in colour and behaviour, adding to our explanation for their significantly smaller size compared to the lighter coloured Polish sample whose larvae were not aggregated in the water's edge at time of collection.

Conclusion

Phylogeographic data based on microsatellite analysis has demonstrated all present natterjack populations are derived from a post-Pleistocene northward expansion from a single refugium in south-east Spain. Measures of genetic diversity indicated a reduction as a function of geographic distance from the Spanish source population. Our Irish and Polish larvae represent sampling near the range margin extremes, where isolation in suboptimal conditions have caused not only genetic differentiation to accrue due to likely influences of drift, directional selection, founder's effect, and bottlenecking, but also morphological differentiation. These influences are enhanced for the Irish samples due to the less stable, stenotopic, insular environment in which they exist compared to the more stable environment of the Polish continental.

Irish larvae may be distinguished from Polish larvae by their smaller overall size, and by their jet black colour *versus* the red brown Polish larvae. Also, the two forms may be quantitatively distinguished by univariate and multivariate methods using 18 morphological features.

Acknowledgement

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References

Altig, R. A. (1970) A key to the tadpoles of the United States and Canada. *Herpetologica* **26**: 180-207.

Angel, F. (1946) Reptiles et amphibians. *Faune de France* **45**.

Banks, B., Beebee, T. J. C. and Denton, J. S. (1993) Long-term management of a natterjack toad (*Bufo calamita*) population in southern Britain. *Amphibia-Reptilia* **14**: 155-168.

Beebee, T. J. C. and Rowe, G. (2000) Microsatellite analysis of natterjack toad *Bufo calamita* Laurenti populations: consequences of dispersal from a Pleistocene refugium. *Biol. J. Linn. Soc.* **69**: 367-381.

Bell, M. and Walker, M. J. C. (1995) Late Quaternary environmental change. Longman Group Ltd, Essex.

Berger, L. and Michałowski, J. (1963) Płazy: klucze do oznaczania kregowców Polski (Amphibians: key to the markings of Polish vertebrates). (Published for the Smithsonian Institution and the National Science Foundation, Washington, D. C. by the Scientific Publications Foreign Cooperation Centre of the Central Institute for Scientific, Technical and Economic Information, 1971.) Warzawa. Pp 1-75.

Boulenger, G. A. (1898) The tailless batrachians of Europe, Part II. Adlard and Son, London.

Carlquist, S. (1974) Island biogeography. Columbia University Press, New York.

Frost, D. R. (2004) Amphibian species of the world: an online reference V3.0

http://research.amnh.org/herpetology/amphibia/index.html

Gosner, K. L. (1960) A simplified table for staging anuran embryos and larvae with notes on identification. *Herpetologica* **16**: 183-190.

Korky, J. K. and Webb, R. G. (1999) Resurvey, biogeography, and conservation of the natterjack toad *Bufo calamita* Laurenti (Anura: Bufonidae) in the Republic of Ireland. *Bull. Ir. biogeog. Soc.* **23**: 2-52.

Korky, J. K. and Webb, R. G. (2001) Geographic variation in larvae of *Bufo calamita* Laurenti (Anura: Bufonidae) in the Republic of Ireland. *Bull. Ir. biogeog. Soc.* **25**: 144-169.

MacArthur, R. H. and Wilson, E. O. (1967) The theory of island biogeography. Princeton University Press, Princeton.

McDiarmid, R. W. and Altig, R. (1999) Tadpoles: the biology of anuran larvae. University of Chicago Press, Chicago.

Najbar, B. (1995) *Płazy i gady Polski* (Amphibians and reptiles of Poland). Zielona Góra, Polska.

Quencez, C. and Bastien, C. (2001) Genetic variation within and between populations of *Pinus sylvestris* L. (Scots pine) for susceptibility to *Melampsora pinitorqua* Rostr. (pine twist rust). *Heredity* **86**: 36-44.

Smith, M. (1964) *The British amphibians and reptiles*. New Naturalist Series, third edition, London.

Wallace, A. R. (1878) Tropical nature and other essays. Macmillan, New York.

Whittaker, R. J. (1998) Island biogeography, ecology, evolution, and conservation. Oxford University Press, Oxford.

Wilbur, H. M. and Collins, J. P. (1973) Ecological aspects of amphibian metamorphosis. *Science* **182**: 1305-1314.

TABLE 1. Descriptive statistics of selected character states for *Bufo calamita* larvae from five localities in Ireland (20 specimens per locality). All measurements are in mm. Range is minimum value-maximum value. Developmental stages for specimens included stage 27 (n = 10), stage 28 (n = 63), and stage 29 (n = 27).

Variable	*n*	Mean	Median	SD	Range
Body length	100	5.57	5.1	1.02	4.0 - 7.8
Tail length	100	7.26	7.0	0.93	5.7 - 9.6
Total length	100	12.83	12.2	1.91	10.2 - 17.4
Tail height	100	2.61	2.5	0.50	1.7 - 3.7
Tail muscle height	100	0.91	0.8	0.25	0.5 - 1.5
Dorsal fin height	100	0.98	0.9	0.21	0.5 - 1.4
Ventral fin height	100	0.89	0.9	0.19	0.5 - 1.3
Interocular distance	100	0.96	0.9	0.17	0.7 - 1.5
Internarial distance	100	0.73	0.7	0.11	0.6 - 1.0
A-1 length	100	0.96	0.9	0.19	0.6 - 1.4
Left A-2 length	100	0.39	0.4	0.05	0.3 - 0.5
Right A-2 length	100	0.39	0.4	0.05	0.3 - 0.5
A-2 gap	100	0.30	0.3	0.06	0.2 - 0.5
A-2 gap ratio	100	1.31	1.3	0.17	0.8 - 2.0
P-1 length	100	0.90	0.9	0.17	0.6 - 1.2
P-1 gap	64	0.11	0.1	0.04	0.1 - 0.3
P-2 length	100	0.78	0.7	0.20	0.3 - 1.2
P-3 length	86	0.38	0.4	0.10	0.2 - 0.7

TABLE 2. Descriptive statistics of selected character states for *Bufo calamita* larvae from Poland. All measurements are in mm. Range is minimum value-maximum value. Developmental stages for specimens included stage 26 (n = 10), stage 27 (n = 17), and stage 28 (n = 1).

Variable	*n*	Mean	Median	SD	Range
Body length	28	7.98	8.0	1.34	5.5 - 11.0
Tail length	28	9.67	10.0	1.49	6.5 - 12.0
Total length	28	17.65	18.0	2.72	12.0 - 23.0
Tail height	28	3.93	4.0	0.84	2.5 - 5.7
Tail muscle height	28	1.32	1.4	0.22	0.7 - 1.7
Dorsal fin height	28	1.38	1.5	0.28	0.9 - 2.0
Ventral fin height	28	1.29	1.3	0.27	0.8 - 1.9
Interocular distance	28	1.02	1.0	0.13	0.7 - 1.3
Internarial distance	28	0.93	1.0	0.12	0.7 - 1.1
A-1 length	28	1.36	1.4	0.26	0.8 - 1.8
Left A-2 length	28	0.46	0.5	0.11	0.3 - 0.7
Right A-2 length	27	0.47	0.5	0.11	0.2 - 0.7
A-2 gap	28	0.43	0.4	0.10	0.2 - 0.6
A-2 gap ratio	28	1.14	1.0	0.50	0.6 - 3.5
P-1 length	28	1.25	1.3	0.27	0.5 - 1.9
P-1 gap	12	0.17	0.2	0.09	0.1 - 0.4
P-2 length	28	1.13	1.2	0.28	0.4 - 1.8
P-3 length	18	0.77	0.8	0.26	0.2 - 1.1

TABLE 3. Descriptive statistics of selected character states for developmental stage 27 *Bufo calamita* larvae from three localities in Ireland (1-5 specimens per locality). All measurements are in mm. Range is minimum value-maximum value.

Variable	*n*	Mean	Median	SD	Range
Body length	10	4.62	4.8	0.29	4.0 - 4.9
Tail length	10	6.31	6.3	0.23	6.1 - 6.7
Total length	10	10.93	11.0	0.44	10.2 - 11.6
Tail height	10	2.08	2.1	0.17	1.7 - 2.3
Tail muscle height	10	0.73	0.7	0.08	0.6 - 0.9
Dorsal fin height	10	0.74	0.8	0.10	0.5 - 0.8
Ventral fin height	10	0.66	0.7	0.07	0.5 - 0.7
Interocular distance	10	0.80	0.8	0.05	0.7 - 0.9
Internarial distance	10	0.62	0.6	0.04	0.6 - 0.7
A-1 length	10	0.81	0.9	0.11	0.6 - 0.9
Left A-2 length	10	0.37	0.4	0.05	0.3 - 0.4
Right A-2 length	10	0.37	0.4	0.05	0.3 - 0.4
A-2 gap	10	0.29	0.3	0.06	0.2 - 0.4
A-2 gap ratio	10	1.29	1.3	0.19	0.8 - 1.5
P-1 length	10	0.80	0.8	0.12	0.60 - 1.0
P-1 gap	7	0.11	0.1	0.04	0.10 - 0.2
P-2 length	10	0.60	0.6	0.14	0.30 - 0.8
P-3 length	7	0.33	0.3	0.08	0.20 - 0.4

TABLE 4. Descriptive statistics of selected character states for developmental stage 27 *Bufo calamita* larvae from Poland. All measurements are in mm. Range is minimum value-maximum value.

Variable	*n*	Mean	Median	SD	Range
Body length	17	8.41	8.0	0.71	7.0 - 10.0
Tail length	17	10.06	10.0	1.14	9.0 - 12.0
Total length	17	18.47	18.0	1.66	16.0 - 21.0
Tail height	17	4.16	4.0	0.76	3.0 - 5.7
Tail muscle height	17	1.41	1.5	0.14	1.1 - 1.6
Dorsal fin height	17	1.49	1.5	0.20	1.2 - 2.0
Ventral fin height	17	1.41	1.4	0.22	1.0 - 1.9
Interocular distance	17	1.06	1.0	0.10	0.9 - 1.3
Internarial distance	17	0.96	1.0	0.09	0.8 - 1.1
A-1 length	17	1.47	1.4	0.18	1.2 - 1.8
Left A-2 length	17	0.49	0.5	0.11	0.3 - 0.7
Right A-2 length	17	0.49	0.5	0.11	0.2 - 0.7
A-2 gap	17	0.42	0.4	0.10	0.2 - 0.6
A-2 gap ratio	17	1.25	1.2	0.61	0.6 - 3.5
P-1 length	17	1.35	1.3	0.18	1.1 - 1.9
P-1 gap	6	0.15	0.2	0.05	0.1 - 0.2
P-2 length	17	1.23	1.2	0.22	0.9 - 1.8
P-3 length	11	0.85	0.9	0.20	0.4 - 1.0

Table 5. Univariate comparisons of selected character states for developmental stage 27 *Bufo calamita* larvae from Ireland (n = 10) and Poland (n = 17). Probabilities are adjusted for Bonferroni inequalities.

	Ireland	Poland	Wilcoxon test	
Variable	**mean +/- SD**	**mean +/- SD**	*Z*	*p*
Body length	4.55 - 6.59	6.64 - 9.32	4.35	0.0018
Tail length	6.33 - 8.19	8.18 - 11.16	4.30	0.0018
Total length	10.92 -14.74	14.93 - 20.37	4.27	0.0018
Tail height	2.11 - 3.11	3.09 - 4.77	4.27	0.0018
Tail muscle height	0.66 - 1.16	1.10 - 1.54	4.35	0.0018
Dorsal fin height	0.77 - 1.19	1.10 - 1.66	4.29	0.0018
Ventral fin height	0.70 - 1.08	1.02 - 1.56	4.30	0.0018
Interocular distance	0.79 - 1.13	0.89 - 1.15	4.35	0.0018
Internarial distance	0.62 - 0.84	0.81 - 1.05	4.37	0.0018
A-1 length	0.77 - 1.15	1.10 - 1.62	4.27	0.0018
Left A-2 length	0.34 - 0.44	0.35 - 0.57	2.99	0.0504
Right A-2 length	0.34 - 0.44	0.36 - 0.58	3.39	0.0126
A-2 gap	0.24 - 0.36	0.33 - 0.53	3.29	0.0180
A-2 gap ratio	1.14 - 1.48	0.64 - 1.64	2.38	0.3132
P-1 length	0.73 - 1.07	0.98 - 1.52	4.30	0.0018
P-1 gap[A]	0.07 - 0.15	0.08 - 0.26	1.25	1.0000
P-2 length	0.58 - 0.98	0.85 - 1.41	4.26	0.0018
P-3 length[B]	0.28 - 0.48	0.51 - 1.03	3.37	0.0126

[A] Ireland, *n* = 7; Poland, *n* = 6.

[B] Ireland, *n* = 7; Poland, *n* = 11.

Table 6. Stepwise discriminant analysis of 16 selected character states for developmental stage 27 *Bufo calamita* larvae from Ireland (n = 10) and Poland (n = 17). Entry and exit significance level set at P < 0.15. Four variables contributed significantly to the discrimination of Irish versus Polish specimens.

Step	Variable	Partial r^2	*F*	*P*
1	Body length	0.911	255.0	0.0001
2	Ventral fin height	0.231	7.2	0.0131
3	A-2 gap	0.146	3.9	0.0595
4	A-1 length	0.114	2.8	0.1065

Table 7. Eigenvalues of the correlation matrix of a principal components analysis of 16 selected character states for developmental stage 27 *Bufo calamita* larvae from Ireland (n = 10) and Poland (n = 17).

		Variability	
Principal component	Eigenvalue	Proportion	Cumulative
PC1	11.91	0.74	0.74
PC2	1.95	0.12	0.87
PC3	0.76	0.05	0.91
PC4	0.46	0.03	0.94

Table 8. Eigenvectors of the first four principal components generated from 16 selected character states for developmental stage 27 *Bufo calamita* larvae from Ireland (n = 10) and Poland (n = 17). Variables are ranked in decreasing order of the absolute value of PC1.

Variable	**PC1**	**PC2**	**PC3**	**PC4**
Total length	0.286	-0.046	-0.028	0.179
Body length	0.284	-0.068	-0.076	0.009
Tail length	0.278	-0.023	0.018	0.334
Tail height	0.275	-0.011	-0.058	0.204
A-1 length	0.273	-0.112	0.135	0.041
Tail muscle height	0.272	-0.009	-0.259	-0.166
Internarial distance	0.271	-0.029	-0.161	0.291
Interocular distance	0.268	0.008	0.027	0.482
P-2 length	0.267	-0.021	0.169	-0.140
P-1 length	0.266	-0.003	0.155	-0.202
Dorsal fin height	0.257	0.078	-0.403	-0.277
Ventral fin height	0.251	-0.052	-0.420	-0.431
A-2 gap	0.211	-0.365	0.432	-0.137
Left A-2 length	0.199	0.415	0.362	-0.127
Right A-2 length	0.188	0.444	0.359	-0.261
A-2 gap ratio	-0.013	0.683	-0.201	0.206

FURTHER DISTRIBUTIONAL RECORDS OF IRISH ACULEATA (HYMENOPTERA), AND A SPECIES LIST FOR IRELAND

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SUMMARY

Distribution records for ninety species of aculeate Hymenoptera belonging to eight families are presented. A list of the 215 taxa of Irish Hymenoptera Aculeata is given in an appendix.

INTRODUCTION

Most of the records in this paper are of species that receive little attention but who comprise the greatest part of the Irish aculeate Hymenoptera fauna, - the 'solitary bees and wasps'. Some records of less common social species are also included.

The majority of records are based on specimens in the collections of the National Museum of Ireland and in the senior author's reference collection. A very small number of records based on field observation alone are included where they are considered to be noteworthy. Records based on material reared by CR from trap-nests and from naturally occurring nests discovered in the field, are also included. In a number of cases these reared specimens are the basis for the only recent Irish records of some species (e.g. *Crossocerus styrius* and *C. walkeri*). Note that emergence dates for reared material should always be treated with caution if incorporating data into analyses of flight-periods, as rearing conditions and disturbance of nest contents when opening traps, may disrupt natural emergence patterns.

The records are presented in the following order: Superfamily; family; subfamily, genus and species name, with author; county and vice-county number; location; Irish national grid reference; sex/caste of insect(s); date of the record; collector; determiner (if different from collector). Where multiple records have been made from the same location, these are grouped together with only the insect details and dates being different.

Synonyms in square brackets follow many of the species names. These are the names used by A.W. Stelfox in his 'List of the Hymenoptera Aculeata of Ireland' (Stelfox, 1927), which was the last complete checklist of the Irish Hymenoptera Aculeata. They are included here to facilitate referral back to that paper. Further synonyms used in the literature relevant to the Irish fauna, can be found in the checklist in the Appendix.

Except where otherwise stated, specimens were collected and determined by CR. Other collectors and determiners are named with their records and are also listed in the acknowledgements.

Determinations by CR were made using works listed in the introduction to Ronayne and O'Connor (2003), and the following additional works: Amiet, F., et al. (2004), Celary, W. (1995), Edwards, M. and Jenner, M. (2005), Else, G. R. (1999), Olmi, M. (1999), Prys-Jones, O.E. and Corbet, S. A. (1987), Skinner and Allen (1996), Wardlaw, J. C. et al. (1998).

The following abbreviations appear in the text: CR= C. Ronayne; JPOC= J. P. O'Connor; JMOC= J. P. and M. A. O'Connor; NNR= National Nature Reserve; NMI= National Museum of Ireland, Dublin; NP= National Park.

CHRYSIDOIDEA

Dryinidae

Aphelopinae

***Aphelopus atratus* (Dalman, 1823)**

MEATH (H22): Thomastown Bog (O008687), west of Duleek, 3♀♀ 19 June 1997, 3♂♂♀ 7 July 1997, all in a Malaise trap in a clearing in wet mixed woodland, CR.

Anteoninae

***Anteon arcuatum* Kieffer, 1905**

WEXFORD (H12): Curracloe (T1127) ♀ 13 June 1991 coll. JMOC, det. CR. **MEATH (H22):** Thomastown Bog (O008687), west of Duleek, 4♂♂♀ 7 July 1999, in a Malaise trap in a clearing in damp woodland, CR.

***Anteon flavicorne* (Dalman, 1818)**

WEXFORD (H12): Raven NNR (T115230) southern end, 2♀♀ 31 July 1999, in a Malaise trap in a sandy clearing close to Raven Point, CR. **MEATH (H22):** Thomastown Bog (O008687), west of Duleek, ♂ 7 July 1999, in a Malaise trap in a clearing in damp woodland, CR.

***Anteon fulviventre* (Haliday, 1828)**

WATERFORD (H6): Harristown Hill (S6704), 2♀♀ 3 July 1990, JPOC, det. CR. **WEXFORD (H12):** Slievecoiltia (S7221), south of New Ross, 4♀♀ 14 June 1990, JPOC, det. CR.

***Anteon jurineanum* Latreille, 1809**

MEATH (H22): Thomastown Bog (O008687), west of Duleek, ♂ 7 July 1999, in a Malaise trap in a clearing in damp woodland, CR.

***Lonchodryinus ruficornis* (Dalman, 1818)**

Meath (H22): Thomastown Bog (O008687), west of Duleek, ♂♀ 19 June 1997, ♂ 6 August 1997, all in a Malaise trap in a clearing in wet mixed woodland, CR.

Gonatopodinae

***Gonatopus clavipes* (Thunberg, 1827)**

LOUTH (H31): Baltray (O1577), 2♀♀ 24 August 1998, at the base of a clump of marram grass (*Ammophila arenaria*), in dunes near the mouth of the river Boyne, CR.

Chrysididae

Elampinae

***Pseudomalus auratus* (L., 1758)**

[*Elampus auratus* L.]

LAOIS (H14): Derry Hills (N2612), ♀ 10 May 1999, reared from a piece of oak branch (*Quercus* sp.) collected on 7 November 1998, also containing *Pemphredon lugubris* and *Ectemnius lapidarius* (Sphecidae), CR. **KILDARE (H19):** Kingsbog (N7108), 4km south of Kildare town, ♀ 16 June 1998, flying at the edge of a clearing in a conifer plantation; ♂ 24 May 1999, reared from a trap nest containing *Pemphredon inornata* pre-pupae and ichneumonid parasites; both CR. **WICKLOW (H20):** Clara Vale (T178918), oak woods, ♂ 30 April 1999, ♀ 4 May 1999, both reared from a *Rubus*-stem trap nest containing pre-pupae of *Pemphredon inornata* (and a single *Ancistrocerus* sp. cell parasitised by *Chrysis rutiliventris*), CR; Knocksink Wood NNR (O2117) Enniskerry, 2 ♀♀ 11 June 1996, emerged from a piece of oak branch, collected in January 1996 (containing cells of both *Pemphredon lugubris* and *Psenulus pallipes* (Sphecidae), CR. **DUBLIN (H21):** Skerries (O245601), near the railway station, ♂ 3 July 1993, on the leaves of an ash (*Fraxinus excelsior*) sapling in a disused gravel-pit, CR; Skerries (O247597) Dublin Road, 4 August 1992, flying close to a blackcurrant bush (*Ribes nigra*), CR; 26 June 1993, flying close to a loganberry bush, CR; ♀ 22 June 1994, emerged from a trap nest containing *Pemphredon inornata*, CR; ♂ 10 June 2002, on dead wood in a domestic garden, CR. **MEATH (H22):** Thomastown Bog (O007688), ♂♀ 5 June 1999, 2♀♀ 13 June 1999, all reared from a piece dead willow (*Salix*), containing pre-pupae and cocoons of *Pemphredon lugubris*, *Ectemnius lapidarius* and *Crossocerus megacephalus* (Sphecidae), CR.

***Hedychridium ardens* (Latreille in Coquebert, 1801)**

WEXFORD (H12): The Raven NNR (T115230), southern end, ♀ 31 July 1999, on open sand in a large sandy clearing among conifers, CR. **WICKLOW (H20):** Six Mile Point (O3203), 11

July 1977, J. Breen, det. M.E.Archer.

Chrysidinae

***Chrysis ignita* (L., 1758)**

[*Chrysis ignita* sensu lato.]

MID-CORK (H4): University College Cork (W6671), ♂ 2 July 1974, in University grounds, J. Breen, det. M. E. Archer. **CLARE (H9):** Dromore Forest Park (R3487), ♂ 6 July 1978, D. N. Dowling, det. M. E. Archer. **DUBLIN (H21):** The Island (O2347), Malahide, ♀ 22 July 1997, hand-netted at the edge of the golf links, CR, det. M. E. Archer; Skerries (O247597) Dublin Road, ♂ 28 June 1994, ♂ 20 June 1998, ♂♀ 14 July 1998, ♂ 9 June 2001, 2♂♂ 10 June 2002, hand-netted in a domestic garden, all CR, det. M. E. Archer; Swords (O1745), ♀ 14 July 1978, ♀ 30 July 1978, J. Breen, det. M. E. Archer.

***Chrysis impressa* Schenck, 1856**

CLARE (H9): near Corker Pass (M308107), ♂ 27 May 1992, 'on green road', JPOC, det. M. E. Archer. **WEXFORD (H12):** Raven National Nature Reserve (T115230) southern end, ♂ 4 August 2000, ♀ 11 June 2000, ♀ 13 June 2000. All reared from the cells of an unidentified *Ancistrocerus* sp. in a trap nest (No intact host cells were present), CR, all det. M. E. Archer. **WEST GALWAY (H16):** Furnace Island (L8324), ♂ 11 June 1998, reared from the cell of an unidentified *Ancistrocerus* sp. in a trap nest in a dry-stone wall (No intact host cells were present), CR, det. M. E. Archer. **WICKLOW (H20):** Devil's Glen Wood (T2498), ♂ 4 June 1998, hand netted in mixed woodland; same location, ♂ 20 June 1998 and ♂ 24 June 1998, both reared from a three-celled *Ancistrocerus* sp. nest in a *Rubus* stem (No intact host cells present); Same location, ♀ 11 July 1998, reared from a single-celled *Ancistrocerus* sp. nest in a *Rubus* stem; Same location, ♀ 26 May 1999, reared from a three-celled nest in a *Rubus* stem (Two un-parasitised cells produced ♂♀ *Ancistrocerus trifasciatus*); all CR, all det. M. E. Archer. **DUBLIN (H21):** Sydney Avenue (O2029) Blackrock, ♀ 21 July 1984, on window of a domestic dwelling, P. Le Clerc, det. M. E. Archer; Beech Park Crescent (O089377), Castleknock, ♀ 21 June 1984, in a Malaise trap (7-21.vi.1984) in a garden, JMOC, det. M. E. Archer; The Island (O2347), Malahide, ♀ 22 July 1997, hand-netted at the edge of the golf links, CR, det. M. E. Archer; Skerries (O247597), Dublin Road, ♀ 28 June 1994, ♀ 15 June 1998, ♂ 13 June 2000, ♀ 12 September 2001, all hand-netted in a domestic garden, CR, all det. M. E. Archer.

***Chrysis mediata* Linsenmaier, 1959**

WEXFORD (H12): Raven NNR (T115230), southern end, ♂ 17 June 2000, reared from a single-celled *Ancistrocerus* sp. nest in a *Rubus* stem, CR, det. M. E. Archer. **WICKLOW (H20):** Devil's Glen Wood (T2498), ♀ 1 July 1998, reared from a two-celled *Ancistrocerus* sp. nest in a *Rubus* stem (No intact host cell present); Same location, ♀ 22 June 1999, reared from a two-celled *Ancistrocerus trifasciatus* nest in a *Rubus* stem (a ♀ *Ancistrocerus trifasciatus* eclosed 6 June 1999 from the other cell); both CR, det. M. E. Archer.

***Chrysis rutiliventris* Abeille de Perrin, 1879**

WEST CORK (H3): Clear Island (V9521), ♀ 28 July 1972, J. Breen, det. M. E. Archer; **WEXFORD (H12):** The Cull embankment (S935068), Ballyteige, ♀ 11 July 1999, investigating cracks and holes in a stone wall, CR, det. M. E. Archer; Raven NNR (T115230), southern end, ♂ 27 June 2000, reared from a single-celled *Ancistrocerus* sp. nest in a *Rubus* stem, CR, det. M. E. Archer. **WEST GALWAY (H16):** Furnace Island (L8324), ♀ 13 July 1997, on a rocky escarpment in flower-rich pasture; Same location 3♀ ♀ 3 July 1998, ♀ 8 July 1998, 2♀ ♀ 18 August 1999, ♀ 18 August 2000, ♂ 26 June 2001, hand-netted in a rocky flower-rich pasture; all CR, det. M. E. Archer. **WICKLOW (H20):** Clara Vale (T178918), oak woods, ♀ 7 June 1999, reared from a *Rubus*-stem trap nest containing a single *Ancistrocerus* sp. cell parasitised by the *Chrysis rutiliventris* (and pre-pupae of both *Pemphredon inornata* and their parasite *Pseudomalus auratus*); Same locality (T1891), ♀ 30 June 2001, at an umbellifer flower head; all CR, det. M. E. Archer. Devil's Glen Wood (T2498), ♀ 13 June 1998, reared from a single -celled *Ancistrocerus* sp. nest in a *Rubus* stem; Same locality, ♂ 20 June 1998, ♂

24 June 1998, both reared from a three-celled *Ancistrocerus* sp. nest in a *Rubus* stem (No host species cell survived intact); Same locality, ♂ 24 June 1998, reared from a single-celled *Ancistrocerus* sp. nest in a *Rubus* stem; Same locality, ♂ 1 July 1998, reared from a two-celled *Ancistrocerus* sp. nest in a *Rubus* stem (Occupant of the other cell failed at the early larval stage); all CR, det. M. E. Archer. **DUBLIN (H21):** Skerries (O247597), Dublin Road, ♀ 17 August 1986, ♀ 28 June 1994, both in a domestic garden, CR, det. M. E. Archer.

VESPOIDEA

Mutillidae

***Myrmosa atra* s. *erythrocephala* Yarrow, 1954**

[*Myrmosa melanocephala* Fabr.]

WEXFORD (H12): South-west of Ballyvaloo (T105297), ♀ 10 August 2000, on bare ground close to nest holes of *Lasioglossum* species (Halictinae) in an area of sandy glacial hills, CR. **OFFALY (H18):** Bunakeeran (N215205), ♂ 24 June 2001, on dry marl clay at the edge of a constructed wetland, CR. **WICKLOW (H20):** Knocksink Wood NNR (O220176), Enniskerry, ♀ 28 July 1995, 2♀♀ 10 September 1996, ♂ 24 July 1998, all on or near the vertical face of a sandy cutting near the entrance of the reserve, CR; Priests Hall (O208112), ♂ 27 July 1998, flying at the edge of a track near a former reservoir, south east of Powerscourt Deer-Park, CR.

Formicidae

***Lasius fuliginosus* (Latreille, 1798)**

WEXFORD (H12): Raven NNR (T115230), southern end, ☿14 July 1999, being carried dead, in the mandibles of a *Formica lemani* worker, in a sandy clearing close to dead wood. No nest was located, det. M. Fox (confirmed by J. Breen), CR.

***Leptothorax acervorum* (Fabr., 1793)**

WEST GALWAY (H16): Furnace Island (L8324), north of Lettermullan, ☿☿♀ 3 July 1998, in a small nest under a flat stone on the south side of rocky outcrop, CR. **WICKLOW (H20):** Clara Vale (T178918), oakwoods, ☿☿ 23 September 1997, under the loose bark of a dead conifer tree on a south-facing slope, CR; Deputy's Pass (T2390) ☿☿ 18 August 1998, nesting in the stump of a felled conifer in mixed woodland, CR; Knocksink Wood NNR (O2118) ☿☿ 30 June 1995, under bark of a dead conifer on the southern boundary of the reserve, CR; The Murrough (T3095) at Broadlough, ☿☿ 8 April 1997, in the dead stems of gorse (*Ulex europaeus*), growing on a shingle ridge, CR. **WESTMEATH (H23):** Long Hill esker (N3636) at Ardmorney, ☿☿♀, nest in rotting wooden fence post at the edge of a disused gravel pit in the side of the esker ridge, CR. **LONGFORD (H24):** Lismagawley bog (N025565) southwest of Newtown Cashel, ☿☿ 22 May 2001, running in cracks in dry peat on the vertical face of an old peat cutting, CR.

***Myrmica sabuleti* Meinert, 1861**

[*Myrmica scabrinodis* var. *sabuleti* Meinert]

DUBLIN (H21): Drumanagh (O273560), south of Loughshinny, ☿☿ 5 June 2002, among tussocky vegetation and bare soil on south facing slope above the sea, CR. **LOUTH (H31):** Baltray (01577), sand dunes near the mouth of the River Boyne, ☿☿ 24 August 1998, under a concrete block in an area of disturbed dunes, CR.

Pompilidae

***Dipogon variegatus* (L., 1758)**

[*Agenia variegata* L.]

Wicklow (H20): Clara Vale (T178918), oakwoods, ♂ 3 June 1999, emerged from a single cocoon lying among pith fragments in a raspberry stem trap nest, CR; Devil's Glen woods (T2498), Ashford, ♀ emerged 16 July 1998, from a *Rubus* stem trap nest set up in May 1997 (A ♂ failed to complete emergence from another cocoon in the same stem), CR; Same location, 2♀♀ 23 June 1999, emerged from cocoons in a *Rubus* stem trap nest set up in 1998, CR. **DUBLIN (H21):** Beggars Bush (O1733), ♀ 15 July 1994, caught by hand in the yard of the National Museum stores, J. M. C. Holmes, det. CR.

***Episyron rufipes* (L., 1758)**

[*Psammochares rufipes* L.]

WATERFORD (H06): Tramore strand (S598008), ♀ 16 July 1999, on a wild carrot (*Daucus carota*) flower head, CR. **WEXFORD (H12):** Ballyteigue Burrrows (S9306), ♂ 11 July 1999, on the dunes opposite the Cull, CR; Chour (T0904), ♂ 16 August 2001, on an umbellifer at the side of a track near the lakeshore, CR; Same location, 2 ♂♂ 1 June 2002, on bare sand behind a shingle ridge, CR; Curracloe (T114270), sand dunes, ♂ 14 July 1999, on the dunes just north of the Raven NNR, CR; Grange Strand (S8006), near Fethard, ♂ 13 July 1999, on an umbellifer in the sand dunes, at the north end of the beach, CR; Raven NNR (T115230), southern end, ♂ 1 July 1999, on bare sand, many others seen, CR; same location ♂ 31 July 1999, ♀ 28 August 1999, on umbellifer flowers, in a sandy clearing at the southern end of the reserve, CR. **WICKLOW (H20):** Five-Mile Point (O3103), ♀ 18 August 1998, on a bank above the shingle beach, CR. **DUBLIN (H21):** The Island (O2347), Malahide, 2 ♂♂ 22 July 1997, ♀ 8 August 1997, all on the estuary side of the peninsula, CR. **LOUTH (H31):** Baltray (O1577), sand dunes, ♂♀ 28 July 1997, on an umbellifer flower in sand dunes near the mouth of the River Boyne, CR; Same locality, ♀ 2 August 1997 on bare sand, ♂ 26 June 2000 on an umbellifer, ♂ 13 August 2002 on marram grass (*Ammophila arenaria*), CR.

***Anoplius nigerrimus* (Scopoli, 1763)**

[*Psammochares nigerrimus* Scopoli]

WEST GALWAY (H16): Furnace Island (L8324), north of Lettermullan, ♀ 13 July 1997, 2 ♂♂ 19 July 2000, ♂ 17 August 2000, all near the base of a rocky outcrop in an unimproved pasture, CR; Same locality, ♀ 3 July 1998, in the vegetation at the base of a dry stone wall, CR; South east of Clifden (L704485), ♂ 18 July 2000, on an umbellifer growing on a dismantled railway, south of Lough Fadda West, CR. **OFFALY (H18):** Bunakeeran wetland (N215205), ♂ 24 June 2001, in a dry area of disturbed marl and peat in a recently created wetland, CR. **KILDARE (H19):** Kingsbog (N7108), 2 ♂♂ 16 June 1998, on a sunny track (with

Arachnospila spissa) through a conifer plantation, CR. **MEATH (H22):** Thomastown Bog (O008687), ♂ 25 July 1997, in a Malaise trap sample (7-25 July 1997) from an area of birch (*Betula*) and oak scrub, CR; Same locality, ♂♀ 5 August 1998, in a Malaise trap sample (15 July 1998 - 5 August 1998) from an area of heather (*Calluna vulgaris*) and Scots pine (*Pinus sylvestris*), CR. **WESTMEATH (H23):** Long Hill esker (N3636) at Ardmorney, ♀ 15 August 1997, in a gravel-pit in the side of the esker ridge, CR. **SLIGO (H28):** Cashelgarran, Drumcliff (G6646), ♀ 21 August 1991, on a dry-stone wall in an Iron-age fort, CR. **LOUTH (H31):** Stormanstown Bog (N913927), ♀ 23 August 2001, on an umbellifer growing in a drainage ditch in a cutover raised bog, CR; Togher (O118895), ♂ 17 August 1987, ♀ 13 June 1988, both in a disused gravel-pit, CR.

***Arachnospila spissa* (Schiødte, 1837)**

[*Psammochares spissus* Schiødte.]

KILDARE (H19): Kingsbog (N7108), 4km south of Kildare, 2 ♂♂ 16 June 1998, on a gravel track (with *Anoplius nigerrimus*), in a conifer plantation growing on cutover bog, CR.

***Ceropales maculata* (Fabr., 1775)**

[*Ceropales maculatus* Fabr.]

WEXFORD (H12): Ballyteigue Burrows (S917069), ♂♂♀♀ 12 August 2003, flying among sea-holly (*Eryngium maritimum*) and sea spurge (*Euphorbia paralias*) on the fore dunes, CR; Raven NNR (T115230), southern end, 4 ♂♂♀ 31 July 1999, on umbellifers on the edge of a dune ridge, CR. **OFFALY (H18)** Clongarret (N5625), ♂ 4 August 1998, on an umbellifer growing at the side of a drainage ditch, CR. **LONGFORD (H24):** Ballinlough (N270815), ♂ 27 June 2000, on an umbellifer at the edge of a boggy track leading to a lake, CR. **ROSCOMMON (H25):** Duggarry bog (M9636), north of Ballydangan, ♂♀ 17 July 1997, on an umbellifer growing in a choked drainage ditch at the edge of cutover bog, CR. **WEST MAYO (H27):** Arderry bog (M480896), ♀ 27 July 2001, on an umbellifer growing in a ditch beside a track, CR.

Vespidae

Eumeninae

***Ancistrocerus parietinus* (L., 1758)**

CLARE (H9): Dromore Forest Park (R3487), ♀ 5 July 1978, M. de C. Williams, det. M. E. Archer; Same location, 2♀♀ 6 July 1978, D. N. Dowling, det. M. E. Archer. **WEXFORD (H12):** Raven Point (T1124), ♂ 28 June 1978, M. de C. Williams, det. M. E. Archer. **WICKLOW (H20):** Clara Vale (T186915), oakwoods, ♀ 21 June1999, reared at ambient outdoor temperature from a cocoon in a trap nest, attached to a dead conifer trunk (Two other intact cocoons failed to produce adult wasps), CR. **DUBLIN (H21):** Gollierstown Bridge (O015320), ♂ 18 June 1978, at flowers on the canal bank, D. N. Dowling; Skerries (O247597), garden, ♀ 23 June 1986, flying around currant (*Ribes*) bushes, ♀ 20 June 1993, on bramble flowers, 2♂♂♀ 30 May 2002, at *Rubus* flowers, all CR. **MEATH (H22):** Drumman House (O005689), west of Duleek, ♀ 7 July 1997, near clay exposure in grazed meadow, CR; Thomastown Bog (O008687), west of Duleek, ♀ 7 July 1997, in a Malaise Trap (19 June-7 July 1997) in a clearing in mixed woodland on basin bog, CR.

***Ancistrocerus scoticus* (Curtis, 1826)**

[*Ancistrocerus trimarginatus* Zetterstedt]

WEST GALWAY (H16): Furnace Island (L8324), north of Lettermullan, ♂ 27 June1997, flying close to a stone wall in a sheltered field; Same locality, 3 ♀♀ 3 July 1997 searching cracks and crevices in a south facing ridge of rock; Same locality, ♂ 25 July 1997 and ♀ August 1997, both reared from a three-celled nest (third cell stocked with caterpillars but no egg present) in a dead bracken (*Pteridium aquilinum*) stem found 8 July 1997; same locality, ♂ 6 July 1998 flying close to a stone-faced road embankment; Same locality, ♂ 18 August 2000 flying in a rough pasture; Same locality, ♂ 19 July 2001 emerged from a three-celled nest found in a horizontal gap between stones in a dry-stone wall (Both of the other cells had been parasitised, from which emerged (12 July 2001 and 15 July 2001) two ♂♂ *Acroricnus stylator*

(Thunberg) (Ichneumonidae: Cryptinae); all CR.

***Ancistrocerus trifasciatus* (Müller, 1776)**

KILKENNY (H11): Castlegannon (S546307), disused quarry, 2 ♀♀ 6 Aug 2002, at a hedgerow on the edge of a quarry, CR. **WEXFORD (H12):** Tintern Abbey (S794100), near Saltmills, ♀13 July 1999, in an area of hawthorn (*Crataegus monogyna*) scrub north of the abbey, CR; Raven NNR (T115230), southern end, ♀ 1 July 1999, a specimen with deformed wings on an old wooden fence-post, at the edge of conifer woodland, CR. **LAOIS (H14):** Derry Hills (N2612) north west of Clonaslee, ♀ 8 June 1999, reared from a single-celled nest in a *Rubus* stem trap nest, CR; Same locality, ♂ 12 June 1999, ♀ 14 June 1999, both reared from a five-celled nest in a *Rubus* stem trap nest (Three cells failed at the pre-pupal stage), CR. **KILDARE (H19):** Kingsbog (N7108), 4km south of Kildare, ♂ 16 June 1998, in a clearing in a conifer plantation on a cut-over bog, CR. **WICKLOW (H20):** Buckroney (T2980), ♂ 14 June 1978, M. C. D.Speight, det. M. E. Archer; Clara Vale (T182916), oakwoods, 2♂♂ 30 June 2001, at bramble flowers, CR; Deputys Pass (T2390), south west of Glenealy, ♀18 August 1998, in mixed woodland, CR. **DUBLIN (H21):** Skerries (O247597), garden, ♀ 28 July 1993, prospecting for a suitable nest site, CR; Same location, ♂ 6 June 1994, reared from *Rubus* stem trap-nest in garden, CR; Same location, ♀ 3 July 1997, caught in a spiders web in garden, CR; same location, 2♀♀ 29 June 1998, reared from *Rubus* stem trap-nest in garden, CR. **MEATH (H22):** Thomastown Bog (O008687), west of Duleek, 2♀♀ 7 July 1997, in Malaise trap (19 June-7 July 1997), CR; Same location, 2♀♀ 25 July 1997, in Malaise trap (7-25 July 1997), CR; Same locality, ♂ 30 May 1999 and ♀ 2 June 1999, from a *Rubus* stem trap nest, CR. **WESTMEATH (H23):** Ballynamonaster (N338617), south of Lough Iron, ♂ 16 July 2002, at an umbellifer in a hedgerow on Tristernagh demesne, CR.

APOIDEA

Sphecidae

Sphecinae

***Podalonia affinis* (Kirby, 1798)**

[*Sphex lutaria* Fabr.]

WEXFORD (H12): Ballyteigue Burrows (S9306), ♀ 9 July 1999, the specimen was first heard buzzing in a grass tussock, and then caught as it emerged into the open. Found in a large 'blow-out' with plenty of loose sand in high dunes, no other examples were seen, CR.

Crabronidae

Larrinae

***Tachysphex pompiliformis* (Panzer, 1805)**

[*Tachysphex pectinipes* L.]

WEXFORD (H12): Raven NNR (T115230), southern end, ♀ 31 July 1999, on bare sand in a large clearing, CR. **WICKLOW (H20):** Five-mile Point (O313023), ♀ 1 July 1993, on a sandy bank at the seaward side of the railway. Others were seen but not examined, CR. **DUBLIN (H21):** Skerries (O245601), the ballast-pit by the railway station, 2♂♂♀ 3 July 1993, the female with captured orthopteran prey, an immature *Chorthippus brunneus* (Thunberg), CR.

***Trypoxylon clavicerum* Lepeletier and Serville, 1828**

WICKLOW (H20): Clara Vale (T1791), oak woods, ♀ 30 May 1997, in the valley of the Avonmore river, south east of Clara, CR; ♀ 18 June 1999, reared from a trap-nest (set up 4 June 1998), CR; Clara Vale (T185915), a disused quarry in the oakwood, ♂ 30 June 2002, reared from a trap-nest (set up 30 June 2001), CR; Deputys Pass (T2390), woodland, ♂ 18 August 1998 (and 3 other ♂♂ seen), flying back and forth at the base of a large Scots pine. No females or possible nest was located despite a careful search, CR; Knocksink Wood NNR (O217176), ♂2♀♀ 5 August 1993, by the side of the track into the reserve, ♀ 30 June 1995, nesting in a fallen tree trunk, in an area cleared of conifer plantations, ♀ 24 July 1998, flying among tree roots on a sandy bank near the entrance to the reserve, all CR.

Crabroninae

***Crabro peltarius* (Schreber, 1784)**

SOUTH KERRY (H01): Derrynane National Historic Park (V534585), 3♀♀ 8 July 1986, nesting in the edge of a trampled pathway through the sand-dune system, CR. **WEXFORD (H12):** Raven NNR (T115230), southern end, ♂ 1 July 1999, 2 ♂♂ 12 July 1999, ♀14 July 1999, all in a clearing at the southern end of the reserve, CR; Raven NNR (T112265), northern end, ♀♀ 14 July 1999, seen nesting in bare sand in a clearing near the entrance of the reserve, ♀ 17 July 1999, in clearing near the northern entrance, all CR. **KILDARE (H19):** Baronsland (N830035), gravel-pit, 2 ♂♂ 16 June1998, at the leaves of a stunted sycamore bush, CR. **WICKLOW (H20):** Powerscourt Estate (O219173), Enniskerry, ♂ 24 June 1995, in a sand pit cleared for new housing beside the village, CR. **DUBLIN (H21):** Ardla dump (O2360), Milverton, Skerries, ♂ 17 July 1994, in a lane-way to the dump-site, CR; Skerries (O245601), a ballast-pit by the railway station, ♂ 3 July 1993, on the leaves of an ash in an old sand/gravel-pit, CR. **LOUTH (H31):** Baltray (O1577), sand dunes, ♂♀ 2 August 1997, ♂ 26 June 2000, all at the foliage of a sycamore (*Acer pseudoplatanus*) beside a track into the dunes, CR.

***Crossocerus* (*Ablepharipus*) *podagricus* (Vander Linden, 1829)**

[*Ablepharipus podagricus* Vander Linden]

WEXFORD (H12): Bann Bridge (S987448), north of Enniscorthy, ♀ 7 August 1998, on an umbellifer flower head in a newly planted wooded area on the south bank of the river Bann, CR. **LAOIS (H14):** Derry Hills (N2612), ♀ 28 June 2000, in scrubby oak woodland growing on an esker hill, CR. **OFFALY (H18):** Grand canal at Toberdaly Bridge (N526312), ♂ 24 August 2000, on sycamore foliage, beside the canal towpath, CR. **DUBLIN (H21):** Skerries (O247597), ♂ 11 July 2003, landed on *Echium pinniana* foliage in a domestic garden, CR. **MEATH (H22):** Thomastown Bog (O008687), west of Duleek, ♀ 25 July 1997, in a Malaise trap set up in a clearing in wet woodland, CR. **WESTMEATH (H23):** Royal canal (N618484), south west of

Croboy Lough, 2♀♀ 7 August 2000, on an umbellifer flower head growing at the side of the canal towpath, CR; Tristernagh Demesne (N345611), numerous ♀♀ and some ♂♂ 16 July 2002, nesting in a standing dead tree close to the ruined priory, CR. **WEST MAYO (H27):** 1km south of Toormakeady (M095670), 3♀♀ 28 July 2001, on umbellifer flower heads in hazel (*Corylus avellana*) scrub growing on the limestone shore of Lough Mask, CR.

***Crossocerus* (*Crossocerus*) *pusillus* Lepeletier and Brullé, 1835**

[*Crossocerus varius* misspelling]

NORTH KERRY (H02): Galway's Bridge (V914801), Killarney National Park, ♂ 7 July 2001, on oak foliage at the edge of a track above the bridge, CR. **WEXFORD (H12):** Scarawalsh Bridge (S984451), ♂ 7 August 1998, at ivy (*Hedera helix*) growing on the arch of the bridge, CR. **LAOIS (H14):** Derry Hills (N2612), north west of Clonaslee, ♀ 15 August 1997, among oaks, ♂ 12 June 1998 at rest on the stump of an oak, CR. **NORTH EAST GALWAY (H17):** West of Summerville Lough (M600499), 2♂♂♀ 29 July 2001, on sycamore foliage in a disused gravel-pit just west of Summerville Lough, CR. **OFFALY (H18):** Clonmeen (N5329), south of Rhode, ♂ 4 August 1998, at a sycamore growing on the embankment of a light railway, CR. **KILDARE (H19):** Baronsland (N830035), a quarry, 5km south of Kilcullen, ♀ 16 June 1998, flying around a sycamore in a disused sand/gravel-pit, CR. **WICKLOW (H20):** South west of Knockalt Bridge (O008018), ♀ 16 June 1998, flying around the base of a dead rowan (*Sorbus aucuparia*) in Kings River valley, CR; Deputy's Pass (T2390), 3km south west of Glenealy, ♂ 2♀♀ 18 August 1998, flying around a sandy bank in mixed woodland, CR; Knocksink Wood NNR (O2117), Enniskerry, ♂3♀♀ 5 August 1993, in a clearing in mixed woodland by the Glencullen river, 2♂♂ 3♀♀ 14 June 1995, at a sandy cutting close to the entrance to the reserve, ♀ 30 June 1995, nesting in the sandy soil of a grassy clearing by the Glencullen river, ♀ 24 July 1995, nesting in the face of a sandy cutting inside the entrance to the reserve, ♀ 24 July 1998, at a sandy cutting close to the entrance to the reserve, all CR. **DUBLIN (H21):** Skerries (O247597), Dublin Road, ♀ 28 July 1993, flying among the leaves of garden plants, CR;

Ardgillen Park (O2161), ♀16 August 1993, in the rubble of a demolished gate lodge, CR; Howth Hill (O2738), near Muck Rock, 4♂♂ 2 July 1994, on birch leaves at the edge of woodland, CR; Ardla dump (O2360), Milverton, 4♂♂ 17 July 1994, on the leaves of planted willow and alder (*Alnus* sp.) near the entrance track, CR. **MEATH (H22):** Gormanston (O175660), ♂♂♀♀ 21 July 1986, in gravel/sand-pit, CR; Herbertstown Bridge (O114637), west of Greenanstown, ♂ 5 July 1997, flying about ivy at the base of the bridge, CR. **ROSCOMMON (H25):** Duggarry bog (M9636), north of Ballydangan, 3♀♀ 17 July 1997, nesting (entrance holes in dried peat) in the face of a deep drainage ditch at the edge of a cut-over bog, CR. **LOUTH (H31):** Baltray (O1577), dunes, ♀ 2 August 1997, CR; East of Giles Quay (J1605), ♂♀ 11 August 1998, flying around sycamores on the bank of the Castletown River, CR; Riverstown (J167071), ♀ 30 August 1991, at sand/gravel banks in a river valley beside the Cooley Distillery, CR; Togher (O1189), east of Dunleer, ♀ 9 August 1998, nesting in a disused sandpit, CR.

***Crossocerus* (*Blepharipus*) *cetratus* (Shuckard, 1837)**

[*Blepharipus cetratus* Shuckard]

OFFALY (H18): Glyn (N093232), south of Ferbane, ♀ 16 June 2000, at a fallen dead ash at the edge of a wooded, disused, railway embankment, CR. **WICKLOW (H20):** Knocksink Wood NNR (O2117), ♀♀ 28 June 1993, at a loose tree stump in a clearing in oak woodland by the Glencullen River, ♂ 7 June 1995, on oak foliage at the edge of the main track on a slope above a clearing in oak woodland, ♀ 23 June 1995, in a clearing beside the reserve building, ♀♀ 30 June 1995, nesting in a large fallen log in a grassy clearing in ash/hazel woodland by the Glencullen River, ♀ 24 July 1995, flying along the edge of a track near the entrance to the reserve, all CR; Powerscourt Estate (O219173), Enniskerry, ♀ 24 June1995, flying along a tree-line above the southern edge of the village, CR. **DUBLIN (H21):** Howth Hill (O2738), near Muck Rock, ♂ 2 July 1994, on birch leaves at the edge of mixed woodland, CR.

***Crossocerus* (*Blepharipus*) *styrius* (Kohl, 1892)**

[*Blepharipus styrius* Kohl]

MEATH (H22): Thomastown Bog (O008687), west of Duleek, a seventeen-celled linear nest in a hollow raspberry stem attached (in a bundle of ten stems) to a willow (*Salix* sp.) branch. Only eight intact cocoons were present when inspected and these produced the following specimens: ♂17 May 1998, 2♂♂ 24 May 1998, ♂♀ 28 May 1998 and ♂ 1 June 1998. Two cocoons failed to produce adults, CR.

***Crossocerus* (*Blepharipus*) *walkeri* (Shuckard, 1837)**

[*Blepharipus aphidum* misident.]

WICKLOW (H20): Knocksink Wood NNR (O218176), Enniskerry, ♀ 10 June 1994, emerged from a piece of dead oak branch, found in a clearing in mixed woodland after gales in January 1994. On 20 September 1994, a ♀ emerged from the same piece of dead branch, CR.

***Crossocerus* (*Crossocerus*) *tarsatus* (Shuckard, 1837)**

[*Crossocerus palmipes* L.]

DUBLIN (H21): Skerries (O245601), a sand pit by the railway station, ♂ 30 July 1992, 2♂♂ 3 July 1993, on the leaves of an ash, CR; The Island (O235475), Malahide, numerous ♂♂ and a ♀ 25 July 1995, flying around willow scrub in a sand/gravel pit at the edge of the golf course, CR. **MEATH (H22):** Gormanston (O175660), ♀ 14 August 1987, in a gravel-pit, CR; Lismullin House (N934615), ♀ 29 August 1991, at a gravelly riverbank in the grounds, CR. **LOUTH (H31):** Riverstown (J167071), ♀ 30 August 1991, at a sand/gravel bank in the river valley beside the Cooley Distillery, CR; Togher (O118895), east of Dunleer, 3♂♂ 13 June 1988, in a gravel/sand-pit, CR.

***Ectemnius* (*Clytochrysus*) *lapidarius* (Panzer, 1804)**

[*Clytochrysus chrysostomus* Lepeletier and Brullé]

WEST GALWAY (H16): Derryclare Wood (L8350), Gleninagh, 2♀♀ 19 August 1999, seen at dead wood in a clearing in oak woodland, CR. **OFFALY (H18)** Clongarret (N5625), west of

Clonbulloge, ♀ 4 August 1998, on an umbellifer at the edge of a drainage ditch, CR; Grand Canal (N151226), at Derry Bridge, ♀ 16 June 2000, at sycamore foliage, CR; Grand Canal (N526312), at Toberdaly Bridge, 2♂♂ 24 August 2000, on umbellifers growing on the canal bank, CR. **KILDARE (H19):** Ballynafagh reservoir (N8128), north west of Prosperous, 3♂♂♀ 5 June 1998, ♂ 20 June 1998, 2 ♂♂♀ 28 June 1998, 2♀♀ 7 July 1998, ♀ 10 July 1998, all reared from a nest in a piece of wood, taken from a dead tree at the edge of a *Phragmites* reed-bed, CR. **WICKLOW (H20):** Clara Vale (T185915), south east of Clara, ♂ 30 June 2001, at a dead tree in an area cleared of conifer trees, CR. **MEATH (H22):** West of Obelisk Bridge (O0475), ♂ 7 August 1997, at ash foliage, CR. **LONGFORD (H24):** Derragh Lough (N397795), ♂ 27 June 2000, on an umbellifer in an area of marsh at the southern edge of the lake, CR. **ROSCOMMON (H25):** Duggarry bog (M9636), north of Ballydangan, ♂ 17 July 1997, on an umbellifer growing in a drainage ditch at the edge of a cutover bog, CR. **WEST MAYO (H27):** Arderry bog (M480896), ♀ 27 July 2001, on an umbellifer in a bog drainage ditch, CR.

***Ectemnius (Hypocrabro) continuus* (Fabr., 1804)**

[*Solenius vagus* misident.]

WEXFORD (H12): The Raven NNR (T115230), southern end, ♀ 1 July 1999, ♂ 12 July 1999, on an umbellifer, ♀♀ 14 July 1999, observed nesting in dead conifer wood, ♂2♀♀ 31 July 1999 on umbellifers, 2♂♂ 28 August 1999, on an umbellifer in a clearing at the southern end of the reserve, CR. **LAOIS (H14):** The Derry Hills (N2612), Clonaslee, ♂♀ 15 August 1997, on an umbellifer growing on a stream bank, ♂ 12 June 1998, emerging from a crack in dry peat at the top of a vertical face in an old peat cutting. Females were observed entering holes in other dry peat cuttings, CR. **NORTH EAST GALWAY (H17):** Clonbrock (M745407), ♂♀ 29 July 2001, on an umbellifer in an area of cleared woodland, CR. **OFFALY (H18):** Bunakeeran wetland (N215205), ♀ 24 June 2001, on an umbellifer in an area of constructed marly fen and peat lakes, CR; Clongarret (N5625), west of Clonbulloge, 2♂♂♀ 4 August 1998, on an umbellifer at the edge of a ditch, CR; Clonmeen (N5329), south of Rhode, ♂ 4 August 1998, at sycamore foliage at the edge of a light-railway cutting, CR; Grand Canal at Derry Bridge (N151226), ♂ 16 June 2000, at bramble flowers, CR. **KILDARE (H19):** Kingsbog (N7108), 4km south of Kildare, ♂ 16 June 1998, flying around a conifer at the edge of a clearing in a conifer plantation growing on cut-over bog, CR. **WICKLOW (H20):** Knocksink Wood NNR (O2117), Enniskerry, ♂ 6 June 1995, flying around dead wood at the edge of a clearing behind the reserve building, CR. **DUBLIN (H21):** The Island (O2347), Malahide, ♀ 8 August 1997, on a flower head of wild carrot, CR. **WESTMEATH (H23):** Scragh Bog (N429585), 2♂♂ 24 June 2001, on trackside umbellifers, CR; The Royal canal (N618484), south west of Croboy Lough, ♂ 7 July 2000, on a canal-bank umbellifer, CR. **LONGFORD (H24):** Ballinlough (N270815), 2♂♂ 27 June 2000, on a trackside umbellifer, CR; Derragh Lough (N397795), ♀ 27 June 2000, on an umbellifer in a marsh at the southern edge of the lake, CR; Lough Bane (N416775), ♂ 27 June 2000, flying around birch foliage, CR. **ROSCOMMON (H25):** Duggarry bog (M9636), north of Ballydangan, 6♂♂4♀♀ 17 July 1997, on the flower heads of angelica (*Angelica sylvestris)* growing in a deep drainage ditch at the edge of the bog, CR. **EAST MAYO (H26):** Carrownagower bridge (M145591), ♂ 25 June 2002, in an area of hazel scrub on disturbed limestone karst beside the Corrib-Mask canal, CR. **WEST MAYO (H27):** East of Cloonee (M142741), ♀ 25 June 2002, in an area of disturbed blanket bog, planted conifers, and marsh, CR. **LOUTH (H31):** Baltray dunes (O1577), ♂4♀♀ 2 August 1997, at large conifer stumps, dumped by the edge of a golf course, CR; Same locality, ♂ 24 August 1998, on an umbellifer at the edge of a track into the dunes area, CR; Stormanstown Bog (N9192), 2♂♂ 23 August 2001, on umbellifers, growing in a cutover raised bog, CR.

***Ectemnius* (*Metacrabro*) *cephalotes* (Olivier, 1791)**

WEXFORD (H12): The Raven NNR (T115230), southern end, ♂ 31 July 1999, in large clearing at southern end of reserve, CR; Tintern Abbey (S794100) north of Saltmills, ♀ 13 July 1999, flying around a standing dead tree. Other females observed emerging from dead wood on a moribund fallen Lime (*Tilia* sp.) tree in the same area, CR. **LAOIS (H14):** The Derry Hills (N2612), north west of Clonaslee, ♂ 9 September 1999, found dead but fresh, facing outwards in the entrance of a trap-nest containing a completed *Symmorphus bifasciatus* (Eumeninae) nest. No other examples were recorded from this site, CR. **DUBLIN (H21):** Ardgillen Park (O218612), north west of Skerries, ♀ 25 September 2000, in a sunny patch in a car park beside Ardgillen castle. Caught by hand, examined and released, CR.

***Oxybelus argentatus* Curtis, 1833**

WEXFORD (H12): Ballyteigue Burrows (S9306), ♂ 11 July 1999, on sea spurge in fore-dunes, CR; The Raven NNR, southern end (T115230), ♂ 12 July 1999, flying around sea spurge, CR; Grange Strand, near Fethard (S805066), ♂ 13 July 1999, at wild carrot, CR.

***Oxybelus uniglumis* (L., 1758)**

WEXFORD (H12): Grange Strand, near Fethard (S805066), ♂ 13 July 1999, at wild carrot, CR; Curracloe Beach, north of the Raven NNR (T114270), ♂ 14 July 1999, on sea spurge, in fore-dunes to the north of the Raven NNR, CR.

Pemphredoninae

***Psenulus pallipes* (Panzer, 1798)**

NORTH KERRY (H1): Galway's Bridge, Killarney NP (V914801), ♀ 7 July 2001, on oak foliage at the edge of the track above Galway's Bridge, CR. **LAOIS (H14):** The Derry Hills (N264126), north west of Clonaslee, reared from an eight celled nest, in a *Rubus* stem trap nest, attached to an oak tree. Successful emergences were as follows: ♀ 17 June 2000, ♀ 18 June 2000, 2♀♀ 19 June 2000, ♀ 20 June 2000. Three cells failed at the pre-pupal stage, CR. **WICKLOW (H20):** Knocksink Wood NNR (O2117), ♀ 11 June 1996, ♀ 16 June 1996, both reared from part of a dead oak branch that fell after a storm in January 1996, CR. **DUBLIN (H21):** Skerries, Dublin Road (O247597), ♂ 7 June 2001, at flowers of cultivated *Euphorbia* var. in a domestic garden, CR. **MEATH (H22):** Thomastown Bog (O008687), 2♀♀ 7 July 1997, ♀ 25 July 1997, ♀ 20 August 1997, ♀ 5 August 1998, all in a Malaise trap set up in a clearing in damp woodland, CR.

***Spilomena troglodytes* (Vander Linden, 1829)**

OFFALY (H18): Grand Canal, Toberdaly Bridge (N526312), ♀ 24 August 2000, on sycamore foliage beside the canal path. A ♀ *Spilomena curruca* (as *S. differens* Blüthgen in Ronayne and O'Connor (2003)) was caught at the same time; CR. **DUBLIN (21):** Ardla, near Skerries (O236600), ♂ 17 July 1994, CR; Skerries (O247597) Dublin Road, ♂ July 1991, ♂ 3 July 1993, ♂ 11 July 1993, ♀ 12 July 1993, ♀ 28 July 1993, ♀ 16 July 1994, ♀ 30 July 1994, ♀ July 1996, at bramble flowers in a domestic garden, all CR; ♂ 9 June 2001, others seen at a piece of wood attached to a shed wall, CR; Same locality, ♂♂♀♀ 28 May-12 June 2003 reared (with the *Spilomena* parasite *Neorhacodes enslini* (Ruschka) (Hymenoptera: Ichneumonidae)), from cocoons found in the borings of *Anobium* sp. (Coleoptera) in dead wood attached to a shed wall, CR.

***Pemphredon* (*Cemonus*) *inornata* Say, 1824**

[*Pemphredon shuckardii* Morawitz, A.]

WEXFORD (H12): Raven NNR (T115230), ♀ 1 July 1999, at sycamore foliage in the corner of a clearing at the southern end, CR. **OFFALY (H18):** Clonmeen, south of Rhode (N5329), ♀ 4 August 1998, at ash growing on the edge of a light railway cutting, CR. **KILDARE (H19):** Baronsland (N830035), south of Kilcullen, 2♂♂♀ 16 June 1998, at ash foliage in a disused gravel-pit, CR; Kingsbog (N7108), 4km south of Kildare, 2♂♂ 16 June1998, at bramble foliage in a clearing in a conifer plantation on a cutover bog, CR. **WICKLOW (H20):** Clara Vale (T1891), oak woods, ♂ 5 June 1998, flying close to brambles, near the Avonmore River, CR; Knocksink Wood NNR (O212183), Enniskerry, ♂♀ 30 June 1995, nesting in a dead fallen conifer in a clearing reverting to scrub, CR. **DUBLIN (H21):** Blakes Cross (O198520), Lusk, ♂ 11 June 1988, flying among plants in a garden centre, CR; Skerries (O245601), near the railway station, ♂ 3 July 1993, at ash foliage in a disused sand/gravel pit, CR; Ardla (O236600), Skerries, 2♂♂17 July 1994, on leaves of willow and alder planted around the edge of a dump in a disused sand pit, CR; Skerries (O247597), Dublin Road, ♂ 24 May 2003, in a domestic garden at dead wood, CR. **MEATH (H22):** Newgrange (N995726), ♀ 18 August 1997, on the foliage of an ash growing by a disused canal lock on the north side of the river Boyne, CR; River Boyne upstream of Oldbridge (O0475), ♂ 7 August 1997, at the foliage of an ash growing beside a disused canal, CR; Thomastown Bog (O008687), west of Duleek, ♂ 30 June 1998, on oak leaves in a clearing in damp woodland, CR. **EAST MAYO (H26):** Carrownagower bridge (M145592), ♀ 25 June 2002, in an area of hazel scrub on disturbed limestone karst beside the Corrib-Mask canal, CR.

***Pemphredon (Cemonus) lethifera* (Shuckard, 1837)**

[*Pemphredon lethifer* Shuckard]

DUBLIN (H21): Skerries (O245601), near the railway station, ♀ 30 July 1992, on sycamore foliage in an old well vegetated, sand/gravel pit, CR; Skerries (O247597), Dublin Road, ♀ 30 June 1999, in a domestic garden flying close to cultivated raspberry; Same locality, 3♂♂ 11 July 1999, emerged from a trap nest, attached to cultivated raspberry in a garden; Same locality, ♂ 19 May 2002, on blackcurrant foliage in a garden, all CR. **WESTMEATH (H23):** Longhill esker at Ardmorney (N3636), ♂ 7 June 1999, at hawthorn foliage in a disused gravel-pit, CR. **LOUTH (H31):** Baltray (O1577), sand dunes, 2♀♀ 13 August 2002, found while searching unsuccessfully for *Mimumesa littoralis*. Both females were flying around the base of marram-grass tussocks in the fore dune ridge, close to nesting *Crossocerus wesmaeli*, a rather unusual location in which to find this species, CR.

***Passaloecus monilicornis* Dahlbom, 1842**

KILKENNY (H11): south of Thomastown (S594402), ♀ 6 August 2002, in a scrubby clearing in mixed oak and conifer woodland by the River Nore, CR. **LAOIS (H14):** The Derry Hills (N264126), ♂ 10 June 2000, reared from a raspberry stem trap nest attached to an oak branch on the side of an esker hill. Two *P. monilicornis* cells had been completed, one of which had failed at the pre-pupal stage, CR. **WICKLOW (H20):** Clara Vale (T183916), oakwood, ♀ 21 May 1999, ♀ 24 May 1999, both reared from a raspberry stem trap nest, containing two intact cells, CR; Deputy's Pass (T2390), south of Glenealy, ♀ 19 June 2000, reared from a raspberry stem trap nest, attached to the branch of a small Scots pine, in mixed woodland. Six larval cells were present, of which, five failed at the pre-pupal stage, CR; Knocksink Wood NNR (O2117), ♂ 17 June 1993, in a clearing in oak woodland; Same locality, ♀ 5 August 1993, ♀ 24 July 1995, ♀ 27 July 1995, ♀ 28 July 1995, all at the edge of the main track into the reserve, close to some mature Scots pine, all CR. **MEATH (H22):** Drumman House (O005689), 2♀♀ 7 July 1997, at a hole in a dead ash stump; Same locality, ♂♀ 6 August 1997, at an ivy covered dead tree, all CR; Thomastown Bog (O008687), west of Duleek, ♀ 7 July 1997, ♀ 5 August 1997, both in a Malaise trap set up in a clearing in damp mixed woodland; Same locality, ♂ 28 April 1998, ♀ 8 July 1998, both reared from a raspberry stem trap nest, containing four intact larval cells, attached to a small oak tree in a clearing in damp mixed woodland. Two other cells failed at the pre-pupal stage; Same locality, ♂ 31 May 1999, ♂♀ 2 June 1999, 2♀♀ 4 June 1999, all reared from a drilled softwood trap nest, attached to an oak tree at the edge of the woodland, containing eight intact larval cells. Three cells failed at the pre-pupal stage, all CR.

Nyssoninae

***Harpactus tumidus* (Panzer, 1801)**

[*Arpactus tumidus* Panzer]

WATERFORD (H6): Tramore Burrows (S615003), ♀♀ 16 July 1999, seen at wild carrot, CR; Tramore Strand (S598008), ♂♂♀♀ 16 July 1999, seen at wild carrot growing on a sandy shingle ridge at the top of the beach, east of the car park, CR. **WEXFORD (H12):** Ballyteige Burrows (S926065), ♀ 12 August 2003, among dune front vegetation, including sea spurge and sea holly (*Eryngium maritimum*), CR. **WICKLOW (H20):** Knocksink Wood NNR (O218179), Enniskerry, ♀ 10 August 1995, on a sparsely vegetated slope at the rear of the reserve building; Same locality, ♀ 26 July 1996, caught on open ground in the clearing beside the reserve building; Same locality, ♂ 12 August 1996, on the ground in the paved courtyard of the reserve building, all CR.

Apidae

Colletinae

***Colletes similis* Schenck, 1853**

[*Colletes picistigma* Thomson]

WATERFORD (H6): Lisselty (X6299), west of Dunmore East, 2♂♂♀ 15 July 1999, at umbellifers on a sandy area below the soft-rock cliffs, CR; Tramore Burrows (S615003), ♀ 16 July 1999, at wild carrot in an area of high sand dunes, CR; Tramore Strand (S598008), ♂2♀♀ 16 July 1999, at wild carrot on a shingle ridge above the beach, CR. **WEXFORD (H12):** Ballyteige Burrows (S9306), ♀ 9 July 1999, 2♂♂ 11 July 1999, all at umbellifers in high dunes, CR; Chour (T0904), near Lady's Island Lake, ♀ 16 August 2001, at *Leontodon* sp. on a sandy ridge, CR; Curracloe (T114270), dunes, ♂♂♀♀ 14 July 1999, seen on dunes north of the Raven NNR, CR; Raven NNR (T114255), northern end, ♀ 12 July 1999, at yellow Compositae growing behind the fore-dunes at the northern end of the reserve; Raven NNR (T115230), southern end, ♂♀ July 1999, ♂ 12 July 1999, ♂♂♀♀ 14 July 1999, 2♂♂♀ 31 July 1999, ♀ 28 August 1999, all at umbellifers or bramble flowers growing in a large sandy clearing at the southern end of the reserve, all CR. **WICKLOW (H20):** Five-Mile Point (O3102), south east of Newcastle, ♂3♀♀ 18 August 1998, at wild carrot growing on the bank between the railway and the top of the shingle beach, 2♀♀ 3 September 2000, on a path at the edge of the railway line, CR. **DUBLIN (H21):** Giant's Grave (O269553), north of Rush, 2♀♀ 27 August 1993, at wild carrot in a cliff-top field beside the remains of a megalithic tomb, CR; Malahide (O235475), 'The Island', ♂♀ 19 July 1994, 3♀♀ 25 July 1995, ♂ 8 August 1997, all at wild carrot and ox-eye daisy (*Leucanthemum vulgare*) at the edge of the dunes on the western side of the peninsula, CR. **LOUTH (H31):** Baltray (O1577), sand dunes, ♂ 28 July 1997, on an umbellifer flower head in a sheltered area of the dunes, 2♂♂ 28 May 1999, reared from a cocoon dug out of a small bank, at the edge of a path through fixed dunes, on 10 February 1999, all CR.

***Colletes succinctus* (L., 1758)**

[*Colletes glutinans* Cuvier]

LAOIS (H14): Derry Hills (N2612), northwest of Clonaslee, 2♂♂2♀♀ 15 August 1997, at heather flowers, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♂ 2♀♀ 18 August 1999, at heath flowers. One female observed nesting in sandy turf on top of an isolated rock outcrop just offshore. ♀ 18 August 2000, at heath flowers, with a satellite fly (*Metopia* sp.) in close proximity, all CR. **OFFALY (H18):** Clongarret (N5625), west of Clonbulloge, ♂ 4 August 1998, at an umbellifer growing at the edge of a conifer plantation, CR; Clonmeen (N5329), south of Rhode, ♂ 4 August 1998, in a light industrial railway cutting at the edge of a bog, CR. **KILDARE (H19):** Lullymore (N7025), ♂ August 2000, in an area of cut-over bog, coll. R. Connolly, det. CR. **WICKLOW (H20):** Clara Vale (T185915), oak woods ♂ 19 September 2001, at heath (with ♀♀ *Andrena fuscipes*, and ♀♀ *Halictus rubicundus*), ♀ 23 August 2003, taken and others seen at heath at a disused sand/gravel pit, CR. **DUBLIN (H21):** Balscadden (O297390), Howth, ♀♀ 15 August 2003, at heath in a disused quarry above the car park, CR; Nose of Howth (O300387), ♂♂♀♀ 15 August 2003, in an area of dry heathland and cliff top vegetation, CR. **LOUTH (H31):** Stormanstown Bog (N9192), ♂♂♀♀ 23 August 2001, common at heath (3♂♂2♀♀ were taken). The size variation between specimens, both males and females, was very notable, CR. **EAST DONEGAL (H34):** Lisfannan (C331277), south of Buncrana, 3♂♂ 11 August 2003, taken in low sand dunes, '…observed at this site in previous years and there seemed to be hundreds if not thousands', R. Aldwell, det. CR.

***Hylaeus (Prosopis) brevicornis* Nylander, 1852**

[*Hylaeus minutus* Fabr.]

WICKLOW (H20): Clara Vale (T185915), oakwoods, ♀ 30 June 2001, on tormentil (*Potentilla erecta*) flowers growing near a disused gravel-pit, CR; Five-mile Point (O3102), south east of Newcastle, ♀ 18 August 1998, CR. **WEST GALWAY (H16):** Furnace Island

(L8324), north of Lettermullan, ♂ 2 July 1998, reared from a nest in a dead bramble stem, originally containing five cells, collected on 28 October 1997, CR.

***Hylaeus* (*Spatulariella*) *hyalinatus* Smith, F., 1843**

WEXFORD (H12): Ballyteigue Burrows NNR (S9306), ♂ 11 July 1999, collected at a low stone-faced bank at the edge of the dunes, just south of the pump-house, CR.

Andreninae

***Andrena* (*Andrena*) *praecox* (Scopoli, 1763)**

KILKENNY (H11): South of Thomastown (S594402), ♀ 8 April 2002, at dandelion (*Taraxacum*) in open oak woodland in the Nore river valley, CR. **DUBLIN (H21):** Grand Canal, Clondalkin (O0632) ♀ 10 April 1977, nesting in grass, 4♂♂♀ 23 April 1978, on *Salix* catkins by canal, D. N. Dowling, det. CR.

***Andrena* (*Melandrena*) *cineraria* (L., 1758)**

KILKENNY (H11): South of Thomastown (S594402), ♂♂♀♀ 8 April 2002, common in open woodland in the Nore river valley. Nesting in the ground was observed in some clearings, CR. **WEXFORD (H12):** East of Sculloge Gap (S838478), 3 May 2000, a nesting aggregation (2♂♂ and 20+♀♀ seen) on a sandy bank at the entrance to a conifer plantation, CR. **CARLOW (H13):** Ballykeenan woods (S725448), ♂ 23 April 2002, in an area cleared of conifer trees on a slope above the east bank of the River Barrow, CR. **MEATH (H22):** Boyne Valley National Park (O026727), Visitor Centre, ♂♂ (no ♀♀ present) 6 April 2000, numerous, flying low along a sunny, south-facing clay bank in the car park, CR; Near Newgrange (N995726), ♂♀ 19 April 1988, on a slope close to blackthorn (*Prunus spinosa*) scrub on the northern bank of the River Boyne; Same location, but now an improved pasture with no blackthorn scrub, ♀ 2 May 1997, all CR. **EAST MAYO (H26):** Carrownagower Bridge (M145591), 2♀♀ 24 June 2002, at yellow Compositae, in an area of disturbed limestone karst, beside the Corrib-Mask canal, CR. **LOUTH (H31):** Ballymakellet (J106118), Cooley peninsula, ♂ 9 May 1987, at the edge of a mountain stream cutting through glacial deposits, at 170m above sea level, CR; Stormanstown

Bog (N913924), 2♀♀ 10 May 2000, seen at willow catkins, CR.

***Andrena* (*Melandrena*) *nigroaenea* (Kirby, 1802)**

WEXFORD (H12): Hook Head lighthouse (X733973), ♂♂ 13 May 1998, flying low over cliff-top thrift (*Armeria maritima*) and dandelions, CR. **WICKLOW (H20):** Knocksink Wood NNR (O220176), ♀ 4 May 1995, at a sandy cutting inside the entrance to the reserve, CR. **DUBLIN (H21):** Drumanagh (O270557), south of Loughshinny, 3♂♂ 2♀♀ 4 May 1996, ♂ 2♀♀ 31 March 1997, ♂ 17 April 1997, all on cliff-top dandelions, CR; Drumanagh (O273560), 2♂♂ 5 June 2002, on hogweed (*Heracleum sphondylium*) at a south-facing cliff top. One of these males carried 15 larvae of an oil beetle (*Meloe* sp.), attached to the hairs of the pronotum and propodeum, CR; North of Loughshinny (O273573), ♂♂ 10 May 2002, flying over short turf on a slope above the sea, CR; Skerries (O247597), Dublin Road, ♀ 28 April 2000, in domestic garden at blackcurrant flowers, 2 ♀♀ 28 April 2001, in a domestic garden at Morello Cherry blossom and dandelion flowers, all CR; The Island (O2347), Malahide, ♂ 9 May 1994, ♂ 1 May 1997, both at dandelions on the estuary side of the dunes, CR. **MEATH (H22):** Boyne Valley NP (O026727), visitor centre, 2♂♂ 6 April 2000, flying along a sunny clay bank in the car park, CR. **WESTMEATH (H23):** Long Hill esker at Ardmorney (N3636), ♂ 7 June 1999, on a grassy slope where a road cuts through the esker ridge, CR. **LOUTH (H31):** Ferrard Cross (O1389), ♂♀ 19 April 1988, in a disused marl/clay pit, CR.

***Andrena* (*Cnemidandrena*) *denticulata* (Kirby, 1802)**

NORTH KERRY (H02): Castlelough (V9788) Killarney, ♂♀ 29 July 1998, at ragwort, coll. and det. I. Raemakers. **KILKENNY (H11):** South of Thomastown (S594402), 2♀♀ 6 August 2002, taken in open oak woodland beside the River Nore, CR. **WEXFORD (H12):** Ballyteige (S937067), The Cull, ♀♀ 12 August 2003, common on ragwort growing north of the pump-house, CR; South-east of Ballyroe (T098327), 3♀♀ 10 August 2000, at thistles (*Cirsium arvense*) at the edge of a dry pond, CR. **WEST GALWAY (H16):** Ballynakill Lough (L865220), Gorumna Island, ♀ 17 July 2000, at bramble flowers growing beside a track around the lake, CR. **WICKLOW (H20):** Knocksink Wood NNR (O218176), 2♂♂♀ 24 July 1998, in a clearing in oak woodland by the Glencullen River, CR.

***Andrena* (*Cnemidandrena*) *fuscipes* (Kirby, 1802)**

WEST GALWAY (H16): Furnace Island (L8324), north of Lettermullan, ♀ 24 August 1992, 2♀♀(one of which was an aberrant specimen: viewed from in front, the right facial fovea extends across the midline of the face and the right antenna and antennal socket are absent) 18 August 1999, both at heather, ♂♂♀♀ 16 August 2000 and 17 August 2000, in a rocky pasture with clumps of heather and bell heather; all CR. **WICKLOW (H20):** Clara Vale (T185915), oakwoods, ♀ 19 September 2001, (worn specimen) at heather beside an old gravel-pit, with ♀♀ *Colletes succinctus*, and ♀♀ *Halictus rubicundus*, CR; Upper Lake at Glendalough (T101963), ♂♂ 15 August 2002, flying among heather, on an open area of a south-facing slope above the track beside the lake, CR. **DUBLIN (H21):** Howth, Balscadden (O297389), ♂♂ 15 August 2003, in a disused quarry (with *Colletes succinctus*), flying above heather in flower, CR; Nose of Howth (O300388), ♂♂♀♀ 15 August 2003, in an area of coastal heath-land (with heather, bell heather and western gorse) at the top of sea-cliffs, CR.

***Andrena* (*Oreomelissa*) *coitana* (Kirby 1802)**

WEXFORD (H12): South-west of Ballyvaloo (T105297), ♀ 29 July 2000, at yellow Compositae in an area of gorse scrub, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♀ 27 June 1997, ♂♀ 3 July 1998, in a sheltered flower-rich pasture, ♀ 17 August 2000, on a sheltered south-facing rocky slope among heather, heath and western gorse, all CR. **OFFALY (H18):** Clonmeen (N5329), south of Rhode, ♀ 8 August 1998, in a cutting of a light industrial railway, CR. **WICKLOW (H20):** Clara Vale (T182916), oak woods, ♂ 30 June 2001, taken at bramble at the edge of a track in an open clearing near the Avonmore River, ♀♀ 21 July 2001, at bramble flowers close to Avonmore River; Same locality (T185915), gravel-pit, ♀♀ 30 June 2001, at flowers of heath speedwell (*Veronica officinalis*) at the edge of a track beside a disused gravel-pit; all CR. **WEST MAYO (H27):** Levalinree (M198983), ♂♂

21 July 2000, flying around birch foliage beside a stream, CR. **LOUTH (H31):** Riverstown (J167071), 7km south-east of Carlingford, ♀ 30 August 1991, at a sandy bank in the valley of the Castletown River, CR.

***Andrena* (*Leucandrena*) *barbilabris* (Kirby, 1802)**

[*Andrena sericea* Christ]

WEXFORD (H12): Ballyteige Burrows (S9306), 2♀♀ 9 July 1999, others seen, ♀♀ 11 July 1999, nesting in areas of loose sand, on the land side of the main dune ridge, CR; Raven NNR (T114255), northern end, ♀♀ 14 July 1999, seen nesting in an area of bare sand 25m in from the entrance of the reserve, 2♀♀ 1 June 2002, nesting in the same area, all CR. **OFFALY (H18):** Fin Lough (N034297), ♀ 1 June 2003, at yellow Compositae growing at the edge of an esker ridge, CR. **WICKLOW (H20):** Powerscourt estate (O219173), Enniskerry, ♀ 24 July 1995, in an area of bare sandy soil, cleared of conifers for a housing development, CR. **LOUTH (H31):** Baltray (O150772), sand-dunes, ♂♂♀♀ 15 May 1997, visiting flowers of hawthorn at the edge of dunes by the mouth of the River Boyne, CR.

***Andrena* (*Margandrena*) *marginata* Fabr., 1776**

WEST GALWAY (H16): Furnace Island (L8324), north of Lettermullan, ♀ 24 August 1992, ♂ 18 August 1999, ♀ 16 August 2000, ♂ 17 August 2000, ♂ 18 August 2000, all at devil's bit scabious (*Succisa pratensis*) in rocky unimproved flower-rich pastures, CR.

***Andrena (Micrandrena) minutula* (Kirby, 1802)**

[*Andrena minutula* K. sensu stricto.]

WEST CORK (H3): Coolcolaughta (V940402), south of Durrus, 2♀♀ 1 August 2001, (others seen), at *Potentilla* shrub in a garden, CR. **CLARE (H9):** Ballyeighter (R346940), ♀ 29 May 1984, JMOC, det CR. **KILKENNY (H11):** Archersgrove Quarry (S520548), ♀ 23 April 2002, in an overgrown disused quarry by the river Nore, south of Kilkenny city, CR; South of Thomastown (S594402), ♀ 3 May 2000, 4♂♂ 8 April 2002, all in open oak woodland beside the river Nore, CR. **CARLOW (H13):** Ballykeenan woods (S725448), ♂2♀♀ 23 April 2002, in an area cleared of conifers on a west-facing slope above the river Barrow, CR. **OFFALY (H18):** Clonmeen (N5329), south of Rhode, ♂♀ 4 August 1998, at bramble in the cutting of a light industrial railway, CR. **WICKLOW (H20):** Deerpark (N966155), Glending Wood, 2♀♀ 26 July 2002, on yellow Compositae growing on the edge of a track through mixed woodland, CR. **LOUTH (H31):** East of Giles Quay (J1605), ♀ 11 August 1998, in a gravel-pit, beside the Castletown River, CR; Togher (O1189), ♂ 9 August 1998, in a disused gravel-pit, CR.

***Andrena* (*Micrandrena*) *semilaevis* Pérez, 1903**

[*Andrena saundersella* Perkins]

WEXFORD (H12): Chour (T099044), Lady's Island Lake, ♀ 12 July 1999, at yellow Compositae on a sandy shingle ridge, CR. **OFFALY (H18):** Glyn (N093232), south of Ferbane, ♀ 16 June 2000, at yellow Compositae on the embankment of a dismantled railway, CR. **WICKLOW (H20):** Clara Vale (T195915), oakwoods, 2♀♀ 30 June 2001, at yellow Compositae at the edge of a track near a disused gravel-pit, CR; Powerscourt estate (O219173), Enniskerry, ♂ 24 July 1995, in an excavated sandy area cleared for a new housing development, CR. **DUBLIN (H21):** North of Loughshinny (O273573), 2♂♂ 10 May 2002, (others seen) on short turf on a slope above the sea, CR; Skerries (O247597), Dublin Road, ♀ 8 June 1997, ♀ 2 August 2000, both in a domestic garden, CR.

Halictinae

***Halictus* (*Halictus*) *tumulorum* (L., 1758)**

KILKENNY (H11): Archersgrove quarry (S520548), ♀ 23 April 2002, in an overgrown quarry by the River Nore, CR. **WICKLOW (H20):** Clara Vale (O1791), oak woods, ♂ 23 September 1997, in open woodland, CR. **DUBLIN (H21):** Drumanagh (O273560), ♀ 5 June 2002, on south-facing cliffs, above the sea, CR; Nose of Howth (O300387), ♂♂ 15 August 2003, common in an area of coastal heathland (with bell heather (*Erica cinerea*) and western gorse) at the top of the sea-cliffs, CR; Skerries (O245601), ballast-pit by railway station, 2 ♂♂ 21 August 1993, on an umbellifer flower head on a south-facing slope above a football-pitch, CR; Skerries

(O247597), Dublin Road, ♀ 24 August 2001, at *Eryngium planum* in a domestic garden, CR. **MEATH (H22):** Boyne Valley National Park (O027728), Visitor Centre, ♀ 6 April 2000, at a south-facing embankment in the carpark, CR.

***Lasioglossum* (*Lasioglossum*) *lativentre* (Schenck, 1853)**

[*Halictus lativentris* Schenck]

CLARE (H09): Kilnaboy (R2892), ♀ 13 June 1979, 'hazel scrub on limestone pavement with grassy patches', D. N. Dowling, det. CR.

***Lasioglossum* (*Evylaeus*) *fratellum* (Pérez, 1903)**

[*Halictus freygessneri* Alfken]

KILKENNY (H11): South of Thomastown (S594402), 3 ♀♀ 8 April 2002, nesting in an area of sparse great wood-rush (*Luzula sylvatica*) in open oak/conifer woodland, on the west bank of River Nore, CR. **WEXFORD (H12):** West of Kiltealy (S838477), ♀ 3 May 2000, on a dry bank at the entrance to a conifer plantation, between Sculloge Gap and Kiltealy, CR. **LAOIS (H14):** The Derry Hills (N2612), ♀ 28 June 2000, at yellow Compositae growing on the edge of an esker hill, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♀ 16 May 1986, taken at dandelion, 3♂♂ 24 August 1992, sheltering from wind on a purple-loosestrife (*Lythrum salicaria*) flower-spike, growing in a boggy ditch, 2♂♂ 13 July 1997, at bramble flowers, ♀ 19 August 1999, in an unimproved pasture, 2♀♀ 18 August 2000, at yellow Compositae in unimproved pasture, all CR; West of Cloonbeg Bridge (L756464), ♀ 20 June 2002, at yellow Compositae at the edge of a track through conifer plantations, CR. **NORTH EAST GALWAY (H17):** Clonbrock (M745407), ♂ 29 July 2001, at yellow Compositae in an area of cleared conifer plantation, CR. **OFFALY (H18):** Clonmeen (N5329), south of Rhode, ♂ 2♀♀ 4 August 1998, at bramble flowers in the cutting of a light industrial railway, CR; Derries (N6528), south of Edenderry, ♀ 23 April 1997, on dandelion at the edge of a cutover bog, CR. **WICKLOW (H20):** Clara Vale (O1791), oakwoods, ♀ 23 September 1997, at the edge of the main track in open woodland; Same locality (O185915), oak woods, ♂ 19 September 2001, at devil's-bit scabious in an old gravel-pit in open oak woodland, all CR; Deputy's Pass (T2390), oak woods, 2♀♀ 18 August 1998, in a clearing in mixed woodland, CR; Devil's Glen Woods (O2498), ♀ 30 May 1997, at the edge of the main track near the car park, CR; Kings River valley (O008018), south west of Knockalt Bridge, ♀ 16 June 1998, at yellow Compositae in an area of felled conifer plantation, CR; Knocksink Wood NNR (O218179), ♀ 31 May 1994, on the grassed roof of the reserve building, CR; Priest's Hall (O208112), Powerscourt Deerpark, ♀ 27 July 1998, at *Hieracium* sp. on the edge of a drained reservoir, CR. **LONGFORD (H24):** Royal Canal at Lyneen Bridge (N098678), ♀ 22 May 2001, nesting in the bank above the derelict canal, CR. **EAST MAYO (H26):** Carrownagower Bridge (M145591), 2♀♀ 25 June 2002, on yellow Compositae growing on disturbed limestone karst beside the Corrib-Mask canal, CR. **WEST MAYO (H27):** North east of Creggannagappul (L8175), ♀ 23 June 2002, at yellow Compositae on a track through conifer plantations on blanket bog, CR. **LOUTH (H31):** Stormanstown Bog (N9192), ♀ 4 June 1998, at dandelion, ♀ 10 May 2000, at willow catkins, ♂ 23 August 2001, at yellow Compositae, all in an area of cutover raised bog; all CR.

***Lasioglossum* (*Evylaeus*) *nitidiusculum* (Kirby, 1802)**

[*Halictus nitidiusculus* Kirby]

CARLOW (H13): Ballykeenan Woods (S724447), ♀ 23 April 2002, in an area cleared of conifers, on a west-facing slope above the River Barrow, CR. **WICKLOW (H20):** Knocksink Wood NNR (O218179), ♀ 31 May 1994, on the grassed roof of the reserve building, 2♀♀ 6 April 1995, ♀ 20 May 1995, ♂ 24 July 1995, all at yellow Compositae, CR; Powerscourt Estate (O219173), Enniskerry, ♀ 24 June 1995, in a sand pit cleared for a housing development, CR. **DUBLIN (H21):** Coast east of Kenure (O2655), 4♂♂♀ 27 August 1993, in cliff-top fields, CR; Skerries (O247597), Dublin Road, 2♂♂ August 1995, in a domestic garden, CR; The Island (O2347), Malahide, 2♀♀ 9 May 1994, ♀ 1 May 1997, 2♂♂ 22 July 1997, 6♂♂ 8 August 1997, at yellow Compositae and ox-eyed daisy; all CR. **LOUTH (H31):** East of Giles Quay (J1605), ♀ 11 August 1998, in a gravel pit, near the mouth of the Castletown River, CR.

***Lasioglossum* (*Evylaeus*) *rufitarse* (Zetterstedt, 1838)**

MEATH (H22): West of Obelisk Bridge (O040754), River Boyne, ♀ 7 August 1997, at a low earth bank beside the towpath of the derelict Boyne Navigation canal, CR.

***Lasioglossum* (*Dialictus*) *cupromicans* s. *hibernicum* Ebmer 1970**

[*Halictus smeathmanellus* K. (part)]

KILKENNY (H11): Castlegannon (S545305), quarry, ♀ 6 August 2002, on yellow Compositae growing in a disused quarry, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♂ 10 August 1996, ♀ 27 June 1997; both CR. **DUBLIN (H21):** Drumanagh (O2755), Loughshinny, 2♀♀ 9 September 1997, on cliff-top vegetation, CR; Skerries, Dublin Road (O247597), ♀ 21 July 1989, 2♂♂ 31 August 1994, all in a domestic garden, CR. **EAST MAYO (H26):** Carrownagower Bridge (M145591), 3♀♀ 24 June 2002, ♀ 25 June 2002, all at yellow Compositae in an area of hazel scrub growing on limestone karst, south of the Corrib-Mask canal, CR. **LOUTH (H31):** Dunany Point (O1591), 3♂♂ 24 August 1998, on a sloping boulder-clay cliff above the shoreline, CR.

***Sphecodes ephippius* (L., 1767)**

[*Sphecodes divisus* Kirby]

KILKENNY (H11): Archersgrove quarry (S520548), 3♀♀ 23 April 2002, in an overgrown disused quarry by the river Nore, CR; South of Thomastown (S594402), 2♀♀ 3 May 2000, 2♀♀ 8 April 2002, ♀ 23 April 2002, all in open oak woodland along Nore river valley, CR. **WEXFORD (H12):** West of Kiltealy (S838477), 2♀♀ 3 May 2000, at the entrance to a conifer plantation between Sculloge Gap and Kiltealy, CR. **NORTH EAST GALWAY (H17):** Mountsilk (M597500), northwest of Moylough, ♀ 29 July 2001, in disused gravel pit in an esker ridge, CR. **WICKLOW (H20):** Clara Vale (T1891), oak woods, ♀ 5 June 1998, at heath speedwell, CR; Knocksink Wood NNR (O216179), grassy clearing, ♀ 18 May 1993, in a grassy clearing in ash/hazel woodland by Glencullen river; Same locality (O218176), clearing in oakwood, ♀ 31 May 1993, ♀ 10 June 1993, ♀ 30 April 1996, all in a clearing in oak woodland beside the Glencullen river; Same locality (O220176), ♀ 4 May 1995, at a sandy cutting inside the entrance of the reserve; all CR. **DUBLIN (H21):** Skerries (O245601), ballast pit by railway station, ♀ 3 July 1993, on a south-facing sandy slope, ♀ 21 August 1993, on an umbellifer; both in a disused sand/gravel-pit, CR; **MEATH (H22):** Near Newgrange (N9972), 2♀♀ 19 April 1988, ♀ 2 May 1997, all on the north bank of the River Boyne, between Newgrange and Knowth, CR. **LOUTH (H31):** East of Giles Quay (J1605), ♂ 11 August 1998, in an area of gravel workings by the Castletown River, CR.

***Sphecodes geofrellus* (Kirby, 1802)**

[*Sphecodes affinis* von Hagens]

KILKENNY (H11): South of Thomastown (S594402), ♀ 23 April 2002, ♂ 6 August 2002, both at a gravel bank in open oak woodland along the Nore river valley, CR. **NORTH EAST GALWAY (H17):** Mountsilk (M597500), north-west of Moylough, ♀ 29 July 2001, in an old gravel-pit in an esker, CR. **OFFALY (H18):** Clonmeen (N5329), south of Rhode, ♂♀ 4 August 1998, at bramble flowers growing in a cutting of a light industrial railway, CR. **KILDARE (H19):** Baronsland (N830035), gravel pit, ♀ 16 June 1998, on a yellow Composite in a disused gravel pit, CR. **WICKLOW (H20):** Devil's Glen woods (T2498), ♀ 4 June1998, on yellow Compositae beside the main track; Knocksink Wood NNR (O220176), entrance, ♀ 9 June 1994, at a sandy cutting inside the entrance to the reserve; all CR; Powerscourt estate (O219173), Enniskerry, 2♀♀ 24 July 1995, in a sand pit cleared for a housing development, CR. **DUBLIN (H21):** Coast east of Kenure Park (O2655), 3♂♂2♀♀ 27 August 1993, at umbellifers and thistles, CR; Nose of Howth (O300388), ♀ 15 August 2003, in an area of dry coastal heath (with heather, heath and gorse) at the top of sea-cliffs, CR; Skerries (O2360), Milverton, ♀ 20 August 1993, on an umbellifer on a former dump, CR; Skerries (O245601), ballast pit by railway station, 2♂♂2♀♀ 21 August 1993, on umbellifers in a disused sand/gravelpit, CR; The Island (O2347), Malahide, ♂♀ 8 August 1997, on the estuary side of the peninsula, CR. **MEATH (H22):** Gormanston (O178674), north of the railway station, ♀ 20 July 1998, in a disused gravel/sand pit, CR; Near Newgrange (N9972), ♀ 2 May 1997, on a slope above the River Boyne, CR. **LONGFORD (H24):** Lismagawley bog (N025565), ♀ 22 May 2001, investigating holes in dry peat at the top of an old peat cutting, CR. **ROSCOMMON (H25):** Duggarry bog (M9636), north of Ballydangan, 4♂♂ 17 July 1997, on umbellifers and yellow Compositae, growing in and beside a drainage ditch, in a cutover bog, CR. **LOUTH (H31):** East of Giles Quay (J1605), 2♀♀ 11 August 1998, at thistles in gravel-workings by the Castletown River, CR; Togher gravel pit (O118895), ♂ 17 August 1987, 2♀♀ 25 May 1997, all in a disused gravel pit, CR.

***Sphecodes monilicornis* (Kirby, 1802)**

DUBLIN (H21): Skerries (O245601), ballast pit by railway station, ♀ 30 July 1992, ♀ 21 August 1993, on umbellifers on a south-facing slope in a disused sand/gravel-pit; all CR. **MEATH (H22):** Gormanston (O176661), gravel pit, ♂ 25 July 1989, in an abandoned gravel pit, CR; Lismullin House (N934615), 2♂♂ 29 August 1991, close to holes in a gravelly river bank, CR; Near Newgrange (N9972), ♀ 2 May 1997, 2♀♀ 18 August 1997, all at an area of bare clay on the north bank of the River Boyne between Newgrange and Knowth, CR. **ROSCOMMON (H25):** Duggarry bog (M9636), north of Ballydangan, 2♀♀ 17 July 1997, on umbellifers growing in and beside a drainage ditch, in a cutover bog, CR. **LOUTH (H31):** Baltray (O1577), dunes, ♀ 18 May 1998, beside a hawthorn bush in the dunes, CR; Togher (O1189), gravel pit, ♂ 9 August 1998, in an abandoned gravel pit, CR.

Megachilinae

***Megachile* (*Megachile*) *centuncularis* (L., 1758)**

WEXFORD (H12): Grange Wood (S802060), cliffs, ♀ 13 July 1999, at bramble growing on a clay bank above a low cliff, CR. **DUBLIN (H21):** Drumanagh (O2755), south of Loughshinny, ♀ 9 September 1997, at a blackberry flower on cliff top, CR; Skerries (O247597), Dublin Road, ♂ 15 August 1993, on *Dimorphotheca* flowers in a domestic garden, ♀ 2 August 1994, ♀ 7 August 1994, ♀ 21 August 1994, all emerged from cells found in the cavity of a ventilationbrick, ♂ 8 August 1994, in garden, ♂14 August 2000, ♀ 17 August 2000, ♀ 20 August 2000, all emerged from cells in a bored-wood trap nest attached to a wooden trellis in a domestic garden, ♂ 16 May 2002, sunning itself on a wall in garden; all CR.

***Megachile* (*Megachile*) *versicolor* Smith, F., 1844**

WEXFORD (H12): Raven NNR (T115230), southern end, ♂ 1 July 1999, flying over sandy ground in a clearing in conifer woodland, ♀♀ 12 July 1999, nesting in dead wood, ♂♂♀♀ 14 July 1999 and 31 July 1999, flying near dead Scots pines; all CR. **LAOIS (H14)** Derry Hills (N2612), north-west of Clonaslee, ♀ 15 August 1997, at the edge of a cutover raised bog, CR. **WEST GALWAY (H16):** Ballynakill Lough (L865220), Gorumna Island, 2♂♂ 17 July 2000, at bramble flowers, in rough pasture south of the lake, all CR; Furnace Island (L8324), north of Lettermullan, ♀ 10 August 1996, and others seen, nesting in a dry piece of salvaged driftwood, riddled by ship-worm (*Toredo* sp.) borings; Same location, ♀ 17 July 1997; all CR. **DUBLIN (H21):** Lucan (O0436), ♀11 June 1978, on flowers in a wild garden near the river, coll. D. N. Dowling, det. CR; Skerries (O247597), Dublin Road, ♂♀♀ 14 July 1998, nesting in bored wood, ♂♀♀ 4 August 2000, nesting in bored wood, ♂ 7 July 2002, at devil's-bit scabious; all in a domestic garden, all CR. **LOUTH (H31):** Stormanstown Bog (N9192), ♀ 23 August 2001, at bramble flowers growing on a cutover bog, CR.

***Megachile* (*Delomegachile*) *willughbiella* (Kirby, 1802)**

WEXFORD (H12): The Cull (S935070), Ballyteige, ♂ 12 August 2003, at a sand pile close to the pump-house, CR. **LAOIS (H14):** The Derry Hills (N2612), north-west of Clonaslee, ♀15 August 1997, at the edge of a cutover raised bog, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♀ 27 June 1997, nesting in piece of dry driftwood riddled by ship-worm (*Toredo* sp.) borings, ♀ 19 July 2000, taken at a stone wall, other females seen in the area and ♂ (with the expanded fore tarsi) seen; all CR. **DUBLIN (H21):** Skerries (O247597), Dublin Road, ♀ 8 July 1997, on the windowpane of a shed, ♂ 22 August 1998, 2♂♂ 7 September 1998, ♀ 9 September 1998, ♀ 19 September 1998, ♂ 4 October 1998, all reared from cocoons found in rotting timber during renovation of a shed roof in September 1997. Dates given are emergence dates from the cocoons; all CR.

***Megachile (Xanthosarus) maritima* (Kirby, 1802)**

WATERFORD (H6): Tramore Burrows (S615003), ♀ 16 July 1999, CR. **WEXFORD (H12):** Ballyteige Burrows NNR (S9306), ♂ 11 July 1999, CR; Ballyteige (S935070), The Cull, ♀ 12 August 2003, at common bird's-foot-trefoil (*Lotus corniculatus*) growing close to a pump-house, CR; Northern end of the Raven NNR (T114255), 2♀♀ 14 July 1999, nesting in a flat sandy area of sparse grass near picnic tables inside the entrance of the reserve; Raven NNR (T115230), southern end, ♀♀ 14 July 1999, seen at bramble flowers, pair *in copulation* on 17 July 1999, under a piece of dead wood lying on bare sand in a clearing, 2♀♀ 31 July 1999, in sandy clearing in conifer plantation; all CR.

***Coelioxys (Coelioxys) elongata* Lepeletier, 1841**

WEXFORD (H12): Raven NNR (T115230), southern end, ♀ 1 July 1999, flying close to nests of *Megachile versicolor* in dead conifer trees, CR; Same location, ♀ 20 July 2002, flying low over the surface of the sand in a large clearing, CR. **LAOIS (H14):** The Derry Hills (N2612), 2♀♀ 15 August 1997, at flowers of knapweed (*Centaurea nigra*) at the edge of cut over bogland, CR.

***Coelioxys (Coelioxys) inermis* (Kirby, 1802)**

WEXFORD (H12): Raven NNR (T115230), southern end, ♂ 31 July 2000, ♂ 3 August 2000, ♀ 5 August 2000, all reared from a three-celled *Megachile* sp. nest in a trap nest. No un-parasitised host cells were present; Same location, ♂ 29 July 2000, ♀ 8 August 2000, both reared from a 6-celled nest of *Megachile versicolor* in a *Rubus* stem trap nest. Three ♀♀ *Megachile versicolor* eclosed from the unparasitised cells and one cell failed; Same location, ♂ 28 July 2000, reared from a bored-wood trap nest containing five *Megachile versicolor* cells, two of which failed, two produced ♂♂ *Megachile versicolor* and the last contained the *Coelioxys* cocoon (Eight *Ancistrocerus trifasciatus* (Vespidae) cells were also present in the same boring); Same location, ♂ 2 August 2000, reared from a bored-wood trap nest containing 5 cells of *Megachile versicolor* (3♀♀, 1♂ *Megachile* eclosed successfully); all CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♀17 July 1997, flying near a rocky outcrop, ♂ 3 July 1998, sunning itself on a stonewall; Same location, 2♂♂ 24 July 2002, ♀ 27 July 2002, all reared from a drilled-wood trap nest attached to a fence post (No intact host cells survived); all CR.

Apinae

***Nomada argentata* Herrich-Schäffer, 1839**

WEST GALWAY (H16): Furnace Island (L8324), north of Lettermullan, 2 ♂♂ 18 August 1999, flying low on a sheltered slope in a rocky pasture, 4♀♀ 17 August 2000, flying among heather and western gorse on a sheltered slope in an unimproved rocky pasture; all CR.

***Nomada fabriciana* (L., 1767)**

KILKENNY (H11): South of Thomastown (S594402), ♂3♀♀ 8 April 2002, and many others seen, in oak/conifer woodland beside the River Nore, CR. **CARLOW (H13):** Ballykeenan woods (S724447), ♂ 23 April 2002, in an area cleared of conifer trees, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♀ 13 July 1997, flying low on a sheltered slope, in an unimproved rocky pasture, CR. **WICKLOW (H20):** Knocksink Wood NNR (O2117), ♀ 10 July 1995, on sloping ground at the back of the reserve building, ♀ 18 May 1996, near some mature Scots pines by the edge of the track into the reserve; all CR. **DUBLIN (H21):** Skerries (O247597), Dublin Road, ♀ 30 April 2001, seen flying slowly over an area of bare soil in a domestic garden, CR. **MEATH (H22):** Near Newgrange (N9972), ♂2♀♀ 19 April 1988, on the slope above the north bank of the river Boyne, CR; North of railway station at Gormanston (O178674), ♂ 20 July 1998, in a disused sand/gravel pit, CR. **LOUTH (H31):** Riverstown (J167071), 7km south east of Carlingford, ♀ 30 August 1991, at a sandy riverbank in the valley of the Castletown River, CR; Togher (O1189), east of Dunleer, ♀ 19 April 1988, in a sand/gravel pit, CR.

Nomada goodeniana **(Kirby, 1802)**

WICKLOW (H20): West of Woodenbridge (O175781), ♂ 3 May 2000, flying around willow in woodland by the Aughrim River, CR. **DUBLIN (H21):** Drumanagh (O270557), south of Loughshinny, ♂ 4 May 1996, on dandelion, at the top of a boulder-clay cliff, ♂ 17 April 1997, on cliff-top vegetation, CR; North of Loughshinny (O273575), ♂ 10 May 2002, flying along grassy bank near the sea, CR; Skerries (O247597), Dublin Road, ♂ 30 April 1994, in a domestic garden, CR. **MEATH (H22):** Near Newgrange (N9972), ♀ 2 May 1997, on a slope above the north bank of the River Boyne, CR.

Nomada leucophthalma **(Kirby, 1802)**

SOUTH TIPPERARY (H7): Glengarra Wood (R9219), ♂ 18 July 1979, 'open mature mixed wood by stream', D. N. Dowling, det. CR. **WICKLOW (H20):** Knocksink Wood NNR (O2117), ♂2♀♀ 21 April 1979 'sandy bank in deciduous wood', coll. D. N. Dowling, det. CR. Same locality (O218176), 4♀♀ 6 April 1995, ♀ 21 April 1995, all at the edge of the track into the reserve, CR; Same locality (O220176), ♀ 19 April 1996, ♀ 26 April 1996, both at a sandy cutting at the entrance to the reserve, CR; **DUBLIN (H21):** Clondalkin (O0632) 2♀♀ 23 April 1978 'at nest burrows in canal bank', coll. D. N. Dowling, det. CR. **MEATH (H22):** Near Newgrange (N9972), 2♀♀ 19 April 1988, on the slope above the north bank of the River Boyne, CR. **LOUTH (H31):** Togher (O110890), gravel pit, 4♀♀ 19 April 1988, flying close to a sandy ridge in a disused gravel pit, CR.

Nomada rufipes **Fabr., 1793**

WEXFORD (H12): South west of Ballyvaloo (T105297), ♂♀ 10 August 2000, at a sandy bank in an area of gorse, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, 3♂♂ 18 August 1999, 3♂♂♀ 16 August 2000, ♀ 17 August 2000, ♀ 18 August 2000, all flying low among heather and western gorse on a south-facing slope in an unimproved rocky pasture, CR. **DUBLIN (H21):** Nose of Howth (O300387), ♂♂♀♀ 15 August 2003, ♀♀ common along a low south facing bank in an area of coastal heathland (with heather, heath and western gorse), CR. **LOUTH (H31):** Riverstown (J167071), 7km south west of Carlingford, ♀ 30 August 1991, at a sandy river bank in the valley of the Castletown River, CR.

***Nomada striata* Fabr., 1793**

[*Nomada hillana* Kirby]

WEXFORD (H12): Ballyteige (S937068), The Cull, ♀ 11 June 1999, flying along a low grassy clay bank, in an area of reclaimed polder-land, CR (This specimen was incorrectly identified as *Nomada ruficornis* in Ronayne, 2000). **WICKLOW (H20):** Clara Vale (T1891), oak woods, ♂2♀♀ 5 June 1998, at heath speedwell, growing at the side of a track through open oak woodland; Same locality, ♀ 30 June 2001, at the side of a track, at a disused gravel-pit; all CR.

***Bombus (Pyrobombus) jonellus* (Kirby, 1802)**

[*Bombus scrimshiranus* Kirby]

SOUTH KERRY (H01): Derrynane (V5458), Caherdaniel, ☿☿ 14 May 2001, at birdsfoot trefoil and red clover in sand dunes, coll. and det. I. Raemakers.

***Bombus (Pyrobombus) monticola* Smith, 1849**

WICKLOW (H20): Kings River valley (O008018), south west of Knockalt Bridge, 2☿☿ 16 June 1998, visiting white clover (*Trifolium repens*), in a felled conifer plantation, CR.

***Bombus (Thoracobombus) muscorum* (L., 1758)**

SOUTH KERRY (H01): Derrynane (V5458), Caherdaniel, ☿☿ 14 May 2001, 'mainly at kidney vetch (*Anthyllis vulneraria*) on sand dunes', coll. and det. I. Raemakers. **DUBLIN (H21):** Botanic Gardens (O148375), Glasnevin, ♀ and ☿ 5 May 2002, queen seen at azaleas and a fresh-looking worker at flowering heather, during a Dublin Naturalists Field Club visit, R. Aldwell and CR; Clondalkin (O0632) ♀ 20 May 1978, coll. D. N. Dowling, det. CR; Drumanagh (O273560), south of Loughshinny, ♀ 5 June 2002, on ground in short turf on south facing slope above the sea, CR. **LONGFORD (H24):** Lismagawley Bog (N025565), ♀ 22 May 2001, flying over an area of herb rich river meadow, CR.

***Bombus* (*Thoracobombus*) *ruderarius* (Müller, 1776)**

WEST GALWAY (H16): Furnace Island (L8324), north of Lettermullan, 2☿☿ 3 July 1998, ♂ 18 August 1999, ♂ 16 August 2000, all in an area of rough pasture, CR; South of Ballynakill Lough (L865220), Gorumna Island, ☿ 17 July 2000 in rough pasture beside lake, CR.

***Bombus* (*Psithyrus*) *barbutellus* (Kirby, 1802)**

[*Psithyrus barbutellus* Kirby]

NORTH KERRY (H2): Cloghoreen Blue Pool (V9886), Killarney, ♀ 27 June 1976, D. N. Dowling, det. CR; **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, ♂ 16 August 2000, in an area of rough unimproved pasture and rocky outcrops, CR.

***Bombus* (*Psithyrus*) *bohemicus* (Seidl, 1837)**

[*Psithyrus distinctus* Pérez]

KILKENNY (H11): South of Thomastown (S594402), ♀ 3 May 2000, ♀ 8 April 2002, ♂ 6 August 2002, in open oak woodland along the Nore river valley; all CR. **OFFALY:** Blundell Aqueduct (N643313), Edenderry, ♂ 27 July 2000, on bramble flower beside canal, CR. **WICKLOW (H20):** Near Newcastle (O3002), ♀ 6 August 1978, 'freshwater marsh on coast, with Salix scrub', D.N. Dowling, det. CR. **WEST MAYO (H27):** Creggannagappul (L8175), ♀ 23 June 2002, on track side flowers, in conifer plantation on blanket bog, G. Sharkey and CR. **LOUTH (H31):** Stormanstown Bog (N913924), west of Ardee, 2♂♂ 10 May 2000, at the edge of a cut over raised bog, CR.

***Bombus* (*Psithyrus*) *campestris* (Panzer, 1800)**

[*Psithyrus campestris* Panzer]

NORTH KERRY (H2): Cloghoreen Blue Pool (V9886), Killarney, ♀ 6 July 1976, D. N. Dowling, det. CR. **LAOIS (H14):** South east of Bordowin (N294019), ♂ 16 June 2000, at a bramble patch in a clearing in the Delour river valley, CR. **WEST GALWAY (H16):** Furnace Island (L8324), north of Lettermullan, 7♂♂ 18 August 1999, both pale and dark forms common at various flowers in an unimproved pasture; Same location, 3♂♂ 16 August 2000, two pale and one dark form; Same location, ♀ 26 June 2001, completely black except for reddish hairs on tarsi; all CR.

***Bombus* (*Psithyrus*) *rupestris* (Fabr., 1793)**

[*Psithyrus rupestris* Fabr.]

WEST GALWAY (H16): South of Ballynakill Lough (L865220), ♀ 17 July 2000, in a flower-rich pasture, CR; Furnace Island (L8324), north of Lettermullan, ♀ 3 July 1998, flying low in a rocky flower-rich pasture; Same location, 2♀♀ 17 July 2000, flying low over an area of rocky outcrops with heath and western gorse; both CR.

***Bombus* (*Psithyrus*) *sylvestris* Lepeletier, 1833**

[*Psithyrus quadricolor* misident.]

WICKLOW (H20): Priest's Hall (O208112), former reservoir, ♂ 27 July 1998, at the edge of a track through conifer plantation, CR. **EAST MAYO (H26):** Carrownagower Bridge (M145591), ♂ 24 June 2002, on bramble flowers growing on disturbed limestone karst beside the Corrib-Mask canal, G. Sharkey and CR. **WEST MAYO (H27):** South-east of Cloonee (M142741), ♀ 25 June 2002 in an area of drained blanket bog and birch scrub, G. Sharkey and CR.

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REFERENCES

Amiet, F., Hermann, M., Müller, A., and Neumeyer, R. (2004) Apidae 4. *Fauna Helvetica* **9**. Centre Suisse de cartographie de la faune.

Celary, W. (1995) Nomadini of Poland. *Monografie Fauny Polski* **20.** Polska Akademia Nauk Instytut Systematyki I Ewolucji Zwieraząt.

Edwards, M. and Jenner, M. (2005) *Field guide to the bumblebees of Great Britain and Ireland.* Countryside and Garden Conservation Series, Ocelli Press, U. K.

Else, G. R. (1999) Leaf cutter bees. *British Wildlife* **10** (No. 6): 388-392. British Wildlife Publishing, Rotherwick, Hampshire.

Else, G. R. (2005) Checklist of British Hymenoptera Aculeata. Pp 113-131. *In* Archer M. E. (ed.) *Bees, Wasps and Ants Recording Society Members Handbook.* Third edition. Centre for Ecology and Hydrology, N. E. R. C.

Murray, T. E., Stout, J. C. and Brown, M. J. F. (2005) Additions to the Irish Apoidea: *Andrena trimmerana* and *Osmia rufa* (Hymenoptera). *Irish Naturalists' Journal* **28**: 48-49.

Nelson, B., Ronayne, C., Nash, R. and O'Connor, J. P. (2001). Additions and changes to the Irish aculeate Hymenoptera checklist. *Irish Naturalists' Journal* **26**: 453-459.

O'Connor, J. P. and Ashe, P. (2000) *Irish indoor insects – a popular guide.* Townhouse Press, Dublin.

Olmi, M. (1999) Hymenoptera Dryinidae-Embolemidae. *Fauna d'Italia* **37**. Edizioni Calderini, Bologna.

Prys-Jones, O. E. and Corbet, S. A. (1987) *Bumblebees.* Naturalists' Handbooks **6**. Cambridge University Press, Cambridge.

Richards, O. W. (1978) Aculeata. Pp 126-140. *In* Fitton, M. G. and Graham, M. W. R. de V. (eds) A check list of British insects. Part 4: Hymenoptera. *Handbooks for the Identification of British Insects* **9**(4): i-ix, 1-159.

Ronayne, C. (2000) Aculeate Hymenoptera from southeast Ireland, July and August 1999. *Bees Wasps and Ants Recording Society Newsletter,* Spring 2000.

Ronayne, C. and O'Connor, J. P. (2003). Distributional records of some Aculeata (Hymenoptera) collected in Ireland from 1980-2002. *Bulletin of the Irish Biogeographical Society* **27**: 227-254.

Skinner, G. J. and Allen, G. W. (1996) *Ants*. Naturalists Handbooks **24**. The Richmond Publishing Company, Slough.

Stelfox, A. W. (1927) A list of the Hymenoptera Aculeata of Ireland. *Proceedings of the Royal Irish Academy* **22B:** 201-335.

Wardlaw, J. C., Elmes, G. W., and Thomas, J. A. (1998) Techniques for studying *Maculinea* butterflies: II. Identification guide to *Myrmica* ants found on *Maculinea* sites in Europe. *Journal of Insect Conservation* **2:** 119-127.

Appendix

List of Irish Hymenoptera (Aculeata): Chrysidoidea, Vespoidea, and Apoidea

A. W. Stelfox published the last complete list of the Hymenoptera Aculeata occurring in Ireland (Stelfox, 1927). The following list brings the species nomenclature and higher classification up to date, and includes those species added to the Irish list since 1927.

Vagrant species (e.g. *Polistes omissus* Weyrauch (Vespidae) associated with imported fruit and vegetables), hothouse species (e.g. *Tetramorium lucayanum* Wheeler and *Monomorium pharaonis* (L.) (Formicidae) only found in artificially heated structures), and warehouse species (e.g. *Holepyris sylvanidis* (Brèthes) and *Plastanoxus munroi* Richards (Bethylidae)) associated with pests in imported stored grain and foodstuffs, have been excluded. References relating to the occurrence in Ireland of these and other 'tramp species' can be found in Stelfox (1927), O'Connor and Ashe (2000) and Ronayne and O'Connor (2003).

The list of Dryinidae draws on the distribution information given in Olmi (1999), based on his examination of specimens in the A. H. Haliday collection in NMI, Dublin.

Currently accepted names are in bold type, followed in indented normal type by selected species synonyms relevant to the Irish fauna (For further synonomies see Richards (1978) and Else (2005)).

CHRYSIDOIDEA

Dryinidae

Aphelopinae

***Aphelopus atratus* (Dalman, 1823)**

    holomelas Richards, 1939

***Aphelopus melaleucus* (Dalman, 1818)**

***Aphelopus serratus* Richards, 1939**

Anteoninae

***Anteon arcuatum* Kieffer, 1905**

imberbis Kieffer, 1905

bensoni Richards, 1939

jurineanum Perkins, J.F. 1976

***Anteon brachycerum* (Dalman, 1823)**

lyde (Walker, 1837)

nigricornis Kieffer, 1905

triareolatus Kieffer, 1905

brevicollis Kieffer, 1905

flavitarsis Kieffer, 1905

indivisus Kieffer, 1905

nigroclavatus Kieffer, 1905

curvatus Kieffer, 1906

obscuricomis Kieffer, 1906

suffolciensis (Chitty, 1908)

curvus Kieffer, 1914

***Anteon ephippiger* (Dalman, 1818)**

collaris (Dalman, 1818)

albidicollis Kieffer, 1905

albidocolle Richards, 1939

***Anteon flavicorne* (Dalman, 1818)**

subflavicornis Haupt, 1941

***Anteon fulviventre* (Haliday, 1828)**

similis Kieffer, 1905

gracilicollis Kieffer, 1905

flavinervis Kieffer, 1905

parvulus Kieffer, 1905

xanthostigma Kieffer, 1905

flaviscapus Kieffer, 1905

parvus Kieffer, 1906

alutaceus Richards, 1935

***Anteon gaullei* Kieffer, 1905**

cameroni Kieffer, 1905

trivialis Kieffer, 1905

rufulocollis (Chitty, 1908)

***Anteon infectum* (Haliday, 1837)**

inclytus (Haliday, 1837)

fusiformis Kieffer, 1905

luteicornis Kieffer, 1905, *sensu* Richards, 1939, and Perkins, 1976

ellimani (Chitty, 1908)

***Anteon jurineanum* Latreille, 1809**

brevicornis (Dalman, 1818)

cursor (Haliday, 1828)

otiartes (Walker, 1837)

sisithrus (Walker, 1837)

nanus (Haliday, 1837)

crenulatus Kieffer, 1905

vicinus Kieffer, 1905

marginatus Kieffer, 1905

rectus Kieffer, 1905

scoticus Kieffer, 1905

barbatus (Chitty, 1908)
nec *jurineanum* Richards, 1939
nec *jurineanum* Perkins, J. F., 1976

***Anteon pubicorne* (Dalman, 1818)**

lucidus (Haliday, 1828)
penidas (Walker, 1837)
alorus (Walker, 1837)
fuscoclavatus Kieffer, 1905
triangularis Kieffer, 1905
divisus Kieffer, 1905
vulgaris Kieffer, 1905
breviventralis (Chitty, 1908)
delicatulus (Chitty, 1908)

***Anteon tripartitum* Kieffer, 1905**

tricarinatus Kieffer, 1905
kiefferi (Chitty, 1908)

***Lonchodryinus ruficornis* (Dalman, 1818)**

frontalis (Dalman, 1818)
basalis (Dalman, 1818)
fuscicornis (Dalman, 1818)
longicornis (Dalman, 1823)
crassimanus (Haliday, 1828)
daos (Walker, 1837)
ilus (Walker, 1837)
misor (Walker, 1837)
subapterus (Kieffer, 1905)

aequalis (Kieffer, 1905)

melanocera (Kieffer, 1905)

vitellinipes (Kieffer, 1905)

procericornis (Kieffer, 1905)

declivis (Kieffer, 1905)

pallidinervis (Kieffer, 1905)

integer (Kieffer, 1905)

curvinervis (Kieffer, 1905)

fractinervis (Kieffer, 1905)

hyalinipennis (Kieffer, 1905)

longifilis (Kieffer, 1906)

halidayi (Kieffer, 1906)

morleyi (Chitty, 1908)

luffnessensis (Chitty, 1908)

beaumonti (Chitty, 1908)

walkeri (Kieffer, 1914)

parcepunctatus (Kieffer, 1914)

foveatus (Richards, 1971)

Gonatopodinae

***Gonatopus bicolor* (Haliday, 1828)**

vitripennis (Haliday, 1833)

excisus (Westwood, 1833)

***Gonatopus distinguendus* Kieffer, 1905**

flavicornis Thomson, 1860

excavatus Sahlberg, 1910

thomsoni Hellén, 1953

***Gonatopus striatus* Kieffer, 1905**

richardsi (Moczar, 1965)

***Gonatopus clavipes* (Thunberg, 1827)**

sepsoides Westwood, 1833

sociabilis Kieffer, 1907

barbatellus Richards, 1939

Bethylidae

Epyrinae

***Cephalonomia formiciformis* Westwood 1833**

polypori (Förster, 1850)

brevipennis Kieffer, 1906

formiciformis var. *sulcata* Kieffer, 1906

Bethylinae

***Bethylus cephalotes* Förster, 1860**

fuscicornis var. *tibialis* Kieffer, 1905

***Bethylus fuscicornis* (Jurine, 1807)**

sygenesiae Haliday, 1834

fulvicornis Curtis, 1838

triareolatus Förster, 1851

variabilis (Thomson, 1862)

hyalinus (Marshall, 1874)

fuscicornis var. *maurus* Kieffer, 1905

fuscicornis brevipennis Hellén, 1920

berlandi Arle, 1929

Chrysididae

Elampinae

***Pseudomalus auratus* (Linnaeus, 1758)**

***Hedychridium ardens* (Latreille in Coquebert, 1801)**

Chrysidinae

***Chrysis ignita* (Linnaeus, 1758)**

***Chrysis impressa* Schenck, 1856**

***Chrysis mediata* Linsenmaier, 1951**

***Chrysis rutiliventris* Abeille de Perrin, 1879**

vanlithi Linsenmaier, 1959

VESPOIDEA

Tiphiidae

Tiphiinae

***Tiphia minuta* Vander Linden, 1827**

Mutillidae

Myrmosinae

***Myrmosa atra* s. *erythrocephala* Yarrow, 1954**

Formicidae

Formicinae

***Formica aquilonia* Yarrow, 1955**

***Formica fusca* Linnaeus, 1758**

***Formica lemani* Bondroit, 1917**

***Formica lugubris* Zetterstedt, 1838**

***Lasius alienus* (Förster, 1850)**

***Lasius flavus* (Fabricius, 1781)**

***Lasius fuliginosus* (Latreille, 1798)**

***Lasius mixtus* (Nylander, 1846)**

mixtoumbratus Forel, 1874

***Lasius niger* (Linnaeus, 1758)**

***Lasius platythorax* Seifert, 1991**

***Lasius umbratus* (Nylander, 1846)**

Myrmicinae

***Myrmica rubra* (Linnaeus, 1758)**

laevinodis Nylander, 1846

longiscapus Curtis, 1854

***Myrmica ruginodis* Nylander, 1846**

ruginodolaevinodis Forel, 1874

macrogyna Brian and Brian, 1949

microgyna Brian and Brian, 1949

***Myrmica sabuleti* Meinert, 1860**

***Myrmica scabrinodis* Nylander, 1846**

***Myrmica schencki* Emery, 1895**

***Leptothorax acervorum* (Fabricius, 1793)**

***Tetramorium caespitum* (Linnaeus, 1758)**

hammi Donisthorpe, 1936

***Stenamma westwoodi* Westwood, 1840**

Pompilidae

Pepsinae

***Priocnemis (Priocnemis) exaltata* (Fabricius, 1775)**

***Priocnemis (Priocnemis) fennica* Haupt, 1927**

***Priocnemis (Priocnemis) gracilis* Haupt, 1927**

***Priocnemis (Umbripennis) perturbator* (Harris, 1780)**

***Dipogon (Deuteragenia) variegatus* (Linnaeus, 1758)**

Pompilinae

***Pompilus cinereus* (Fabricius, 1775)**

***Episyron rufipes* (Linnaeus, 1758)**

***Anoplius (Anoplius) concinnus* (Dahlbom, 1845)**

***Anoplius (Anoplius) nigerrimus* (Scopoli, 1763)**

***Arachnospila (Ammosphex) anceps* (Wesmael, 1851)**

***Arachnospila (Anoplochares) spissa* (Schiødte, 1837)**

***Evagetes crassicornis* (Shuckard, 1837)**

Ceropalinae

***Ceropales maculata* (Fabricius, 1775)**

Vespidae

Eumeninae

***Odynerus (Odynerus) spinipes* (Linnaeus, 1758)**

***Ancistrocerus gazella* (Panzer, 1798)**

***Ancistrocerus nigricornis* (Curtis, 1826)**

callosus (Thomson, 1870)

***Ancistrocerus oviventris* s. *hibernicus* Blüthgen, 1937**

pictus (Curtis, 1829)

***Ancistrocerus parietinus* (Linnaeus, 1761)**

***Ancistrocerus scoticus* (Curtis, 1826)**

trimarginatus misident.

***Ancistrocerus trifasciatus* (Muller, 1776)**

trimarginatus (Zetterstedt, 1838)

***Symmorphus bifasciatus* Linnaeus, 1761**

mutinensis (Baldini, 1894)

sinuatus (Fabricius, 1793) preoccupied

sinuatissimus Richards, 1935

Vespinae

***Dolichovespula* (*Pseudovespula*) *norwegica* (Fabricius, 1781)**

***Dolichovespula* (*Pseudovespula*) *sylvestris* (Scopoli, 1763)**

***Vespula* (*Vespula*) *austriaca* (Panzer, 1799)**

***Vespula* (*Vespula*) *rufa* (Linnaeus, 1758)**

***Vespula* (*Paravespula*) *germanica* (Fabricius, 1793)**

***Vespula* (*Paravespula*) *vulgaris* (Linnaeus, 1758)**

APOIDEA

Sphecidae

Sphecinae

***Ammophila sabulosa* (Linnaeus, 1758)**

***Podalonia affinis* (Kirby, 1798)**

lutaria (Fabricius, 1787)

Crabronidae

Astatinae

***Dryudella pinguis* (Dahlbom, 1832)**

stigma misident.

Larrinae

***Tachysphex pompiliformis* (Panzer, 1805)**

pectinipes misident.

***Trypoxylon attenuatum* Smith, F., 1851**

***Trypoxylon clavicerum* Lepeletier and Serville, 1828**

Crabroninae

***Crabro peltarius* (Schreber, 1784)**

***Crossocerus* (*Crossocerus*) *elongatulus* s. *proximus* (Shuckard, 1837)**

varipes Lepeletier and Brullé, 1834

***Crossocerus* (*Crossocerus*) *pusillus* Lepeletier and Brullé, 1834**

varus Lepeletier and Brullé, preoccupied

varius misspelling

***Crossocerus* (*Crossocerus*) *tarsatus* s. *tarsatus* (Shuckard, 1837)**

palmipes misident.

***Crossocerus* (*Crossocerus*) *wesmaeli* (Vander Linden, 1829)**

***Crossocerus* (*Blepharipus*) *capitosus* (Shuckard, 1837)**

***Crossocerus* (*Blepharipus*) *cetratus* (Shuckard, 1837)**

***Crossocerus* (*Blepharipus*) *megacephalus* (Rossius, 1790)**

leucostomus misident.

leucostomoides (Richards, 1935)

***Crossocerus* (*Blepharipus*) *nigritus* (Lepeletier and Brullé, 1834)**

pubescens (Shuckard, 1837)

inermis (Thomson, 1870)

***Crossocerus* (*Blepharipus*) *styrius* (Kohl, 1892)**

***Crossocerus* (*Blepharipus*) *walkeri* (Shuckard, 1837)**

aphidium misident.

***Crossocerus* (*Ablepharipus*) *podagricus* (Vander Linden, 1829)**

***Crossocerus* (*Hoplocrabro*) *quadrimaculatus* (Fabricius, 1793)**

***Crossocerus* (*Cuphopterus*) *dimidiatus* (Fabricius, 1781)**

serripes (Panzer, 1797)

***Ectemnius* (*Clytochrysus*) *cavifrons* (Thomson, 1870)**

cephalotes Saunders, 1896 misident.

***Ectemnius* (*Clytochrysus*) *lapidarius* (Panzer, 1804)**

chrysostomus (Lepeletier and Brullé, 1834)

***Ectemnius (Hypocrabro) continuus* (Fabricius, 1804)**

vagus misident.

***Ectemnius (Metacrabro) cephalotes* (Olivier, 1791)**

quadricinctus misident.

interruptus misident.

***Lindenius albilabris* (Fabricius, 1793)**

***Rhopalum (Rhopalum) clavipes* (Linnaeus, 1758)**

***Rhopalum (Corynopus) coarctatum* (Scopoli, 1763)**

tibiale (Fabricius, 1798)

***Oxybelus argentatus* Curtis, 1833**

mucronatus misident.

***Oxybelus uniglumis* (Linnaeus, 1758)**

Pemphredoninae

***Mimumesa littoralis* (Bondroit, 1934)**

celtica (Spooner, 1948)

unicolor Vander Linden, 1829 misident.

***Psenulus pallipes* (Panzer, 1798)**

atratus Fabricius, 1804

***Spilomena curruca* (Dahlbom, 1843)**

differens Blüthgen, 1953

***Spilomena enslini* Blüthgen, 1953**

***Spilomena troglodytes* (Vander Linden, 1829)**

vagans Blüthgen, 1953

***Pemphredon (Pemphredon) lugubris* (Fabricius, 1793)**

***Pemphredon (Cemonus) inornata* Say, 1824**

shuckardi (Morawitz, 1864)

***Pemphredon (Cemonus) lethifera* (Shuckard, 1837)**

***Passaloecus monilicornis* Dahlbom, 1842**

Mellininae

***Mellinus arvensis* (Linnaeus, 1758)**

Nyssoninae

***Nysson spinosus* (J. Forster, 1771)**

***Harpactus tumidus* (Panzer, 1801)**

***Argogorytes mystaceus* (Linnaeus, 1761)**

Apidae

Colletinae

***Colletes daviesanus* Smith, F., 1846**

***Colletes floralis* Eversmann, 1852**

montanus Morawitz, F., 1876

***Colletes similis* Schenck, 1853**

picistigma Thomson, 1872

***Colletes succinctus* (Linnaeus, 1758)**

***Hylaeus (Hylaeus) communis* Nylander, 1852**

***Hylaeus (Prosopis) brevicornis* Nylander, 1852**

***Hylaeus (Prosopis) confusus* Nylander, 1852**

***Hylaeus (Spatulariella) hyalinatus* Smith, F., 1843**

Andreninae

***Andrena (Andrena) apicata* Smith, F., 1847**

***Andrena (Andrena) clarkella* (Kirby, 1802)**

***Andrena (Andrena) fucata* Smith, F., 1847**

***Andrena* (*Andrena*) *fulva* (Müller *in* Allioni, 1766)**

armata (Gmelin *in* Linnaeus, 1790)

***Andrena* (*Andrena*) *lapponica* Zetterstedt, 1838**

***Andrena* (*Andrena*) *praecox* (Scopoli, 1763)**

smithella (Kirby, 1802)

clypeata Smith, 1855.

***Andrena* (*Hoplandrena*) *rosae* Panzer, 1801**

zonalis (Kirby, 1802)

eximia misident.

***Andrena* (*Hoplandrena*) *scotica* Perkins, R.C.L., 1916**

?*carantonica* Pérez, 1902

jacobi Perkins, R.C.L., 1921

jacobi var. johnsoni Perkins, R.C.L., 1921

***Andrena* (*Hoplandrena*) *stragulata* Illiger, 1806**

strangulata Illiger 1806 *in* Dalla Torre, 1896

eximia Smith, 1847

***Andrena* (*Hoplandrena*) *trimmerana* (Kirby, 1802)**

spinigera (Kirby, 1802)

***Andrena* (*Euandrena*) *bicolor* Fabricius, 1775**

gwynana (Kirby, 1802)

aestiva Smith, 1849

***Andrena* (*Ptilandrena*) *angustior* (Kirby, 1802)**

***Andrena* (*Melandrena*) *cineraria* (Linnaeus, 1758)**

***Andrena* (*Melandrena*) *nigroaenea* (Kirby, 1802)**

***Andrena* (*Cnemidandrena*) *denticulata* (Kirby, 1802)**

listerella (Kirby, 1802)

***Andrena* (*Cnemidandrena*) *fuscipes* (Kirby, 1802)**

***Andrena* (*Trachandrena*) *haemorrhoa* (Fabricius, 1781)**

albicans misident.

***Andrena* (*Plastandrena*) *pilipes* Fabricius, 1781**

?*riparia* Scopoli, 1763

spectabilis Smith, 1853

praetexta Smith, 1872

nigrospina Thomson, 1872

carbonaria misident.

***Andrena* (*Poliandrena*) *tarsata* Nylander, 1848**

analis misident.

***Andrena* (*Oreomelissa*) *coitana* (Kirby, 1802)**

shawella (Kirby, 1802)

***Andrena* (*Leucandrena*) *barbilabris* (Kirby, 1802)**

sericea (Christ, 1791) preoccupied

albicrus (Kirby, 1802)

***Andrena* (*Chlorandrena*) *humilis* Imhoff, 1832**

fulvescens Smith, 1847

***Andrena* (*Margandrena*) *marginata* Fabricius, 1777**

cetii (Schrank, 1781)

schrankella (Kirby, 1802)

frontalis Smith, 1849

***Andrena* (*Micrandrena*) *minutula* (Kirby, 1802)**

parvula (Kirby, 1802)

nigrifrons Smith, 1855

***Andrena* (*Micrandrena*) *semilaevis* Pérez, 1903**

saundersella Perkins, R.C.L., 1914

nana: Saunders, E., 1896 misident.

***Andrena* (*Micrandrena*) *subopaca* Nylander, 1848**

***Andrena* (*Taeniandrena*) *wilkella* (Kirby, 1802)**

barbatula (Kirby, 1802)

Halictinae

***Halictus* (*Halictus*) *rubicundus* (Christ, 1791)**

quadrifasciatus Smith, 1870

***Halictus* (*Seladonia*) *tumulorum* (Linnaeus, 1758)**

***Lasioglossum* (*Lasioglossum*) *lativentre* (Schenck, 1853)**

decipiens (Perkins, 1913)

***Lasioglossum* (*Evylaeus*) *albipes* (Fabricius, 1781)**

***Lasioglossum* (*Evylaeus*) *calceatum* (Scopoli, 1763)**

cylindricum (Fabricius, 1793)

***Lasioglossum* (*Evylaeus*) *fratellum* (Pérez, 1903)**

freygessneri (Alfken, 1904)

subfasciatum (Saunders, E., 1896) misident.

***Lasioglossum* (*Evylaeus*) *nitidiusculum* (Kirby, 1802)**

***Lasioglossum* (*Evylaeus*) *punctatissimum* (Schenck, 1853)**

longiceps (Saunders, 1879)

***Lasioglossum* (*Evylaeus*) *rufitarse* (Zetterestedt, 1838)**

atricorne (Smith, F., 1870)

***Lasioglossum* (*Evylaeus*) *villosulum* (Kirby, 1802)**

punctulata (Kirby, 1802)

***Lasioglossum* (*Chloralictus*) *cupromicans* s. *hibernicum* Ebmer, 1970**

***Lasioglossum* (*Chloralictus*) *leucopus* (Kirby, 1802)**

***Sphecodes ephippius* (Linnaeus, 1767)**

divisus (Kirby 1802)

similis Wesmael, 1835

***Sphecodes ferruginatus* von Hagens, 1882**

rufescens Fourcroy, 1785

***Sphecodes geoffrellus* (Kirby, 1802)**

affinis von Hagens, 1882

fasciatus von Hagens, 1882

***Sphecodes gibbus* (Linnaeus, 1758)**

***Sphecodes hyalinatus* von Hagens, 1882**

***Sphecodes monilicornis* (Kirby, 1802)**

subquadratus Smith, F., 1845

***Sphecodes pellucidus* Smith, 1845**

pilifrons Thomson, 1870

Megachilinae

***Osmia* (*Osmia*) *rufa* (Linnaeus, 1758)**

bicornis (Linnaeus, 1758)

***Osmia* (*Helicosmia*) *aurulenta* (Panzer, 1799)**

***Megachile* (*Megachile*) *centuncularis* (Linnaeus, 1758)**

***Megachile* (*Megachile*) *ligniseca* (Kirby, 1802)**

***Megachile* (*Megachile*) *versicolor* s. *versicolor* Smith, 1844**

***Megachile* (*Megachile*) *versicolor* s. *hiberniae* Perkins, R. C. L., 1925**

***Megachile* (*Delomegachile*) *willughbiella* s. *willughbiella* (Kirby, 1802)**

***Megachile* (*Delomegachile*) *willughbiella* s. *hibernica* Perkins, R. C. L., 1925**

***Megachile (Xanthosarus) maritima* (Kirby, 1802)**

***Coelioxys elongata* Lepeletier, 1841**

simplex Nylander, 1852

***Coelioxys inermis* (Kirby, 1802)**

acuminata Nylander, 1852

Apinae

***Nomada argentata* Herrich-Schäffer, 1839**

***Nomada fabriciana* (Linnaeus, 1767)**

***Nomada flavoguttata* (Kirby, 1802)**

***Nomada goodeniana* (Kirby, 1802)**

alternata (Kirby, 1802)

succincta misident.

***Nomada leucophthalma* (Kirby, 1802)**

borealis Zetterstedt, 1838

***Nomada marshamella* (Kirby, 1802)**

alternata misident.

***Nomada obtusifrons* Nylander, 1848**

***Nomada panzeri* Lepeletier, 1841**

ruficornis misident.

***Nomada roberjoetiana* Panzer, 1799**

tormentillae Alfken,1901

***Nomada ruficornis* (Linnaeus, 1758)**

bifida Thomson, 1872

***Nomada rufipes* Fabricius, 1793**

solidaginis misident.

picta (Kirby, 1802)

***Nomada sheppardana* (Kirby, 1802)**

furva misident.

***Nomada striata* Fabricius, 1793**

hillana (Kirby, 1802)

ochrostoma (Kirby, 1802)

***Bombus (Bombus) lucorum* (Linnaeus, 1761)**

***Bombus (Bombus) magnus* Vogt, 1911**

***Bombus (Bombus) terrestris* (Linnaeus, 1758)**

virginalis (Geoffroy in Fourcroy, 1785)

***Bombus (Megabombus) hortorum* s. *ivernicus* Sladen, 1912**

splendida Stelfox, 1938

***Bombus (Melanobombus) lapidarius* (Linnaeus, 1758)**

***Bombus (Psithyrus) barbutellus* (Kirby, 1802)**

***Bombus (Psithyrus) bohemicus* (Seidl, 1837)**

distinctus (Pérez, 1884)

***Bombus (Psithyrus) campestris* (Panzer, 1800)**

rossiellus (Kirby, 1802)

franciscanus (Kirby, 1802)

***Bombus (Psithyrus) rupestris* (Fabricius, 1793)**

***Bombus (Psithyrus) sylvestris* Lepeletier, 1833**

quadricolor misident.

***Bombus (Psithyrus) vestalis* (Geoffroy in Fourcroy, 1785)**

***Bombus (Pyrobombus) jonellus* (Kirby, 1802)**

scrimshiranus (Kirby, 1802)

nivalis misident.

***Bombus* (*Pyrobombus*) *monticola* Smith, 1849**

lapponicus misident.

***Bombus* (*Pyrobombus*) *pratorum* (Linnaeus, 1761)**

***Bombus* (*Subterraneobombus*) *distinguendus* Morawitz, F., 1869**

***Bombus* (*Thoracobombus*) *muscorum* s. *celticus* Yarrow, 1978**

muscorum s. *pallidus* Evans, 1901 preocc.

***Bombus* (*Thoracobombus*) *muscorum* s. *allenellus* Stelfox, 1933**

smithianus misident.

***Bombus* (*Thoracobombus*) *pascuorum* s. *floralis* (Gmelin *in* Linnaeus, 1790)**

agrorum (Fabricius, 1787) preocc.

smithianus White, 1851

***Bombus* (*Thoracobombus*) *ruderarius* (Müller, 1776)**

derhamellus (Kirby, 1802)

***Bombus* (*Thoracobombus*) *sylvarum* (Linnaeus, 1761)**

***Apis mellifera* Linnaeus, 1758**

mellifica Linnaeus, 1761

ESTUARINE RIPARIAN WETLANDS AS A HABITAT FOR STAPHYLINIDAE AND CARABIDAE (COLEOPTERA) ON THE BLACK WATER TRIBUTARY OF THE RIVER SUIR, CO. KILKENNY, IRELAND

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Abstract

A total of 72 species of Staphylinidae, and 20 species of Carabidae, were recorded from estuarine riparian wetlands (all originally reclaimed land, subsequently recolonised by *Carex riparia* beds, marsh and tall-herb vegetation, and salt meadow) on the Black Water tributary of the River Suir. Six species (*Agonum nigrum*, *Atheta liliputana*, *A. zosterae*, *Philonthus fumarius*, *P. micantoides* and *Stenus europaeus*) were considered indicators of ecologically well-developed habitat, and 37% of the species recorded were restricted to wetlands. This indicates a relatively high biodiversity value for the soil fauna of this type of estuarine riparian ecosystem. A further rarely-recorded species (*Omalium exiguum*) was also present.

Introduction

The lower estuarine reaches of large rivers frequently produce areas of seasonally or regularly flooded habitat, either directly inundated at spring high tides by brackish water, or with richly vegetated soils flooded by the back-up of fresh groundwater or by river floods. In the past, much of this type of floodplain land was reclaimed, but in some parts due to inaccessibility or persistent difficulties in maintaining drainage of land with a high watertable, riparian marsh or swamp vegetation and stands of reeds and sedges have survived or successfully re-established. An example is the estuarine part of the Black Water immediately north of its discharge into the River Suir, north of Waterford city. The rivers of south-eastern

Ireland (the Suir, Barrow, Slaney and the Waterford Blackwater) have a characteristically long tidal reach, whether for tectonic reasons (Mitchell, 1990) or otherwise, providing potentially large areas for this type of biotope.

There is relatively little information on the soil invertebrate fauna of estuarine riparian habitats in Ireland, although the biodiversity value of this type of ecosystem is recognised in general (Hammond, 1998; Buijse *et al.*, 2002). An opportunity to obtain some data was provided by the ecological survey of the lower Black Water area associated with the Waterford Bypass road development. The results of a survey of the staphylinid fauna are reported here, with supplementary information on carabids and other Coleoptera.

Methods

Four locations on the Black Water (River Suir tributary) floodplain were sampled, as follows:

(1) Strangsmill, Co. Kilkenny (S585150): (a) a pair of Malaise traps (Marris House Nets, black netting) located near to a hedge at the base of a cliff/slope, in pasture with *Carex riparia*, *Agrostis stolonifera* and *Juncus effusus*, 20 May to 10 June 1999; (b) six plastic cup pitfall traps with undiluted ethylene glycol (commercial antifreeze) as preservative, 20-27 May and 26 June to 14 July 1999 in pasture with *Carex riparia*, etc.; (c) six S-vac suction subsamples (see Good and Butler, 1998), 10 June 1999, in pasture with *Carex riparia*, etc.

(2) Strangsmill, Co. Kilkenny (S585149): (a) six pitfall traps (as above), 20-27 May and 26 June to 14 July 1999, in salt meadow.

(3) Dunkitt, Co. Kilkenny (S580158): (a) a pair of Malaise traps (as above) located in ungrazed marsh/wet grassland, 27 May to 17 June 1999; (b) six pitfall traps (as above), 27 May to 17 June 1999, in marsh/wet grassland with groundwater frequently exceeding soil capacity; (c) six S-vac suction subsamples, 26 June 1999, in marsh/wet grassland when soil was not flooded.

(4) Mullinabro, Co. Kilkenny (S589150): (a) a pair of Malaise traps (as above) located in *Carex*

riparia-dominated seasonally-flooded depression (originally a drainage ditch) in grassland with *Agrostis stolonifera* and *Juncus effusus*, and *circa* 20m from the river bank and a reed (*Phragmites australis*) bed, 10-31 June 2000; (b) six pitfall traps (as above), 15 July - 11 August 2000, in the *C. riparia*-dominated depression; (c) six S-vac suction subsamples, 11 August 2000, in the *C. riparia*-dominated depression.

Species were selected as indicators of well-developed habitat if: (1) they have a restricted preference to the types of habitat associated with riparian ecosystems (see Lott, 2003), and (2) they are reported in the literature as being local or rare, from which it is assumed that they are less likely to survive in historically degraded ecosystems. By 'well-developed habitat' it is meant that the ecosystem is sufficiently undisturbed by human activity to allow it to retain many local or rare characteristic species.

Typical wetland species were selected from those listed as having high wetland fidelity by Lott (2003), but excluding species which have been recorded in numbers ($n>2$ per sample) in cereal crops or intensively-managed grassland in Ireland (Good and Giller, 1990; J. A. Good, unpublished). The excluded species are *Philhygra elongatula* and *Stenus cicindeloides* (Staphylinidae) and *Carabus granulatus* (Carabidae).

Nomenclature of Staphylinidae follows Lott and Duff (2003), with the exception of the genus concept of *Atheta*, where Anderson *et al.* (1997) is followed. Nomenclature of Carabidae follows Anderson *et al.* (2000), and Anderson *et al.* (1997) for other Coleoptera. Vascular plant nomenclature follows Stace (1997). Data on habitat associations were taken from Central European published information (Koch, 1989); Atlantic European data being, as yet, uncompiled. The similarities in wetland ecosystems in Atlantic and Central Europe (e.g. Polunin and Walters, 1985) compared to other ecosystems such as woodlands and grasslands, argue in favour of accepting Central European habitat data. However, until habitat data is systematically compiled for Atlantic European species, the applicability of this data to Irish wetlands remains an assumption. The Shannon-Weiner Diversity Index follows Ricklefs (1979) (a diversity index is considered useful here because it is used for a specific habitat-associated subset of the total species pool, and this provides a higher signal-to-noise ratio than an indiscriminate use of an index for all species, the latter being more likely to give misleading or meaningless results).

Results

In total, 72 species of Staphylinidae, and 20 species of Carabidae, were recorded from riparian wetlands adjacent to the estuarine Black Water during 1999 and 2000, of which six species (*Agonum nigrum*, *Atheta liliputana*, *A. zosterae*, *Philonthus fumarius*, *P. micantoides* and *Stenus europaeus*) are considered to be indicators of well-developed estuarine or freshwater riparian habitat (Tables 1-3).

The carabid *Agonum nigrum* is local in both Great Britain and Ireland (Speight *et al.*, 1982; Luff, 1998; Good and Butler, 1998; Anderson *et al.*, 2000). It has been recorded from salt-marshes and estuarine habitats in Ireland (Good and Butler, 1998; Anderson *et al.*, 2000), vegetation-rich marshes and salt-marshes, and lentic water shores, in Great Britain and Central Europe (Luff, 1998; Koch, 1989). It was only recorded from the Strangsmill salt meadow during this survey (Table 3); species determination was based on male characters using the key and aedeagal illustrations in Schmidt (1998).

This is the fourth Irish record of *Atheta liliputana*, previously recorded from Pollardstown Fen, Co. Kildare (Good, 1994, 2005), Lady's Is. Lake, Co. Wexford (Good and Butler, 1998) and Boora, Co. Offaly (a single female, 19 July 1991, J. A. Good, unpublished)). Two males and a female were recorded from Malaise traps in Mullinabro (Table 2). The species is apparently rare in Scandinavia and Central Europe (Palm, 1970; Benick and Lohse, 1974), and appears to be local in Great Britain, but not rare (originally recorded as Notable by Hyman (1986; cited in Hyman and Parsons (1994)), but omitted by Hyman and Parsons (1994) (i.e. occurring from >20 vice-counties). Although it is not listed as a wetland species by Lott (2003), it is nevertheless considered to be an indicator species because all the Irish records are from wetlands, and it has been found in numbers (n>2) from Malaise traps in wetlands both at Mullinabro (Table 2) and at Pollardstown Fen (Good, 2005). Palm (1970) also recorded the species in Sweden from a damp hollow (a clayey cattle-watering place) in a wooded meadow and Hansen *et al.* (1991) recorded it from a grassy salt-meadow in Denmark. Koch (1989), however, records it from carrion, pigeon dung and decomposing fungi in deciduous woodland and ravines.

Atheta zosterae is known from seven locations in Ireland (Anderson, 1997; Good and Butler, 2000; Good, 2005; Dr R. Anderson, pers. comm.), and is local in Great Britain (Hyman and Parsons, 1994). It is a stenotopic species of birds nests, especially of waterbirds (Benick and Lohse, 1974; Koch, 1989; Lott, 2003). It has also been recorded in numbers in June in nests of carrion crows (*Corvus corone* L.) near the coast (Spittle, 1947), but here it might possibly be associated with the remains of wetland-derived food (such as shell-fish) brought to the nest.

Omalium exiguum is recorded as generally rare throughout its range in Europe, and very local in Britain and Ireland (Horion, 1963; Hammond, 1980; Hyman and Parsons, 1994). A single male was captured in an S-vac suction sample from the *Carex riparia/Agrostis stolonifera/Juncus effusus* pasture at Mullinabro; this is the second Irish locality for this species which was recorded near the River Flesk in Killarney by E.F. Bullock (Hammond, 1980; Anderson, 1997). However, despite its rarity it cannot be considered an indicator species because it was very probably vagrant. It is mainly associated with carrion and similar decomposing organic matter in non-wetland habitats, although there is one record from a reed-fringed pool in northern Germany (Horion, 1963; Zanetti, 1987; Koch, 1989; Hyman and Parsons, 1994).

Philonthus fumarius has been recorded relatively frequently at ecologically well-developed wetland sites in Ireland (Johnson and Halbert, 1902; Lott and Bilton, 1991; Owen, 1997; Good and Butler, 1998; Good, 2004), although it is still likely to be a local species (given the number of sites sampled by these authors), as it is in Great Britain (Hyman and Parsons, 1994). It is not rare in Central Europe, but apparently rare elsewhere in its range (Horion, 1965). The species occurs in marshes including muddy and marshy freshwater shores, and especially on coastal marshes (Horion, 1965; Koch, 1989; Hyman and Parsons, 1994).

Philonthus micantoides has been recorded from four localities in Ireland (Good, 1990; Regan and Anderson, 2004), and appears to be local in Europe generally (see Good, 1990). It is a stenotopic species, preferring marshy shores of rivers, lakes and ponds (Koch, 1989).

Stenus europaeus is recorded from 14 10-km squares in Ireland (Dr R. Anderson, pers. comm.), and is very local in Great Britain (Hyman and Parsons, 1994). It appears to be local in western Europe, becoming more frequent to the north and east of Europe (Horion, 1963). Koch (1989) records its habitat as including reed litter and moss in alder carr, swamp woods, wet wood margins, shady shores of rivers, lakes and meadow ditches. In Great Britain, it is recorded chiefly from reed and sedge litter in fens, but also in marshes and bogs (Hyman and Parsons, 1994). In Ireland, it has been recorded from wooded bogs and wooded lakeshore fens including *Carex* beds (Anderson, 1997; Good, 2004). A single male was recorded from a pitfall trap in *Carex riparia/Agrostis stolonifera/Juncus effusus* vegetation at Mullinabro (Table 2).

Three other beetle species with local distribution were also captured (as single individuals in Malaise traps) at Mullinabro: *Sinodendron cylindricum* (L.) (Lucanidae), *Halyzia sedecimguttata* (L.) (Coccinellidae) and *Pyrochroa serraticornis* (Scopoli) (Pyrochroidae).

A total of 34 (37%) wetland species (derived from Lott (2003); see methods for selection criteria) were recorded; 29 Staphylinidae and five Carabidae (Table 4). Combining both Staphylinidae and Carabidae (Table 4), 74% of the wetland species were associated with *Carex* or marsh litter (the habitats sampled here), based on Central European data (Koch, 1989). A similar figure (68%) was associated with reedbed microhabitats (*Phragmites* litter or stems, waterbird nests, silty or muddy shores), reedbeds being the dominant estuarine riparian habitat in the area (Gittings and O'Mahony, 1998)). Two of the six indicator species were associated with reedbed microhabitats, and also two with marsh litter (Table 4). However, there was a greater number of species (nine) associated with sedge and marsh litter but not with reedbed microhabitats, than of species (six) associated with reedbed microhabitats but not with sedge or marsh litter. There was also a higher Shannon-Weiner Diversity Index (Ricklefs, 1979): H = 1.28 for exclusively sedge and marsh litter species (n = 9), compared to H = 1.04 for exclusively reedbed microhabitats (n = 6). This index downweights rare species (Ricklefs, 1979), which is appropriate here given than species represented by singletons are more likely to be vagrant.

Discussion

The occurrence of six wetland indicator species (*Agonum nigrum*, *Atheta liliputana*, *A. zosterae*, *Philonthus fumarius*, *P. micantoides* and *Stenus europaeus*), and 37% wetland species, indicates that estuarine riparian wetlands in the River Suir system have a high soil biodiversity value, in addition to other potential environmental and resource values (see Everard, 1998).

Within the estuarine riparian wetlands, reedbeds (*Phragmites*- and *Typha*-dominated) can be distinguished from sedgebeds (*Carex*-dominated) and marshes, as macrohabitats for Staphylinidae and Carabidae (Koch, 1989). 'Marsh' is a highly variable term, with different formal uses (e.g. Hofstetter, 1983; Rodwell, 1995; Fossitt, 2000), and with different interpretations for the coleopterists who generated species data which probably bear little relation to vegetation types. However, for the purposes of this paper 'marsh and *Carex* litter' can be distinguished from 'reedbeds' as separate habitat categories, roughly corresponding to marsh + tall herb swamp + sedgebed subcategory, compared with reedbed subcategory, in Fossitt (2000). This division of habitats is also related to dominance of processes: reedbeds result more from tidal and river geomorphological processes; sedgebeds and marshes more from socioeconomic processes of reclamation and abandonment of maintenance of agricultural land. Vegetation such as that at the wetlands in Dunkitt is responding to rewetting of historically drained pasture or meadow, as well as release from grazing. In consequence, the wetlands contain a mixture of habitat types (*sensu* Fossitt, 2000): upper salt marsh, tall sedge swamp, tall-herb swamp, marsh and wet grassland, and in some cases difficult to readily assign to clear vegetation-defined habitat classes. None of the recorded beetle species were halobiont; the importance of the 'estuarine' part of the biotope is not that it provides habitat for characteristic salt-marsh species, but that it makes drainage of the riparian land more difficult.

In the estuarine River Suir, reedbeds might be expected to be more natural (i.e. less disturbed by drainage), and the results show the biodiversity importance of reedbeds in the vicinity (two indicator species). In contrast, all the sedgebeds and marshes sampled were originally reclaimed land (presumably for grazing), and it could be questioned whether they have any biodiversity value because of a lack of apparent historical continuity. The results show otherwise, with two indicator species and a relatively high Shannon-Weiner diversity index for non-reedbed wetland species ($H = 1.28$; $n = 9$). Dispersal by flight is an adaptive feature of stapylinids escaping flooding, and they readily recolonise riparian habitats after disturbance (Adis and Junk, 2002). Secondary sedge-beds and marshes, as well as reed-beds, are therefore indicated as being important for characteristic riparian soil fauna in the Lower River Suir system.

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References

Adis, J. and Junk, W. J. (2002) Terrestrial invertebrates inhabiting lowland river floodplains of Central Amazonia and Central Europe: a review. *Freshwater Biology* **47**: 711-731.

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

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

Anderson, R., Nash, R. and O'Connor, J. P. (1997) Irish Coleoptera. A revised and annotated list. *Irish Naturalists' Journal Special Entomological Supplement 1997*: 1-81.

Benick, G. and Lohse, G. A. (1974) Staphylinidae II (Aleocharinae, Callicerini). Pp 72-220. *In* Freude, H., Harde, K. W. and Lohse, G. A. (eds) *Die Käfer Mitteleuropas*. **5**. Goecke and Evers, Krefeld.

Buijse, A. D., Coops, H., Staras, M., Jans, L. H., van Geest, G. J., Grift, R. E.,Ibelings, B. W., Oosterberg, W. and Roozen, F. C. J. M. (2002) Restoration strategies for river floodplains along large lowland rivers in Europe. *Freshwater Biology* **47**: 889-907.

Everard, M. (1998) The contribution of reedbeds to floodplain and river systems. Pp 117-141. *In* Bailey, R. G., José, P. V. and Sherwood, B. R. (eds) *United Kingdom floodplains*. Wetbury, Otley.

Fossitt, J. (2000) *A guide to habitats in Ireland*. The Heritage Council, Kilkenny.

Gittings, T. and O'Mahony, T. (1998) *Waterford Bypass Environmental Assessment. Botanical surveys of Grannyferry proposed Natural Heritage Area and adjoining sites*. Unpublished report, RPS Cairns Ltd, Cork.

Good, J. A. (1990) *Philonthus micantoides* Benick & Lohse (Coleoptera:Staphylinidae): a river bank beetle new to Ireland. *Irish Naturalists' Journal* **23**: 220.

Good, J. A. (1994) *Atheta liliputana* (Brisout) (Coleoptera: Staphylinidae), a marsh beetle new to Ireland. *Irish Naturalists' Journal* **24**: 413.

Good, J. A. (2004) Lake-shore fens and reedbeds as a habitat for Staphylinidae and Carabidae (Coleoptera) in the East Burren area of Co. Clare, Ireland. *Bulletin of the Irish*

Biogeographical Society **28**: 163-188.

Good, J. A. (2005) Spring-fed fen as a habitat for Staphylinidae (Coleoptera) at Pollardstown Fen, Co. Kildare, Ireland, with an assessment of staphylinid sampling by Malaise traps. *Bulletin of the Irish Biogeographical Society* **29**: 213-241.

Good, J. A. and Butler, F. T. (1998) Coastal lagoon shores as a habitat for Staphylinidae and Carabidae (Coleoptera) in Ireland. *Bulletin of the Irish Biogeographical Society* **21**: 22-65.

Good, J. A. and Butler, F. T. (2000) Coastal lagoon and saline lake shores as a habitat for Staphylinidae, Carabidae and Pselaphidae (Coleoptera) in Ireland: Part 2. *Bulletin of the Irish Biogeographical Society* **24**: 111-141.

Good, J. A. and Giller, P. S. (1990) Staphylinid beetles (Coleoptera) from cereal and grass fields in south-west Ireland. *Bulletin of the Irish Biogeographical Society* **13**: 2-22.

Hammond, P. M. (1980) Staphylinidae (Coleoptera) in Ireland, 1: Micropeplinae, Proteininae, Omaliinae and Piestinae. *Irish Naturalists' Journal* **20**: 133-140.

Hammond, P. M. (1998) Riparian and floodplain arthropod assemblages: their characteristics and rapid assessment. Pp 237-282. *In* Bailey, R. G., José, P. V. and Sherwood, B. R. (eds) *United Kingdom floodplains*. Wetbury, Otley.

Hansen, M., Kristensen, S., Mahler, V. and Pedersen, J. (1991) Tiende tillaeg til "Fortegnelse over Danmarks biller" (Coleoptera). *Entomologiske Meddelelser* **59**: 99-126.

Hofstetter, R.H. (1983) Wetlands in the United States. Pp 201-244. *In* Gore, A J. P. (ed.) *Ecosystems of the world*. **4B**. *Mires: swamp, bog, fen and moor*. Elsevier, Amsterdam.

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

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

Hyman, P. S. and Parsons, M. S. (1994) *A review of the scarce and threatened Coleoptera of*

Great Britain. Part 2. UK Nature Conservation Series No. **12**, Joint Committee for Nature Conservation, Peterborough.

Johnson, W. F. and Halbert, J. N. (1902) A list of the beetles of Ireland. *Proceedings of the Royal Irish Academy* (3) **6**: 535-827.

Koch, K. (1989) *Die Käfer Mitteleuropas. Ökologie*. **1-2**. Goecke and Evers, Krefeld.

Lott, D. A. (2003) An annotated list of wetland ground beetles (Carabidae) and rove beetles (Staphylinidae) found in the British Isles including a literature review of their ecology. *English Nature Research Reports* No. **488**: 1-85.

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

Lott, D. A. and Bilton, D. T. (1991) Records of Coleoptera from Irish wetland sites in 1989. *Bulletin of the Irish Biogeographical Society* **14**: 60-72.

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

Mitchell, F. (1990) *The way that I followed: a naturalist's journey around Ireland*. Country House, Dublin.

Owen, J. A. (1997) Beetles (Coleoptera) recorded from various Irish sites in 1993, 1994 and 1996. *Bulletin of the Irish Biogeographical Society* **20**: 136-154.

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

Polunin, O. and Walters, M. (1985) *A guide to the vegetation of Britain and Europe*. Oxford University Press, Oxford.

Regan, E. C. and Anderson, R. (2004) Terrestrial Coleoptera recorded in Ireland, May 2003. *Bulletin of the Irish Biogeographical Society* **28**: 85-132.

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

Rodwell, J. S. (ed.) (1995) *British plant communities*. **4**. *Aquatic communities, swamps and tall-*

herb fens. Cambridge University Press, Cambridge.

Schmidt, J. (1998) Tribus: Platynini. Pp 58-72. *In* Lucht, W. and Klausnitzer, B. (eds) *Die Käfer Mitteleuropas*. **15**. *4. Supplementband*. Goecke and Evers, Krefeld.

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

Spittle, R. J. (1947) The coleopterous fauna of carrion-crows' nests. *Entomologist's Monthly Magazine* **83**: 270.

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

Zanetti, A. (1987) Coleoptera, Staphylinidae, Omaliinae. *Fauna d'Italia* **25**: 1-472.

TABLE 1. Staphylinidae recorded from Malaise traps (Mal. t.), and from suction samples plus pitfall traps (S-vac + p. t.), from riparian wetlands on the Black Water tributary of the River Suir, Co. Kilkenny. Abbreviations: *Carex* - *Carex riparia/Agrostis stolonifera*-dominated sward; Salt-m. salt meadow. For definition of indicator and other wetland species, see text (Methods).

	Dunkitt		***Strangsmill***		
Species	***Mal. t.***	***S-vac + p. t.***	***Mal. t.***	***S-vac + p. t.***	
				Carex	***Salt-m.***
Indicator wetland species					
Philonthus fumarius (Gravenhorst)	-	-	-	1	-
Philonthus micantoides Benick & Lohse	1	-	-	1	-
Other wetland species					
Alianta incana (Erichson)	-	1	-	1	-
Atheta graminicola (Gravenhorst)	8	14	8	71	-
Euaesthetus ruficapillus Lacordaire	-	-	-	7	-
Hygronoma dimidiata (Gravenhorst)	-	-	-	6	-
Ischnopoda atra (Gravenhorst)	2	-	-	-	-
Lathrobium quadratum (Paykull)	-	-	1	-	-
Lesteva sicula Erichson	-	2	-	2	-
Myllaena dubia (Gravenhorst)	-	-	-	1	-
Ocyusa maura (Erichson)	-	-	-	1	-
Oxypoda elongatula Aubé	-	-	-	2	-
Paederus fuscipes Curtis	-	-	-	-	9
Paederus riparius (Linnaeus)	-	-	2	4	-
Philhygra malleus (Joy)	9	-	-	1	-
Philonthus micans (Gravenhorst)	1	-	-	-	-
Rybaxis longicornis (Leach)	-	6	-	12	1
Stenus bifoveolatus Gyllenhal	-	41	-	7	-

TABLE 1 (continued)

	Dunkitt		***Strangsmill***		
Species	***Mal. t.***	***S-vac + p. t.***	***Mal. t.***	***S-vac + p. t.***	
				Carex	***Salt-m.***
Stenus bimaculatus Gyllenhal	-	1	-	-	-
Stenus boops Ljungh	-	13	-	12	5
Stenus canaliculatus Gyllenhal	-	-	-	-	6
Stenus juno (Paykull)	-	12	-	14	2
Stenus lustrator Erichson	1	4	1	18	-
Stenus nitidiusculus Stephens	-	93	-	86	-
Stenus pallitarsis Stephens	-	1	-	-	-
Stenus picipennis Erichson	-	1	-	-	-
Other species					
Aleochara lanuginosa Gravenhorst	1	-	-	-	-
Aloconota gregaria (Erichson)	3	-	2	-	-
Anotylus rugosus (Fabricius)	1	3	-	16	-
Atheta amplicollis (Mulsant & Rey)	2	-	-	8	2
Atheta atramentaria (Gyllenhal)	-	-	1	-	-
Atheta fungi (Gravenhorst)	4	2	-	4	-
Atheta nigripes (Thomson)	-	-	1	-	-
Bisnius fimetarius (Gravenhorst)	1	-	-	-	-
Carpelimus corticinus (Gravenhorst)	-	-	-	4	2
Encephalus complicans Stephens	-	1	-	-	-
Gabrius breviventer (Sperk)	-	1	1	10	2
Liogluta longiuscula (Gravenhorst)	5	-	-	-	-
Omalium excavatum Stephens	-	1	-	-	-
Philonthus carbonarius (Gravenhorst)	-	-	-	2	1
Philonthus cognatus Stephens	-	-	-	1	-

TABLE 1 (continued)

Species	***Dunkitt*** *Mal. t.*	***Dunkitt*** *S-vac + p. t.*	***Strangsmill*** *Mal. t.*	***Strangsmill*** *S-vac + p. t.* *Carex*	***Strangsmill*** *S-vac + p. t.* *Salt-m.*
Philonthus splendens (Fabricius)	-	-	-	2	-
Platystethus arenarius (Fourcroy)	1	-	-	-	-
Sepedophilus littoreus (Linnaeus)	1	-	-	-	-
Staphylinus dimidiaticornis Gemminger	1	6	-	1	-
Stenus cicindeloides (Schaller)	4	3	2	14	2
Stenus clavicornis (Scopoli)	-	-	-	-	1
Stenus fulvicornis Stephens	-	-	-	2	1
Stenus similis (Herbst)	1	-	-	-	-
Tachinus signatus Gravenhorst	6	8	-	7	-
Tachyporus chrysomelinus (Linnaeus)	-	-	-	2	-
Tachyporus dispar (Paykull)	-	-	-	1	-
Tachyporus nitidulus (Fabricius)	-	-	2	-	-
Tachyporus solutus Erichson	-	2	-	2	-
Xantholinus longiventris Heer	-	-	-	2	6

TABLE 2. Staphylinidae recorded from Malaise traps, and from S-vac suction samples plus pitfall traps, from a pasture depression with *Carex riparia/Agrostis stolonifera /Juncus effusus* at Mullinabro, Co. Kilkenny. For definition of indicator and other wetland species, see text (Methods).

Species	***Malaise traps***	***S-vac + pitfall traps***
Indicator wetland species		
Atheta liliputana (Brisout)	3	-
Atheta zosterae (Thomson)	-	1
Philonthus micantoides Benick & Lohse	-	1
Stenus europaeus Puthz	-	1
Other wetland species		
Alianta incana (Erichson)	1	-
Atheta graminicola (Gravenhorst)	6	11
Carpelimus rivularis (Motschulsky)	2	1
Lesteva sicula Erichson	-	1
Myllaena dubia (Gravenhorst)	1	-
Paederus fuscipes Curtis	1	9
Philhygra malleus (Joy)	3	-
Rybaxis longicornis (Leach)	-	47
Stenus bifoveolatus Gyllenhal	-	1
Stenus canaliculatus Gyllenhal	-	10
Stenus juno (Paykull)	-	8
Stenus nitidiusculus Stephens	-	7
Stenus pallitarsis Stephens	1	1
Other species		
Acrotona aterrima (Gravenhorst)	2	-

TABLE 2 (continued)

Species	***Malaise traps***	***S-vac + pitfall traps***
Aloconota gregaria (Erichson)	8	-
Amischa analis (Gravenhorst)	3	2
Anotylus rugosus (Fabricius)	1	4
Anotylus tetracarinatus (Block)	-	1
Atheta amplicollis (Mulsant & Rey)	2	46
Atheta fungi (Gravenhorst)	6	12
Atheta macrocera Thomson	1	-
Atheta nigripes (Thomson)	1	-
Atheta sordidula (Erichson)	1	-
Carpelimus corticinus (Gravenhorst)	2	7
Gabrius breviventer (Sperk)	2	1
Omalium exiguum Gyllenhal	-	1
Philhygra elongatula (Gravenhorst)	15	2
Philonthus carbonarius (Gravenhorst)	-	3
Philonthus cognatus Stephens	-	2
Philonthus laminatus (Creutzer)	-	5
Philonthus marginatus (Müller)	-	1
Rugilus erichsoni (Fauvel)	-	2
Stenus brunnipes Stephens	-	5
Stenus cicindeloides (Schaller)	2	14
Stenus fulvicornis Stephens	-	8
Stenus ossium Stephens	-	17
Tachinus signatus Gravenhorst	-	9
Tachyporus chrysomelinus (Linnaeus)	4	2
Tachyporus dispar (Paykull)	-	5
Tachyporus nitidulus (Fabricius)	2	-

TABLE 2 (continued)

Species	***Malaise traps***	***S-vac + pitfall traps***
Tachyporus obtusus (Linnaeus)	1	-
Tachyporus pusillus Gravenhorst	-	1
Tachyporus solutus Erichson	-	1

TABLE 3. Carabidae recorded from Malaise traps (Mal. t.), and from suction samples plus pitfall traps (S-vac + p. t.), from riparian wetlands on the Black Water tributary of the River Suir, Co. Kilkenny. Abbreviations: *Carex* - *Carex riparia/Agrostis stolonifera*-dominated sward; Salt-m.- salt meadow; Mullin. - pasture depression with *Carex riparia/Agrostis stolonifera/Juncus effusus* at Mullinabro. For definition of indicator and other wetland species, see text (Methods).

	Dunkitt		***Strangsmill***			***Mullin.***
Species	***Mal. t.***	***S-vac + p. t.***	***Mal. t.***	***S-vac + p. t.***		***S-vac + p. t.***
				Carex	***Salt-m.***	
Indicator wetland species						
Agonum nigrum Dejean	-	-	-	-	4	-
Other wetland species						
Agonum afrum (Duftschmid)	-	-	-	-	1	2
Agonum thoreyi Dejean	-	3	-	-	-	-
Bembidion assimile Gyllenhal	-	-	-	-	-	6
Elaphrus cupreus Duftschmid	-	-	-	6	1	-
Other species						
Agonum muelleri (Herbst)	1	-	-	-	-	2
Agonum fuliginosum (Panzer)	-	1	-	-	-	-
Bembidion aeneum Germar	-	-	-	-	-	1
Bembidion guttula (Fabricius)	-	-	-	6	1	-
Bembidion mannerheimii Sahlberg	-	1	-	-	2	1
Carabus granulatus Linnaeus	-	1	-	5	1	2
Demetrias atricapillus (Linnaeus)	-	-	-	1	-	1
Dromius linearis (Olivier)	-	3	1	2	-	1
Dromius meridionalis Dejean	-	-	1	-	-	-

TABLE 3 (continued)

	Dunkitt		***Strangsmill***			***Mullin.***
Species	***Mal. t.***	***S-vac + p. t.***	***Mal. t.***	***S-vac + p. t.***		***S-vac + p. t.***
				Carex	***Salt-m.***	
Platynus albipes (Fabricius)	-	1	-	-	-	-
Pterostichus crenatus (Duftschmid)	-	-	-	-	1	-
Pterostichus diligens (Sturm)	-	-	-	5	1	-
Pterostichus niger (Schaller)	-	-	-	-	-	3
Pterostichus nigrita (Paykull)	-	-	-	2	-	1
Pterostichus strenuus (Panzer)	-	1	-	-	-	1

TABLE 4. Wetland staphylinid species (selected from listing by Lott (2003)) and their association with *Phragmites* reedbeds and *Carex*/marsh litter (data from Koch (1989)). Indicator species are marked with an asterisk. Microhabitat descriptions refer to those associated with reedbeds or marshes only, and are not the exclusive microhabitat for any of the species except *A. incana* and *A. zosterae*.

Species	Reedbeds	Marshes
Staphylinidae		
Alianta incana	*Typha* swamps/marshes	-
Atheta graminicola	-	Marsh litter
*Atheta zosterae**	Waterbird nests	-
Carpelimus rivularis	*Phragmites* marsh litter	Marsh litter
Euaesthetus ruficapillus	*Phragmites* marsh litter	*Carex* marsh litter
Hygronoma dimidiata	*Phragmites* marsh litter	*Carex* marsh litter
Ischnopoda atra	-	Marsh litter on silt soils
Lathrobium quadratum	*Phragmites* marsh litter	-
Lesteva sicula	*Phragmites* marsh litter	*Carex* marsh litter
Myllaena dubia	*Phragmites* marsh litter	Marsh litter
Ocyusa maura	*Phragmites* marsh litter	*Carex* marsh litter
Oxypoda elongatula	*Phragmites* marsh litter	*Carex* marsh litter
Paederus fuscipes	*Phragmites* marsh litter	*Carex* marsh litter
Paederus riparius	-	Marsh litter
Philhygra malleus	-	Marsh litter
*Philonthus fumarius**	-	Marsh litter
Philonthus micans	*Phragmites* marsh litter	-
*Philonthus micantoides**	-	Marsh litter
Rybaxis longicornis	Reed zones of tide-influenced land	Marsh litter

TABLE 4 (continued)

Stenus bifoveolatus	*Phragmites* marsh litter	*Carex* marsh litter
Stenus bimaculatus	-	Marsh litter
Stenus boops	-	Marsh litter
Stenus canaliculatus	Silt & litter on muddy shores	-
*Stenus europaeus**	*Phrag.* litter, shaded river banks	-
Stenus juno	*Phragmites* marsh litter	*Carex* marsh litter
Stenus lustrator	-	Marsh litter
Stenus nitidiusculus	-	-
Stenus pallitarsis	*Phrag.* litter, silty stream banks	*Carex* marsh litter
Stenus picipennis	*Phragmites* marsh litter	*Carex* marsh litter
Carabidae		
Agonum afrum	-	*Carex* litter
*Agonum nigrum**	-	Marshy shores
Agonum thoreyi	*Phragmites* litter	-
Bembidion assimile	Reed stems	Marsh & marshy meadow litter
Elaphrus cupreus	Reedy shore litter	-
Total species	34	34
Reedbed microhabitats	22 (68%)	-
Sedge & marsh litter	-	25 (74%)

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THE MARINE MOLLUSCA OF IRELAND 3. LOUGH HYNE, CO. CORK

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Introduction

Lough Hyne (Lough Ine) is a sheltered sea-lough in west Cork on the south west coast of Ireland, declared a nature reserve since June 1981 under section 15 of the Wildlife Act 1976. It was the first statutory Marine Nature Reserve in Europe, and is a Special Area of Conservation, Natural Heritage Area, and an Irish Biogenetic Reserve, set up under the auspices of the Council of Europe. This marine lake lies on a NNW-SSE axis, ~1km long and ~0.75km wide, divided unequally into north and south basins by Labhra Island. The deepest area of ~50m is to its west forming the Western Trough, but it is only ~1m deep at low water directly to the east of the Island. To the south-east of the Lough, there is a narrow and shallow channel ~1.2km long. At its narrowest (20m, depth ~1m at low water), a tidal Rapids is formed over a sill of bedrock. This channel connects through Southern's Bay and Barloge Creek out to the Atlantic Ocean, at Carrigathorna to the west (Kitching and Ebling, 1967) at Bullock Island to the east, and through The Coosh at high water (a bank of gravel and large stones). There is a 97m long cave from this channel into Bullock Island. The origin of Lough Hyne is thought to be due to glacial erosion. The initial marine transgression was during Neolithic times, through the Rapids area (Holland, 1988). There is a good description of the geology of the area in this publication.

There are good general descriptions of Lough Hyne in Kitching (1987b, c) and Myers *et al.*

(1991). One of the earliest was by Robert Lloyd Praeger (Praeger, 1937): '...the clear sheltered lake...resembles a gigantic marine aquarium... Many forms common on the surrounding shores are absent or very rare in the lough...On the other hand, many animals and some plants grow to quite unusual dimensions. The fauna is characterized by a remarkable abundance and variety of species....To lean over the side of a boat and view the bottom with a 'water-telescope' is like peeping into a strange calcareous sort of fairyland'. Lough Hyne has a wide variety of habitats; from bedrock to sand, cliffs (littoral and sublittoral), gravel, boulders, and depths ranging to 50m. Special habitats include eelgrass beds in Barloge Creek, and current swept kelps in the Rapids. There is an early, full description of the fauna and flora of Lough Hyne in Renouf (1931), with further detailed summaries in Myers *et al.* (1991).

The catchment about Lough Hyne is small due to high surrounding land, and freshwater inputs are small, being mainly due to streams at the north-east corner, West Quay and the western corner of the Goleen. Salinity, as a result, remains close to that of the open sea, with a continual and periodic selective exchange with coastal water passing *via* the Rapids. Occasional heavy rain draining into the Lough results in a layer of freshwater over the salt water, lowering shallow water salinity to as little as 30‰, but there is no significant difference in bottom water salinity (Kitching *et al.*, 1952; Minchin, 1992c).

Temperatures vary between 4°C and 21°C during the year, with the highest temperatures being in August, and can reach 25°C in that month in the shallow waters of the Goleen (Kitching and Ebling, 1967; DM). During the summer, inflow brings in cooler water from the open sea over the Rapids, but there is no effect in areas like Codium Bay, which are largely influenced by surface water temperatures in the main Lough. (Kitching *et al.*, 1952). During warm summer periods, deoxygenation below *circa* 25m takes place in the Western Trough, the depth of the hypolimnion varying according to meteorological conditions (Bassindale *et al.*, 1957); these conditions normally result in the mortality of all the mobile fauna living below that depth.

There is limited wave-action, due to a short fetch, and shelter by the high surrounding land, with waves rarely exceeding 30cm in the Lough. Tides in the Lough are asymmetric in rhythm, due to the delay caused by the presence of the Sill [Rapids], with an inflow of 4 hours and ebb of 8.5 hours. Tidal heights inside the Lough vary by 0.7-1.0m (Kitching and Ebling, 1967). Currents over the Rapids approach 3m/sec., but are negligible over much of the Western Trough and North Basin. Currents do not exceed 0.5 cm/sec in Barloge Creek (Kitching *et al.*, 1952).

Within the reserve area (Figure 1), there is a wide variation of wave-exposure, current speed, depth, light penetration and siltation. Substrata range from vertical cliffs of bedrock, boulder slopes to fine sediments. Lough Hyne is generally accessible and small enough to sample. The wide range of habitats suggests that Lough Hyne may be expected to have a significant number of molluscan species present.

Historical background to molluscan studies in Lough Hyne

In the National Museum of Ireland is a small collection of material donated by Mrs Thomas Townshend: 'Some native marine shells including specimens of the *Pecten maximus* var. *anomia*', donated on 8th March 1859; and later 'A few scallops, *Pecten maximus* from Loughine' donated on 6th June 1859. Other material donated by Mrs Townshend includes five specimens of *Ianthina communis* [*Janthina janthina*] Lough Ine, Co. Cork 1861, and *Cardium edule* [*Cerastoderma edule*] Lough Ine. Although these are the first known specimens collected in Lough Hyne, the first scientific investigation took place from a small rowing boat on the morning of 7th July 1886. The *Lord Bandon*, used for research on the south Irish coast (1886 Royal Irish Academy cruise, led by W. S. Green), made a chance visit as a result of rough seas, to Barloge Creek for shelter (Haddon and Green, 1888; Minchin, 1991b). The North and South Basin shallows were examined (dredging in 'dense fine malodorous mud'). A general description of the lough was published (Haddon and Green, 1888). It was noted that 'this beautiful lough is worthy of a detailed investigation, both from a physical and biological point of view'. The scientific results of the visit were published in Chaster (1898), under 'Log 39 Lough Hyne depth 0-20 fathoms; fine dense, foul mud'. 19 species were found, plus one now known to be an error.

The information gleaned persuaded Rowland Southern to visit the Lough in November 1916 for five days, whilst the research vessel *Helga* was stormbound (Renouf, 1931). It should be noted however, that Renouf also refers to fieldwork by Southern in Lough Hyne in 1914 and 1915 (Renouf, 1931, 1937). Southern's notebooks were passed to Louis Renouf (1887-1968), who first visited the area in February 1923, at Praeger's instigation, who had suggested the Lough as an area for study when he met Renouf in 1922.

Renouf (the first Chair of Zoology at University College Cork) undertook research in the area into the 1960s, but most of his work was concentrated here between 1926-1940s. The studies began first in 1925, with rented accommodation at Baltimore; then with a packing case set-up beside the Rapids in which to shelter equipment from 1926 until 1929. A hut by the Rapids was used from 1928 to 1962, until it was borne away in a storm surge. Further wooden buildings were constructed that were used for student field trips. From this time, Renouf published information gathered on molluscs collected from 1931-1939. He described the dredging in the main lough as disappointing, due to there being only a small area of hard ground, and large area of mud (Renouf, 1931).

Following the publications by Renouf in the 1930s, further studies were undertaken by the British workers Jack Kitching and John Ebling. This led to a continuous and detailed series of publications following annual visits with students, principally from the University of East Anglia, until the early 1980s. They constructed two laboratories from which they based their work, one bedside the Rapids (Dromadoon in 1954) and the other near Glannafeen (1952-57). The majority of their studies were centred about the South Basin, the Rapids, Southern's Bay, Barloge Creek and at the exposed headland at Carrigathorna. These laboratories were later donated to University College Cork, who established a concrete building in 1987 close to the site for two adjacent wooden huts that students had previously been used and had fallen into disrepair by the late 1970s. Presently this is the main working area on the Lough, and is known as the Renouf Laboratory.

The work by the Kitching group of researchers included studies on: *Sacchoriza polyschides* (Ebling *et al.*, 1948; Norton, 1971); other laminarian species (Sloane *et al.*, 1957; Norton *et al.*, 1977); *Himanthalia elongata* (Kitching, 1987a); undergrowth algae (Sloane *et al.*, 1961); 33 littoral stations for distribution of general species (Ebling *et al.*, 1960); *Amphisbetia* [*Sertularia*] *operculata* (Round *et al.*, 1961); *Patella* spp. (Ebling *et al.*, 1962); *Mytilus edulis* and *Nucella lapillus* (Kitching *et al.*, 1959; Ebling *et al.*, 1964; Kitching *et al.*, 1967; Kitching, 1977); diurnal rhythmns in *Gibbula cineraria* (Thain, 1971); *Gibbula umbilicalis* (Thain *et al.*, 1985); *Paracentrotus lividus* (Kitching and Ebling, 1961; Kitching and Thain, 1983); boulders (Lilly *et al.*, 1953); sea caves (Norton *et al.*, 1971); Western Trough (Kitching *et al.*, 1967); tidepools at Carrigathorna and Barloge Creek (Goss-Custard *et al.*, 1979); Whirlpool Cliff (Kitching *et al.*, 1990). All these publications included records for Mollusca.

Over a period from the 1960s to 1980s, caravans were used by Keith Hiscock and by DM on or close to the North Quay. Although their work covered the entire reserve area, it was concentrated within the North Basin. All of these investigations yielded information on the distribution of molluscs within the Lough.

Since the late 1970s however, especially with the advent of SCUBA diving, considerable fieldwork has taken place. Diving observations in 1979-1981, principally of nudibranchs, were recorded in two reports to the Praeger Committee, Royal Irish Academy, by BEP (Picton, 1979, 1981). Hiscock (1976) studied the sublittoral faunal rock communities at Whirlpool Cliff, Labhra Cliff and Carrigathorna resulting in detailed species lists from 1971. A number of species studies on Mollusca took place in the Lough on *Patella vulgata*, and littorinids in the 1980s (e.g. Little and Williams, 1989; Little *et al.*, 1990, 1991), mainly by students from the

University of Bristol. The deeper fauna of the south basin was studied by Thrush (Thrush and Townsend, 1986). In November 1993 and April 1994, 14 sites (littoral and sublittoral) within Lough Hyne were investigated as part of a European Union Life Programme. This was undertaken by BioMar (based at Trinity College Dublin) as part of a survey of the marine biotopes around the coast of the Republic of Ireland. It included important marine fauna and flora, but not any specialised groups (Picton and Costello, 1998). As a result of all this intensive study, there are more than 250 scientific accounts from this area since it was first studied in 1886 (Wilson, 1984; Myers *et al.*, 1991).

The Lough up until the 1980s had little human interference. Diving had been mainly limited to scientific studies. In advance of the setting up of the marine reserve, there had been an interest in developing the area for finfish and mussel cultivation; some fishing activities by permit continued for a short time for the capture of mullet and trapping of shrimp. Human activities greatly increased during the 1980s, mainly boating, swimming, snorkelling and wading by horses. All of these will have had some impact on some shallow water areas, in particular near to the North and West quays. In November 1986, a cargo ship (*Kowloon Bridge*) carrying ore struck rocks near to Lough Hyne, releasing 1600 tonnes of oil. No oil reached the Lough itself due to the placing of a boom across Barloge Creek (Kitching, 1987c). No long-term effects are known from this event.

In this account, all known previous records of marine Mollusca and their distribution within the reserve area of Lough Hyne are reported, together with the results of further fieldwork and a comprehensive bibliography.

Methods

Compilation of this checklist was achieved in three ways *viz.*

1) Searches of all previous literature, museum collections and known surveys.

2) From private notebooks and observations, in particular personal research by authors DM (1975-1986) and BEP (1979-1981, 1983, 1984, 1989 and 1990); and by J. M. C. Holmes (1977 to date).

3) A field survey of 72 stations from 126 site visits (July 1990 to November 2005) by JDN.

(a) Literature Search

The sources of information for records of the Mollusca of Lough Hyne are listed in the references. Bibliographies in Wilson (1984) and Myers *et al.* (1991) were essential starting points. The principal areas of search were: (i) **Marine Mollusca collections**: Ulster Museum (Belfast), National Museum of Ireland (Dublin), The Natural History Museum (London), National Museums and Galleries of Wales (Cardiff), National Museums of Scotland (Edinburgh); (ii) **Journals**. *Journal of Conchology*, *Journal of Molluscan Studies*, *Proceedings of the Malacological Society*, *Irish Naturalist*, *Irish Naturalists' Journal*, *Proceedings of the Royal Irish Academy* were all examined from their inception to date; (iii) **BioMar survey**. The records from this survey are available on CD (Picton and Costello, 1998); (iv) **Molluscan records for Sea Area 37**. These records are held by Dr David McGrath as marine recorder for this area on behalf of the Conchological Society of Great Britain and Ireland; (v) **A number of individuals** were consulted for personal records of species.

(b) Littoral Survey 1990-2005

Littoral sites were selected to include: (i) the full range of habitats present in the area; (ii) representative sites for the principal habitats; (iii) sites with restricted or unusual features; (iv) even geographic coverage; (v) high human impact areas.

A total of 36 stations (45 site visits) were surveyed from July 1990 to July 2005 (Figure B; Table 1). In July 2005, there was a special study on the distribution of *Osilinus lineatus.* The recent effort in the study of Lough Hyne is similar to that devoted to Strangford Lough (118 sites) (Nunn, 1994), which is a very much larger body of water (240km shoreline, compared with *circa* 7.4km in Lough Hyne; and 80km, 67 sites, for Mulroy Bay (Nunn, 1996)). Most sites were searched for 1-1½ hours. Sites in the Rapids/Barloge Creek were examined on a good spring tide (predicted low water 0.5m or less above Chart Datum; tidal range 3.0m). Within Lough Hyne itself, the tidal range is narrow (<1.0m), and maximised during neap tides. Sites were visited in July and August. Methodology was as described in Nunn (1994).

(c) Sublittoral Survey 1990-2005

Dive stations were selected on the same basis as the littoral sites and over the same time period, but restricted to depths less than 25m. Areas deeper than 25m (principally Western Trough and part of Southern Basin) were undertaken by other workers, and their observations are included. The great majority of molluscs occur down to depths of less than 25m, due to the summer thermocline in the Western Trough creating anoxic conditions below that depth.

A total of 36 dive sites (81 dives) were surveyed over the period July 1990 to November 2005 in the depth range 0-25m, principally 0-15m (Figure C; Table 2). Depths for dive sites (Table 2) were not corrected to Chart Datum. In many cases, the exact time of the dive was unrecorded, so corrections could not be made. Inaccuracy of depth recorded is no more than +/- 2m, and less than 1m in the main Lough. Visibility underwater ranged from 2-10m. Methodology was as described in Nunn (1994). As dredging is not permitted in Lough Hyne, no dredged data are available except from published literature.

Identification was based on personal experience by JDN, but several texts were used for the most difficult species *viz*. Jones and Baxter (1987), Fretter and Graham (1976-1986), Picton and Morrow (1994) and Tebble (1966). Confirmation of identification of the most difficult species was obtained from J. Baxter (chitons) and S. M. Smith (all others). Identification of nudibranchs by DM during the 1970s was made using Brown and Picton (1979).

Discussion: survey results

The total number of molluscan species recorded from Lough Hyne is 239; 223 living, 12 shell only, together with 4 species not seen since the 19th century (Table 3A). At Carrigathorna, three species are present that do not occur elsewhere within the reserve area. Since 1970, 207 species have been recorded living. The species richness compares well with other well-studied inlets such as Strangford Lough, Co. Down (249 since 1960) (Nunn, 1994) and Mulroy Bay, Co. Donegal (196 since 1970) (Nunn, 1996).

Since 1990, JDN has recorded 177 living, and shells from thirteen species. Eighteen species remain unrecorded since the 1950s (most pre-1940; Table 3B), and may yet be found in the Lough. Six species are considered to be errors of identification, and seven with uncertain status, where identification is considered to be difficult and unconfirmed, but not unlikely. There is one possible addition that awaits confirmation.

Two species are new or upgraded records for Ireland from Lough Hyne (Table 3C). These are *Liostomia clavula*, a first live record; and *Folinella excavata*, a first live record since before 1900, although the status of the older record is uncertain. In 2002, *Calma glaucoides* was split into two species, *C. glaucoides* and *C. gobioophaga*. The specimens from Lough Hyne are of the latter new species, and are therefore the first confirmed records for this species for Ireland and Britain.

There have been 12 new records obtained for Sea Area 37 Fastnet (Conchological Society of GB and Ireland; Seaward, 1982; Table 3D). This survey has also recorded 43 new species for the Lough (Table 3E). Two species are unknown elsewhere in Ireland or Britain - *Facelina dubia* and *Dicata odhneri*. Current unpublished records by JDN indicate that there are >500 mollusc species in Irish coastal and inshore waters, and of these perhaps 50% are known from Lough Hyne.

The greatest molluscan species diversity/richness in the intertidal area was found on the south-east shore of the Rapids (53 living, 1 shell); north-east Southern's Bay (51, 2); south-east Castle Island (49, 3) and the west shore of the Rapids (47, 1) (Table 1). These sites are associated with cleaner, current-swept rocks and boulders with coarse sediments. The richest sublittoral sites were Whirlpool Cliff (79, 18); Rapids (69, 18); Labhra Cliff (53, 4); Goleen

Cliff (52, 20); Southern's Bay N (50, 17) and Codium Bay (49, 9) (Table 2).

The molluscan fauna of Lough Hyne is predominantly composed of species with more southern (Lusitanian) distributions and several of these are at their most northern limits of distribution (*Facelina dubia*, *Dicata odhneri*). Other mainly south/south-western species present (absent in Scotland) are *Barleeia unifasciata*, *Runcina ferruginea*, *Cuthona genovae*, *Aeolidiella alderi* and *Gastrochaena dubia* (Seaward, 1991). Many species with predominantly west coast distributions such as *Eatonina fulgida* are also present in Lough Hyne. These include *Leptochiton cancellatus*, *Simnia patula*, *Raphitoma purpurea*, *Aeolidiella sanguinea*, *Venus verrucosa*, *Gari depressa* and 10 other species. The only apparently northern species present is *Turbonilla rufescens*, but all the other well known northern species are absent e.g. *Tonicella marmorea*, *Tectura testudinalis*, *Margarites helicinus*, *Adalaria proxima*, *Crenella decussata*, *Limatula subauriculata*. There are a few apparently 'missing' species: such as *Musculus costulatus*, *Colpodaspis pusilla*, *Goodallia triangularis*, *Loripes lucinalis*, which may yet be found. Lough Hyne lies within the influence of the Eastern Atlantic Boreal Region (Briggs, 1974) together with most of Britain and Ireland. Warm water from the North Atlantic Drift, passes to the west of Ireland towards the west coast of Scotland. This permits more southern species to occur on Irish south and west coasts. In addition, summer temperatures in parts of Lough Hyne, reach at least as high as 21°C. These conditions would ensure the survival of viable populations of 'southern' species. The increase in range and abundance of populations of the south-western species *Osilinus lineatus* in the Lough may also be a first indication of the effects of global warming in the Lough and adjacent areas.

Conclusion

This account increases the knowledge of the biodiversity of Irish coastal inlets. The number of species recorded for the reserve is comparable to other well studied but larger areas in Ireland. This endorses the importance of Lough Hyne as a site for conservation. Impacts by non-native species are likely to occur into the future, and some of these already occur within the reserve area. However, there is only one known introduced mollusc recently found within the Lough (*Crassostrea gigas*). There would appear to be temporal changes following declines of *Paracentrotus lividus* and *Chlamys varia* in the lough since the earlier investigations before the 1970s. It is not clear how dependant molluscs within the Lough are on recruitment from populations outside of the reserve area. There are three rare nudibranch species that are known only from within the Lough in Ireland, which may have confined distributions there. However, the finding of a new record within Lough Hyne can lead to the species being found elsewhere in Ireland, and may improve the knowledge of molluscan distributions elsewhere within Europe.

Checklist and distribution maps

The records collected (old and new) were used to compile a checklist of the marine Mollusca of Lough Hyne, together with ecological notes, and the location of material in museum collections. Sea Area 37 records, and records new to Lough Hyne refer only to those found during the present survey by JDN, 1990-2005.

Distribution maps for each species were drawn up, showing presence/absence (not abundance), and all live records for species with three or more records. Records considered to be unreliable have not been mapped, nor where the position for a record could not reasonably be inferred. Maps (such as those published here) display distribution clearly, and as distribution is limited by physical factors to which the physiology of the animals respond, are likely to reflect environmental conditions. This can act as a stimulus to ecological investigations (Norton, 1978).

There are a number of abbreviations and terms used in the checklist:

Ireland: refers to the island of Ireland.

LH: Lough Hyne; the place names referred to in the text are shown in Figures 1 and 2.

SA: Sea Area, as defined in Seaward (1982).

Renouf S-: refers to the numbering system for the littoral sections into which Renouf divided the entire coast of Lough Hyne and Barloge Creek, as defined in Renouf (1931) and republished in Myers *et al.* (1991). The other numbering for sites e.g. B5, C2, I7, refers to the grid coordinate system developed by DM for Lough Hyne, and which is indicated on the x and y axes of each map below.

Recorders: JDN: Julia Nunn; **BEP**: Bernard Picton; **DM**: Dan Minchin; **BioMar**: BioMar survey team 1993/94 - B. E. Picton (field leader); C. S. Emblow; C. C. Morrow; E. M. Sides. All other recorders of Mollusca are referred to by their full name, or to a reference where the record was published.

coll.: 'collected by' a particular recorder.

det., **conf**: 'determined by', or 'confirmed by' i.e. identification made, or confirmed by a particular expert.

Recent: refers to records made post 1970.

Collections: UM: Ulster Museum; **NMI**: National Museum of Ireland; **NMGW**: National Museums and Galleries of Wales; **NHM**: The Natural History Museum (London); **NMS**: National Museum of Scotland.

Taxonomy follows Howson and Picton (1997). Where changes have been made, the name used by Howson and Picton (1997) has been included as a synonym. Brackish species follow Anderson (2005).

CLASS POLYPLACOPHORA

ORDER NEOLORICATA

LEPTOCHITONIDAE

Leptochiton asellus (Gmelin, 1791) (Figure 5)

Recorded living from the Southern's Bay, Rapids, Whirlpool Cliff, north-east North Basin (Hiscock, 1976; Kitching and Thain, 1983; 1990-2005 JDN). Depth range: intertidal, but normally sublittoral to 11m. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud (Chaster, 1898). Collections: NMI, UM.

***Leptochiton cancellatus* (G. B. Sowerby II, 1840) (Figure 5)**

First recorded living, Western Trough 14.7.1990 12m (JDN, det. J. Baxter). A few further records from the Rapids, Southern's Bay in gravel, Southern's Bay Narrows and Whirlpool Cliff (1990-2005 JDN, det. S. M. Smith). Depth range: sublittoral 3-18m. New record for LH. Widespread around Ireland, although uncommon. Collections: NMI, UM.

ISCHNOCHITONIDAE

***Ischnochiton albus* (Linnaeus, 1767)**

First recorded from north of Whirlpool Cliff 14.7.1990 14m, one juvenile (JDN, det. J. Baxter). A second specimen was recorded from the Rapids 4.7.1992 6m. New record for LH. There are few recent living records from Ireland. Collection: UM.

***Callochiton septemvalvis* (Montagu, 1803) (Figure 6)**

A single specimen recorded by DM in 1980 from J7 [Whirlpool Cliff]. Only found living in Whirlpool Cliff, the Rapids, Southern's Bay and Barloge Creek (1990-1993 JDN). Depth range: intertidal to 15m. Collections: NMI, UM.

***Lepidochitona cinerea* (Linnaeus, 1767) (Figure 6)**

First recorded from Renouf S12-S17 *circa* 1930, as *Craspedochilus cinereus* (Renouf, 1931). Widely recorded from throughout the Lough (Hiscock, 1976; Kitching and Thain, 1983). Many intertidal sites, where it is found under small stones (1990-2005 JDN). Depth range: intertidal to 18m. Collections: NMGW, NMI, UM.

***Tonicella marmorea* (O. Fabricius, 1780)**

Recorded in error by A. Trew 15.8.1981 shore, LH. This specimen has been seen by JDN in the collections of NMGW; it is *Lepidochitona cinerea*.

***Tonicella rubra* (Linnaeus, 1767) (Figure 7)**

Recorded living from Codium Bay and Square Rock, one each on top of boulders, 1950 (Lilly *et al.*, 1953). Widely distributed throughout the South Basin, and at the entrance to Barloge Creek (Urchin Reef and Carrigathorna) (Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; Thrush, 1985; 1990-2005 JDN). Apparently absent from North Basin. Depth range: intertidal to 20m.

Acanthochitonidae

***Acanthochitona crinita* (Pennant, 1777) (Figure 7)**

Recorded from Renouf S12-S17 *circa*1930 and the east side of the Coosh, as *Acanthochites fascicularis* (Renouf, 1931). Widely distributed throughout the South Basin, the Rapids and at the entrance to Barloge Creek (Lilly *et al.*, 1953; Sloane *et al.*, 1961; Hiscock, 1976; Goss-Custard *et al.*, 1979; 1990-1997 JDN). Apparently absent from North Basin. The species is discouraged by *Paracentrotus lividus* grazing (Kitching and Thain, 1983). Depth range: intertidal to 20m. Collections: NMI, UM.

CLASS GASTROPODA

ORDER ARCHAEOGASTROPODA

SUPERFAMILY FISSURELLACEA

FISSURELLIDAE

***Emarginula fissura* (Linnaeus, 1758) (Figure 8)**

First recorded from Renouf S12-S17 *circa* 1930 and the east side of the Coosh (Renouf, 1931). Found living from the eastern half of the South Basin, the Rapids (particularly on boulders), north-west LH and Carrigathorna (Lilly *et al.*, 1953; Norton *et al.*, 1977; Kitching and Thain, 1983; 1990-1992 JDN). Shells are common in these areas, which are generally cleaner gravel. Depth range: intertidal to 18m. Collections: NMI, UM.

***Diodora graeca* (Linnaeus, 1758) (Figure 8)**

Scattered records from the South Basin, e.g. Renouf S12-S17 *circa* 1930, as *Fissurella graeca* (Renouf, 1931); on or under boulders in the Rapids 1948 (Lilly *et al.*, 1953; 1990-1993 JDN; 1994 BioMar); Southern's Bay 25.7.1993 (JDN); west side of Barloge Creek 26.4.1994 (BioMar) and Carrigathorna on a *Laminaria hyperborea* holdfast (Goss-Custard *et al.*, 1979). Shells are found throughout this area, and at Whirlpool Cliff. One specimen was apparently found on August 1968 at 25m in the south section of the Western Trough (Kitching *et al.*, 1976). Depth range: intertidal normally, but also sublittoral to 25m. Old records: live, Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud (Chaster, 1898). Collections: NMI, UM.

Superfamily Trochacea

Turbinidae

***Tricolia pullus* (Linnaeus, 1758) (Figure 9)**

First recorded at Renouf S12-S17 *circa* 1930 and dredged Barloge, as *Phasianella pullus* (Renouf, 1931). Found throughout the South Basin, Rapids and Barloge Creek, but most frequently Whirlpool Cliff and Carrigathorna, (Hiscock, 1976; Norton *et al.*, 1977; Goss-Custard *et al.*, 1979; Kitching *et al.*, 1990; 1990-1997 JDN). *Tricolia pullus* was found on *Ulva*, *Codium spp.*, *Cryptopleura* and *Polyneura* in the Rapids area (Sloane *et al.*, 1961). Depth range: intertidal to 18m. Collections: NHM, NMI, UM.

Trochidae

***Gibbula magus* (Linnaeus, 1758) (Figure 9)**

Recorded living, a single specimen, from north of Whirlpool Cliff 14.7.1990 14m (JDN), and throughout Southern's Bay to the Narrows, in gravel (1993-2005 JDN). Renouf (1931) reported dead shells occupied by *Eupagurus bernhardus*. Depth range: 4-14m. New live record for LH. Widespread throughout Ireland, particularly south-west Ireland. Collections: NMI, UM.

***Gibbula tumida* (Montagu, 1803) (Figure 10)**

Recorded living, a single specimen, from north of Whirlpool Cliff 14.7.1990 14m (JDN), Western Trough 14.7.1990 12.5m; south of the Rapids and north Southern's Bay 28.7.1993 2.6m, 5.6m in gravel. Depth range: 2.6-14m. New record for LH. Widespread throughout Ireland. Collection: UM.

***Gibbula cineraria* (Linnaeus, 1758) (Figure 10)**

One of the most widely distributed and abundant species in LH. First recorded as common in

1930, dredged off Barloge and the east side of the Coosh (Renouf, 1931). Found throughout the Reserve except Carrigathorna and south Bullock Island in July 1955 (Ebling *et al.*, 1960; Kitching and Ebling, 1967). Subsequently found at Bullock Cave, summer 1967 and 1968 (Norton *et al.*, 1971) and Carrigathorna 1968-1972 9-18m (Norton *et al.*, 1977). A repeat study showed a similar distribution (Kitching and Thain, 1983), and also this work (1990-2005 JDN). This species is found in the Rapids on *Saccorhiza polyschides* stipes and fronds in the quieter regions (Ebling *et al.*, 1948), a wide range of algae (Sloane *et al.*, 1961), *Amphisbetia operculata* (Round *et al.*, 1961) and *Himanthalia elongata* straps (Kitching, 1987a). Known to be predated by hooded crows (Berrow *et al.*, 1992). The species migrates upwards at first light, and downward at sunset (Ebling *et al.*, 1966). It can also be found on the top of rocks by day, underneath at night – neither of these behaviours is linked to tide times (Thain, 1971). It has been seen spawning in shallows in August following temperature rises (Minchin, 1992c). Depth range: intertidal to 19m. Collections: NMGW, NMI, UM.

***Gibbula umbilicalis* (da Costa, 1778) (Figure 11)**

First recorded as common in 1930, from Renouf S12-S17 and the east side of the Coosh, as *Gibbula umbilicata* (Renouf, 1931). Found throughout the Reserve except Whirlpool Cliff, Carrigathorna and south Bullock Island in July 1955 (Ebling *et al.*, 1960). Subsequently found at Bullock Cave, summer 1967 and 1968 (Norton *et al.*, 1971) and Carrigathorna 1975/1976 (Goss-Custard *et al.*, 1979). Common 1990-2005 (JDN). Shells are rare. *Gibbula umbilicalis* is found in the Rapids on *Codium fragile* (Sloan *et al.*, 1961), but generally inhabits alga covered rock surfaces in the middle and lower half of the littoral region (Thain *et al.*, 1985). Depth range: intertidal only. Collections: NMGW, NMI, UM.

***Jujubinus miliaris* (Brocchi, 1814)**

Not seen recently in LH. Recorded only from Barloge, dredged *circa* 1930, as *Gibbula miliare* (Renouf, 1931). Many old or shell records from around Ireland, only recently living from Northern Ireland and Killary Harbour.

***Jujubinus montagui* (W. Wood, 1828)**

Recorded living from north of Whirlpool Cliff 18.7.1993 13m, and subsequently at Whirlpool Cliff 10.8.1997 18m (JDN). A shell was found in 1980 (DM). New record for LH and SA37. Only a few recent living records from around Ireland. Collection: NMI.

***Osilinus lineatus* (da Costa, 1778) (Figure 11)**

The only record for *Osilinus lineatus* in LH prior to 2003, was from Castle Island, with a few (less than 10) seen during the period 1976-1984 (DM). None were seen by JDN from 1990 to 1997. Subsequently, it was reported from west of Renouf Bay 10.5.2003 by C. Simkanin. Two specimens were found at Renouf E3 10.7.2005 (JDN). In view of the apparent range extension of this species in other parts of Ireland e.g. Strangford Lough (Nunn, 2004), the entire shoreline (where practicable) of LH was examined (12-15.7.2005) to ascertain the current status of the species. Small populations were found in every area where the habitat was suitable (e.g. primarily small boulders, stones and sheltered bedrock - not exposed bedrock or sheltered mud/gravel). Densities were low ($<1/m^2$), although more than 20 individuals were observed on Castle Island (NW) at a density of $3/m^2$, and 19 individuals over a wider area on the eastern shore of the Lough. The settlement dates ranged from *circa* 1997 to 2001, ascertained from growth checks on the shell. A very few small (probably 1-2 years old) individuals were found under stones in the Goleen by J. Bass 16.7.2005. *O. lineatus* was also found in both Southern's Bay (density $3/m^2$) and Barloge Creek, but only two specimens were seen on the outside main coast at Tragumna. There has been an unprecedented extension of range of *Osilinus lineatus* into Lough Hyne. This is consistent with the current status for this species in Britain and Ireland – not only is *O. lineatus* extending its range, but is also expanding the size of its populations, particularly at its previous range limits. It is unclear why this species has been largely absent from Lough Hyne until the late 1990s (Nunn, 2005).

***Calliostoma zizyphinum* (Linnaeus, 1758) (Figure 12)**

Uncommon, occasionally common species, confined to areas of moderate current, mainly Whirlpool Cliff, Rapids, Southern's Bay, Barloge Creek and Carrigathorna (1990-2005 JDN). First recorded in 1930, from Renouf S12-S17 and the east side of the Coosh (Renouf, 1931). Found in the Rapids and Barloge Creek in July 1955 (Ebling *et al.*, 1960). *Calliostoma zizyphinum* was subsequently found at Bullock Cave (Norton *et al.*, 1971), Carrigathorna and Whirlpool Cliff (Hiscock, 1976; Norton *et al.*, 1977), Castle Narrows (Kitching and Ebling, 1967). O'Loughlin (1989) noted that the species was absent in Lough itself and at the edge of the lower end of the Rapids. Found on a wide range of algae, preferring places in current of medium speed (Ebling *et al.*, 1948; Sloane *et al.*, 1961), *Amphisbetia operculata* (Round *et al.*, 1961) and *Himanthalia elongata* straps 1982-85 (Kitching, 1987a). Depth range: intertidal to 18m. Collections: NMI, UM.

Order Patellogastropoda

SUPERFAMILY PATELLACEA

Lottiidae

***Tectura virginea* (O. F. Müller, 1776) (Figure 12)**

First recorded from Renouf S12-S17 and the east side of the Coosh *circa* 1930, as *Acmaea virginea* (Renouf, 1931). Found in the Rapids on the tops of boulders away from maximum water movement, July 1948 (Lilly *et al.*, 1953; Kitching and Ebling, 1967), and on *Himanthalia elongata* straps (Kitching, 1987a). Found throughout LH, Rapids, Southern's Bay, Barloge Creek and Carrigathorna (Sloane *et al.*, 1961; Kitching and Ebling, 1961; Norton, 1971; Norton *et al.*, 1971, 1977; Hiscock, 1976; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; Kitching *et al.*, 1990). Additional records from D2 and G2 (DM) and throughout LH (1990-2005 JDN). Depth range: intertidal to 15m, but abundant only in less than 6m. Collections: NMI, UM.

Patellidae

***Patella ulyssiponensis* Gmelin, 1791 (Figure 13)**

First recorded living from the Sill [Rapids] in 1949 (Lilly *et al.*, 1953). Generally confined to the sublittoral fringe and very shallow sublittoral, although present over the whole tidal range at Carrigathorna (Ebling *et al*., 1962; Goss-Custard *et al*., 1979; Kitching, 1987b). Many records in 1977 from the North Wall, northern shore of Castle Island where spawning at E7 was seen, and western shore (DM). Additional records from this work (1990-2005 JDN). This species was encouraged by grazing *Paracentrotus lividus* (Kitching and Thain, 1983). Depth range: littoral to 5m. Collections: NMI, UM.

***Patella vulgata* Linnaeus, 1758 (Figure 13)**

First recorded living from Renouf S12-S17 *circa* 1930 (Renouf, 1931), and above HW on *Verrucaria maura*, Southern's Bay and lower Barloge Creek, April 1934 (Renouf, 1934b). Widely distributed over the intertidal range throughout LH, Rapids, Southern's Bay, Barloge Creek and Carrigathorna (Lilly *et al*., 1953; Ebling *et al*., 1962; Norton *et al*., 1971; Goss-Custard *et al*., 1979; Kitching, 1987b; Kitching and Thain, 1983; 1990-2005 JDN). In September 1990 and July 1991, Little *et al*. (1992) repeated fieldwork from 1955 (Ebling *et al*., 1960), and showed a significant increase in abundance of *Patella* spp. since that date. As this took place in the littoral, this result applies almost exclusively to *P. vulgata*. The foraging behaviour of the species has been extensively studied (Little *et al*., 1988, 1990; Little and Stirling, 1985; Little, 1989; Little *et al*., 1991; Evans and Williams, 1991), and it has been shown that *P. vulgata* is predated by hooded crows (Berrow *et al*., 1992). Depth range: intertidal. Collections: NMI, UM.

***Patella pellucida* (Linnaeus, 1758)** [Helcion pellucidum] **(Figure 14)**

First recorded from Renouf S12-S17 and the east side of the Coosh *circa* 1930, as *Helcion pellucidum* (Renouf, 1931). Generally found in the entrance to the Rapids, Southern's Bay, Barloge Creek and Carrigathorna, with higher densities towards the open sea (Ebling *et al*., 1960; Kitching and Ebling, 1967; Norton, 1971; Norton *et al*., 1971; Kitching, 1987a). More recent records suggest an extension of range north to Whirlpool Cliff and Renouf E3, and west to Labhra Cliff, Renouf S5, I15 (Hiscock, 1976; Kitching and Thain, 1983; Kitching *et al*., 1990; 1990-2005 JDN). Found in the Rapids on *Sacchoriza polyschides* where it prefers moderate current (Ebling *et al.*, 1948; Sloane *et al.*, 1957) and a wide range of algae (Sloane *et al.*, 1961), on *Lithothamnion*, *Laminaria hyperborea*, *Palmaria palmata* at Carrigathorna (Norton *et al.*, 1977; Goss-Custard *et al.*, 1979). Depth range: intertidal and to 18m. Collections: NMI, UM.

Order Mesogastropoda

SUPERFAMILY CERITHIACEA

Cerithiidae

***Bittium reticulatum* (da Costa, 1778) (Figure 14)**

First recorded from Renouf S12-S17 and dredged from Barloge Creek *circa* 1930 (Renouf, 1931). Widely distributed, and abundant, throughout LH (Kitching and Ebling, 1961; Norton, 1971; Norton *et al.*, 1977; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; Kitching *et al.*, 1990; 1990-2005 JDN). Found in the Rapids on *Sacchoriza polyschides* in weak current (Ebling *et al.*, 1948), a wide range of algae (Sloane *et al.*, 1961), *Amphisbetia operculata* (Round *et al.*, 1961), amongst *Audouinella floridula* (Kitching *et al.*, 1976; Kitching, 1987b), on *Himanthalia elongata* straps (Kitching, 1987a). The species is discouraged by *Paracentrotus lividus* grazing (Kitching and Thain, 1983). Depth range: intertidal to 25m. Old records: nine specimens, some possibly living, Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy, 0-20f, fine foul dense mud (Chaster, 1898). Collections: NMGW, NMI, UM.

Turritellidae

***Turritella communis* Risso, 1826 (Figure 15)**

First recorded living dredged in LH *circa* 1930 (Renouf, 1931). Widely distributed in soft sediment throughout the main Lough, especially Western Trough, but absent elsewhere (Kitching *et al.*, 1976; Thrush, 1985; DM). Additional recent records are by JDN (1990-2005) and from the north-east of North Basin 1993 (BioMar). Depth range: sublittoral 1-26m. Old records: six specimens, Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, fine foul dense mud, as *Turritella terebra* (Chaster, 1898). Collections: NMI, UM.

Cerithiopsidae

***Cerithiopsis tubercularis* (Montagu, 1803) (Figure 15)**

First recorded from the Rapids July 1953 on a wide range of algae (Sloane *et al.*, 1961), and *Amphisbetia operculata* (Round *et al.*, 1961). Further records are from the Rapids, in 1977 (Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977) and 15.7.1983 (Kitching, unpublished), and Whirlpool Cliff August 1984 5.5m (Kitching *et al.*, 1990) and elsewhere, with occasional shells (1990-1997 JDN). Depth range: intertidal to 18m. Collections: NMI, UM.

SUPERFAMILY LITTORINACEA

Littorinidae

***Lacuna pallidula* (da Costa, 1778) (Figure 16)**

First recorded from Carrigathorna and Urchin Reef 1975/1976 (Goss-Custard *et al.*, 1979), and subsequently from *Himanthalia elongata* straps at Holly Creek (Barloge) and Renouf E19 1982-1985 (Kitching, 1987a). Recorded from the Rapids, Southern's Bay and Barloge Creek (1990-1993 JDN). Depth range: mainly intertidal, but to 2-3m. Collections: NMI, UM.

***Lacuna parva* (da Costa, 1778) (Figure 16)**

This species is confined to Barloge Creek, being first recorded from near Bullock Island 15.7.1990 10m and near Bullock Cave 20.7.1990 14m (JDN). Found on the west side of the creek 15.8.1997 in 4-5m (JDN). New record for LH. Common all around Ireland.

***Lacuna vincta* (Montagu, 1803) (Figure 17)**

First recorded from *Saccorhiza polyschides* in the Rapids and Renouf Bay, 1946 (Ebling *et al.*, 1948). Generally found at the entrance to the Rapids, Southern's Bay, Barloge Creek and Carrigathorna (Norton, 1971; Norton *et al.*, 1977; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; Kitching *et al.*, 1990; 1990-2005 JDN). Recorded from *Codium fragile* July 1953 Nita's Rock (Sloane *et al.*, 1961) and *Himanthalia elongata* straps (Kitching, 1987a). Depth range: intertidal in pools at Carrigathorna, but generally sublittoral 2m to 25m. Collections: NHM, NMI.

***Littorina littorea* (Linnaeus, 1758) (Figure 17)**

First recorded living, common, in the littoral throughout LH *circa* 1930 (Renouf, 1931). Generally common, occasionally abundant, throughout the reserve except Barloge Creek (Ebling *et al.*, 1960; Kitching and Ebling, 1967; Goss-Custard *et al.*, 1979; 1977 DM 1977). Subsequently found in Barloge Creek (Kitching, 1987b). A detailed study by Little and Williams (1989) found the species throughout most of the reserve, abundant at sheltered sites on rock faces, with juveniles common inside barnacle shells. Recent fieldwork confirms this distribution (1990-2005 JDN). *L. littorea* is predated by hooded crows (Berrow *et al.*, 1992). Depth range: littoral. Collections: NMGW, NMI, UM.

***Littorina arcana* Ellis, 1978 (Figure 18)**

First recorded living by Little and Williams (1989) from stations 1-5 at or above MHWN in Barloge Creek only. Its presence did not appear to be related to wave exposure. This species is an egg laying species, and the eggs may be vulnerable to predators such as small fish and crabs which are abundant in the main Lough. Shores in the Lough also experience longer desiccation times than those under a normal 6-6.5 hour tidal regime. Identification of this species is difficult as it requires dissection. Collection: NHM.

***Littorina compressa* Jeffreys, 1866** [Littorina nigrolineata]

First recorded living by Little and Williams (1989) from stations 2 and 3 in Barloge Creek between MNWS and MHWN to densities of $30/m^2$, as *Littorina nigrolineata*. *Littorina compressa* is an egg laying species, and the eggs may be vulnerable to predators such as small fish and crabs which are abundant in the main Lough. Shores in the Lough also experience longer desiccation times than those under a normal 6-6.5 hour tidal regime. Collection: NHM.

***Littorina fabalis* Turton, 1825** [Littorina mariae] **(Figure 18)**

First recorded living by A. Trew from the shore in LH 15.8.81. Found throughout LH by

Little and Williams (1989) and this fieldwork (1990-2005 JDN). Only separated as a species from *Littorina obtusata* in 1966 (as *Littorina mariae*), so not recorded before that time. Depth range: littoral only. Collections: NHM, NMI, UM, NMGW.

***Littorina neglecta* Bean in Thorpe, 1844**

Recorded in LH by Little and Williams (1989), but it is now known that *L. neglecta* is not a true species, but a mixture of several littorinid species (Reid, 1993).

***Littorina obtusata* (Linnaeus, 1758) (Figure 19)**

First recorded living within Renouf S12-S17 *circa* 1930 (Renouf, 1931). Throughout LH, Carrigathorna and south Bullock Island, July 1955 (Ebling *et al.*, 1960) and Bullock Cave, summer 1967, 1968 (Norton *et al.*, 1971). On *Saccorhiza polyschides* in the Rapids 1946 (Ebling *et al.*, 1948). All these records may include *Littorina fabalis*, which was not recognized at the time. Found throughout LH by Little and Williams (1989) and this fieldwork (1990-2005 JDN). Depth range: littoral only. Collections: NHM, NMI, UM.

***Littorina saxatilis* (Olivi, 1792) (Figure 19)**

Recorded living from Renouf S12-S17 *circa* 1930, as *Littorina rudis* (Renouf, 1931), and above HW on *Verrucaria maura* April 1934 from Southern's Bay and lower Barloge Creek (Renouf, 1934b). Widely distributed and common throughout the reserve (Ebling *et al.*, 1960; Norton *et al.*, 1971; Goss-Custard *et al.*, 1979). More recently, Little and Williams (1989) recorded the species from all stations in the reserve, from all exposures, in barnacle shells, crevices, on open rock and under stones. Down to low water in the Lough, densities no more than $200/m^2$, but restricted to high water outside Lough, at least $2000/m^2$. Common in the reserve (1990-2005 JDN). Depth range: littoral only. Collections: NHM, NMI, UM.

***Melarhaphe neritoides* (Linnaeus, 1758) (Figure 20)**

First recorded living from outer Barloge Creek, April 1934 (Renouf, 1934b). Found in outer Barloge, Carrigathorna and Bullock Island, July 1955 (Ebling *et al.*, 1960; Norton *et al.*, 1971; Kitching and Ebling, 1967; Kitching, 1987b). Subsequently, Little and Williams (1989) also recorded *Melarhaphe neritoides* from the North Wall, and two other sites in eastern half of the South Basin. All sites where this species was found either have some wave exposure or are subject to strong currents. Found Barloge Creek, Carrigathorna and North Wall (1990-2005 JDN). Collections: NMI, UM.

Skeneopsidae

***Skeneopsis planorbis* (O. Fabricius, 1780) (Figure 20)**

First recorded from Carrigathorna and Urchin Reef (Goss-Custard *et al.*, 1979). Subsequently found Renouf S4 1977-1981 (Kitching and Thain, 1983), Nita's Rock on *Himanthalia elongata* straps 1982-1985 (Kitching, 1987a), a single specimen Whirlpool Cliff August 1984 at 11.5m (Kitching *et al.*, 1990), and more widely throughout the reserve (1990-2005 JDN). Depth range: littoral, except off North Island 1.11.2005 in *circa* 5-10m. Collections: NHM, NMI, UM.

SUPERFAMILY CINGULOPSACEA

Cingulopsidae

***Eatonina fulgida* (J. Adams, 1797) (Figure 21)**

First recorded living from Codium Bay, July 1953 on *Codium fragile* (Sloane *et al.*, 1961). Subsequently found Urchin Reef and Carrigathorna 1975/1976 (Goss-Custard *et al.*, 1979, and throughout the main lough (Kitching and Thain, 1983; Kitching *et al.*, 1990), Rapids and Barloge Creek (Kitching, 1987a). This species is discouraged by grazing by *Paracentrotus lividus*. Recorded throughout the reserve, abundant in places particularly in the south-east of the main lough (1990-2005 JDN). Depth range: littoral to 18m. Collections: NHM, NMGW, NMI, UM.

SUPERFAMILY RISSOACEA

Barleeidae

***Barleeia unifasciata* (Montagu, 1803) (Figure 21)**

First recorded living from the Rapids on *Sacchoriza polyschides* in 1946 (Ebling *et al.*, 1948), and subsequently on *Codium fragile*, *Chondrus*, *Corallina* (Sloane *et al*., 1961), on *Amphisbetia operculata* (Round *et al*., 1961). Frequently recorded from Carrigathorna and Urchin Reef (Goss-Custard *et al*., 1979), and along the entire south shore, 1977-1981 (Kitching and Thain, 1983). Occasionally found in Barloge Creek (on *Himanthalia elongata* straps) and Castle Island 1982-1985 (Kitching, 1987a), but is discouraged by *Paracentrotus lividus* grazing (Kitching and Thain, 1983). This species is confined to the South Basin, Rapids, Barloge Creek and Carrigathorna (1990-1997 JDN). Depth range: littoral to 18m. Collections: NHM, NMI, UM.

Rissoidae

***Rissoa interrupta* (J. Adams, 1800) (Figure 22)**

First recorded living from Renouf S12-S17 *circa* 1930 (Renouf, 1931), and subsequently a single specimen from Whirlpool Cliff August 1984 at 15m as *Rissoa parva* var. *interrupta* (Kitching *et al*., 1990). Common throughout the reserve, although apparently absent from the western shore and trough (1990-2005 JDN). Depth range: littoral to 18m. Collections: NMI, UM.

***Rissoa lilacina* Recluz, 1843 (Figure 22)**

First recorded from Renouf S12-S17 *circa* 1930, as *Rissoa violacea* (Renouf, 1931). Found at scattered sites in the main Lough, but principally in Southern's Bay and Barloge Creek (on *Zostera marina*) (1993-2005 JDN). Depth range: littoral to 18m.

***Rissoa membrancea* (J. Adams, 1800) (Figure 23)**

First recorded from Urchin Reef, a single specimen, 1975/1976 (Goss-Custard *et al*., 1979). Confined to Southern's Bay 12.8.1997 6m, 14.8.1997 4m and Barloge Creek 31.7.1993 4m, 15.8.1997 4m (on *Zostera marina*) (JDN). Collection: NMI.

***Rissoa parva* (da Costa, 1778) (Figure 23)**

First recorded living from S12-S17 *circa* 1930 (Renouf, 1931). Widely distributed and occasionally abundant throughout the reserve (Norton *et al*., 1977; Goss-Custard *et al*., 1979;

Kitching and Thain, 1983; Kitching, 1987a, b; Kitching *et al.*, 1990; 1990-2005 JDN). In the Rapids on a wide range of algae including *Sacchoriza polyschides* (Ebling *et al.*, 1948; Sloane *et al.*, 1961), on *Amphisbetia operculata* (Round *et al.*, 1961), and discouraged by *Paracentrotus lividus* grazing (Kitching and Thain, 1983). Depth range: littoral to 20m. Collections: NHM, NMGW, NMI, UM.

***Alvania beanii* (Hanley *in* Thorpe, 1844) (Figure 24)**

First recorded from a number of sites in the Rapids and Codium Bay, July 1953, on *Ulva*, *Codium fragile*, *Polyneura*, *Rhodymenia pseudopalmata* (Sloane *et al.*, 1961). Found at Curlew Bay (Kitching and Ebling, 1961), Labhra Cliff 15.8.81 A. Trew, Renouf S5 1977-1981 (Kitching and Thain, 1983), and Whirlpool Cliff (Thrush, 1985; Kitching *et al.*, 1990). Widespread and common in the main Lough, Rapids and Southern's Bay, but absent from Barloge Creek and Carrigathorna (1990-2005 JDN). Shells common. Depth range: littoral to 20m. Collections: NMGW, NMI, UM.

***Alvania cimicoides* (Forbes, 1844)**

Recorded living in August 1984 from Whirlpool Cliff (det. J. Taylor) (Kitching *et al.*, 1990). Although not improbable, *A. cimicoides* is very similar in appearance to *Alvania beanii*, which is very common in LH. This record is therefore considered to be dubious.

***Alvania punctura* (Montagu, 1803) (Figure 24)**

First recorded living from Carrigathorna 15-18m and Labhra Cliff 4-15m in early 1970s (Hiscock, 1976; Norton *et al.*, 1977), and 1975/76 there and Urchin Reef (Goss-Custard *et al.*, 1979). Found at Whirlpool Cliff August 1984 11.5m (Kitching *et al.*, 1990). Widespread in South Basin and Rapids, occasional elsewhere in the reserve (1990-2005 JDN). Depth range: littoral to 20m. Collections: NHM, NMI, UM.

***Alvania semistriata* (Montagu, 1808) (Figure 25)**

First recorded from Renouf S12-S17 *circa* 1930, as *Cingula semistriata* (Renouf, 1931), and subsequently from Carrigathorna in 1975/76 (Goss-Custard *et al.*, 1979). Scattered records, mainly from the cliffs in the South Basin and the Rapids (1990-2005 JDN). Depth range: littoral to 16m. Collections: NMI, UM.

***Alvania carinata* (da Costa, 1778)**

Not recorded living in LH. Dead shells only from Whirlpool Cliff 18.7.1993 15m, Rapids to Southern's Bay north 29.7.1993 6.5m and Goleen Cliff 31.7.1993 13m (JDN). New record for LH. This species is generally distributed around Ireland – there have been no recent live records.

***Cingula cingillus* (Montagu, 1803) (Figure 25)**

Recorded from Urchin Reef 1975/1976 (Goss-Custard *et al.*, 1979) and subsequently from near the Rapids 1977 (Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977), general shore of Lough Hyne 15.8.1981 (A. Trew), Renouf E19 *Himanthalia elongata* straps 1982-1985 (Kitching, 1987a). Widespread in the reserve (1990-2005 JDN). Depth range: littoral only. Old records: one specimen Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Cingula trifasciata* (Chaster, 1898). Collections: NMGW, NMI, UM.

***Manzonia crassa* (Kanmacher *in* G. Adams, 1798) (Figure 26)**

First recorded living from Whirlpool Cliff August 1984, one specimen at 11m (Kitching *et al.*, 1990), and at this site subsequently 10.8.1997 18m, 13.8.1997 15m (JDN). Elsewhere found on the south-east shore of the Rapids 24.7.1993, and south of the Rapids 4.7.1992 6m. Dead shells are widespread, including one found at Carrigathorna (Goss-Custard *et al.*, 1979).

***Obtusella intersecta* (S. V. Wood, 1857)**

Recorded living from Urchin Reef 16.7.1976 (conf. J. Taylor), as *Cingula alderi*, with possibly occasional specimens in pools at Carrigathorna, but the shells were corroded by preservative (Goss-Custard *et al.*, 1979). Some of these specimens have been seen by JDN in the collections of NHM, and are *Rissoella opalina*. The habitat and position on the shore are very unlikely for this species, so all these records are dubious.

***Onoba aculeus* (Gould, 1841) (Figure 26)**

First recorded from west of Codium Bay 11.8.1997 shore (JDN), and subsequently from Renouf S2 15.8.1997 shore and Whirlpool cliff 11.7.2005 17m. A single shell only was found at Goleen Cliff 6.9.1998 8m. New record for LH. Common and widespread around Ireland. This species is closely similar to *Onoba semicostata*, and may have been unrecognised by previous workers.

***Onoba semicostata* (Montagu, 1803) (Figure 27)**

First recorded from Renouf Bay and Rapids July 1953 on a wide range of algae (Sloane *et al.*, 1961). Widespread and common throughout the reserve (Norton *et al.*, 1977; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; Thrush, 1985; on *Himanthalia elongata* straps, Kitching, 1987a, b; Kitching *et al.*, 1990; 1990-2005 JDN). Depth range: littoral to 18m. Old records: live, Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Onoba striata* (Chaster, 1898). Collections: NHM, NMGW, NMI, UM.

***Pusillina inconspicua* (Alder, 1844) (Figure 27)**

First recorded from Codium Bay west 12.7.1990 13m (JDN). Subsequently recorded from all around LH and Southern's Bay, although apparently absent from the Rapids and Barloge Creek (1990-2005 JDN). Depth range: littoral to 18m. New record for LH. Common and widespread around Ireland, except the east coast. Collections: NMI, UM.

***Pusillina sarsi* (Lovén, 1846) (Figure 28)**

Recorded by A. Trew 15.8.1981 from the general area of Lough Hyne. Found in the South Basin, close to Whirlpool Cliff in 1982 and 1983, 19m, as *Rissoa albella* (Thrush, 1985). Widespread throughout the main Lough and Southern's Bay, but apparently absent from the Rapids and most of Barloge Creek (1990-2005 JDN). Depth range: littoral to 20m. Old records: live, Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Rissoa inconspicua* var. *albella* (Chaster, 1898). Collections: NMGW, NMI, UM.

Hydrobiidae

***Peringia ulvae* (Pennant, 1777)** [Hydrobia ulvae] **(Figure 28)**

First recorded from Nita's Rock July 1953 on *Ulva* (Sloane *et al.*, 1961). Throughout Lough and inner Barloge Creek, July 1955 (Ebling *et al.*, 1960). This survey was repeated in September 1990 and July 1991 by Little *et al.* (1992), who showed a significant decrease in abundance, mainly from all shores in the North Basin except the north shore of Castle Island. Widespread, but uncommon (1990-2005 JDN). Depth range: littoral only. Collections: NMGW, NMI, UM.

***Ventrosia ?ventrosa* (Montagu, 1803)**

Recorded from Carrigathorna and Urchin Reef as 'probably' *Hydrobia ventrosa*, det. J. Taylor (Goss-Custard *et al.*, 1979). This species is confined to brackish lagoons, not from exposed rock pools, and is difficult to identify from preserved specimens except by dissection. It is an error of identification for another rissoid/hydrobid species.

Iravadiidae

***Ceratia proxima* (Forbes and Hanley, 1850)**

Not seen recently in LH. Recorded from Renouf S12-S17 *circa* 1930, as *Rissoa proxima* (Renouf, 1931).

Caecidae

***Caecum glabrum* (Montagu, 1803) (Figure 29)**

Recorded living from *Audouinella floridula* zone, Western Trough in 7-9m (Kitching *et al.*, 1976), and I8 12.7.1990, J10 14.7.1990 (J. M. C. Holmes). Widespread, occasionally abundant throughout the Lough, Rapids and Southern's Bay. Apparently absent from most of the western half of the Western Trough, and Barloge Creek (1990-2005 JDN). Depth range: littoral to 18m. Old records: live, Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Caecum incurvatum* (Chaster, 1898). Collections: NHM, NMI, UM.

SUPERFAMILY CYPRAEACEA

Ovulidae

***Simnia patula* (Pennant, 1777) (Figure 29)**

First recorded living from Carrigathorna 12m, a single animal (Hiscock, 1976; Norton *et al.*, 1977). Subsequently found on *Alcyonium digitatum* on Whirlpool Cliff March 1991 (I. Lawler), and two specimens on the cliff face opposite Bullock Island 15.7.1992 (T. Flint and C. Frid). Collection: NMI.

SUPERFAMILY LAMELLARIACEA

Triviidae

***Trivia arctica* (Pulteney, 1799) (Figure 30)**

Recorded as common, especially in the Rapids and Southern's Bay, but also Renouf S12-S17 and dredged from Barloge *circa* 1930, as *Trivia europaea* agg. (Renouf, 1931). This record could be this species, or *T. monacha.* Few records since the 1930s – Carrigathorna 9m (Norton *et al.*, 1977), near the Rapids (Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977; Kitching unpublished), Renouf E10 1977-1981 (Kitching and Thain, 1983). Confined to the South Basin, Rapids, Southern's Bay, Barloge Creek and Carrigathorna (1990-2005 JDN; BioMar). Depth range: littoral to 16m. Collections: NMI, UM.

***Trivia monacha* (da Costa, 1778) (Figure 30)**

First recorded on *Sacchoriza polyschides* in the Rapids 1946 (Ebling *et al.*, 1948). Scattered records throughout the reserve, most common in the Rapids (Norton *et al.*, 1977; 1977 DM; 1990-2005 JDN; 1994 BioMar). Depth range: littoral to 15m. Collections: NMI, UM.

Lamellariidae

***Lamellaria latens* (O. F. Müller, 1776) (Figure 31)**

First recorded from near the Rapids August/September 1977 (Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977), and at the same site 11.8.1990 3m (BEP). Confined to the South Basin, Rapids, Southern's Bay and Barloge Creek (1992-1998 JDN).

Depth range: littoral to 18m. Collections: NMI, UM.

Lamellaria perspicua **(Linnaeus, 1758)**

Recorded from only two sites: one specimen from the Rapids 20.7.1990 2-3m, and Whirlpool Cliff 5.7.1992 14m (JDN). New record for LH, and for SA37. Widely distributed around Ireland, although uncommon. Collection: UM.

Velutinidae

Velutina velutina **(O. F. Müller, 1776)**

Not seen recently in LH. Recorded from Renouf S17 (Renouf Bay), July 1953 on *Ulva* (Sloane *et al.*, 1961). Rarely found in Ireland, with most living records being from the north-east and east coasts.

Superfamily Naticacea

Naticidae

Polinices pulchellus **(Risso, 1826) (Figure 31)**

First recorded from Barloge dredged *circa* 1930, as *Natica alderi* (Renouf, 1931). Sand collars (egg masses) were observed in Southern's Bay 12.8.1981, probably this species (DM). There are few records: Labhra Cliff 23.7.1983 20m (Dave Connor); north of Whirlpool Cliff 14.7.1990 14m one specimen; north of Southern's Bay 25.7.1993 4m and in gravel from Southern's Narrows 14.7.1997 4.2m; and off North Island 1.11.2005 12m (JDN). Collections: NMI, UM.

Superfamily Triphoracea

Triphoridae

Marshallora adversa **(Montagu, 1803)**

First recorded living from Whirlpool Cliff August 1984, one specimen, 5m (Kitching *et al.*, 1990), and subsequently at the same site 20.7.1990 14m, 5.7.1992 14m (JDN). Only elsewhere living south of the Rapids 19.7.1990 5m (JDN). Shells only from Castle Island Narrows and Southern's Bay. Collections: NMI, UM.

SUPERFAMILY EPITONIACEA

Epitoniidae

***Epitonium clathratulum* (Kanmacher in G. Adams, 1798)**

Not seen recently in LH. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Scalaria clathratula* (Chaster, 1898). Collection: NMI.

Janthinidae

***Janthina janthina* (Linnaeus, 1758)**

Not seen recently in LH. Three specimens washed ashore on the Coosh, Barloge Creek September 1928, as *Ianthina communis* (Renouf, 1934c). Old records: five specimens Lough Ine, Co. Cork 1861, donated by Mrs Thomas Townshend to NMI. Collection: NMI.

Aclididae

***Graphis albida* (Kanmacher in G. Adams, 1798)**

Not seen recently in LH. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Cioniscus unicus* (Chaster, 1898).

SUPERFAMILY EULIMACEA

Eulimidae

***Melanella frielei* (Jordan, 1895)**

Not recorded living in LH. Dead shell only from Rapids to Southern's Bay north 29.7.1993 6.5m (JDN, det. S. M. Smith). New record for LH. Only elsewhere in Ireland (live) from Galway Bay.

***Vitreolina philippi* (Rayneval and Ponzi, 1854)**

A single specimen found in the Narrows of Southern's Bay in 14.8.1997 in 4.2m by JDN (conf. S. M. Smith). New record for LH. Widely distributed around Ireland.

Order Neogastropoda

SUPERFAMILY MURICACEA

Muricidae

***Ocenebra erinacea* (Linnaeus, 1758) (Figure 32)**

First recorded from Renouf S12-S17 *circa* 1930, as *Ocinebra erinacea* (Renouf, 1931). Mainly found in the eastern half of the Lough, the Rapids, Southern's Bay and Barloge Creek (Kitching and Ebling, 1961; Kitching *et al.*, 1967; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; 1977 DM; 1990-2005 JDN; 1994 BioMar). In the Rapids on *Ulva* (Sloane *et al.*, 1961) and *Amphisbetia operculata* (Round *et al.*, 1961). Depth range: littoral to 6.5m. Collections: NMGW, NMI, UM.

***Nucella lapillus* (Linnaeus, 1758) (Figure 32)**

First recorded from Renouf S12-S17 *circa* 1930, as *Purpura lapillus* (Renouf, 1931). Occasional, mainly absent from the South Basin, in the Lough and Rapids, common Carrigathorna and Bullock Island, July 1955 (Lilly *et al.*, 1953; Ebling *et al.*, 1960; Kitching and Ebling, 1967; Norton *et al.*, 1971; Goss-Custard *et al.*, 1979). Found within tunnels inside mussel carpets 21.7.1976 (DM). It was thought that *Nucella lapillus* was unable to establish itself as a predator on *Mytilus edulis* in the Lough, due to heavy predation, mainly by *Carcinas maenas* (Kitching *et al.*, 1959). Individuals from the Rapids had thicker shells (as an anti-predator mechanism) than those from Carrigathorna (Ebling *et al.*, 1964). Recent fieldwork however, has recorded *N. lapillus* from all round the shore of the reserve, including the South Basin (1990-2005 JDN). In a study to ascertain imposex in *Nucella lapillus*, a condition whereby female snails develop a penis and *vas deferens* due to the presence of organotins, there was moderately low contamination at the anchorage in Barloge Creek in 1987 and 1993. This may have resulted from brief visits by >100 yachts each summer. There was a reduction in imposex between 1987, when legislation prohibiting general use of organotins on vessels under 25m and other structures was implemented, and 1993 (Minchin *et al.*, 1995). A study by Bell and Okamura (2005) showed isolation and reduced genetic diversity in populations of this species in the main Lough, when compared with those from the outside coast and elsewhere in Europe. Depth range: littoral only, except in the Rapids (2-3m). Collections: NMGW, NMI, UM.

Buccinidae

***Hinia reticulata* (Linnaeus, 1758)**

Only one record of a single specimen, from Renouf I7 1977-1981 as *Nassarius reticulatus* (Kitching and Thain, 1983).

***Hinia incrassata* (Ström, 1768) (Figure 33)**

First recorded from Renouf S12-S17 and dredged from Barloge *circa* 1930, as *Nassa incrassta* (Renouf, 1931). Subsequently from Renouf Bay (Ebling *et al.*, 1948; Norton, 1971), Carrigathorna and Urchin Reef (Norton *et al.*, 1977; Goss-Custard *et al.*, 1979). Widely distributed throughout the reserve (Kitching and Thain, 1983; 1977 DM; Thrush, 1985; Kitching *et al.*, 1990; 1990-2005 JDN; 1994 BioMar). In the Rapids on a wide range of algae (Ebling *et al.*, 1948; Sloane *et al.*, 1961), on *Amphisbetia operculata* (Round *et al.*, 1961) and *Himanthalia elongata* straps (Kitching, 1987a). Depth range: littoral to 26m. Collections: NMGW, NMI, UM.

***Hinia pygmaea* (Lamarck, 1822)**

Recorded living by Hiscock (1976) from Carrigathorna (6-18m), Whirlpool Cliff 1-15m and Labhra Cliff 4-12m in the early 1970s (also in Norton *et al.*, 1977). Also recorded in 1975/1976 from Carrigathorna (Goss-Custard *et al.*, 1979). This species is normally associated with muddy sand, not habitats such as the cleaner wave-exposed rock of Carrigathorna. These records are therefore considered to be dubious, and likely to be errors of identification for *Hinia incrassata*.

SUPERFAMILY CONACEA

Turridae

***Haedropleura septangularis* (Montagu, 1803) (Figure 33)**

First recorded living from clean gravel at Whirlpool Cliff 10.8.1997 18m, and there again 13.8.1997 15m, 11.7.2005 18m (JDN). Also from Southern's Narrows 14.8.1997 4m and Renouf S13 Codium Bay 12.7.2005 15m. New record for LH. Only recently found elsewhere in

Ireland from Donegal Bay, Galway Bay, Strangford Lough and Sherkin Island. Collection: NMI.

***Mangelia attenuata* (Montagu, 1803)**

First recorded from a sample collected by H. Wilkins and S. de Grave off Renouf S13 Codium Bay 10.7.1990 3m (det. S. M. Smith). Subsequently found on Goleen Cliff 15.8.1997 14m (JDN). Shells have been recorded from Castle Island Narrows 1993 and south-east of South Bay, Castle Island 1997. Old records: one specimen, Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud (Chaster, 1898). Collections: NMI, UM.

***Mangelia brachystoma* (Philippi, 1844)**

Not seen living in LH? Recorded from near the Rapids in August/September 1977 status unknown (Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977)). A single shell collected by JDN from Metridium Rocks 15.7.2005 *circa* 12m, det. S. M. Smith.

***Mangelia coarctata* (Forbes, 1840) (Figure 34)**

First recorded from G8, a single specimen 11.7.1980 as *Mangelia costata* (J. M. C. Holmes). Subsequently found on Whirlpool Cliff August 1984, a single specimen at 11m (Kitching *et al.*, 1990), and 1990-2005 3m-15m (JDN). Present only in the South Basin, mainly on the cliffs (1990-2005 JDN). Collections: NMI, UM.

***Raphitoma linearis* (Montagu, 1803) (Figure 34)**

First recorded from Carrigathorna 1975/1976 one specimen (Goss-Custard *et al.*, 1979). Confined to the South Basin, mainly the cliffs, Bullock Island and Carrigathorna (1990-2005 JDN). Depth range: sublittoral to 18m. Collections: NMI, UM.

***Raphitoma purpurea* (Montagu, 1803)**

Recorded living only from gravel below the Rapids 4.7.1992 6m (JDN). Shells are more widespread – Whirlpool Cliff 1980, 1990 (DM, JDN), Goleen Cliff 1993 and Metridium Rocks 1993. New record for LH and SA37. Rarely recorded, all recent records being from the west and south coast of Ireland, often with maerl.

Order Heterostropha

SUPERFAMILY RISSOELLACEA

Rissoellidae

***Rissoella diaphana* (Alder, 1848) (Figure 35)**

First recorded from Carrigathorna and Urchin Reef, 1975/1976 (Goss-Custard *et al.*, 1979). Also found from Renouf S5 1977-1981 (Kitching and Thain, 1983) and samples from Renouf S15 and E11 in September 1978 (Kitching, unpublished). Generally distributed around LH except the west and north-west (Kitching, 1987b; 1990-2005 JDN). Depth range: littoral to 15m. Collections: NMI, UM.

***Rissoella opalina* (Jeffreys, 1848) (Figure 35)**

First recorded living from Carrigathorna and Urchin Reef, 1975/1976, (Goss-Custard *et al.*, 1979). Also found in Renouf S5, 1977-1981 (Kitching and Thain, 1983) and a sample from Renouf S15, 10.7.1978 det. J. Taylor (Kitching, unpublished). Distributed throughout the reserve, although largely absent from Barloge Creek (1990-2005 JDN). Depth range: littoral to 18m. Collections: NMI, UM.

SUPERFAMILY OMALOGYRACEA

Omalogyridae

***Omalogyra atomus* (Philippi, 1841) (Figure 36)**

First recorded from Codium Bay and Nita's Rock July 1953 on *Codium fragile* and *Cystoseira* (Sloane *et al.*, 1961). Subsequently found from Urchin Reef and Carrigathorna 1975/1976 (Goss-Custard *et al.*, 1979), and many sites around the Lough 1977-1981 (Kitching and Thain, 1983). Widespread, and common throughout the reserve (1990-2005 JDN). The species is discouraged by *Paracentrotus lividus* grazing (Kitching and Thain, 1983). Depth range: littoral to 18m. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Homalogyra atomus* 'a good number of fine live specimens' (Chaster, 1898). Collections: NMI, UM.

***Ammonicerina rota* (Forbes and Hanley, 1850) (Figure 36)**

Widely distributed in the South Basin, Rapids/Southern's Bay and the east shore of North Basin (1990-2005 JDN). Depth range: littoral to 18m. Old records: a single specimen of *Homalogyra fischeriana*, 'devoid of characteristic radiating ribs of *H. rota* – but closer to this than *H. atomus*' Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud (Chaster, 1898). *Homalogyra rota* var. *tricarinata*, dredged LH, S. W. Ireland during the Royal Irish Academy cruise (Marshall, 1916).

***Retrotortina fuscata* Chaster, 1896**

Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, dredged 0-20f, fine foul dense mud, a single specimen (shell). 'Though evidently specifically identical with my types from Tangier Bay, the shell from Lough Hyne is rather more flattened than they' (Chaster, 1898). This is a known error, possibly with assignation of locality to the specimen.

SUPERFAMILY PYRAMIDELLACEA

Pyramidellidae

***Odostomia plicata* (Montagu, 1803) (Figure 37)**

First recorded living from Renouf N9, 1977-1981 a single specimen (Kitching and Thain, 1983). Elsewhere from Renouf E11 to E15 16.7.1990 shore, north-east of Southern's Bay 25.7.1993 shore, Renouf I11-I13, Castle Island 27.7.1993 shore and south of the Rapids 12.7.2005 6m (JDN, all det. S. M. Smith).

***Odostomia turrita* Hanley, 1844 (Figure 37)**

First recorded living from LH at Codium Bay west 12.7.1990 13m, det. S. M. Smith (JDN). Common and widespread in LH (1990-2005 JDN, det. S. M. Smith). Depth range: mainly littoral, but to 25m. New record for LH. Common and widespread around Ireland. Collections: NMI, UM.

***Odostomia unidentata* (Montagu, 1803) (Figure 38)**

First recorded living from north Barloge Creek 4.7.1992 shore, det. S. M. Smith (JDN).

Occasional specimens from scattered sites in LH, mainly Rapids and Southern's Bay (1993-2005 JDN). Depth range: littoral to 6m. New record for LH. Common and widespread around Ireland. Collections: NMI, UM.

Brachystomia carrozzai **(Aartsen, 1987) (Figure 38)**

First recorded from north of Southern's Bay 3.7.1992 shore, single specimen (JDN, det. S. M. Smith). Subsequently collected from Western Bank 4.7.1992 shore and Metridium Rocks 19.7.1993 10m. New record for LH and SA37. Only a few scattered recent living records from Ireland. Collection: NMI.

Brachystomia eulimoides **(Hanley, 1844) (Figure 39)**

A single specimen was recorded from Carrigathorna 7.9.1977 (Goss-Custard *et al*., 1979). A pyramidellid, probably this species, was found on the ears of *Pecten maximus* 31.5.1977 at Whirlpool Cliff (DM). This species was found on the ears of *Pecten maximus*, Castle Island Narrows 11.8.1997 5m (JDN). A shell was recorded from here in 1980 (DM). Scattered records throughout the reserve, mainly South Basin (1990-2005 JDN, det. S. M. Smith). Depth range: littoral to 15m. Collections: NMI, UM.

Brachystomia scalaris **(Macgillivray, 1843) (Figure 39)**

First recorded from the west shore of the Rapids 11.7.1990 (JDN, det. S. M. Smith), and subsequently from Glannafeen Cliff 14.7.1990 13m and from the Rapids to north Southern's Bay 29.7.1993 6m. Shells have only been found at Goleen Cliff 1993. New record for LH. Widespread around Ireland.

Chrysallida indistincta **(Montagu, 1808)**

Not seen recently in LH. Few recent living records for Ireland, mainly in northern half in Mulroy Bay and Strangford Lough. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Pyrgulina indistincta* var. *simulans* (Chaster, 1898).

Chrysallida interstincta **(J. Adams, 1797)**

Not recorded living in LH. A single shell only recorded from a gravel sample, north-west

Castle Island 27.7.1993 1.8m, (JDN, det. S. M. Smith). New record for LH. Widely distributed around Ireland, mainly old or shell records.

***Folinella excavata* (Philippi, 1836)**

Recorded living Western Cliff 10.8.1997 14m, and Goleen Cliff 14.7.2005 14m (conf. S. M. Smith). Shells widespread in South Basin and Rapids/Southern's. New record for LH. New live record for Ireland since 1900, possibly new live, as the status of the record from Killala Bay is uncertain. Nothing is known about this animal (Graham, 1988).

***Jordaniella nivosa* (Montagu, 1803)**

Recorded only from Urchin Reef (shore), 1975/1976 (Goss-Custard *et al.*, 1979). Widespread around Ireland, although there are few recent live records.

***Liostomia clavula* (Lovén, 1846)**

A single live specimen collected by JDN from the west shore of the Rapids in 11.7.1990 shore. Identification was confirmed by A. Warén. New record for LH, new live for Ireland. Little is known about this species, although it has sometimes been found in association with pennatulids (Graham, 1988).

***Megastomia conspicua* (Alder, 1850)**

First recorded living from Western Trough 14.7.1990 12m, det. S. M. Smith (JDN). Shells have been found at Castle Island Narrows and the west shore of the Rapids 1990. New record for LH and SA37. Only recently live elsewhere in Ireland from Galway Bay.

***Ondina diaphana* (Jeffreys, 1848)**

A single live specimen collected by JDN from off West Quay 15.7.2005 in *circa* 5-12m, conf. S. M. Smith. New record for LH and SA37. Only elsewhere recent, living, from Donegal coasts.

***Partulida pellucida* (Dillwyn, 1817) (Figure 40)**

First recorded from Western Cliff 3.7.1992 14m, det. S. M. Smith (JDN), and subsequently from Renouf N2-N3 North Wall 5.7.1992 shore, south-east of Castle Island 27.7.1993 shore, south of the Rapids in gravel 28.7.1993 5m, and north of Whirlpool Cliff 18.7.1993 15m (JDN). New record for LH. Widely distributed around Ireland. Collection: NMI.

***Turbonilla rufescens* (Forbes, 1846)**

Not recorded living in LH. Dead shell only from north of Whirlpool Cliff 14.7.1990 14m coll. JDN, det. S. M. Smith. New record for LH. A few old or shell records from Ireland – only elsewhere recently live from Mulroy Bay.

Order Cephalaspidea

Superfamily Philinacea

Philinidae

***Philine aperta* (Linnaeus, 1767) (Figure 40)**

First recorded from Barloge, dredged *circa* 1930 (Renouf, 1931). Renouf commented that records of this species were similar to *Akera bullata*, although at times more or less abundant. Occasionally found between islets in the Goleen (Renouf, 1934d). Widespread, occasionally abundant, on mud in the North Basin, Western Trough and around Castle Island in the *Audouinella floridula* zone (1970-1972 Kitching *et al*., 1976; August/September 1980 DM; Kitching, 1987b; 1990-2005 JDN; 1993-1994 BioMar). Depth range: 3-20m. Collections: NMGW, NMI, UM.

***Philine punctata* (J. Adams, 1800)**

First recorded from Labhra Cliff 3.7.1992 15m, and subsequently from Whirlpool Cliff 18.7.1993 15m (JDN). New record for LH. Widely distributed around Ireland, except for east coast.

SUPERFAMILY RETUSACEA

Retusidae

***Retusa obtusa* (Montagu, 1803)**

First recorded from Metridium Rocks 15.7.2005 13m, conf. S. M. Smith (JDN), with a single shell from Whirlpool Cliff 2005. New record for LH. Widespread around Ireland.

***Retusa truncatula* (Bruguière, 1792) (Figure 41)**

First recorded living at Carrigathorna and Urchin Reef, one specimen each site, 1975/1976 (Goss-Custard *et al.*, 1979). Subsequently from north of Barloge Creek 15.4.1976 (Kitching, unpublished), Renouf S15 1977-1981 (Kitching and Thain, 1983) and Whirlpool Cliff August 1984 11m, 15m (Kitching *et al.*, 1990). Widespread, generally throughout the South Basin, but uncommon (1990-2005 JDN). Depth range: littoral to 15m. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Tornatina truncatula* (Chaster, 1898). Collections: NMI, UM.

SUPERFAMILY RUNCINACEA

Runcinidae

***Runcina coronata* (Quatrefages, 1844)**

Recorded only from Upper Gully Pool and High Pool, Carrigathorna 23.7.1975, det. T. E. Thompson (Goss-Custard *et al.*, 1979). Collection: NMI.

***Runcina ferruginea* Kress, 1977 (Figure 41)**

A single specimen found by G. H. Brown amongst sublittoral algae, the first record for Ireland (Wilson and Picton, 1983). No date or exact location was given. Widespread throughout the South Basin only, and one site (one specimen on a rocky outcrop) off North Island in the North Basin (1990-2005 JDN). Depth range: 3m to 10m. The only site in Ireland where this species can commonly and regularly be found. Known elsewhere in Ireland only from Valentia, Kenmare River and Mulroy Bay. Collections: NMI, UM.

Order Sacoglossa

SUPERFAMILY ELYSIACEA

Elysiidae

***Elysia viridis* (Montagu, 1804) (Figure 42)**

First recorded, common, from Renouf S12-S17 *circa* 1930 (Renouf, 1931, 1934a, 1937). Subsequently from Codium Bay and the Rapids, July 1953 on *Codium spp.*, *Cystoseira*, *Ceramium* (Sloane *et al*., 1961) and one specimen from Urchin Reef 1975/1976 (Goss-Custard *et al*., 1979). Widespread, occasionally abundant, throughout the reserve (1980, 1981 DM; Kitching and Thain, 1983; Kitching, 1987b; 1990-2005 JDN; 2003 C. Trowbridge). Discouraged by *Paracentrotus lividus* grazing(Kitching and Thain, 1983). Depth range: littoral occasionally, but mainly sublittoral *circa* 2-5m. Collections: NMI, UM.

Stiligeridae

***Stiliger bellulus* (Orbigny, 1837) (Figure 42)**

First recorded living from the LH area, on not more than two occasions (Renouf, 1937). Subsequently from Curlew Bay 1959 (Kitching and Ebling, 1961) and off Glannafeen Quay (Renouf S4) 28.7.1974. det. T. E. Thompson (Kitching and Thain, 1983). Scattered sites in the Lough only, and principally off the south shore (1990-1993 JDN). Depth range: littoral to 15m. Collections: NMI, UM.

***Placida dendritica* (Alder and Hancock, 1843) (Figure 43)**

First recorded from the LH area on not more than two occasions (Renouf, 1937). Subsequently recorded from G10 July 1988 (J. M. C. Holmes), Glannafeen Cliff 14.7.1990, Goleen Cliff 13.7.1990 and 27.7.1993, Castle Island Narrows 12.7.1990 (all JDN, sublittoral in less than 6m), and Renouf W15 shore 12.4.2003 (C. Trowbridge), all on *Codium* sp. Collections: NMI, UM.

Alderiidae

***Alderia modesta* (Lovén, 1844)**

Not seen recently in Lough Hyne. Recorded on not more than two occasions by Dr Eales and Dr Frances from Southern's Bay (Renouf, 1937). The type locality for the species is close by at the River Ilen, Skibereen, in salt marsh.

Hermaeidae

***Hermaea bifida* (Montagu, 1815) (Figure 43)**

First recorded living, a single specimen, in spring 1935 on *Griffithsia* collected by Miss

Parke of Port Erin (Renouf, 1935). Subsequently, from the north-east of LH, 27.7.1983 15m (BEP and C. M. Howson), and the South Basin Cliffs and Metridium Rocks (1993-2005 JDN). Depth range: littoral occasionally, but mainly sublittoral to 14m.

Limapontiidae

***Limapontia capitata* (O. F. Müller, 1774) (Figure 44)**

First recorded as common, Renouf S12-S17, *circa* 1930 (Renouf, 1931). Collected by W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). More recently, found living from Castle Narrows 12.7.1990 10m and north-east of Castle Island 13.7.1990 12m (JDN). Collection: UM.

Order Anaspidea

SUPERFAMILY APLYSIACEA

Akeridae

***Akera bullata* O. F. Müller, 1776 (Figure 44)**

First recorded living *circa* 1930 from dredging in LH. Not dredged often, but in very large numbers, sometimes occurring right inshore (Renouf, 1931). Obtained in large numbers by dredging in various parts of the Lough. At other times, few specimens or none have been found, though searched for deliberately. In LH, appears to have a double breeding period, since found spawning in both April and September, but not in June. Seen swimming July 1930s, as *Acera bullata* (Renouf, 1934d). Hundreds in shallowing water in north-east and north-west, spring and autumn, spawning profusely, 1935. Not seen since (Renouf, 1935, 1937). Easter 1938 abundant, the first record since 1935 (Renouf, 1939). Sporadic records subsequently. Known to be abundant in 1979, throughout the eastern half of the North Basin (DM). No adults were seen in 1980. Common G2 23.7.1985, and mating animals seen at E2 14.4.1986 (DM). Seen North Basin in the years 1990, 1992, 1993, 1994, 1997, 2005 (JDN; BioMar). Adults were seen west of North Island in July 2005, with many juveniles only in the same area 5-13m 1.11.2005. Depth range: littoral at West Quay Renouf W6 5.7.1992 (JDN); normally sublittoral 3m to 15m. Collections: NHM, NMI, UM.

Aplysiidae

***Aplysia punctata* Cuvier, 1803 (Figure 45)**

First recorded as occasionally dredged from Barloge Creek *circa* 1930 (Renouf, 1931). However, later recorded as never taken by dredge, sometimes fair numbers south shore. Occasional small numbers Barloge Creek; abundant some years, shore Southern's Bay (Renouf, 1934c). Present in numbers especially on the Island in 1935 (Renouf, 1935), and abundant Easter 1939 (Renouf, 1939). Occasional records throughout the reserve except south Barloge Creek and Carrigathorna (1970-1972 Kitching *et al.*, 1976; Hiscock, 1976; 1977 J. M. C. Holmes; 1980 DM; Wilson and Picton, 1983; 1990-2005 JDN). Depth range: littoral occasionally, normally 4m to 18m. Collections: NMI, UM.

Order Notaspidea

SUPERFAMILY PLEUROBRANCHACEA

Pleurobranchidae

***Pleurobranchus membranaceus* (Montagu, 1815) (Figure 45)**

'Until this year, only six specimens in all recorded, three in Lough Ine dredged June 1926, three at low water on south shore [Renouf S12-S17, *circa* 1930, as *Oscanius membranaceus*]. This year, the south shore of Lough and region from islets to half way round south shore of Castle Island thickly populated by breeding individuals from the middle of March until nearly the middle of April [1934], and these two areas abounded in spawn spirals until at least the beginning of May. Not seen since' (Renouf, 1934a, d, 1935, 1937). Seen by divers on land-plant debris, Western Trough (Kitching *et al.*, 1976). Subsequently only seen at two sites: one specimen, east shore of North Basin 15.7.1990 14m, and Western Cliff 30.7.1993 30m (JDN). Collection: UM.

***Berthella plumula* (Montagu, 1803) (Figure 46)**

First recorded from Renouf S12-S17, moderately common *circa* 1930, as *Pleurobranchus plumula* (Renouf, 1931). Present every year, shores in Lough and Southern's Bay 1930s

(Renouf, 1934d, 1935). Easter 1938 and Easter 1939, moderate numbers (Renouf, 1939). Apparently seen by divers on land-plant debris, Western Trough 1970-1972 (Kitching *et al.*, 1976). More recently, recorded from J8 11.7.1993, I7 12.7.1993 (J. M. C. Holmes) and west of Codium Bay 11.7.1990 and 11.8.1997 shore – one specimen each (JDN). Collections: NMI, UM.

Order Nudibranchia

SUPERFAMILY DENDRONOTACEA

Tritoniidae

***Tritonia lineata* Alder and Hancock, 1848**

Not seen recently in LH. First recorded by W. M. Tattersall for the Lough Ine area, during April 1932, as *Duvaucelia lineata* (Renouf, 1932a). It was since recorded as occurring each year (Renouf, 1934d, 1937).

***Tritonia plebeia* Johnston, 1828**

Not seen recently in LH. First recorded by W. M. Tattersall for the Lough Ine area during April 1932, as *Duvaucelia plebia* (Renouf, 1932a). It was since recorded as occurring each year (Renouf, 1934d, 1937). This species feeds on *Alcyonium digitatum*, and could therefore be found at Whirlpool Cliff, or off Carrigathorna.

Dotidae

***Doto coronata* (Gmelin, 1791) (Figure 46)**

First recorded from Renouf S12-S17 *circa* 1930, as *Idulia pinnatifida* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a). Identification was changed to *Idulia coronata* (Renouf, 1937). Widespread throughout the reserve, although apparently absent from Western Trough (1980, 1981 DM; Kitching, 1987a; 1990-2005 JDN). *Doto coronata* is considered to be an aggregate species. Many specimens feeding on *Bougainvillia ramosa* (particularly in 2005) and *Obelia geniculata* have been found in LH. Depth range: littoral, but mainly sublittoral, 3m to 25m. Collections: NMI, UM.

***Doto eireana* Lemche, 1976**

Occasionally found living on the hydroid *Amphisbetia operculata* from the Rapids, and especially Codium Bay samples (Round *et al.*, 1961). This species was originally recorded as *Doto coronata*, which is an aggregate species. However, *Doto eireana*, described in 1976 by Lemche, feeds exclusively on *A. operculata*.

***Doto millbayana* Lemche, 1976**

Recorded living, frequent, from the east shore of the Rapids, 26.4.1994 (BioMar), probably on the large epilithic hydroid *Plumaria setacea*. Collection: NMI.

***Doto sarsiae* Morrow, Thorpe and Picton, 1992**

Hiscock (1976) reported abundant specimens of '*Doto coronata*' at Carrigathorna in 3m on the hydroid *Sarsia eximia*. A few 'very pink' specimens of '*Doto coronata*' were seen by JDN on a dive below the Rapids on the east side in the early 1990s, although not seen there later. Subsequently, the species *Doto sarsiae* was described, being both a deep pink in colour, and having *Sarsia eximia* as its exclusive food. It is likely that either or both of these records are of this species, but this requires confirmation.

Embletoniidae

***Embletonia pulchra* (Alder and Hancock, 1851)**

First recorded from gravel in Southern's Bay 25.7.1993 4.8m (JDN). Recorded several times from this area - 28.7.1993 5.6m and 6.5m, 12.7.2005 6.3m, and from Whirlpool Cliff 13.8.1997 15m, 11.7.2005 18m. New record for LH and SA37. Scattered recent records around Ireland. A small species, easily overlooked. Collection: UM

SUPERFAMILY ONCHIDORIDACEA

Goniodorididae

***Goniodoris castanea* Alder and Hancock, 1845**

Not seen recently in LH. Recorded from Renouf S12-S17 *circa* 1930 (Renouf, 1931). It was coll. and det. by W. M. Tattersall in 1931 (Renouf, 1932a, 1934a, 1937).

***Goniodoris nodosa* (Montagu, 1808)**

First recorded from LH *circa* 1930 (Renouf, 1931, 1934a, 1937), and unusually abundant Easter 1939 (Renouf, 1939). One specimen found I7 18.9.1980 (DM). Wilson and Picton (1983) confirmed the species to be present 1979-1982, but no details are listed.

Okeniidae

***Ancula gibbosa* (Risso, 1818)**

First recorded from Renouf S12-S17 *circa* 1930 (Renouf, 1931) and subsequently coll. and det. W. M. Tattersall 1931, as *Ancula cristata.* Found in Southern's Bay and along south shore of Lough every year [1932-1934] (Renouf, 1932a, 1934a, d, 1937). Wilson and Picton (1983) confirmed the presence of this species 1979-1982, but no details are listed. Several specimens found on Whirlpool Cliff 11.7.2005 17m (JDN).

Onchidorididae

***Onchidoris bilamellata* (Linnaeus, 1767) (Figure 47)**

First recorded from Renouf S12-S17 *circa* 1930, as *Lamellidoris bilamellata* (Renouf, 1931). Collected in the LH general area by W. M. Tattersall 1931, as *Lamellidoris bilamellata* (Renouf, 1932a, 1934a, 1937). Found abundant, with spawn, feeding on barnacles on Whirlpool Cliff 18.3.1979, and here again in 10m and on the shore by the Rapids 19.3.1979 (BEP). Two individuals were observed on rock at I7, 17.9.1980 (DM).

***Onchidoris depressa* (Alder and Hancock, 1842)**

Recorded living Easter 1938 (Renouf, 1939). One individual, 3mm, 18.9.1980 at I7 (DM). Wilson and Picton (1983) confirmed the presence of the species in 1979-1982. One specimen recorded from Whirlpool Cliff, 18.7.1993 15m (JDN).

***Onchidoris muricata* (O. F. Müller, 1776)**

Recorded living from the general LH area as *Onchidoris aspera* (Renouf, 1937). A specimen from Carrigathorna 15m, coll. K. Hiscock, 1972, was published as *Onchidella celtica* (Cuvier, 1817) (Norton *et al.*, 1977), but was later re-identified as *Onchidoris muricata* by N. J. Evans in

1986 (Kitching, 1987b). This specimen has been seen by JDN in the collections of NHM, and is *Acanthodoris pilosa*. *Onchidoris muricata* has a northern distribution in Ireland, and the record by Renouf is considered to be dubious.

***Onchidoris oblonga* (Alder and Hancock, 1845)**

Not seen recently in LH? Recorded in Easter 1938 (Renouf, 1939). Wilson and Picton (1983) stated that this was the first record for Ireland, and confirmed its presence in LH, but there are no details listed. There are few recent live records for Ireland.

***Onchidoris pusilla* (Alder and Hancock, 1845)**

First recorded in last week of March and first week of April 1934, in Southern's Bay, as *Atalodoris pusilla* (Renouf, 1934a, d, 1937). Two individuals were observed feeding on an orange encrusting bryozoan within the same dead scallop shell, I7 [Whirlpool Cliff] 17.9.1980 12m (DM). Wilson and Picton (1983) confirmed the presence of the species in LH. Only two other recent live records from Ireland (Galway Bay and Murles Point).

***Onchidoris sparsa* (Alder and Hancock, 1846)**

A single specimen found at Glannafeen Cliff on 14.7.1990 13m (JDN). New record for LH. Scattered records from Ireland, mainly the west coast.

***Diaphorodoris luteocincta* (M. Sars, 1870) (Figure 47)**

First recorded Easter 1938 (Renouf, 1939). Subsequently recorded from Whirlpool Cliff (Hiscock, 1976) and Codium Bay 19.3.1979 10m (BEP). Recorded on four occasions from Whirlpool Cliff 1990-1993, Bullock Cave 20.7.1990 14m and south-east of South Bay, Castle Island 11.8.1997 11m (JDN). Collections: NMI, UM.

***Acanthodoris pilosa* (Abildgaard *in* O. F. Müller, 1789)**

First recorded from LH *circa* 1930 (Renouf, 1931) and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Wilson and Picton (1983) confirmed the presence of this species 1979-1982, but no details are listed. Found at Carrigathorna (Hiscock and Mitchell, 1980) and below the Rapids 4.7.1992 6m one juvenile (JDN).

SUPERFAMILY POLYCERACEA

Aegiretidae

***Aegires punctilucens* (Orbigny, 1837) (Figure 48)**

First recorded from Renouf S12-S17 *circa* 1930 (Renouf, 1931), and subsequently collected by W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Found throughout the South Basin, on the cliffs, and the boulder slope of Codium Bay (1990-2005 JDN). Collection: UM.

Polyceridae

***Polycera faeroensis* Lemche, 1929 (Figure 48)**

Wilson and Picton (1983) reported the first record for LH, but no details are listed. Found at only three sites in LH: Labhra Cliff 3.7.1992 15m, 19.7.1993 14m (JDN), 24.4.1994 (BioMar), 11.7.2005 15m (JDN), Western Cliff 30.7.1993 13m and Whirlpool Cliff 25.4.1994 (BioMar). Collection: NMI.

***Polycera quadrilineata* (O. F. Müller, 1776) (Figure 49)**

First recorded from LH *circa* 1930 (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Easter 1939, unusually abundant (Renouf, 1939). Widespread throughout the reserve, although largely absent from Barloge Creek, and most commonly found in the Rapids (Ebling *et al.*, 1948; Sloane *et al.*, 1957; Norton *et al.*, 1977; 1980, 1981 DM; 1990-2005 JDN). Feeding on *Membranipora membranacea*, with spawn coils 1981 (K. Wilson). Depth range: littoral only on both shores of the Rapids, elsewhere sublittoral 2m to 20m. Collections: NMI, UM.

***Limacia clavigera* (O. F. Müller, 1776) (Figure 49)**

First recorded from Renouf S12-S17 *circa* 1930, as *Triopa clavigera* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Widespread although uncommon throughout reserve (1979 J. M. C. Holmes; 1980 DM; Picton, 1981; 1990-2005 JDN; 1994 BioMar). Depth range: littoral only south Southern's Bay 3.7.1992, mainly sublittoral 3m to 18m. Collections: NMI, UM.

***Palio nothus* (Johnston, 1838)**

First recorded *circa* 1930, as *Polycera ocellata* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a), and as *Palio lessoni* (Renouf, 1934a, 1937). Identification of the specimens by Renouf as *P. lessoni* (synonymous with *P. dubia*) is thought to be an error for *P. nothus*. Found on trawler at C3 14.12.80 2m three specimens (Picton, 1981). Recorded from Western Cliff 3.7.1992 14m, 30.7.1993 13m (JDN).

SUPERFAMILY DORIDACEA

Chromodorididae

***Cadlina laevis* (Linnaeus, 1767)**

Not seen recently in LH? Recorded from the general area of Lough Hyne as *Doris repanda* (Renouf, 1937). Wilson and Picton (1983) confirmed the presence of the species, but there are no details listed.

Rostangidae

***Rostanga rubra* (Risso, 1818)**

First recorded from Renouf S12-S17 *circa* 1930, as *Rostangia coccinea* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Only recently found on the east shore of the Rapids, one specimen, 19.7.1990 (JDN). Collection: UM.

Archidorididae

***Archidoris pseudoargus* (Rapp, 1827) (Figure 50)**

First recorded from Renouf S12-S17 *circa* 1930, as *Archidoris tuberculata* and as *Doris flammea* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Unusually abundant Easter 1938 and Easter 1939, as *Archidoris britannica* (Renouf, 1939). Common, mainly found in the South Basin and the Rapids (Norton, 1971; Norton *et al.*, 1971; Hiscock, 1976; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; 1979, 1980 BEP; 1980 DM; 1990-2005 JDN; 1994 BioMar). Depth range: mainly littoral, but also to 16m. Collections: NMI, UM.

Discodorididae

***Geitodoris planata* (Alder and Hancock, 1846) (Figure 50)**

First recorded from Renouf S12-S17 *circa* 1930, as *Archidoris testudinaria* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Two individuals were found on the west side of LH 24.7.1983 20m (BEP). Recorded from Western Cliff 30.7.1993 13m, and two specimens from Goleen and Goleen Cliff 1.11.2005 6/18m (JDN). Depth range: sublittoral 6m to 18m.

Kentrodorididae

***Jorunna tomentosa* (Cuvier, 1804) (Figure 51)**

First recorded from Renouf S12-S17, abundant, several colour forms, 1928, as *Jorunna johnstoni* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). There is a specimen from the Rapids in NMI collections, donated in 1931 by Cork University Biological Station. Found in Codium Bay 19.3.1979 10m (BEP) and elsewhere as scattered records (1990-2005 JDN; 1994 BioMar). Two-three specimens were seen spawning in July 1990 on the east shore of North Basin (JDN). Collections: NMI, UM.

SUPERFAMILY ARMINACEA

Arminidae

***Armina loveni* (Bergh, 1860)**

Recorded on three occasions; from Renouf S12-S17 *circa* 1930, as *Pleurophyllidia loveni* (Renouf, 1931), a solitary specimen from Scyllium [Codium] Bay on the south shore of the Lough in the1930s (Renouf, 1934a, d, 1937), and the third record in Easter 1938 (Renouf, 1939). *Armina loveni* feeds in the sublittoral on the sea pen *Virgularia mirabilis*, which has not been seen in LH. Wilson and Picton (1983) considered the records to be doubtful and require confirmation. It is almost certainly an error of identification.

Janolidae

***Janolus cristatus* (delle Chiaje, 1841) (Figure 51)**

First recorded *circa* 1930, as *Janolus cristata* (Renouf, 1931, 1934a, 1937). Seen by divers on land-plant debris, Western Trough (Kitching *et al.*, 1976). Found recently, but not uncommonly at only six scattered sites in the reserve (1980, 1981 on *Audouinells floridula* DM; 1980, 1981, 1989, 1990 BEP; 1990-1997 JDN). Depth range: 3m-18m. Collection: UM.

***Janolus hyalinus* (Alder and Hancock, 1854) (Figure 52)**

Found for first time during last week of March and first week of April 1934 in Southern's Bay, as *Janolus hyalina* (Renouf, 1934a, d, 1937). Scattered, occasional records throughout the main Lough, Rapids and Southern's Bay (Picton, 1981; 1980, 1981 DM; 1990-2005 JDN). Figured in Picton and Morrow (1994). Depth range: sublittoral, 3m to 15m. Collection: UM.

***Proctonotus mucroniferus* (Alder and Hancock, 1844)**

A single specimen was recorded in spring 1935 from LH by Miss M. M. Murphy of University College Cork as *Zephyrina mucroniferus* (Renouf, 1935, 1937). Wilson and Picton (1983) did not comment on this record. *Proctonotus mucroniferus* is very rare, and in the absence of a specimen to confirm the identification, is considered dubious, and a possible error of identification for the closely similar *Janolus hyalinus* which is common in LH.

SUPERFAMILY AEOLIDIACEA

Flabellinidae

***Coryphella browni* Picton, 1980**

Renouf recorded specimen(s) from the LH area as *Coryphella rufibranchialis* (Renouf, 1934a, 1937). *C. rufibranchialis* is a synonym for *Coryphella verrucosa*. Wilson and Picton (1983) considered this record, as *C. verrucosa*, to be doubtful and require confirmation. It is almost certainly *C. browni*, which had not been described at that time. The first confirmed report of *C. browni* was one small specimen from Whirlpool Cliff 18.3.1979 10m (BEP; Wilson and Picton, 1983). This is still the only site in the Lough: 9.6.1984 18m, 12.9.1989 18m (BEP);

18.7.1993 15m (JDN).

***Coryphella gracilis* (Alder and Hancock, 1844)**

First recorded from the LH area in the 1930s (Renouf, 1937). Known with certainty from only two sites in the Lough: Whirlpool Cliff 18.3.1979 10m with spawn, September 1979 several specimens (BEP), 29.7.1993 14m (JDN), 25.4.1994 6-15m (BioMar), and Goleen Cliff 27.7.1993 13m (JDN). Collection: NMI.

***Coryphella lineata* (Lovén, 1846) (Figure 52)**

Found for first time during last week of March and first week of April 1934 in Southern's Bay (Renouf, 1934a, d, 1937). Subsequently for Carrigathorna 3m, early 1970s (Norton *et al.*, 1977), Whirlpool Cliff 18.3.1979 17m (BEP) and the trawler hull (C3) 22.9.1980, three individuals (DM). Scattered records in the reserve, never seen commonly (Picton, 1981; 1994 BioMar; 1990-2005 JDN). Has been found on *Eudendrium* sp. Depth range: 3m-18m. Collections: NMI, UM.

***Flabellina pedata* (Montagu, 1815) (Figure 53)**

First recorded spring 1935, one specimen, found by Prof. Tattersall's class as *Coryphella pedata* (Renouf, 1935, 1937). Confined to the South Basin, exclusively the cliffs, and the boulder slope off Codium Bay (1981, 1984, 1989 BEP; 1990-2005 JDN; 1993 BioMar). Depth range: sublittoral 10m to 18m. Collection: UM.

***Flabellina pellucida* (Alder and Hancock, 1843)**

First recorded from the general area of Lough Hyne by Renouf (Renouf, 1937). Wilson and Picton (1983) considered this record to be doubtful and require confirmation. Subsequently, one specimen was collected from Whirlpool Cliff 12.9.1989 18m (BEP). This is the only site in Ireland for this species.

Tergipedidae

***Tergipes tergipes* (Forsskål, 1775) (Figure 53)**

First recorded from Renouf S12-S17, as *Tergipes despectus* (Renouf, 1931, 1934a, 1937).

More recently from a structure at F5 August/September 1980 (DM). Wilson and Picton (1983) confirmed the presence of the species 1979-1982, but no details are listed. Found at Labhra Cliff 10.7.1990 13m and Whirlpool Cliff 29.7.1993 14m, 11.7.2005 18m (JDN). Collection: UM.

***Catriona gymnota* (Couthouy, 1838) (Figure 54)**

First recorded from the LH area as *Cratena aurantia* (Renouf, 1937). Sites are clustered at the entrance to the Rapids in the South Basin, particularly Whirlpool Cliff, in the Rapids (Norton, 1971; Picton, 1981; 1990-2005 JDN), and the trawler hull (C3) in the North Basin (Picton, 1981). Normally found on *Tubularia* spp. Depth range: littoral on south-east shore of the Rapids, normally sublittoral 3m to 18m. Collections: NMI, UM.

***Cuthona caerulea* (Montagu, 1804)**

First recorded from the LH area, as *Cratena caerulea* (Renouf, 1937). Only found at one site, Whirlpool Cliff 24.7.1983 10m, many on food *Sertularia polyzonias* (BEP), 10.7.1990 15m one individual, 4.7.1992 14m (JDN). Collection: UM.

***Cuthona concinna* (Alder and Hancock, 1843)**

Recorded living from the general LH area (Renouf, 1937). Possible specimens of this species were observed by DM beneath the hull of the moored boat at C3 in 1980, and one individual at I7 in 17.8.1980 within a scallop shell. Wilson and Picton (1983) considered the Renouf record to be doubtful. Although this species has been found as far south as Skomer (1988), in Ireland all records are confined to Northern Ireland. The records from LH are therefore considered to be dubious, and require confirmation.

***Cuthona foliata* (Forbes and Goodsir, 1839)**

Recorded living from the general area of LH as *Cratena foliata* (Renouf, 1937). Also recorded by BEP from the trawler in 3m at C3, 14.12.1980, with many cerata missing (Picton, 1981). Wilson and Picton (1983) confirmed the presence of this species in LH on the basis of this latter record. The very closely similar species *Cuthona genovae* is common in LH, but was unrecognised in Ireland or Britain before 1980. The Renouf record could therefore be of this species.

***Cuthona genovae* (O'Donoghue, 1926) (Figure 54)**

First recorded in LH and first for Ireland and Britain from underside of fishing vessel moored in *circa* 20m off West Quay, Lough Hyne 14.12.1980, three specimens amongst hydroids and ascidians, and here also in 15.8.1981 3m. Only previously known from the Mediterranean (Picton, 1981, Wilson and Picton, 1983; Picton and Wilson, 1984). An earlier record from the same site was unknown at the time of the original publication: one individual 6mm, C3 boat 22.9.1980, with a distinctive orange line in front of and behind rhinophores, originally as *C. foliata* (DM). Separation from the closely similar *C. foliata* is based on a distinctive orange streak across the mid-line of the head, a white streak along the mid-line of the head, and a very distinct V-shaped orange band lying behind the rhinophores. Found throughout the main Lough and below the Rapids (1990-2005 JDN). One specimen, found at Whirlpool Cliff 1993, contained the endoparasitic copepod *Splanchnotrophus brevipes* Hancock and Norman, 1863, a first record for Ireland (Holmes and Nunn, 1996). The finding of specimens in LH (JDN) in years 1990 (7 sites, 40+ specimens), 1992 (1 site), 1993 (2 sites), 1997 (5 sites), 1998 (1 site) suggests that there is a resident population. It was not however found in 2005, although five of the sites were dived where it had been previously found, and at the same time of year e.g. Labhra Cliff (1990, 1992, 1997), Goleen Cliff (1990, 1998) and Western Cliff (1990, 1993, 1997). It has been suggested that the habitat of this species is characterized by being warmer than offshore water during the summer (Picton and Wilson, 1984). Known elsewhere in Ireland only from Salt Lake, Mulroy Bay (Nunn and Minchin, 1994) and Kenmare River (unpublished, JDN). Depth range: sublittoral 3m to 18m. Collections: NMI, UM.

***Cuthona nana* (Alder and Hancock, 1842)**

Not seen recently in LH. Recorded from Renouf S12-S17 *circa* 1930, as *Cuthona peachi* (Renouf, 1931).

***Cuthona viridis* (Forbes, 1840)**

Not seen recently in LH. Collected and determined in 1931 by W. M. Tattersall as *Eolis viridis* (Renouf, 1932a), and as *Cratena viridis* (Renouf, 1937).

Eubranchidae

***Eubranchus doriae* (Trinchese, 1874)**

Wilson and Picton (1983) published the first record for Ireland from LH, but there are earlier records from Galway Bay by Lemche (in 1974) and Mulroy Bay by BEP (in 1977). No details are given for the LH record. Found on Goleen Cliff 27.7.1993 13m, and Western Cliff 30.7.1993 13m, 14.7.2005 18m (JDN).

***Eubranchus exiguus* (Alder and Hancock, 1848) (Figure 55)**

First recorded living from F5 structures, one animal August-September 1980 (DM). Found on buoyline north of Castle Island 30.8.1980, and on the trawler off West Quay and moorings 15.8.1981 3m (Picton, 1981). Common in the southern half of LH, and Rapids, on hydroids especially *Obelia* (1990-2005 JDN). Depth range: sublittoral 6m to 18m. Collections: NMI, UM.

***Eubranchus farrani* (Alder and Hancock, 1844) (Figure 55)**

First recorded from Renouf S12-S17 *circa* 1930, as *Galvinia farrani* (Renouf, 1931, 1934a, 1937), with a second record Easter 1938 (Renouf, 1939). A single individual was collected from Whirlpool Cliff 14.12.1980 (Picton, 1981). Unusually, *Eubranchus farrani* was found on the west shore of Barloge Creek 26.4.1994 (BioMar). A single animal was collected from south of the Rapids 12.8.1997 6m (JDN). Collection: NMI.

***Eubranchus pallidus* (Alder and Hancock, 1842)**

Not seen recently in LH? Recorded from Renouf S12-S17 *circa* 1930, as *Galvinia picta* (Renouf, 1931, 1934a, 1937). Wilson and Picton (1983) confirmed the species as present, but no details are listed.

***Eubranchus tricolor* Forbes, 1838**

Not seen recently in LH. Recorded from Renouf S12-S17 *circa* 1930, as *Galvinia tricolor* on not more than two occasions (Renouf, 1931, 1934a, 1937).

Calmidae

***Calma gobioophaga* Calado and Urgorri, 2002**

Three specimens found on the east shore under one flat stone, Renouf E6-E9, 16.7.1990 (JDN). This was thought to be the 'littoral form' of *Calma glaucoides* (Alder and Hancock, 1854), with short cerata, described in Picton and Morrow (1994). Subsequently, this species was split into two (Calado and Urgorri, 2002). The form seen in LH is the new species *C. gobioophaga*. This is the first confirmed report of this species from Ireland and Britain. There are only recent, living records of *Calma glaucoides* agg. from three other sites in Ireland – Liscannor (1994 JDN), Teelin Harbour (1996 BioMar) and Gurraig Sound (2005 JDN). The record from Liscannor is also of *C. gobioophaga*. *Calma glaucoides* agg. was recorded from LH, April 1932, coll. and det. W. M. Tattersall, as *Eolis glaucoides* (Renouf, 1932a). The species occurred each year since (Renouf, 1934a, d, 1937). The species was unusually abundant in Easter 1938 and Easter 1939 (Renouf, 1939). It is not possible to determine to which species these records refer. Collection: UM.

Facelinidae

***Facelina annulicornis* (Chamisso and Eysenhardt, 1821)**

Not seen recently in LH. Recorded from Renouf S12-S17 *circa* 1930, as *Facelina punctata* (Renouf, 1931, 1934a, 1937).

***Facelina auriculata* (O. F. Müller, 1776) (Figure 56)**

First recorded *circa* 1930, as *Facelina coronata* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). Most records are from Whirlpool Cliff and the Rapids (Norton, 1971; 1984 BEP; 1990-2005 JDN) with a few scattered records elsewhere (Norton *et al.*, 1977; 1980 DM; Picton, 1981). Found on *Tubularia* 1990, spawning

December 1980, and seen by divers on land-plant debris, Western Trough (Kitching *et al.*, 1976). Depth range: littoral to 18m. Collections: NMI, UM.

***Facelina bostoniensis* (Couthouy, 1838) (Figure 56)**

First recorded from LH *circa* 1930, as *F. drummondi* (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall 1931 (Renouf, 1932a, 1934a, 1937). More recently seen on a buoyline north of Castle Island (F5) 30.8.1980 15m (G. H. Brown; Picton, 1981), August/September 1980 (DM) and trawler moorings (C3) 22.9.1980 (DM) and 15.8.1981 3m (BEP).

***Facelina dubia* Pruvot-Fol, 1949 (Figure 57)**

First recorded on mooring rope amongst hydroids north of Castle Island, Lough Hyne 30.8.80 5-10m, three specimens 20mm, coll. BEP (Picton and Brown, 1981). This is the first and only area in Ireland or Britain for this species, which was previously only known from the Mediterranean and Bay of Biscay (Wilson and Picton, 1983). Subsequently found on the hull of the trawler at C3 August/September 1980, two individuals up to 32mm (DM). Found here 15.8.1981 3m on mooring ropes with *Tubularia larynx* (Picton, 1981). The commonest nudibranch off North Pier May 1982 3-20m on small hydroids (not *Tubularia*) attached to *Ascidiella* tests or *Chaetopterus* tubes (K. Wilson, unpublished). The species is figured in Picton and Morrow (1994). It has been more recently recorded from these areas and in the South Basin (1990, 1992, 1993 JDN). On 19.7.1993, it was common and spawning on Metridium Rocks. It was not seen in 1997 or 2005, although the known areas were all dived several times. Collections: NMI, UM.

***Caloria elegans* (Alder and Hancock, 1845)**

Recorded from the general area of Lough Hyne and Southern's Bay below Rapids as *Eolis elegans* (Renouf, 1937). Although not improbable, currently the only record for Ireland is from Lough Swilly in 1989. Wilson and Picton (1983) indicated that *Facelina dubia*, recently recorded, bears a superficial resemblance to Alder and Hancock's plate for *Eolis elegans*, suggesting an error of identification for this species.

Favorinidae

***Favorinus branchialis* (Rathke, 1806) (Figure 57)**

First found in early April 1934, coinciding with the spawn of *Archidoris pseudoargus*, as *Favorinus albidus* (Renouf, 1934a, d, 1937). More recently, a single individual was recorded from the hull of the trawler at C3, 22.9.1980 (DM). It has now been found on Labhra Cliff 10.7. 1990 15m, 3.7.1992 15m (JDN); Whirlpool Cliff 12.8.1990 18m (BEP), 25.4.1994 6-15m (BioMar); the west side of Barloge Creek 26.4.1994 (BioMar); and Metridium Rocks 15.7.2005 13m (JDN). Collection: UM.

***Dicata odhneri* Schmekel, 1967 (Figure 58)**

First recorded living from the vertical rock faces of Labhra Cliff 28.8.1980 15m two specimens coll. G. Brown; and subsequently at the same site 29.8.1980 15m (BEP, J. Picton), 9.8.1981 (K. Wilson), 15.8.81 15m (Picton, 1981), 23.8.1981 3+ specimens 6m, 19.7.1990 6-7 specimens (JDN) Lough Hyne is the first and only site for *Dicata odhneri* from Ireland and Britain, previously known only from Naples (Picton and Brown, 1981). Two other sites in Lough Hyne are known: Western Cliff, 16.7.1990 15m two specimens (JDN), August 1990 (BEP), 30.7.1993 13m (JDN); and Goleen Cliff 14.7.2005 6m 2 specimens (JDN). The species is figured in Picton and Morrow (1994). Collections: NMI, NMS, UM.

Aeolidiidae

***Aeolidia papillosa* (Linnaeus, 1761) (Figure 58)**

First recorded from Renouf S12-S17 *circa* 1930 (Renouf, 1931), and subsequently coll. and det. W. M. Tattersall, 1931 (Renouf, 1932a, 1934a, 1937). Seen by divers on land-plant debris, Western Trough (Kitching *et al.*, 1976), and near the Rapids August/September 1977 (Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977). Wilson and Picton (1983) confirmed the species to be present 1979-1982, but no details are listed. More recently it has been found around Castle Island: Narrows 12.7.1990 10m, north-east 5.7.1992 13m, north-west 27.7.1993 10m; and on the shore on the east and south-east sides of the Rapids 19.7.1990, 21.7.1990 (JDN). Collection: UM.

***Aeolidiella alderi* (Cocks, 1852)**

A single specimen found under a boulder at low water springs on the east shore of the Rapids 19.7.1990 (Nunn 1993, figured). Also found there subsequently 26.4.1994 (BioMar). New record for LH and SA37. Very few specimens found in Ireland to date, although apparently present around most of the western and southern coastline. Collections: NMI, UM.

***Aeolidiella glauca* (Alder and Hancock, 1845) (Figure 59)**

A species recorded as *Eolis angulata* was listed in the MS list of R. Southern, collecting in 1914 in LH (Renouf, 1931). Subsequently, this species was coll. and det. W. M. Tattersall Renouf, 1931 (Renouf, 1932a, 1934a, 1937). Wilson and Picton (1983) state that while '*Eolis angulata*' is generally considered to be synonym now of *Aeolidiella glauca*, it could have been any species of *Aeolidiella* found at that time. The first confirmed records for LH are from below the recent oxycline, climbing up *Polydora* sp. tubes at bottom of Labhra Cliff 9.6.1984 15m, and Whirlpool Cliff 9.6.1984 18m (BEP). Also seen in the Goleen August 1984 (DM) and off North Island 13.7.2005 14m (JDN).

***Aeolidiella sanguinea* (Norman, 1877) (Figure 59)**

First recorded living from the hull of the trawler 14.12.1980 3m (C3) (BEP; Wilson and Picton, 1983). Subsequently found on the shore, one animal each site, on south-east Castle Island 12.7.1990, north of Castle Island 13.7.1990, Renouf E6-E9 16.7.1990 and south-east Rapids 21.7.1990 and spawning there 5.7.1992. Further records were made from the east side of the Rapids in 11.8.1990 3m under a stone (BEP) and 26.4.1994 (BioMar). Collections: NMI, UM.

Order Systellommatophora

SUPERFAMILY OTINACEA

Otinidae

***Otina ovata* (Brown, 1827)**

Recorded living from Springtide Pool, Carrigathorna 11.7.1975, det. T. E. Thompson (Goss-Custard *et al.*, 1979). Collection: NMI.

Order Actophila

SUPERFAMILY ELLOBIACEA

Ellobiidae

***Leucophytia bidentata* (Montagu, 1808)** [Auriculinella bidentata] **(Figure 60)**

First recorded near the Rapids August/September 1977 (Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977). Scattered records from the main Lough, Rapids and Southern's Bay (1990-2005 JDN). Probably under-recorded from its habitat under flat stones, high on the shore. Collections: NMI, UM.

Myosotella denticulata [Ovatella myosotis] **(Montagu, 1803)**

A single living specimen recorded from south-east Castle Island 12.7.1990 and in 27.7.1993, from a similar habitat to *Leucophytia bidentata*, high on the shore under slatey stones (JDN). A single shell was found in a shellsand sample 1980 (DM). New record for LH and SA37. Widely distributed around Ireland.

Class: SCAPHOPODA

Order Dentalioida

Dentaliidae

***Antalis entalis* (Linnaeus, 1758)**

First recorded by J. M. C. Holmes, a single juvenile I8 in 1977. A further specimen was found at the same site 12.7.1990 1-2m by J. M. C. Holmes, det. JDN. Collection: UM.

Class: PELECYPODA

Order Nuculoida

SUPERFAMILY NUCULACEA

Nuculidae

Nucula nucleus **(Linnaeus, 1758) (Figure 60)**

First recorded living from north of Whirlpool Cliff 18.7.1993 15m in gravel pockets, (JDN, conf. S. M. Smith), and subsequently from the shore south-east of the Rapids 24.7.1993 and north Southern's Bay 30.7.1993 4.5m. Shells were found in the same areas, and at Goleen Cliff 1997. New record for LH. Common and widespread around Ireland except in the north-west. Collection: NMI.

Nucula sulcata **Bronn, 1831**

Only recorded living from the west of South Basin, summer 1983 20m, and the mouth of the Goleen, summer 1982, 19m (Thrush, 1985).

Order Mytiloida

SUPERFAMILY MYTILACEA

Mytilidae

Mytilus edulis **Linnaeus, 1758 (Figure 61)**

The first record of this widespread species from LH was from clumps from the north corner of Goleen, the Sill [Rapids], abundant and general, and Renouf S12-S17 *circa* 1930 (Renouf, 1931). Recorded many times from around the entire reserve (Renouf, 1937; Ebling *et al.*, 1948; Lilly *et al.*, 1953; Sloane *et al.*, 1957; Ebling *et al.*, 1960; Kitching and Ebling, 1967; Ebling *et al.*, 1964; Norton 1971; Norton *et al.*, 1971, 1977; 1977-1981 DM and J. M. C. Holmes; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983). It was found in three types of habitat; open coast (shore) as a small form, very sheltered shores (large form), and sublittorally in strong current on the Sill [Rapids]. The main predator *Nucella lapillus* was abundant on the open coastal dense beds at Carrigathorna (Kitching *et al.*, 1959). The species is also the major prey item for hooded crows (Berrow *et al.*, 1992). *Mytilus edulis* has been found in the Rapids on a wide variety of algae (Sloane *et al.*, 1961) and spat on *Amphisbetia operculata* in the Rapids and Codium Bay (Round *et al.*, 1961). Spawning occurs in the spring, sometimes during July and August, with settlement occurring within 3m of the surface (DM). Very common and widespread throughout the reserve (1990-2005 JDN; 1994 BioMar). Depth range: littoral mainly, shallow sublittoral, occasionally deeper to 18m.

The first record for '*Mytilus galloprovincialis* Lamarck, 1819' was in July 1955 (forming mixed populations with *M. edulis*) especially north and east shores, Bullock Island and Carrigathorna, with a ration of *circa* 2 or 3: 1 *galloprovincialis*: *edulis* (Ebling *et al.*, 1960). Seed (1974) also recorded this 'species' from LH (unlocalised) and Carrigathorna. In Ireland, '*Mytilus galloprovincialis*' occurs mainly at exposed sites, and hybridization with *M. edulis* occurs frequently. Systematic status of the two forms remains uncertain in light of genetic evidence of hybridization and intergradation between them. Mussels morphologically resembling *M. galloprovincialis* have been found in LH (Gosling and Wilkins, 1981). Many authors did not separate these two 'species' (e.g. Norton *et al.*, 1977). There are considerable practical difficulties in distinguishing between these two species, should taxonomic status be resolved in favour of separation into two species. Therefore all records have been treated here as being of *Mytilus edulis*. Collections: NMGW, NMI, UM.

***Modiolus barbatus* (Linnaeus, 1758)**

Recorded living, occasional, on Sill [Rapids] in 1948, but absent in 1950 (Lilly *et al.*, 1953). This record is almost certainly an error of identification for (juvenile) *Modiolus modiolus*. *Modiolus barbatus* is distributed down the mid western coast of Ireland only. While its presence in LH is not improbable, identification of this group of mytilids is prone to error, and the record is considered dubious and requiring confirmation.

***Modiolus modiolus* (Linnaeus, 1758) (Figure 61)**

First recorded from Renouf S12-S17 *circa* 1930, as *Volsella modiolus* (Renouf, 1931). Subsequently from Carrigathorna (12-18m) and Whirlpool Cliff (6-15m) early 1970s (Hiscock, 1976). Occasional individuals were located between boulders in North and South Basins of LH in 1-4m (1970s/1980s DM). A juvenile was recorded from Whirlpool Cliff August 1984 (Kitching *et al.*, 1990). Widespread but scarce around Castle Island, Whirlpool Cliff, the

Rapids, and Southern's Bay as the small form (1990-1993 JDN). Not seen since 1993. Depth range: littoral to 14m. Collection: UM.

***Modiolula phaseolina* (Philippi, 1844) (Figure 62)**

First recorded from S12-S17 *circa* 1930, as *Volsella phaseolina* (Renouf, 1931), and subsequently from the Rapids on boulders, and Codium Bay in 1948, 1950 (Lilly *et al.*, 1953). Further seen at Urchin Reef and Carrigathorna, many juveniles (Norton *et al.*, 1977; Goss-Custard *et al.*, 1979), and S15 as spat 1977-1981 (Kitching and Thain, 1983). Found on a wide range of algae in the Rapids (Sloane *et al.*, 1961), and occasional spat on *Amphisbetia operculata* (Round *et al.*, 1961). Largely confined to the South Basin and Rapids, with few records elsewhere (1990-1993 JDN, det. S. M. Smith). Depth range: mainly littoral, but also to 15m. Collections: NMI, UM.

***Modiolarca tumida* (Hanley, 1843) (Figure 62)**

First recorded from Renouf S12-S17 *circa* 1930, as *Modiolaria tumida* (Renouf, 1931). Present in the tests of *Ascidiella aspersa*, extremely common, Easter 1932 as *Musculus marmorata* (Renouf, 1932a). Very common and widespread throughout the reserve, both in the tests of large solitary tunicates and free-living on *Sacchoriza polyschides* and a range of other algae (Ebling *et al.*, 1948; Lilly *et al.*, 1953; Sloane *et al.*, 1961), occasional spat on *Amphisbetia operculata* (Round *et al.*, 1961), and generally (Norton *et al.*, 1971; 1980-1982 (K. Wilson, unpublished; Kitching *et al.*, 1976; 1975-1978 DM; Norton *et al.*, 1977; Goss-Custard *et al.*, 1979; van Soest and Weinberg, 1981; Kitching and Thain, 1983; Kitching, 1987a; Kitching *et al.*, 1990; 1990-2005 JDN). Depth range: littoral to 18m. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud as *Modiolaria marmorata* (Chaster, 1898). Collections: NMI, UM.

***Musculus discors* (Linnaeus, 1767) (Figure 63)**

First recorded from Renouf S12-S17, *circa* 1931 as *Modiolaria discors* (Renouf, 1931). On the tops of boulders in the Rapids, 1948 (Lilly *et al.*, 1953), and there on *Codium* spp., *Chondrus*, *Corallina*, July 1953 (Sloane *et al*., 1961) and under *Himanthalia elongata* buttons 1982-85 (Kitching, 1987a). Found in pools on Urchin Reef and Carrigathorna 1975/76 (Goss-Custard *et al*., 1979). Generally only in South Basin, the Rapids, Southern's Bay, Barloge Creek and Carrigathorna (1975-1978 DM; 1981 A. Trew; 1990-1993 JDN). Depth range: littoral to 15m. Collections: NMI, UM, NMGW.

Order Limoida

SUPERFAMILY LIMACEA

Limidae

***Limaria hians* (Gmelin, 1791)**

First recorded, dredged, from the LH area *circa* 1930 (Renouf, 1931). Praeger (1937) described a characteristic of LH as '....perhaps the queerest feature of this queer place is the occurrence even under only a few feet of water of animals mostly found in deepish or quite deep water -....and that little white cousin of the Common Mussel, *Lima hians*, which can flit about through the water like a marine butterfly..'. It is thought by the authors that this refers rather to scallops, than to the flame shell *Limaria hians*. One individual was taken from a collector in North Basin (in water since July 1976) during October 1978. Only one larval *Lima* sp. noted, and this from outside LH off Carrigathorna. Two shells of *L. hians* were taken from base of boulders at Whirlpool Cliff 12.7.1979 16m, and appeared damaged by crab activity (DM). A specimen of *L. hians* was recorded by J. M. C. Holmes 10.8.1992 from I9. Collection: NMI.

Order Ostreoida

SUPERFAMILY OSTREACEA

Ostreidae

***Ostrea edulis* Linnaeus, 1758 (Figure 63)**

First observed in LH by Haddon and Green (1888): 'oysters were formerly abundant; but these and other Molluscs were killed in large numbers, a few years ago by spring freshets after a heavy fall of snow'. Renouf recorded a scarce, small bed which remained at the south end of

Southern's Bay, and also Renouf S12-S17 *circa* 1930 (Renouf, 1931). Since then, some old living individuals have been observed from the North Basin in 1-4m in front of Lough Hyne House and in the north-west of Lough, 2-3/m^2 at B2. There were many old shells covered with boring sponge. There was no evidence of settlement, apart from three young oysters seen cemented to North Wall. Oysters are thought to have been introduced in LH, not native – an oyster order to cultivate in Lough was granted in the 19th century (1975-1978 DM). In 1980, off the North Wall (B2, C2, D2) some individuals were found brooding young (DM). Still found in these two areas, but also south of Castle Island and Southern's Bay (1992-2005 JDN). Depth range: littoral to about 10m. Collection: NMI.

***Crassostrea gigas* (Thunberg, 1793) (Figure 64)**

J. M. C. Holmes reported large live *Crassostrea*-like shells, seen in shallow water off the south-east of Castle Island (I13) in July 2005. A search there by diving and on the shore in 12.7.2005 failed to find any specimens. Subsequently, a large living specimen was found attached to a stone on the shore at Renouf S9 15.7.2005 by L. Baldock. A further living specimen was found at the Goleen near the Quay by L. Baldock and J. Bass on 16.7.2005. It should be noted that LH is many miles from the nearest farm for this species. New record for LH and SA37. Widespread around Ireland, close to oyster farms. Records here refer only to specimens of this species, introduced to Ireland for aquaculture, found outside oyster farms.

SUPERFAMILY PECTINACEA

Pectinidae

***Pecten maximus* (Linnaeus, 1758) (Figure 64)**

First published from Barloge Creek, dredged *circa* 1930 (Renouf, 1931). Common on sediments, and spat on ropes, algae, hydroids throughout the reserve 5-30m (Ebling *et al.*, 1948; Kitching *et al.*, 1976; 1975-1981 DM; 1977-1980 J. M. C. Holmes; 1980, 1981 K. Wilson; Thrush and Townsend, 1986; Kitching *et al.*, 1990). Scallops are more concentrated near the tops of the soft sediment slopes especially where these meet rock, boulders or stones (Minchin, 1989). Larvae are in the plankton in August and September. During the study period 1975-1981, the only significant settlements were in 1976 and 1981; these were also the warmest years (DM). Young scallops are predated by *Anthopleura ballii* (Cocks 1850) and *Carcinas maenas* (Minchin, 1983, 1991), and the species has been observed off North Quay being eaten by *Marthasterias glacialis*, and showing an escape response to *Natica* sp. south of the Rapids (DM). Depth range: littoral to 30m, although generally in less than 15m. Old records: Lough Hyne donated by Mrs Thomas Townshend 1859. Collections: NMI, UM.

***Aequipecten opercularis* (Linnaeus, 1758) (Figure 65)**

First recorded as spat on *Saccorhiza polyschides* in the Rapids 1946 (Ebling *et al*., 1948). From 1975-1978, 1980, 1983 occasional 'o' group individuals were found on collectors designed to trap scallops in depths to 26m (DM). Mature individuals were taken from the underside of the trawler at C3 9.7.1981 and at J11 1.8.1981 (DM). This species was found in the South Basin 1982-1983 19-26m (Thrush and Townsend, 1986).

***Chlamys distorta* (da Costa, 1778) (Figure 65)**

First recorded as a single individual taken on a collector in 5m, 1976 (DM). Further specimens were seen at I7 17.8.1980, and settled spat on the hull of the trawler (C3) 22.9.80 (DM). There are further records only from the Rapids: south-east shore 21.7.1990, 5.7.1992, 24.7.1993 (JDN) and east shore 19.7.1990 (JDN), 26.4.1994 (BioMar); and Renouf S13 Codium Bay 10.7.1990 (JDN). Collections: NMI, UM.

***Chlamys varia* (Linnaeus, 1758) (Figure 66)**

First recorded along most of the north shore especially the north-west, often with sponges, along half of the north shore of the Island and north part of Goleen; abundant on boulders along the west and south including Renouf S12-S17 *circa* 1930, as *Pecten varius* (Renouf, 1931). Subsequently found near the Rapids *circa* 1936 (Renouf, 1937). Widespread throughout the reserve, often abundant, particularly in the North Basin (Kitching and Ebling, 1961; Muntz *et al*., 1965; Ebling *et al*., 1966; Norton *et al*., 1977; Rodhouse and Burnell, 1979; Hiscock and

Mitchell, 1980; Kitching and Thain, 1983; 1994 BioMar; 1990-2005 JDN). Abundant on shallow ledges about the Lough, but only occasionally encountered in Barloge Creek (1965, 1967, 1969, 1976-1981, 1983 DM). Attached to rocks or loose shell, and may often be found in crevices between rocks or reefs. Particularly dense beds seen off North Island and north of Castle Island in 1976, 100-1000/m^2. The species spawns in relation to a rise in sea water temperature, locally July to October. Larvae are present in the plankton from July to September. Settlement occurs usually on more than one occasion, being good in 1975 and 1976, but otherwise poor from 1977 to 1988 (DM). Since 1981, there has been a reduction in numbers in LH (DM pers. comm., in Gosling and Burnell, 1988). *Chlamys varia* has been found on *Ulva* and *Codium fragile* (Sloane *et al.*, 1961), and in an association with an unknown sponge species (two colour forms) in the north basin of Lough (Forrester, 1979). The species is encouraged by grazing *Paracentrotus lividus* (Kitching and Thain, 1983), but predated by *Carcinas maenas* (DM) and hooded crows (Berrow *et al.*, 1992). Depth range: littoral to 15m. Collections: NMGW, NMI, UM.

***Palliolum tigerinum* (O. F. Müller, 1776)**

Only recorded from north of Rapids at J8 11.8.1981 4-6m one specimen 9mm, and two individuals, both 9mm from J10 Barloge Creek 14.8.1981 2½-3m (DM).

SUPERFAMILY ANOMIACEA

Anomiidae

***Anomia ephippium* Linnaeus, 1758 (Figure 66)**

First recorded as abundant on stones and rocks throughout LH and Barloge Creek, *circa* 1930 (Renouf, 1931) and *circa* 1936 (Renouf, 1937). Praeger (1937) referred to this species in LH: '*Anomia* itself, the Pearly Oyster, is likewise enormously abundant...'. Widespread throughout the edge of the lough on shallow ledges, occasionally abundant, but scarce in the Rapids, Southern's Bay and Barloge Creek. Attached to rock and loose stones and shell. Often found settling on each other and occasionally on *Pecten maximus*, *Chlamys varia* and *Carcinus* *maenas* (particularly those parasitized by *Sacculina carcini*) (Kitching and Ebling, 1961; Muntz *et al*., 1965; 1969, 1975-1981, 1983 DM; Hiscock, 1976; 1977-1980 J. M. C. Holmes; Kitching and Thain, 1983; Kitching, 1987a, b; 1990-2005 JDN; 1994 BioMar). The species is encouraged by *Paracentrotus lividus* grazing (Kitching and Thain, 1983), and is most abundant in the shallow sublittoral at North Wall and Curlew Bay, where predatory starfish such as *Marthasterias glacialis* are scarce (Ebling *et al*., 1966). Spawning occurs from July to September, and appears to be related to an increase in water temperature. Larvae have been identified from the plankton July to September. The only significant settlements were in 1976 and 1981 (during the study period 1976 to 1981, DM), which were also the warmest years. Depth range: littoral to 15m, mainly in 2-5m. Collections: NMGW, NMI, UM.

***Heteranomia squamula* (Linnaeus, 1758) (Figure 67)**

First recorded from boulders in the Rapids, 1950 (Lilly *et al*., 1953), and a variety of algae there July 1953 (Sloane *et al*., 1961; Kitching and Thain, 1983). Generally only found in the South Basin, the Rapids and the entrance to Barloge Creek (Goss-Custard *et al*., 1979; Hiscock and Mitchell, 1980; 1990-2005 JDN). Identified from plankton August to October (DM). Depth range: littoral, but mainly sublittoral to 18m. Collections: NMI, UM.

***Pododesmus patelliformis* (Linnaeus, 1761) (Figure 67)**

First recorded from Renouf S12-S17 *circa* 1930, as *Anomia ephippium* var. *striatum* (Renouf, 1931), and subsequently from boulders in the Rapids, 1950 (Lilly *et al*., 1953). Single specimens found at Carrigathorna 1975/1976 (Goss-Custard *et al*., 1979), although not seen there since, and I8 1977-1981, as *Monia patelliformis* (Kitching and Thain, 1983). Confined to the South Basin, the Rapids and Southern Bay (1990-2005 JDN; 1994 BioMar). Depth range: littoral, occasionally to *circa* 11m. Collections: NMI, UM.

Order Veneroida

SUPERFAMILY LUCINACEA

Lucinidae

***Lucinoma borealis* (Linnaeus, 1767)**

Not recorded living in LH. Dead fresh paired valves from Bullock Island 15.7.1990 10m, and shells only from west Barloge Creek 15.8.1997 4m. New record for LH. Widely distributed, living, around Ireland.

Thyasiridae

***Thyasira flexuosa* (Montagu, 1803) (Figure 68)**

First recorded from the south section of the Western Trough 1968; widely distributed in the mud burrow zone and spionid zone in the Western Trough 1968-1970 15-25m (Kitching *et al.*, 1976). Commonly found on soft mud in the Lough Basins 1977, and G7 11.7.1980 (DM). Throughout the South Basin 1982 and 1983 20-26m (Thrush, 1985). Shell only seen off the north-east of Castle Island 13.7.1990 12m (JDN). Depth range: sublittoral 4m-47m.

SUPERFAMILY GALEOMMATACEA

Galeommatidae

***Kellia suborbicularis* (Montagu, 1803) (Figure 68)**

Early records are from Renouf S12-S17, *circa* 1930 (Renouf, 1931), and boulders in the Rapids 1948, 1950 (Lilly *et al.*, 1953). Largely confined to the Rapids, the entrance to the Rapids and Barloge Creek, and around Castle Island (Kitching and Ebling, 1961; Round *et al.*, 1961; Norton *et al.*, 1971; Hiscock, 1976; Goss-Custard *et al.*, 1979; 1976 DM; 1990-1993 JDN). Found between gravel, within dead shells and on *Amphisbetia operculata* (DM; Round *et al.*, 1961), usually single specimens. Depth range: normally littoral, but occasionally to 18m. Old records: living from Lough Hyne (Nichols, 1900). Collections: NMGW, NMI, UM.

***Lasaea adansoni* (Gmelin, 1791) (Figure 69)**

First recorded from rock pools at Urchin Reef and Carrigathorna 1975/1976 (Goss-Custard *et al.*, 1979), and subsequently from the intertidal in the *Pelvetia canaliculata* zone at E2 11.10.1979 (DM). Widespread throughout the reserve (1990-2005 JDN). Depth range: littoral only. Collections: NMI, UM.

Montacutidae

***Mysella bidentata* (Montagu, 1803) (Figure 69)**

Widespread throughout the reserve, but absent from Barloge Creek and Carrigathorna (1990-2005 JDN). Depth range: littoral to 15m. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, as *Montacuta bidentata* (Chaster, 1898). Collections: NMI, UM.

***Epilepton clarkiae* (Clark, 1852)**

Not seen recently in Lough Hyne. It is possible that this is an error of identification for *Mysella bidentata. Epilepton clarkiae* is associated with sipunculids. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud, valves and rare, as *Lepton clarkiae* (Chaster, 1898).

SUPERFAMILY CARDIACEA

Cardiidae

***Parvicardium exiguum* (Gmelin, 1791) (Figure 70)**

First recorded from Renouf S12-S17 *circa* 1930, as *Cardium exiguum* (Renouf, 1931). Subsequently from G2, F4 and G6 1977-1980 (J. M. C. Holmes) and settled on collectors (DM). Widespread throughout the reserve (1990-2005 JDN). Depth range: littoral to 25m. Collections: NMI, UM.

***Parvicardium ovale* (G. B. Sowerby II, 1840) (Figure 70)**

First recorded living in LH from Labhra Cliff 1.8.1981 (A. Trew NMGW). Subsequently in 1982 and 1983 from the South Basin close to Whirlpool Cliff 19m (Thrush, 1985), a single specimen from Whirlpool Cliff August 1984 15m (Kitching *et al.*, 1990) and Southern's Bay 25.7.1993 5m (JDN). Shells have been found in the enteron of *Anthopleura ballii* on Whirlpool Cliff 1980 (DM), and Goleen Cliff 6.9.1998 18m (JDN). Collection: NMGW.

***Parvicardium scabrum* (Philippi, 1844) (Figure 71)**

First recorded from Barloge Creek, dredged *circa* 1930, as *Cardium nodosum* (Renouf, 1931). Widespread in the South Basin; also present east of North Quay and in Southern's Bay (1990-2005 JDN). Depth range: 1.5m to 18m. Collections: NMI, UM.

***Cerastoderma edule* (Linnaeus, 1758) (Figure 71)**

First published from LH at Renouf S12-S17 *circa* 1930, as *Cardium edule* (Renouf, 1931), and subsequently from the Rapids July 1953, on *Codium spp.*, *Corallina* and *Rhodymenia pseudopalmata* (Sloane *et al.*, 1961). Common about the Lough, although few sites, and in the Goleen. Found usually intertidally amongst gravel and sandy mud or just below low water (1977-80 J. M. C. Holmes; 1981 A. Trew NMGW; 1990-2005 JDN). Dead shells are widespread. Predated by hooded crows (Berrow *et al.*, 1992). Depth range: littoral to 5m. Old records: Lough Ine, donated by Mrs Townshend as *Cardium edule*, on display at NMI. Collections: NMGW, NMI, UM.

SUPERFAMILY MACTRACEA

Mactridae

***Spisula elliptica* (Brown, 1827)**

Not recorded living in LH. Dead shell in gravel, north Southern's Bay 25.7.1993 5m (JDN). New record for LH. Widely distributed, common, around Ireland.

***Lutraria angustior* Philippi, 1844 (Figure 72)**

First recorded living from east Southern's Bay July 1978 3-6m and Whirlpool Cliff 22.9.1981 9-15m on coarse shell sand to gravel (Minchin, 1985). Dead shells found at these sites; and at Bullock Island July 1979, a complete shell was found stranded on the high shore (DM), and also here 15.7.1990 10m (JDN). Seen living in north Southern's Bay 12.8.1997 6.8m (JDN). On 22.09.1981 *Lutraria* sp. settled on collector bags at F5 and at I7 17.8.1980 14-17m (DM). This species is normally confined to regions of moderate to strong water flow. It appears to be associated with *Cancer pagurus*, as damaged shells are frequently seen within excavated pits to *circa* 40cm depth (DM).

SUPERFAMILY SOLENACEA

Pharidae

***Ensis ensis* (Linnaeus, 1758)**

Not recorded living in LH. Dead shells from I7 and Barloge Creek 17.9.80, and D2 1981 (all DM). Widely distributed around Ireland, although only old or shell records from the southern half of the island.

***Ensis siliqua* (Linnaeus, 1758)**

First recorded living from Barloge Creek 31.7.1993 4m in sandy mud (JDN). A single shell was found there in 1980 (DM). New record for LH. Widespread around Ireland.

SUPERFAMILY TELLINACEA

Tellinidae

***Angulus squalidus* (Pulteney, 1799)**

Not recorded living in LH. Dead shell in gravel, below Rapids 19.7.1990 5m (JDN). New record for LH. Widely distributed around Ireland, although few live recent records.

***Angulus tenuis* (da Costa, 1778)**

Not recorded living in LH. Dead shell in muddy gravel, Barloge Creek 31.7.1993 4m (JDN). New record for LH. Widespread and common, living, around Ireland.

***Moerella pygmaea* (Lovén, 1846)**

One record, living, from near Whirlpool Cliff winter 1982/1983 and spring 1983 19m, as *Tellina pygmaea* (Thrush, 1985). A shell was found in shellsand from Whirlpool Cliff in 1980 (DM).

***Gastrana fragilis* (Linnaeus, 1758)**

Only one record, living, from near Whirlpool Cliff summer 1983 19m (Thrush, 1985).

Psammobiidae

***Gari depressa* (Pennant, 1777) (Figure 72)**

First certainly recorded living from LH at G6, 11.7.1977 (DM and J. M. C. Holmes), and subsequently from off the North Wall (B2, C2, D2) 12.7. 1980 and E2 August 1986 (DM). Fresh shells found at a number of sites in North Basin and in gravel south of the Rapids (1990-2005 JDN). Old records: as *Psammobia vespertina* Lough Hyne (Dublin Museum, pres. by Mrs Townshend) (Nichols, 1900). Collection: NMI.

***Gari tellinella* (Lamarck, 1818)**

First recorded living close to Whirlpool Cliff in 1982 and 1983 19m (Thrush, 1985). Confined otherwise to the gravel in the north of Southern's Bay 25.7.1993 5m (JDN).

***Gari fervensis* (Gmelin, 1791)**

Not recorded living in LH. A fresh shell from Barloge dredged *circa* 1930, as *Gari ferroensis* (Renouf, 1931). Widely distributed around Ireland.

Semelidae

***Abra alba* (W. Wood, 1802) (Figure 73)**

First recorded as widely distributed in mud in LH, 1969-1971 11-46m (Kitching *et al.*, 1976). Found at G6 10.10.1979 4m and G7 11.7.1980 (DM), and close to Whirlpool Cliff 19m (Thain and Townsend, 1986). Generally in the South Basin and around Castle Island (1990-1993 JDN). Depth range: 1.8m to 46m. Collection: UM.

***Abra nitida* (O. F. Müller, 1776) (Figure 73)**

First recorded as being widely distributed in the mud burrow and spionid zones, 1969, 1970 (Kitching *et al.*, 1976, 1987b). Subsequently found G7 11.7.1980 (DM) and close to Whirlpool Cliff 19m (Thain and Townsend, 1986). Shell from Codium Bay 1993 (JDN). Depth range: 10m to 42m

***Scrobicularia plana* (da Costa, 1778)**

Not recorded living in LH. A few shells recorded from the mud of Goleen in 0-1m and intertidally in muddy gravel where a freshwater stream enters lough in the north-west region in 1977 and 1980 (DM).

SUPERFAMILY VENERACEA

Veneridae

Venus verrucosa Linnaeus, 1758 (Figure 74)

First recorded from Renouf S12-S17 *circa* 1930 (Renouf, 1931), and subsequently at Curlew Bay 1959 (Kitching and Ebling, 1961). Abundant within LH in shallow water, in shelly and muddy gravel, and Southern's Bay (1976-1981, 1983, 1985 DM; Kitching and Thain, 1983; 1990-2005 JDN; 1993 BioMar). A large individual (67mm) was found being devoured by starfish *Marthasterias glacialis* near to Rookery Nook, July 1978 (DM). This species is also predated by hooded crows (Berrow *et al.*, 1992). Spawning takes place during July and August (Minchin, 1992c). Depth range: littoral to 7m mainly, but occasionally to 18m. Collections: NMI, UM.

Circomphalus casina (Linnaeus, 1758)

First recorded living from Whirlpool Cliff 14.12.1980 12m (BEP), and at the base of the cliff 12.8.1981 (DM). Also apparently recorded from the point to south-west of Lough Hyne House 25.11.1993 3-16m (BioMar). This area is not the normal habitat for this species (muddy gravel, rather than the preferred clean coarse gravel), and the very closely similar species *Venus verrucosa* is common in this part of the North Basin, suggesting an error of identification. There is no voucher specimen.

Gouldia minima (Montagu, 1803)

First recorded living from north-west of Castle Island 27.7.1993 10m, and subsequently from gravel south of the Rapids 28.7.1993 5.6m (JDN). Shells were found in the north of Southern's Bay 2005. New record for LH and SA37. Only recent living record for the south coast of Ireland, widespread elsewhere in Ireland.

Chamelea gallina (Linnaeus, 1758)

First recorded from close to Whirlpool Cliff, summer 1983 19m, as *Venus striatula* (Thrush, 1985). Shell only found north west Castle Island in muddy gravel 27.7.1993 1.8m (JDN).

***Clausinella fasciata* (da Costa, 1778) (Figure 74)**

First recorded from close to Whirlpool Cliff, 1982 and 1983, 19m, as *Venus fasciata* (Thrush, 1985). Shells have been found nearby in coarse shell sand and stones 1980, and also south of the Rapids 1980 (DM). Confined to Whirlpool Cliff and vicinity, the Rapids and Southern's Bay in coarse clean gravel (1992-1997 JDN). Depth range: 3 to 19m. Collections: NMI, UM.

***Timoclea ovata* (Pennant, 1777) (Figure 75)**

Recorded living from near Whirlpool Cliff 1982 19m, as *Venus ovata* (Thrush,1985). Confined to this area, the Rapids and Southern's Bay (1992-1997 JDN). Depth range: 2.6m-19m. Old records: Log 39 Lough Hyne, 7.7.1886, Royal Irish Academy cruise, 0-20f, foul dense mud (Chaster, 1898). Collection: NMI.

***Tapes aureus* (Gmelin, 1791) (Figure 75)**

First recorded from Curlew Bay, 1959 (Kitching and Ebling, 1961). Common in shallow water about edge of Lough, mainly the northern half of North Basin and around Castle Island. Also commonly taken on collectors July to October, with spawning noted in August following rises in temperature (Minchin, 1992c). Dead shells often washed ashore (1975-1980 DM; 1990-2005 JDN). Depth range: mainly littoral to 4m, but also to 13m. Collections: NMI, UM.

***Tapes decussatus* (Linnaeus, 1758) (Figure 76)**

First recorded from Renouf S12-S17 *circa* 1930 (Renouf, 1931). Found scattered throughout the northern and western parts of the Lough, and Southern's Bay, in intertidal gravel, sand and mud (1975-1980 DM: 1990-2005 JDN). Depth range: littoral to 5m. Collection: NMI.

***Tapes rhomboides* (Pennant, 1777) (Figure 76)**

First recorded living from Whirlpool Cliff (I7) 31.5.1977 (DM), and around the shallow waters of the North Basin (1975-1980, 1983, 1985 DM). Widespread throughout the Lough, although apparently absent from most of the South Basin, Western Trough and Barloge Creek (Kitching and Thain, 1983; Thrush, 1985; 1985 DM; Kitching *et al.*, 1990; 1990-2005 JDN).

Spawning is possibly related to rise in sea temperature, and the species was noted to spawn at the same time as *Anomia ephippium* and *Chlamys varia* in the North Basin in 1978 (Minchin, 1992c). Depth range: littoral only W6 West Quay 5.7.1992 (JDN); normally 2m to 19m. Collections: NMI, UM.

***Venerupis senegalensis* (Gmelin, 1791) (Figure 77)**

First recorded from LH in 1975, and commonly seen in shallow water throughout the reserve in muddy gravel (1975-1980, 1981 DM; Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam, 1977; 1990-2005 JDN). *Anthopleura ballii* is a predator on this species, with shells being recovered from the enteron of the anemone in Barloge Creek (DM). Spawning was observed in August after rises in temperature (Minchin, 1992c). Depth range: littoral to 15m. Collections: NMI, UM.

***Dosinia lupinus* (Linnaeus, 1758)**

First recorded from Barloge dredged *circa* 1930, as *Dosinia lupulina* (Renouf, 1931). Subsequently only found in the north of Southern's Bay 25.7.1993 4-5m (JDN).

***Dosinia exoleta* (Linnaeus, 1758)**

Common in Southern's Bay among shell and gravel in 1-4m (DM), with spawning occurring after rises in temperature (Minchin, 1992c). Subsequently found near Whirlpool Cliff spring 1983 19m (Thrush, 1985), and Southern's Bay 29.7.1993 6m and 12.8.1997 6m (JDN).

Petricolidae

***Mysia undata* (Pennant, 1777)**

First recorded living from Castle Island Narrows on muddy gravel 11.8.1997 5m (shell here 1990), and subsequently from North Island 14.8.1997 4m (JDN). New record for LH. Widespread around Ireland, although uncommon.

Order Myoida

SUPERFAMILY MYACEA

Myidae

***Mya truncata* Linnaeus, 1758**

First recorded living as a juvenile from Western Cliff 16.7.1990 15m, and subsequently (also juvenile) from Metridium Rocks 28.7.1993 11m (JDN). A shell was found at Metridium Rocks 2005. New record for LH. Widespread around Ireland. Collection: UM.

Corbulidae

***Corbula gibba* (Olivi, 1792) (Figure 77)**

First recorded from the south section of the Western Trough 1968, 15-44m, and then commonly in the mud burrow and spionid zones to deepest parts of the Western Trough 1969-1971 (Kitching *et al.*, 1976, 1987a, b). Subsequently found at F5 7.10.1975 20m and G7 11.7.1980 17m (DM). Recorded by Thrush (1985) throughout the South Basin. Common throughout the reserve, although absent from Barloge Creek (1990-2005 JDN). Depth range: only littoral S17 Renouf Point 18.7.1993, usually sublittoral 1.5m to 49m. Collections: NMI, UM.

Superfamily Gastrochaenacea

Gastrochaenidae

***Gastrochaena dubia* (Pennant, 1777)**

Recorded living from Carrigathorna under encrusting coralline algae on a north shelf, Carrigathorna (Goss-Custard *et al.*, 1979), and at East Twin Pool, Carrigathorna 22.7.1977 by J. Kitching. A single shell, bored into limestone rock, was washed up on high shore at G6 11.7.1980 (DM). Collection: NMI.

SUPERFAMILY HIATELLACEA

Hiatellidae

***Hiatella arctica* (Linnaeus, 1767) (Figure 78)**

First recorded from S12-S17, *circa* 1930, as *Saxicava rugosa* (Renouf, 1931), and subsequently a single individual in the test of *Ascidiella aspersa* Easter 1932 (Renouf, 1932b) and boring into coralline algae at Carrigathorna *circa* 1939 (Renouf, 1939). Very common throughout the reserve, on a wide range of algae, or between stones and in hydroids (Ebling *et al.*, 1948; Lilly *et al.*, 1953; Sloane *et al.*, 1957, 1961; Kitching and Ebling, 1961; Round *et al.*, 1961; Norton *et al.*, 1971, 1977; Goss-Custard *et al.*, 1979; Kitching and Thain, 1983; Kitching, 1987a; Kitching *et al.*, 1990; 1990-2005 JDN; 1994 BioMar). The species occurs in the plankton July to September (DM). Depth range: littoral to 25m+. Collections: NMGW, NMI, UM.

***Panomya arctica* (Lamarck, 1818)**

Recorded from close to Whirlpool Cliff, summer 1982 and spring 1983, 19m (Thrush, 1985; Thrush and Townsend, 1986). This species has only been found as a shell once in Irish waters, in 1981 from the Porcupine Bank in 690m. These records from LH are errors of identification, probably for *Hiatella arctica.*

Order Pholadomyoida

SUPERFAMILY THRACIACEA

Thraciidae

***Thracia phaseolina* (Lamarck, 1818)**

Only recorded living from south of the Rapids in gravel 4.7.1992 6m (JDN, conf. S. M. Smith), with shells from Castle Narrows 1990. New record for LH. Widespread around Ireland. Collection: UM.

***Thracia villosiuscula* (Macgillivray, 1827) (Figure 78)**

First recorded living from the South Basin near Whirlpool Cliff in 1982 and 1983, 19m (Thrush, 1985). A shell was found in shellsand from Whirlpool Cliff in 1980 (DM). This species has also been found in gravel south of the Rapids and Southern's Bay (1993 JDN, det. S. M. Smith). Depth range: littoral to 19m. Shells are more widespread, being also recorded from Goleen Cliff 1993 and North Island 1997.

***Thracia distorta* (Montagu, 1803)**

Only recorded from Whirlpool Cliff in gravel 18.7.1993 11m (JDN, conf. S. M. Smith), with a shell found in the same area in 1980 (DM). New record for LH and SA37. Only recently living from the west and south coasts of Ireland.

Class: CEPHALOPODA

Order Sepioidea

Sepiidae

***Sepia officinalis* Linnaeus, 1758**

Not seen recently in LH. Many cuttle bones were washed ashore in early 1928 during winter gales; large numbers were still present in March at south end of Goleen, as *Eusepia officinalis* (Renouf, 1934c). Spawn was dredged from Barloge *circa* 1930 (Renouf, 1931). The only recent live record from Ireland is from Strangford Lough.

Sepiolidae

***Sepiola atlantica* Orbigny in Ferussac and Orbigny, 1840 (Figure 79)**

First recorded as young individuals washed ashore in large numbers on the Coosh in Barloge Creek in the first two days of August 1928, as *Heterosepiola atlantica* (Renouf, 1934c). One animal was seen north of Castle Island in 0.5m at night 26.7.1976, and another in the Goleen (E12) 13.7.1981 (DM). A single animal was seen at night on the surface to the right of Glannafeen Laboratory (Renouf S4) 8.4.1978 (Kitching and Thain, 1983). Collection: NMI.

Order Teuthoidea

Loliginidae

***Loligo* sp.**

A species of unknown squid was seen by DM near North Quay at night, 20.7.1985. A sketch of the animal was identified as probably *Loligo* sp. by L. Allcock. *Loligo forbesii* Steenstrup, 1856, is the commonest *Loligo* species off the south-west of Ireland.

Order Octopoda

Octopodidae

***Eledone cirrhosa* (Lamarck, 1798)**

Occasional individuals dredged from the southern half of Barloge in 1930 (Renouf, 1931). Recorded from Metridium Rocks (date pre-1997) (J. Turner pers. comm.).

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References

*contains records of Mollusca, or molluscan research, from Lough Hyne; not necessarily cited in the text.

Anderson, R. (2005) An annotated list of the non-marine Mollusca of Britain and Ireland. *J. Conch. Lond.* **38**: 607-637.

*Bell, J. J. and Okamura, B. (2005) Low genetic diversity in a marine nature reserve: re-evaluating diversity criteria in reserve design. *Proc. R. Soc. B.* **272**: 1067-1074.

*Bell, J. J. and Shaw, C. (2002) Lough Hyne: a marine biodiversity hotspot? Pp 35-43. *In* Nunn, J. D. (ed.) *Marine biodiversity in Ireland and adjacent waters*. Ulster Museum, Belfast

*Berrow, S. D. (1991) *The feeding behaviour and impact of the hooded crows* Corvus corone cornix *L. on populations of intertidal molluscs.* Unpublished Ph.D. Thesis, University College, Cork.

*Berrow, S. D., Kelly, T. C. and Myers, A. A. (1991) The impact of hooded crows *Corvus corone cornix* L. on populations of intertidal molluscs. Pp 79-88. *In* Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds) *The ecology of Lough Hyne*. Proceedings of a conference, 4-5 September 1990. Royal Irish Academy, Dublin.

*Berrow, S. D., Kelly, T. C. and Myers, A. A. (1992) The diet of coastal breeding hooded crows *Corvus corone cornix*. *Ecography* **15**: 337-346.

*Berrow, S. D., Kelly, T. C. and Myers, A. A. (1992) The mussel caching behaviour of hooded crows *Corvus corone cornix*. *Bird Study* **39**: 115-119.

Briggs, J. C. (1974) *Marine zoogeography*. McGraw-Hill, New York.

Brown, G. H. and Picton, B. E. (1979) *Nudibranchs of the British Isles – a colour guide*. Produced for the Underwater Conservation Society, Manchester, by R. Earll. 30pp.

Calado, G. and Urgorri, V. (2002) A new species of *Calma* Alder and Hancock, 1855 (Gastropoda: Nudibranchia) with a review of the genus. *J. Moll. Stud.* **68**: 311-317.

*Chaster, G. W. (1898) A report upon the Mollusca (excluding Cephalopoda and

Nudibranchiata) obtained by the Royal Irish Academy cruises of 1885-1888. *Proc. R. Ir. Acad.* (Series 3) **5**: 1-33.

*Ebling, F. J. (1991) The exploration of the Rapids. Pp 31-40. *In* Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds) *The ecology of Lough Hyne*. Proceedings of a conference, 4-5 September 1990. Royal Irish Academy, Dublin.

*Ebling, F. J., Hawkins, A.D., Kitching, J. A., Muntz, L. and Pratt, V. M. (1966) The ecology of Lough Hyne. XVI. Predation and diurnal migration in the *Paracentrotus* community. *J. Anim. Ecol.* **35**: 559-566.

*Ebling, F. J., Kitching, J. A., Muntz, L. and Taylor, C. M. (1964) The ecology of Lough Hyne. XIII. Experimental observation of the destruction of *Mytilus edulis* and *Nucella lapillus* by crabs. *J. Anim. Ecol.* **17**: 73-82.

*Ebling, F. J., Kitching, J. A., Purchon, R. D. and Basssindale, R. (1948) The ecology of Lough Ine rapids with special reference to water currents. II. The fauna of the *Saccorhiza* canopy. *J. Anim. Ecol.* **17**: 223-244.

*Ebling, F. J., Sleigh, M. A., Sloane, J. F. and Kitching, J. A. (1960) The ecology of Lough Ine. VII. Distribution of some common plants and animals of the littoral and shallow sublittoral regions. *J. Ecol.* **48**: 29-53.

*Ebling, F. J., Sloane, J. F., Kitching, J. A. and Davies, H. M. (1962) The ecology of Lough Hyne. XII. The distribution and characteristics of *Patella* species. *J. Anim. Ecol.* **31**: 457-470.

*Evans, M. R. and Williams, G. A. 1991 Time partitioning of foraging in the limpet *Patella vulgata*. *J. Anim. Ecol.* **60**: 563-575.

*Forester, A. J. (1979) The association between the sponge *Halichondria panicea* (Pallas) and scallop *Chlamys varia* (L.): a commensal-protective mutualism. *J. Exp. Mar. Biol.* **36**: 1-10

Fretter, V. and Graham, A. (1976-86) The Prosobranch Molluscs of Britain and Denmark. *J.*

Moll. Stud. suppl. 1, 3, 5, 6, 7, 9, 11, 15, 16.

*Gosling, E. M. and Burnell, G. M. (1988) Evidence for selective mortality in *Chlamys varia* (L.) transplant experiments. *J. Mar. Biol. Ass. U.K.* **68**: 251-258.

*Gosling, E. M. and Wilkins, N. P. (1981) Ecological genetics of the mussels *Mytilus edulis* and *M. galloprovincialis* on Irish coasts. *Mar. Ecol. Progr. Ser.* **4**: 221-227.

*Goss-Custard, S., Jones, J., Kitching, J. A. and Norton, T. A. (1979) The ecology of Lough Hyne XXI. Tide pools of Carrigathorna and Barloge Creek. *Phil. Trans. R. Soc.* **287B**: 1-44.

*Haddon, A. C. and Green, W. S. (1888) Second report on the marine fauna of the south-west of Ireland. *Proc. R. Ir. Acad.* (Series 3) **1**: 29-56.

*Hiscock, K. (1976) *The influence of water movement on the ecology of sublittoral rocky areas*. Unpublished Ph.D. Thesis, University College, Wales.

*Hiscock, K. and Mitchell, R. (1980) The description and classification of sublittoral epibenthic systems. Pp 323-370. *In* Price, J. H., Irvine, D. E. G. and Farnham, W. E. (eds) *The Shore Environment* 2: *Ecosystems*. The Systematics Association Special volume no. **17** (a). Academic Press.

Holland, C. H. (1988) On the origin of Lough Hyne, Co. Cork. *Ir. Nat. J.* **22**: 521-525.

*Holmes, J. M. C. and Nunn, J. (1996) Parasitic copepod *Splanchnotrophus brevipes* in the nudibranch *Cuthona genovae*. *Ir. Nat. J.* **25**: 186.

Howson, C. M. and Picton, B. E. (eds) (1997) *The species directory of the marine fauna and flora of the British Isles and surrounding seas*. Ulster Museum and The Marine Conservation Society, Belfast and Ross-on-Wye.

*Instituut Voor Taxonomische Zoologie der Universiteit van Amsterdam (1977) *Report on the zoological excursion to Sherkin Island, Co. Cork, Ireland*. Pp 18-20.

Jones, A. M. and Baxter, J. (1987) Molluscs: Caudofoveata, Solenogastres, Polyplacophora and Scaphopoda. *Synopses Br. Fauna* **37**.

*Joyce, J. R. 1980 The flying slugs of Lough Ine. *Taisce J.* **3**: 8.

*Kilroy, M. 1979 A study of *Anomia ephippium* L. in Lough Hyne. Unpublished B.A. Moderatorship Thesis, Trinity College, Dublin. 60pp.

*Kitching, J. A. (1977) Shell form and niche occupation in *Nucella lapillus* (L.) (Gastropoda). *J. Exp. Mar. Biol. Ecol.* **26**: 275-287.

*Kitching, J. A. (1985) The ecological significance and control of shell variability in dogwhelks from temperate rocky shores. Pp 234-248. *In* Moore, P. G. and Seed, R. (eds) *The ecology of rocky coasts*. Hodder and Stoughton, London.

*Kitching, J. A. (1987a) The flora and fauna associated with *Himanthalia elongata* (L.) S.F. Gray in relation to water current and wave action in the Lough Hyne Marine Nature Reserve. *Est. Coast. Shelf Sci.* **25**: 663-676.

*Kitching, J. A. (1987b) Ecological studies in Lough Hyne. *Adv. Ecol. Res.* **17**: 115-186.

*Kitching, J. A. (1987c) Classic sites: Lough Hyne. *Biologist* **34**: 235-239.

*Kitching, J. A. and Ebling, F. J. (1961) The ecology of Lough Ine. XI. The control of algae by *Paracentrotus lividus* (Echinoidea). *J. Anim. Ecol.* **30**: 373-383.

*Kitching, J. A. and Ebling, F. J. (1967) Ecological studies at Lough Hyne. *Adv. Ecol. Res.* **4**: 197-291.

*Kitching, J. A., Ebling, F. J., Gamble, J. C., Hoare, R., McLeod, A. A. Q. and Norton, T. A. (1976) The ecology of Lough Ine. XIX. Seasonal changes in the Western Trough. *J. Anim. Ecol.* **45**: 731-758.

*Kitching, J. A., Larkum, A. W. D., Norton, T. A., Partridge, J. C. and Shand, J. (1990) The ecology of Lough Ine. XXV. An ecological study of the Whirlpool Cliff, Lough Hyne (Ine). *Prog. Underwater Sci.* **15**: 101-132.

Kitching, J. A., Lilly, S. J., Lodge, S. M., Sloane, J. F., Bassindale, R. and Ebling, F. J. (1952) The ecology of Lough Ine rapids with special reference to water currents. III. The effect of current on other environmental conditions. *J. Ecol.* **40**: 179-201.

*Kitching, J. A., Muntz, L. and Ebling, F. J. (1967) The ecology of Lough Ine. XV. The ecological significance of shell and body forms in *Nucella lapillus. J. Anim. Ecol.* **35**: 113-126.

*Kitching, J. A., Sloane, J. F. and Ebling, F. J. (1959) The ecology of Lough Ine. VIII. Mussels and their predators. *J. Anim. Ecol.* **28**: 331-341.

*Kitching, J. A. and Thain, V. M. (1983) The ecology of Lough Ine. XXII. The ecological impact of the sea urchin *Paracentrotus lividus* (Lamarck) in Lough Ine, Ireland. *Phil. Trans. R. Soc. Lond.* **300B**: 513-552.

*Lilly, S. J., Sloane, J. F., Bassindale, R., Ebling, F. J. and Kitching, J. A. (1953) The ecology of Lough Ine rapids with special reference to water currents. IV. The sedentary fauna of sublittoral boulders. *J. Anim. Ecol.* **22**: 87-122.

*Little, C. (1989) Factors governing patterns of foraging activity in littoral marine herbivorous mollusks. *J. Moll. Stud.* **55**: 273-284.

*Little, C. (1991) Ecology of the rocky intertidal zone. Pp 53-60. *In* Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds) *The ecology of Lough Hyne*. Proceedings of a conference, 4-5 September 1990. Royal Irish Academy, Dublin.

*Little, C., Morritt, D., Paterson, D. M., Stirling, P. and Williams, G. A. (1990) Preliminary observations on factors affecting foraging activity in the limpet *Patella vulgata. J. Mar. Biol. Ass. U.K.* **70**: 181-195.

*Little, C., Morritt, D. and Stirling, P. (1992) Changes in the shore fauna and flora of Lough Hyne. *Ir. Nat. J.* **24**: 87-95.

*Little, C., Partridge, J. C. and Teagle, L. (1991) Foraging activity of limpets in normal and abnormal tidal regimes. *J. Mar. Biol. Ass. U.K.* **71**: 537-554.

*Little, C. and Stirling, P. (1985) Patterns of foraging activity in the limpet *Patella vulgata* L. - a preliminary study. *J. Exp. Mar. Biol. Ecol.* **89**: 283-296.

*Little, C. and Williams, G. A. (1989) Distribution of littorinid gastropods at Lough Hyne. *Ir.*

Nat. J. **23**: 48-53.

*Little, C., Williams, G. A., Morritt, D., Perrins, J. M. and Stirling, P. (1988) Foraging behaviour of *Patella vulgata* L. in an Irish sea-lough. *J. Exp. Mar. Biol. Ecol.* **120**: 1-21.

*Marshall, J. T. (1916) Additions to British Conchology. *J. Conch. Lond.* **15**: 87-89.

*McGrath, D. and King, P. A. (1991) Settlement of mussels, *Mytilus edulis* L., on wave-exposed shores in Irish waters: a survey. *Proc. R. Ir. Acad.* **91B**: 49-58.

*Minchin, D. (1976) Culture of escallops in Lough Hyne. p. 9 *In* Minchin, D. (ed.), *Proc. Scallop Workshop* 11-16 May 1976, Baltimore, Ireland, Abstract only. Department of Agriculture and Fisheries, Dublin.

*Minchin, D. (1980) *Nudibranch molluscs collected at Lough Hyne during August to September 1980*. Unpublished manuscript.

*Minchin, D. (1983) Predation on young *Pecten maximus* (L.) (Bivalvia), by the anemone *Anthopleura ballii* (Cocks). *J. Moll. Stud.* **49**: 228-231.

*Minchin, D. (1984) *Aspects of the biology of young escallops* Pecten maximus *L. (Pectinidae: Bivalvia) about the Irish coast.* Unpublished Ph.D. Thesis, Trinity College, Dublin

*Minchin. D. (1985) *Lutraria angustior* Philippi (Mollusca: Lamellibranchia) in Irish waters. *Ir. Nat. J.* **21**: 454-459.

*Minchin, D. (1989) Up-slope movements in the scallop *Pecten maximus*. *J. Moll. Stud.* **55**: 423-425.

*Minchin, D. (1991a) Observations on shell colour in the scallop, *Pecten maximus* (L.). *J. Conch. Lond.* **34**: 41-46.

*Minchin, D. (1991b) An historical summary of scientific activities. Pp 25-29. *In* Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds) *The ecology of Lough Hyne*. Proceedings of a conference, 4-5 September 1990. Royal Irish Academy, Dublin.

*Minchin, D. (1992a) Biological observations on young scallops, *Pecten maximus*. *J. Mar. Biol. Ass. U.K.* **72**: 807-819.

*Minchin, D. (1992b) Decapod predation and the sowing of the scallop, *Pecten maximus* (Linnaeus, 1758). Pp 191-197. *In* Shumway, S. E. and Sandifer, P. A. (eds) *An international compendium of scallop biology and culture world aquaculture workshops* no. 1. Baton Rouge.

*Minchin, D. (1992c) Multiple species, mass spawning events in an Irish sea lough: the effect of temperatures on spawning and recruitment of invertebrates. In *Proc. 6th Int. Congress on Invertebrate Reproduction* Trinity College, Dublin 1992. *Economic and Applied Aspects of Invertebrate Reproduction* **22**: 229-238.

*Minchin, D. and Duggan, C.B. (1986) Organotin contamination in Irish waters. *ICES Report* CM 1986/F: 48.

*Minchin, D., Duggan, C. B. and King, W. (1987) Possible effects of organotins on scallop recruitment. *Mar. Poll. Int. Bull.* **18**: 604-608.

*Minchin, D., Oehlmann, J., Duggan, C. B., Stroben, E. and Keatinge, M. (1995) Marine TBT antifouling contamination in Ireland, following legislation in 1987. *Mar. Poll. Int. Bull.* **30**: 633-639.

*Muntz, L., Ebling, F. J. and Kitching, J. A., (1965) The ecology of Lough Hyne. XIV. Predatory activity of large crabs. *J. Anim. Ecol.* **34**: 315-329.

*Murphy, M. M. (1927) Studies on *Philine aperta.* Unpublished M.Sc. Thesis, University College, Cork.

*Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds) (1991) *The ecology of Lough Hyne*. Proceedings of a conference, 4-5 September 1990. Royal Irish Academy, Dublin. 175pp.

*Nichols, A. R. (1900) A list of the marine Mollusca of Ireland. *Proc. R. Ir. Acad.* (Series 3) **5**: 477-662.

*Norton, T. A. (1971) An ecological study of the fauna inhabiting the sublittoral marine algae *Saccorhiza polyschides* (Lightf.) Batt. *Hydrobiologia* **37**: 215-231.

*Norton, T. A. (1978) Mapping species distributions as a tool in marine ecology. *Proc. R. Soc. Edinb.* **76B**: 201-213.

*Norton, T. A., Ebling, F. J. and Kitching, J. A. (1971) The ecology of Lough Ine. XVII. Light and the distribution of organisms in a sea cave. Pp 409-432. *In* Crisp, D. J. (ed) *Proc. 4th Eur. Mar. Biol. Symp.*

*Norton, T. A., Hiscock, K. and Kitching, J. A. (1977) The ecology of Lough Ine. XX. The *Laminaria* forest at Carrigathorna. *J. Ecol.* **65**: 919-841.

*Nunn, J. D. (1993) *Aeolidiella alderi* (Cocks, 1852) (Mollusca: Opisthobranchia) in Ireland. *Ir. Nat. J.* **24**: 258-260.

Nunn, J. D. (1994) The marine Mollusca of Ireland: 1. Strangford Lough, Co. Down. *Bull. Ir. biogeog. Soc.* **17**: 23-214.

Nunn, J. D. (1996) The marine Mollusca of Ireland: 2. Mulroy Bay, Co. Donegal. *Bull. Ir. biogeog. Soc.* **19**: 15-138.

Nunn, J. D. (2004) *Osilinus lineatus* and other intertidal Mollusca near range limits in the north of Ireland. *Porcupine MNHS Newsletter* 16: 32-36.

*Nunn, J. D. (2005) *Osilinus lineatus* in Lough Hyne, Co. Cork. *Porcupine MNHS Newsletter* 18: 9-11.

*Nunn, J. D. and Minchin, D. (1994) *Cuthona genovae* (O'Donoghue, 1926) (Mollusca: Opisthobranchia) from the north coast of Ireland. *Ir. Nat. J.* **24**: 416-417.

*Nunn, J. D. and O'Donnell, D. (1997) Lough Hyne Marine Nature Reserve. *Porcupine Newsletter* **6**: 203-207

*O'Loughlin, E. F. M. (1989) Notes on the distribution of *Calliostoma zizyphinum* on the shores and shallow waters of the Irish coast. *Bull. Ir. biogeog. Soc.* **12**: 22-30.

*O'Loughlin, E. F. M. and Aldrich, J. C. (1987) Morphological variation in the painted topshell, *Calliostoma zizyphinum* (L.) (Prosobranchia: Trochidae), from intertidal rapids on the Irish coast. *J. Moll. Stud.* **53**: 267-272.

* Picton, B. E. (1979) *Collections of nudibranch Mollusca from the Republic of Ireland made during 1979.* Report to the Praeger Committee, Royal Irish Academy, Dublin. 5pp.

* Picton, B. E. (1981a) *Collections of nudibranch Mollusca from the Republic of Ireland made during 1981.* Report to the Praeger Committee, Royal Irish Academy, Dublin. 5pp.

*Picton, B. E. (1981b) Rare nudibranchs from south-west Ireland. *Conchologists' Newsletter* **77**: 309

*Picton, B. E. and Brown, G. H. (1981) Four nudibranch gastropods new to the fauna of Great Britain and Ireland including a description of a new species of *Doto* Oken. *Ir. Nat. J.* **20**: 261-268.

*Picton, B. E. and Costello, M. J. (1998) *The BioMar biotope viewer: a guide to marine habitats, fauna and flora in Britain and Ireland* (version 2.0). Environmental Sciences Unit, Trinity College, Dublin (CD).

*Picton, B. E. and Morrow, C. C. (1994) *A field guide to the Nudibranchs of the British Isles*. Immel Publishing, London.

*Picton, B. E. and Wilson, K. (1984) *Cuthona genovae* (O'Donoghue, 1926), an aeolid nudibranch new to the fauna of the British Isles. *J. Conch., Lond.* **31**: 349-352.

*Praeger, R. Ll. (1937) *The way that I went: an Irishman in Ireland.* Pp 356-358. Hodges, Figgis and Co., Dublin and London.

Reid, D. G. (1993) Barnacle dwelling ecotypes of three British *Littorina* species and the status of *Littorina neglecta* Bean. *J. Moll. Stud.* **59**: 51-62.

*Renouf, L. P. W. (1931) Preliminary work of a new biological station (Lough Ine, Co. Cork, I.F.S.). *J. Ecol.* **19**: 410-438.

*Renouf, L. P. W. (1932a) Lough Ine records. *Ir. Nat. J.* **4**: 64.

*Renouf, L. P. W. (1932b) X. Mollusc galls on *Ascidiella aspersa* (O.F. Müller). *Ann. Mag. Nat. Hist.* (Series 10) **10**: 114-115.

*Renouf, L. P. W. (1934a) XXXIX. Tectibranchs and nudibranchs on the south coast of Cork.

Ann. Mag. Nat. Hist. (Series 10) **14**: 399-400.

*Renouf, L. P. W. (1934b) The common limpet, *Patella vulgata* L., and the rough winkle, *Littorina rudis* (Maton) above high water mark. *Ir. Nat. J.* **5**: 88.

*Renouf, L. P. W. (1934c) Observations on periodic, sporadic, occasional and unusual appearances of certain organisms. *Acta Phaen.* **3**: 88-93.

*Renouf, L. P. W. (1934d) Observations on periodic, sporadic, occasional and unusual appearances of certain organisms. *Acta Phaen.* **3**: 110-119.

*Renouf, L. P. W. (1935) XIX. Faunistic notes from the coast of Co. Cork, I.F.S. *Ann. Mag. Nat. Hist.* (Series 10) **16**: 212-214.

*Renouf, L. P. W. (1937) LVI. Faunistic notes from the south coast of County Cork, I.F.S. *Ann. Mag. Nat. Hist.* (Series 10) **20**: 477.

*Renouf, L. P. W. (1939) XLII. Faunistic notes from the south coast of County Cork, I.F.S. *Ann. Mag. Nat. Hist.* (Series 11) **4**: 520-525.

*Rodhouse, P. G. and Burnell, G. M. (1979) *In situ* studies on the scallop *Chlamys varia*. *Prog. Underwater Sci.* **4**: 87-98.

*Round, F. E., Sloane, J. F., Ebling, F. J. and Kitching, J. A. (1961) The ecology of Lough Ine. X. The hydroid *Sertularia operculata* (L.) and its associated flora and fauna: the effects of transference to sheltered water. *J. Ecol.* **49**: 617-629.

Seaward, D. (1982) *Sea Area Atlas of the Marine Molluscs of Britain and Ireland.* NCC, Peterborough.

Seaward, D. (1991) *Distribution of the marine molluscs of north west Europe.* NCC, Peterborough.

*Seed, R. (1974) Morphological variations in *Mytilus* from the Irish coasts in relation to the occurrence and distribution of *Mytilus galloprovincialis* Lmk. *Cah. Biol. Mar.* **15**: 1-25.

*Sloane, J. F., Ebling, F. J., Kitching, J. A. and Lilly, S. J. (1957) The ecology of the Lough Ine rapids with special reference to water currents V. The sedentary fauna of the laminarian algae in the Lough Ine area. *J. Anim. Ecol.* **26**: 197-211.

*Sloane, J. F., Bassindale, R., Davenport, E., Ebling, F. J. and Kitching, J. A. (1961) The ecology of Lough Ine. IX. The flora and fauna associated with undergrowth forming algae in the rapids area. *J. Ecol.* **49**: 353-368.

Tebble, N. (1966) *British bivalve seashells*. British Museum (Natural History), London.

*Thain, V. M. (1970) *Diurnal rhythmns in some animals of rocky shores.* Unpublished Ph.D. Thesis, University of East Anglia.

*Thain, V. M. (1971) Diurnal rhythmns in snails and starfish. Pp 513-537. *In Proc. 4th Eur. Mar. Biol. Symp.*

*Thain, V. M., Thain, J. F. and Kitching, J. A. (1985) Return of the prosobranch *Gibbula umbilicalis* (da Costa) to the littoral region after displacement to the shallow sublittoral. *J. Moll. Stud.* **51**: 205-210.

*Thrush, S. F. (1985) *Community ecology of the sublittoral macrobenthos of Lough Hyne (Ine).* Unpublished Ph.D. Thesis, University of East Anglia.

*Thrush, S. F. (1991) The ecology of soft bottoms. Pp 91-97. *In* Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds) *The ecology of Lough Hyne*. Proceedings of a conference 4-5 September 1990. Royal Irish Academy, Dublin.

*Thrush, S. F. and Townsend, C. R. (1986) The sublittoral macrobenthic community composition of Lough Hyne, Ireland. *Est. Coast. Shelf Sci.* **23**: 551-574.

*van Soest, R. W. M. and Weinberg, S. (1981) Preliminary quantitative assessment of the marine hard substrate communities of Roaringwater Bay. *J. Sherkin Island* **1**: 10-26.

*Williams, G. A. and Morritt, D. (1991) Patterns of foraging in *Patella vulgata* (L.). Pp 61-69. *In* Myers, A. A., Little, C., Costello, M. J. and Partridge, J. C. (eds) *The ecology of Lough Hyne*. Proceedings of a conference, 4-5 September 1990. Royal Irish Academy, Dublin.

Wilson, K. (1984) A bibliography of Lough Hyne (Ine) 1687-1982. *J. Life Sci. R. Dubl. Soc.* **5**:

1-11.

*Wilson, K. and Picton, B. E. (1983) A list of the Opisthobranchia: Mollusca of Lough Hyne Nature Reserve, Co Cork, with notes on distribution and nomenclature. *Ir. Nat. J.* **21**: 69-72.

TABLE 1. Littoral sites in Lough Hyne.

No.	Site Name (Renouf Station)	Latitude/Longitude	Date of visit	Species no. (live/dead)
1	Carrigathorna	51° 29.45'N 09° 17.73'W	20.7.1990	(10, 0)
2	The Coosh (Barloge 10)	51° 29.75'N 09° 17.70'W	20.7.1990	(20, 1)
3	Barloge Creek (S) (Barloge N)	51° 29.66'N 09° 17.89'W	04.7.1992	(35, 0)
4	Barloge Creek (N) (Barloge H)	51° 29.73'N 09° 17.93'W	04.7.1992	(28, 0)
5	Southern's Bay (S) (Barloge D/E)	51° 29.93'N 09° 17.91'W	03.7.1992	(35, 1)
6	Southern's Bay (N) (Barloge D)	51° 29.96'N 09° 17.89'W	03.7.1992	(26, 3)
7	Southern's Bay (NE) (Barloge 3)	51° 29.96'N 09° 17.82'W	25.7.1993	(51, 2)
8	Rapids (SE) (Barloge 2)	51° 29.99'N 09° 17.86'W	21.7.1990 05.7.1992 24.7.1993	(53, 1)
9	Rapids (SW)	51° 29.99'N 09° 17.88'W	19.7.1993	(21, 0)
10	Rapids (E) (Barloge 1)	51° 30.04'N 09° 17.86'W	19.7.1990	(29, 0)
11	Rapids (W) (Barloge B/C)	51° 30.02'N 09° 17.88'W	11.7.1990 10.8.1997	(47, 1)
12	Renouf Bay (S17)	51° 30.05'N 09° 17.89'W	18.7.1993	(23, 0)
13	Renouf Point (S16)	51° 30.05'N 09° 17.89'W	11.8.1997	(4, 0)
14	Codium Bay (S13)	51° 30.03'N 09° 17.94'W	10.7.1990 03.7.1992	(31, 2)
15	Codium Bay (W) (S11-S12)	51° 30.02'N 09° 17.95'W	11.7.1990 11.8.1997	(40, 2)
16	South shore (S7-S9)	51° 30.01'N 09° 17.08'W	14.7.1990	(31, 3)
17	Kitching Bay (S4)	51° 29.95'N 09° 18.16'W	03.7.1992	(24, 1)

TABLE 1 (continued)

18	South shore (S2)	51° 29.95'N 09° 18.23'W	15.8.1997	(30, 1)
19	Goleen (W34)	51° 29.86'N 09° 18.25'W	15.8.1997	(15, 1)
20	Goleen Quay (W26)	51° 29.88'N 09° 18.29'W	18.7.1990	(17, 1)
21	Western Bank (W24-W25)	51° 29.93'N 09° 18.36'W	04.7.1992	(27, 1)
22	Western Cliff (W18)	51° 29.96'N 09° 18.32'W	18.7.1990	(19, 0)
23	West shore (W15)	51° 30.04'N 09° 18.45'W	14.8.1997	(22, 3)
24	South of West Quay (W10-W11)	51° 30.15'N 09° 18.39'W	18.7.1990	(16, 2)
25	West Quay (W6)	51° 30.31'N 09° 18.61'W	05.7.1992	(18, 2)
26	North of West Quay (W1-W3)	51° 30.39'N 09° 18.58'W	17.7.1990	(13, 6)
27	North Wall (N2-N3)	51° 30.42'N 09° 18.45'W	05.7.1992 28.7.1993	(39, 1)
28	East of North Quay (N8-N11)	51° 30.42'N 09° 18.34'W	17.7.1990	(30, 1)
29	East shore (E1)	51° 30.39'N 09° 18.13'W	13.8.1997 09.7.2005	(30, 3)
30	East shore (E3)	51° 30.33'N 09° 18.12'W	10.7.2005	(31, 5)
31	East shore (E6-E9)	51° 30.25'N 09° 18.02'W	16.7.1990	(26, 4)
32	East shore (E11-E15)	51° 30.08'N 09° 17.82'W	16.7.1990	(28, 1)
33	Castle Island (N) (I2-I4)	51° 30.08'N 09° 18.02'W	13.7.1990	(29, 1)
34	Castle Island (I7-I8)	51° 30.12'N 09° 17.92'W	12.8.1997	(32, 1)
35	Castle Island (SE) (I11-I13)	51° 30.08'N 09° 17.97'W	12.7.1990 27.7.1993 12.7.2005	(49, 3)
36	Castle Island (I15)	51° 30.03'N 09° 18.02'W	12.8.1997	(22, 1)

TABLE 2. Sublittoral sites in Lough Hyne.

*samples collected by G.V. Day

No.	Site Name	Latitude/Longitude	Depth	Date of visit	Species no. (live/dead)
1	Bullock Island Cave	51°29.61'N 09°17.66'W	14.0m	*20.7.1990	(11, 1)
2	Bullock Island	51°29.63'N 09°17.73'W	10.1m	15.7.1990	(19, 4)
3	Barloge Creek	51°29.74'N 09°17.82'W	4.3m 4.7m	31.7.1993 15.8.1997	(18, 2)
4	Southern's Bay Narrows	51°29.90'N 09°17.85'W	4.2m	14.8.1997	(30, 3)
5	Southern's Bay (S)	51°29.93'N 09°17.88'W	4.5m	30.7.1993	(23, 8)
6	Southern's Bay (N)	51°29.96'N 09°17.88'W	4.8m 2.6m 6.8m	*25.7.1993 28.7.1993 12.8.1997	(50, 17)
7	Rapids	51°30.04'N 09°17.88'W	5.0m 5.7m 6.4m 1.8m 6.5m 6.8m 6.3m	19.7.1990 20.7.1990 04.7.1992 28.7.1993 29.7.1993 12.8.1997 12.7.2005	(69, 18)

TABLE 2 (continued)

8	Whirlpool Cliff	51° 30.12'N 09° 17.89'W	14.8m	10.7.1990	(79, 18)
			14.4m	11.7.1990	
			14.3m	20.7.1990	
			14.3m	04.7.1992	
			14.3m	05.7.1992	
			15.2m	18.7.1993	
			11.1m	18.7.1993	
			14.4m	19.7.1993	
			18.1m	10.8.1997	
			14.9m	13.8.1997	
			17.8m	11.7.2005	
9	Whirlpool Cliff (N)	51° 30.13'N 09° 17.90'W	14.4m	11.7.1990	(42, 20)
			14.4m	14.7.1990	
			15.1m	18.7.1993	
			13.8m	18.7.1993	
10	Renouf Point	51° 30.06'N 09° 17.89'W	10.0m	11.7.1990	(8, 1)
11	Codium Bay	51° 30.03'N 09° 17.94'W	13.3m	12.7.1990	(49, 9)
			10.5m	18.7.1993	
			14.5m	11.8.1997	
			14.9m	12.7.2005	
12	Glannafeen Cliff	51° 29.99'N 09° 18.15'W	13.7m	14.7.1990	(29, 3)
			13.2m	20.7.1993	

TABLE 2 (continued)

13	Goleen Cliff	51°29.94'N 09°18.29'W	13.3m	13.7.1990	(52, 20)
			14.1m	21.7.1990	
			13.9m	27.7.1993	
			13.2m	31.7.1993	
			18.1m	06.9.1998	
			14.4m	14.7.2005	
			18.0m	01.11.2005	
14	Goleen	51°29.91'N 09°18.30'W	5.4m	18.7.1990	(3, 2)
15	Western Cliff	51°29.98'N 09°18.38'W	15.1m	16.7.1990	(46, 3)
			14.6m	18.7.1990	
			14.6m	03.7.1992	
			13.0m	30.7.1993	
			14.7m	10.8.1997	
			18.2m	14.7.2005	
16	Western Trough	51°30.09'N 09°18.50'W	20.1m	13.7.2005	(17, 4)
17	Western Trough	51°30.15'N 09°18.51'W	12.5m	14.7.1990	(18, 4)
18	South of West Quay	51°30.20'N 09°18.57'W	13.0m	17.7.1990	(7, 1)
19	South of West Quay	51°30.29'N 09°18.58'W	13.3m	15.7.2005	(15, 1)
20	West Quay Buoy	51°30.31'N 09°18.58'W	6.3m	21.7.1990	(13, 0)
21	North of West Quay	51°30.39'N 09°18.58'W	11.8m	17.7.1990	(22, 0)
22	West of North Island	51°30.30'N 09°18.43'W	13.1m	01.11.2005	(25, 4)
23	North Island	51°30.30'N 09°18.23'W	10.4m	16.7.1990	(34, 8)
			13.2m	28.7.1993	
			4.2m	14.8.1997	
			14.2m	13.7.2005	

TABLE 2 (continued)

24	East of North Quay	51° 30.42'N 09° 18.34'W	11.3m	16.7.1990	(12, 5)
25	Off E1	51° 30.37'N 09° 18.15'W	12.3m 13.2m	13.8.1997 10.7.2005	(23, 3)
26	East shore (1)	51° 30.33'N 09° 18.18'W	10.1m	15.7.1990	(17, 5)
27	East shore (2)	51° 30.27'N 09° 18.06'W	14.0m	15.7.1990	(15, 2)
28	Castle Island (NE)	51° 30.24'N 09° 18.09'W	12.4m 13.5m	13.7.1990 05.7.1992	(28, 4)
29	Castle Island (NW)	51° 30.20'N 09° 18.24'W	10.2m	27.7.1993	(21, 12)
30	Castle Island Narrows	51° 30.19'N 09° 18.04'W	10.1m 3.3m 5.1m	12.7.1990 20.7.1993 11.8.1997	(39, 19)
31	Castle Island: SE of South Bay	51° 30.11'N 09° 18.09'W	11.8m	11.8.1997	(23, 4)
32	Castle Island (SW)	51° 30.14'N 09° 18.07'W	10.7m	12.7.1990	(24, 2)
33	Labhra Cliff	51° 30.11'N 09° 18.30'W	13.9m 13.3m 15.5.m 14.3m 15.0m 15.2m	10.7.1990 19.7.1990 03.7.1992 19.7.1993 12.8.1997 11.7.2005	(53, 4)
34	Metridium Rocks	51° 30.09'N 09° 18.11'W	10.4m 11.5m 13.1m	19.7.1993 28.7.1993 15.7.2005	(45, 6)
35	South Basin Buoy (1)	51° 30.05'N 09° 18.09'W	25.0m	*21.7.1990	(15, 0)
36	South Basin Buoy (2)	51° 30.08'N 09° 18.02'W	15.0m	05.7.1992	(5, 0)

TABLE 3. Molluscan records from Lough Hyne from this survey (1990-2005).

(A) Not seen since 19th century (status unknown)

Epitonium clathratulum, Graphis albida, Chrysallida indistincta, Epilepton clarkiae.

(B) Not seen since 1950s (most pre-1940)

Living: *Jujubinus miliaris, Ceratia proxima, Velutina velutina, Janthina janthina, Alderia modesta, Tritonia lineata, Tritonia plebeia, Goniodoris castanea, Onchidoris oblonga, Cadlina laevis, Cuthona nana, Cuthona viridis, Eubranchus pallidus, Eubranchus tricolor, Facelina annulicornis, Sepia officinalis.* **Shell:** *Gari fervensis.*

(C) New or upgraded records for Ireland from Lough Hyne

Living: *Liostomia clavula (first live); Folinella excavata (first live, since before 1900).*

(D) New records for Sea Area 37 from Lough Hyne (Seaward, 1982, 1991)

Living: *Jujubinus montagui, Lamellaria perspicua, Raphitoma purpurea, Brachystomia carrozzai, Megastomia conspicua, Ondina diaphana, Embletonia pulchra, Aeolidiella alderi, Ovatella myosotis, Crassostrea gigas, Gouldia minima, Thracia distorta.*

(E) New to Lough Hyne

Living: *Leptochiton cancellatus, Ischnochiton albus, Gibbula magus, Gibbula tumida, Jujubinus montagui, Lacuna parva, Onoba aculeus, Pusillina inconspicua, Lamellaria perspicua, Vitreolina philippi, Haedropleura septangularis, Raphitoma purpurea, Odostomia turrita, Odostomia unidentata, Brachystomia carrozzai, Brachystomia scalaris, Folinella excavata, Liostomia clavula, Megastomia conspicua, Ondina diaphana, Partulida pellucida, Philine punctata, Retusa obtusa, Embletonia pulchra, Onchidoris sparsa, Aeolidiella alderi, Ovatella myosotis, Nucula nucleus, Crassostrea gigas, Ensis siliqua, Gouldia minima, Mysia undata, Mya truncata, Thracia phaseolina, Thracia distorta.*

Shell: *Alvania carinata, Melanella frielei, Chrysallida interstincta, Turbonilla rufescens, Lucinoma borealis, Spisula elliptica, Angulus squalidus, Angulus tenuis.*

FIGURE 1. Places in Lough Hyne: location, and main Lough. Reproduced by kind permission of the Royal Irish Academy, from Myers *et al.*, 1991.

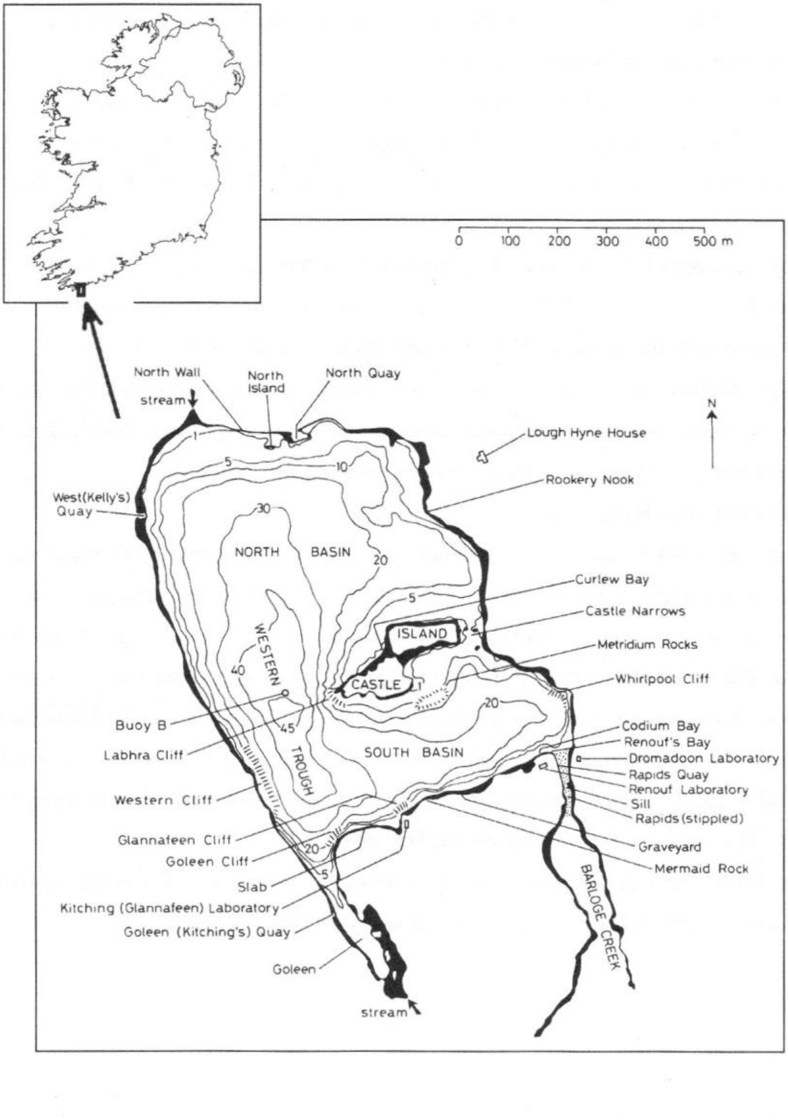


FIGURE 2. Places in Lough Hyne: the Rapids, Barloge Creek and Carrigathorna. Reproduced by kind permission of the Royal Irish Academy, from Myers *et al.*, 1991.

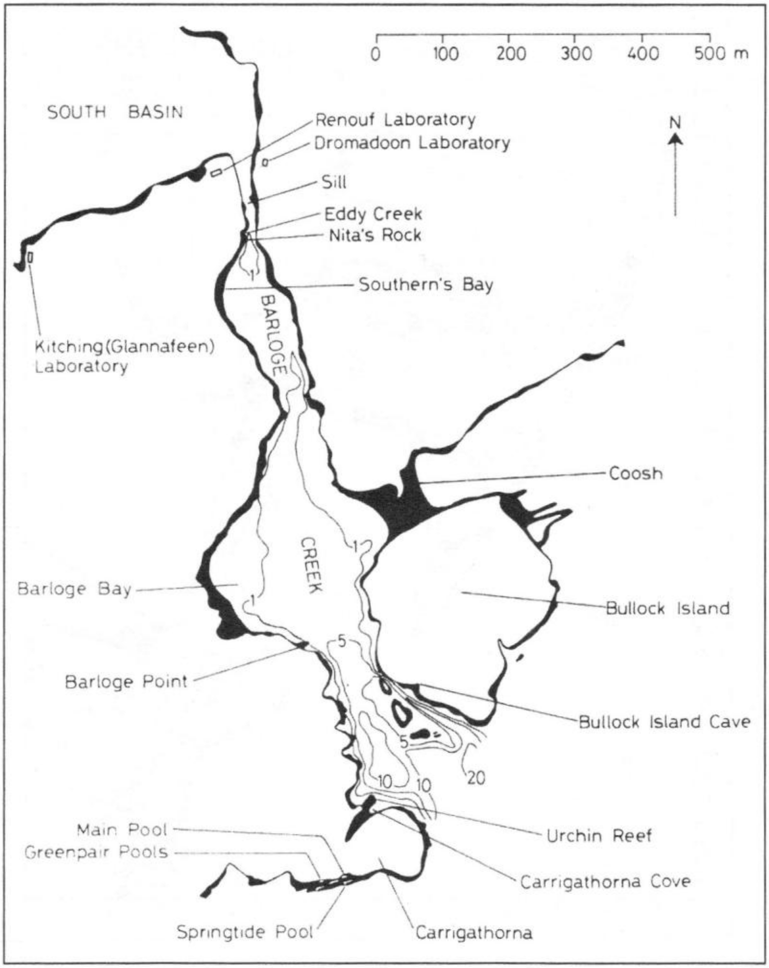


FIGURE 3. Littoral sites in Lough Hyne.

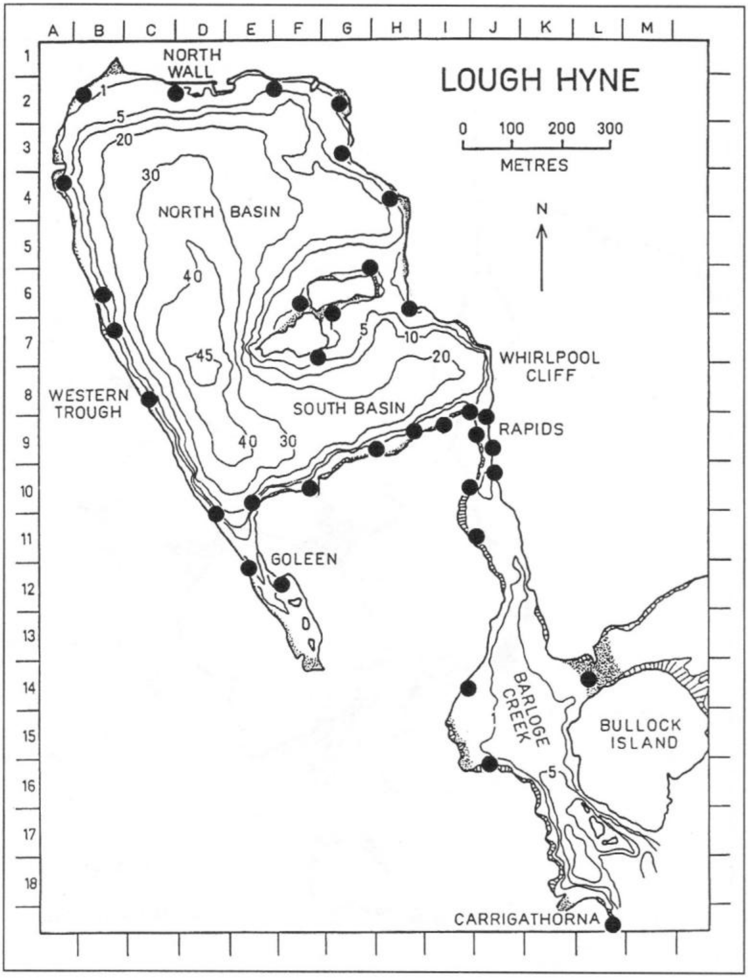


FIGURE 4. Dive sites in Lough Hyne.

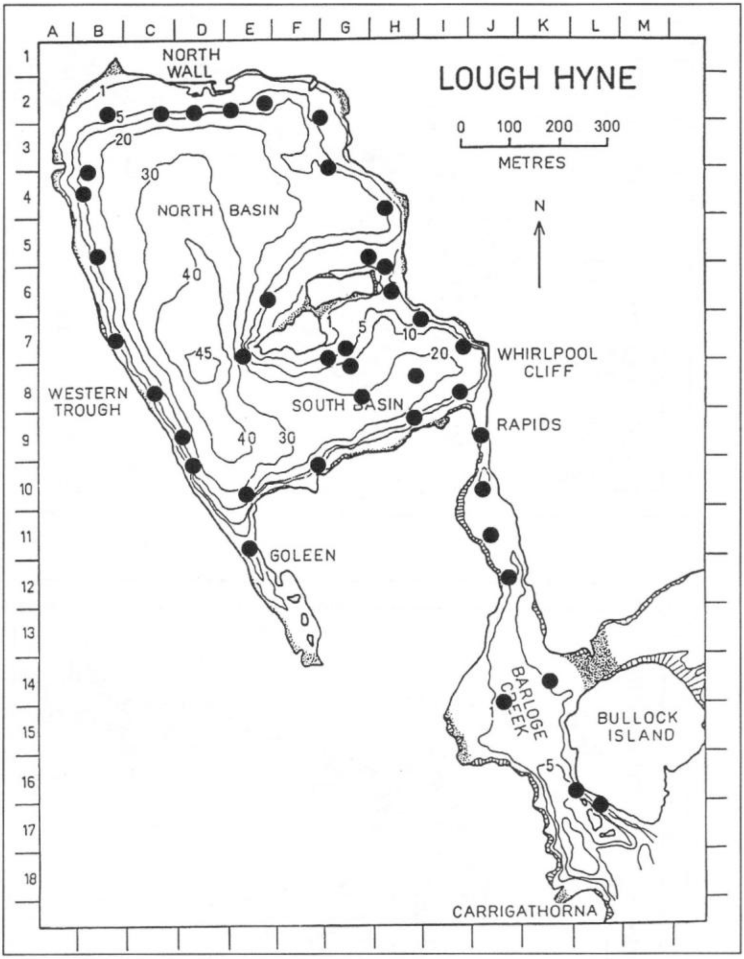
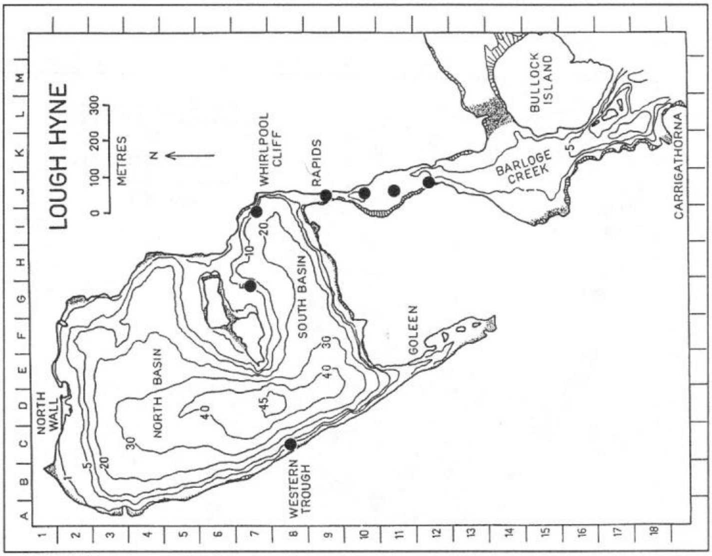
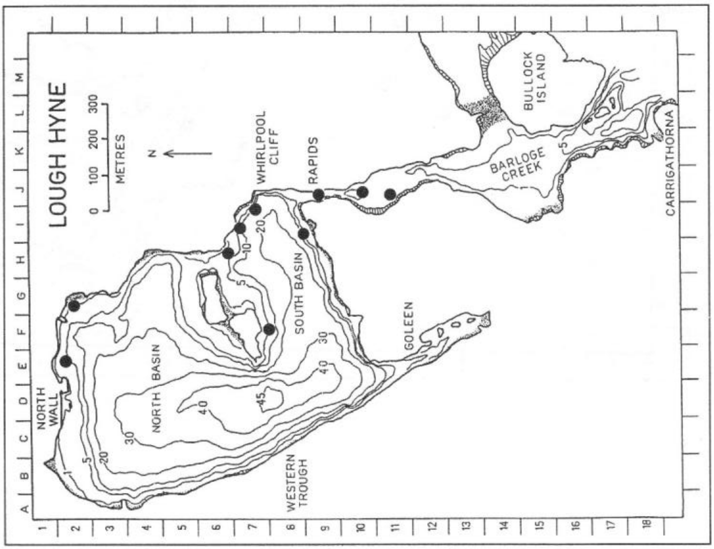


FIGURE 5. Distribution maps for *Leptochiton asellus* and *Leptochiton cancellatus*.



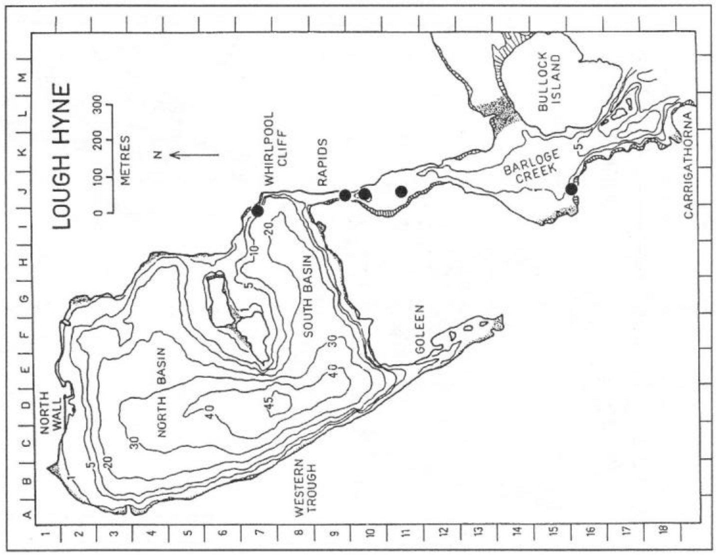
Leptochiton cancellatus (G B Sowerby II, 1840)



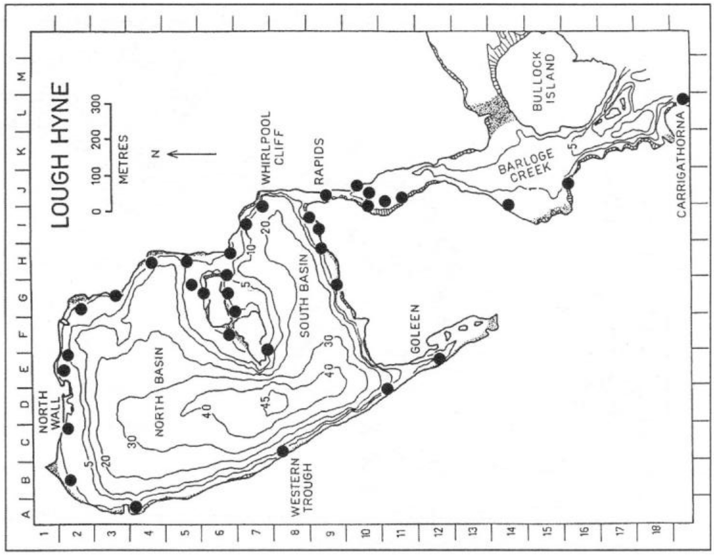
Leptochiton asellus (Gmelin, 1791)

Bull. Ir. biogeog. Soc. No. 30 (2006)

FIGURE 6. Distribution maps for *Callochiton septemvalvis* and *Lepidochitona cinerea.*

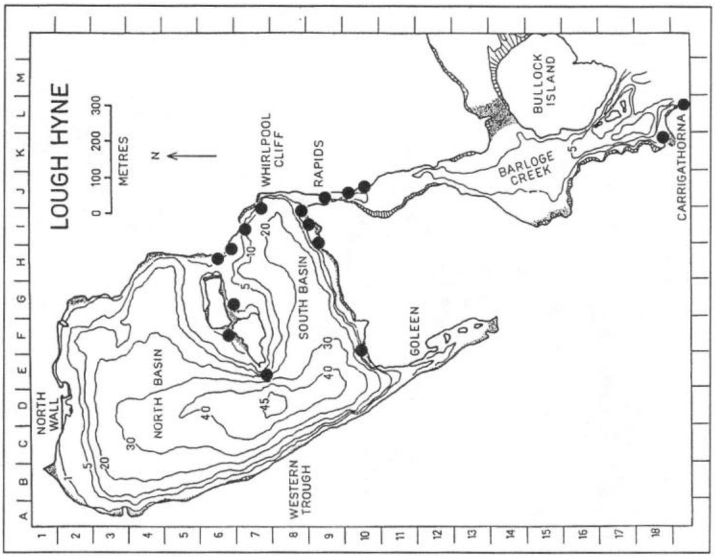


Callochiton septemvalvis (Montagu, 1803)

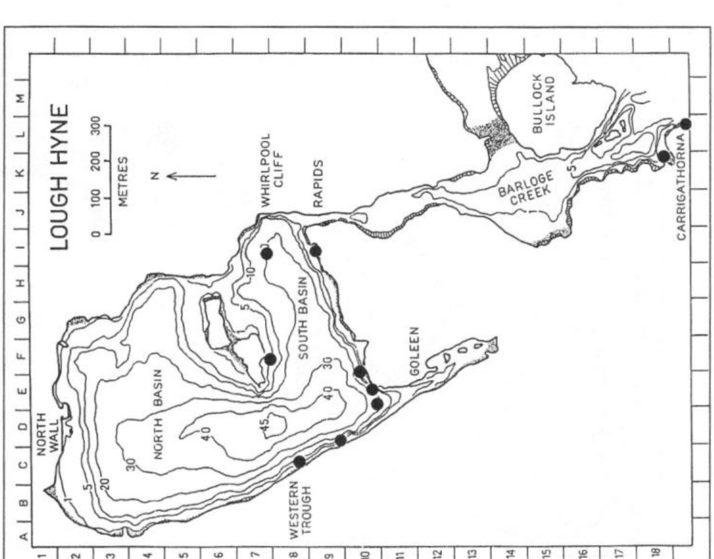


Lepidochitona cinerea (Linnaeus, 1767)

FIGURE 7. Distribution maps for *Tonicella rubra* and *Acanthochitona crinita.*

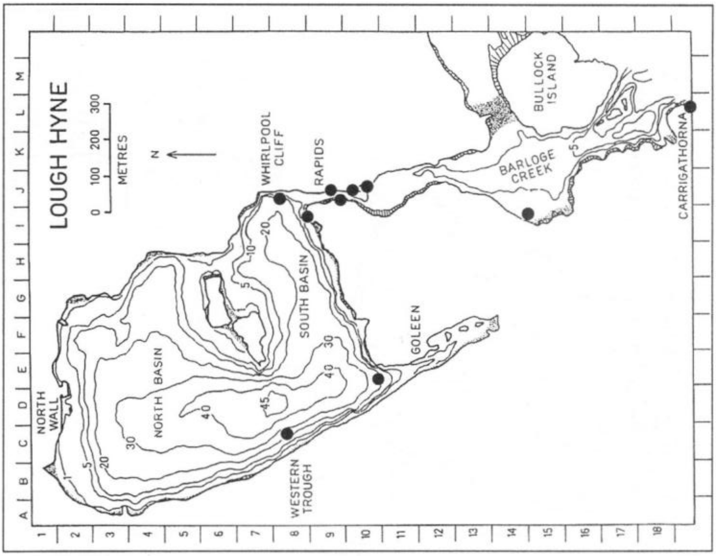


Acanthochitona crinita (Pennant, 1777)

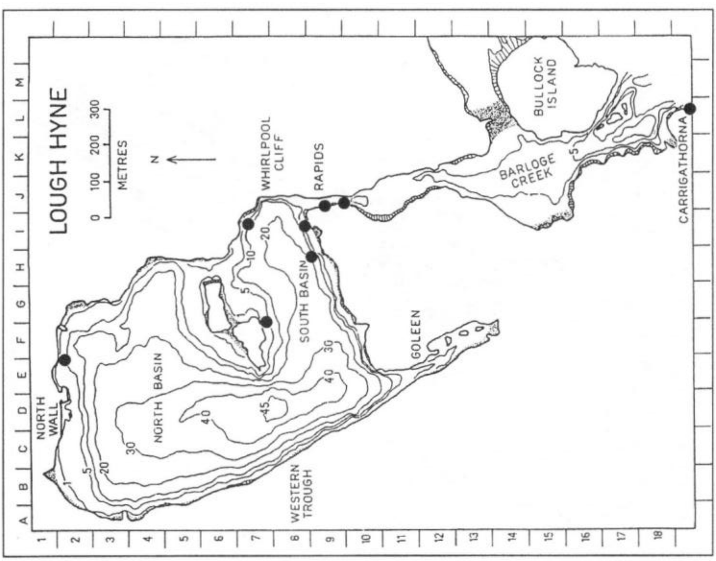


Tonicella rubra (Linnaeus, 1767)

FIGURE 8. Distribution maps for *Emarginula fissura* and *Diodora graeca.*

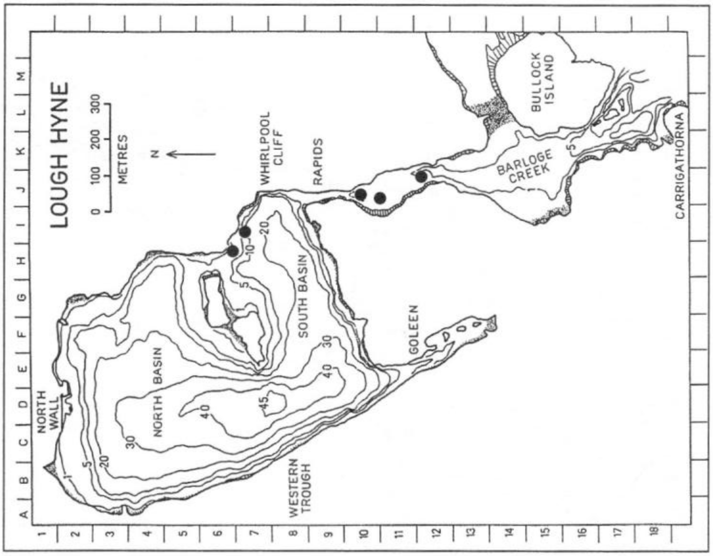


Diodora graeca (Linnaeus, 1758)

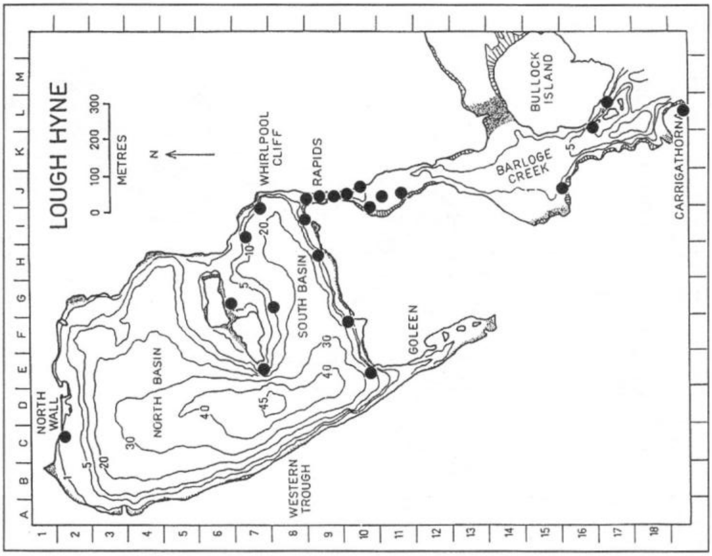


Emarginula fissura (Linnaeus, 1758)

FIGURE 9. Distribution maps for *Tricolia pullus* and *Gibbula magus*.

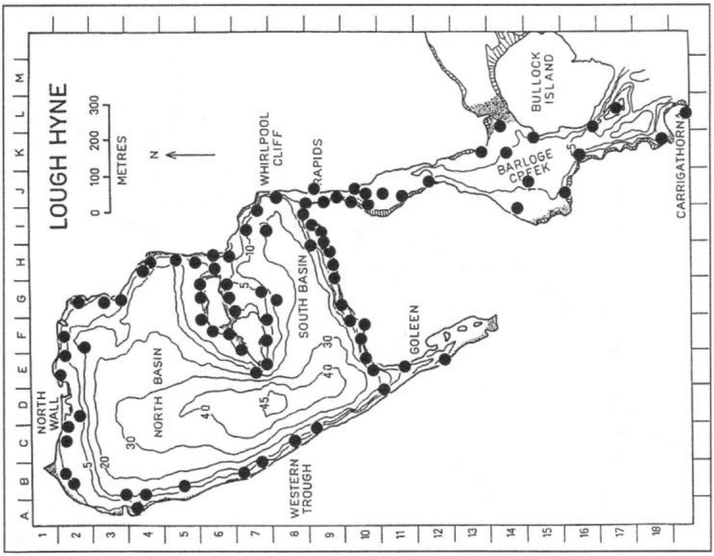


Gibbula magus (Linnaeus, 1758)

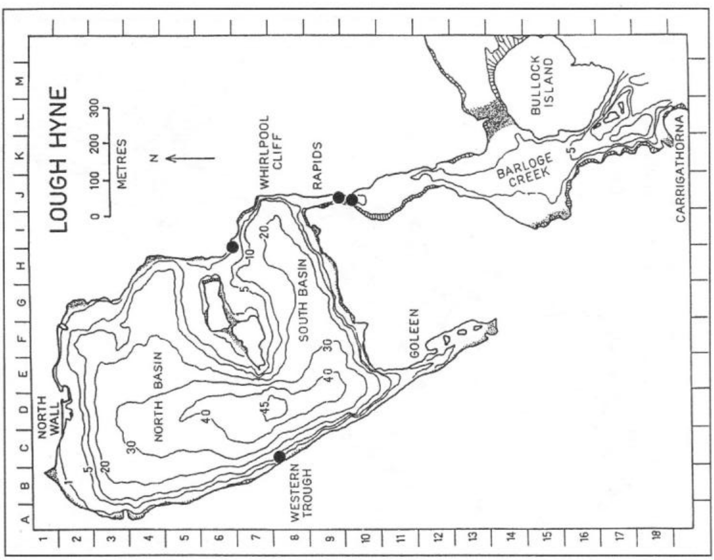


Tricolia pullus (Linnaeus, 1758)

FIGURE 10. Distribution maps for *Gibbula tumida* and *Gibbula cineraria.*

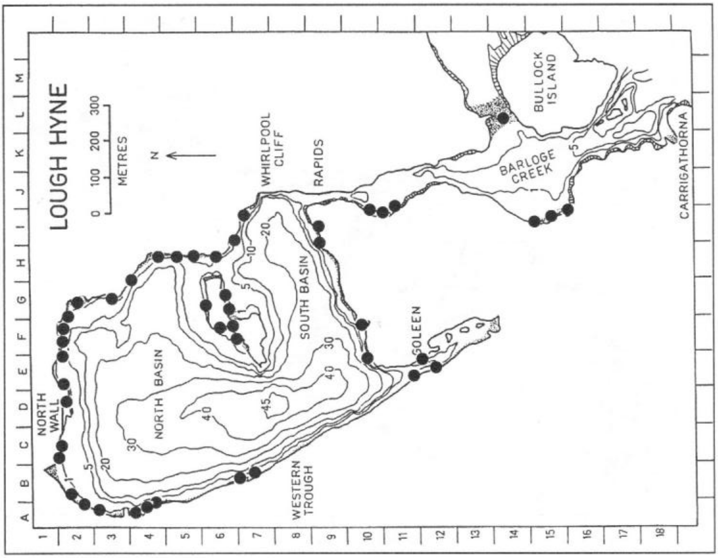


Gibbula cineraria (Linnaeus, 1758)

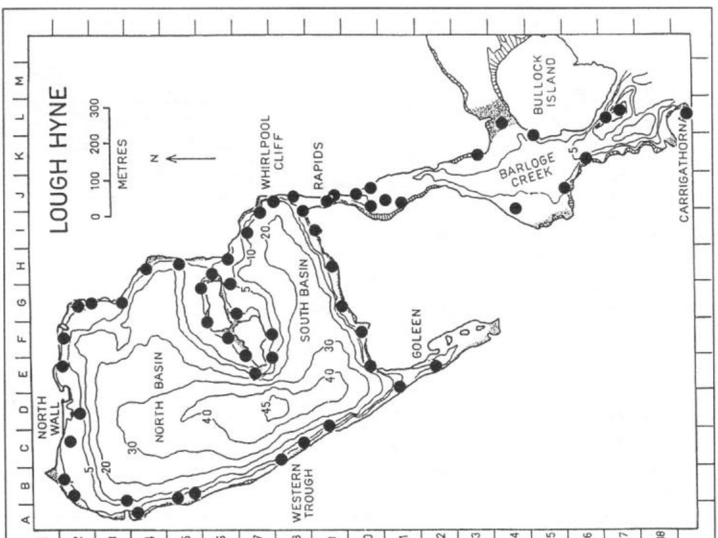


Gibbula tumida (Montagu, 1803)

FIGURE 11. Distribution maps for *Gibbula umbilicalis* and *Osilinus lineatus*.

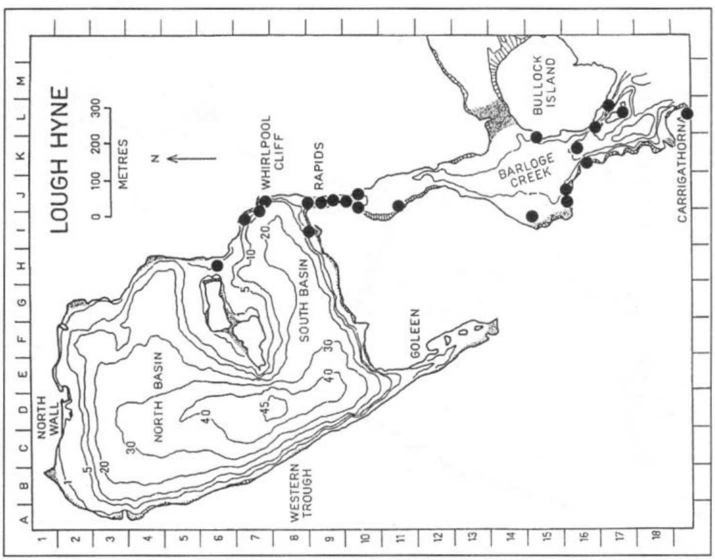


Osilinus lineatus (da Costa, 1778)

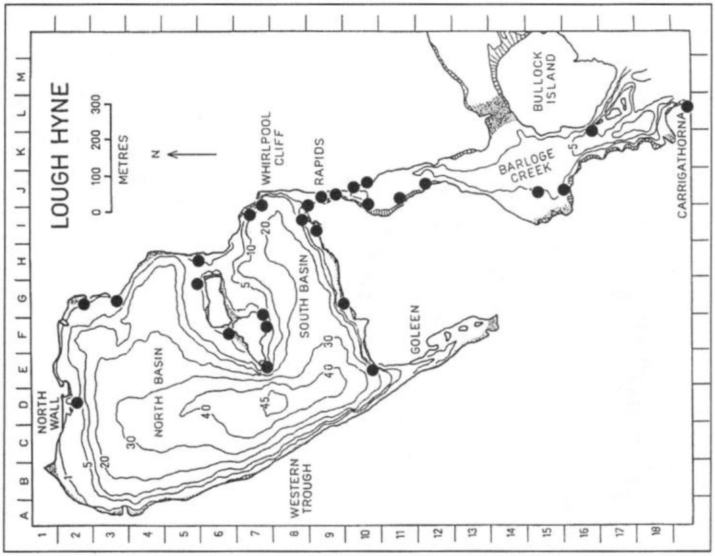


Gibbula umbilicalis (da Costa, 1778)

FIGURE 12. Distribution maps for *Calliostoma zizyphinum* and *Tectura virginea*.

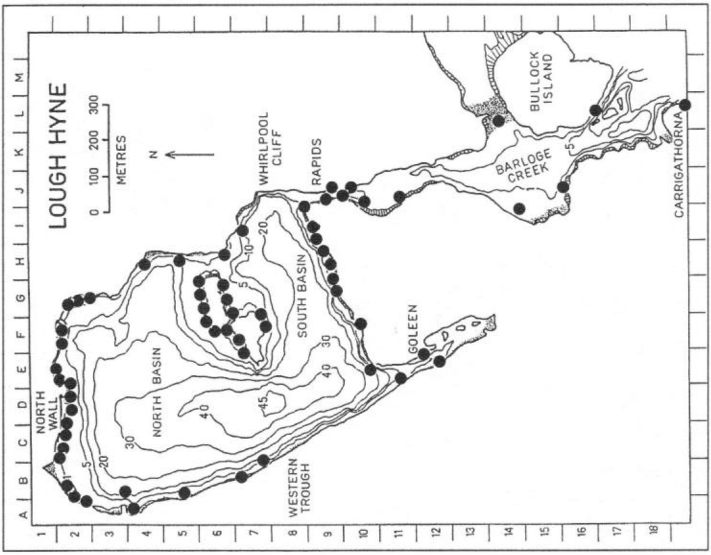


Callisotoma zizyphinum (Linnaeus, 1758)

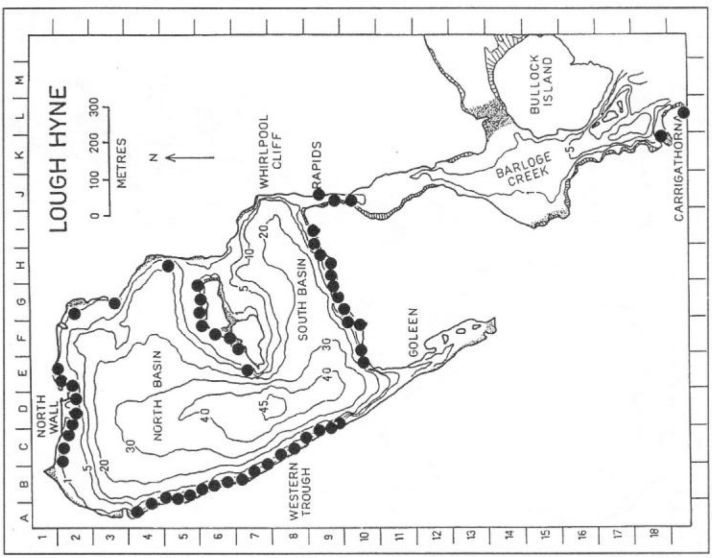


Tectura virginea (O F Müller, 1776)

FIGURE 13. Distribution maps for *Patella ulyssiponensis* and *Patella vulgata*.

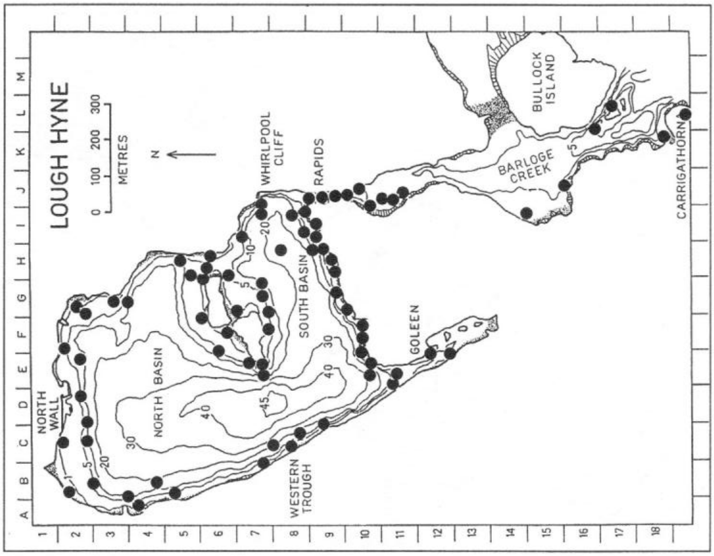


Patella vulgata Linnaeus, 1758

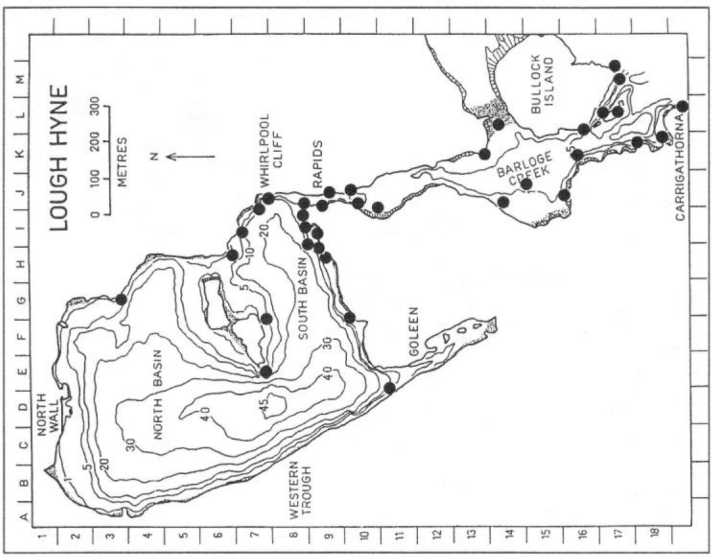


Patella ulyssiponensis Gmelin, 1791

FIGURE 14. Distribution maps for *Patella pellucida* and *Bittium reticulatum*.

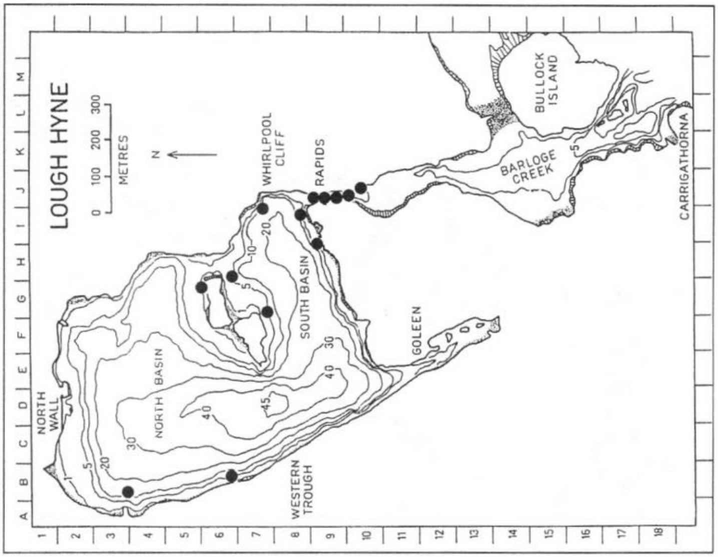


Bittium reticulatum (da Costa, 1778)

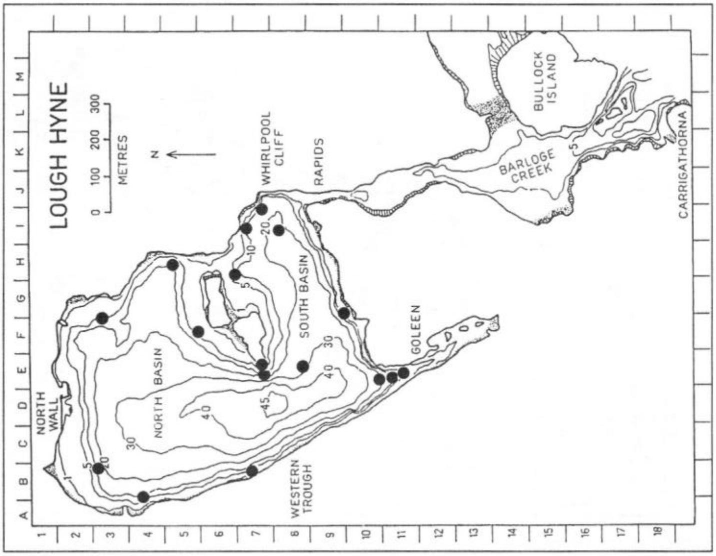


Patella pellucida (Linnaeus, 1758)

FIGURE 15. Distribution maps for *Turritella communis* and *Cerithiopsis tubercularis*.

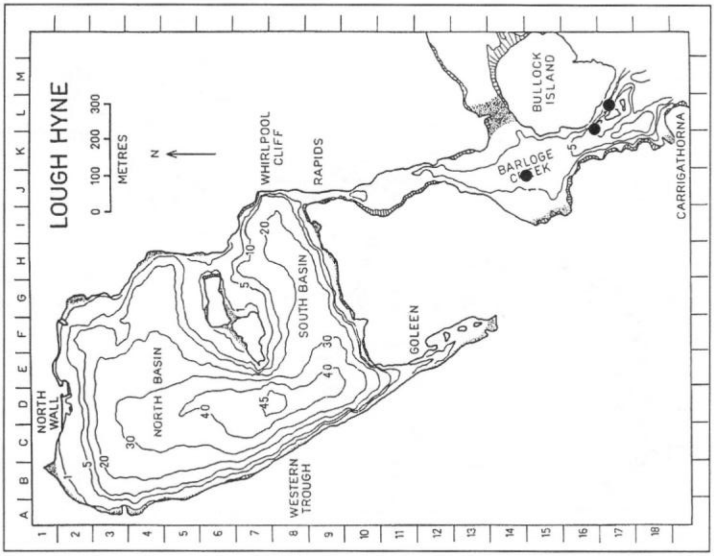


Cerithiopsis tubercularis (Montagu, 1803)

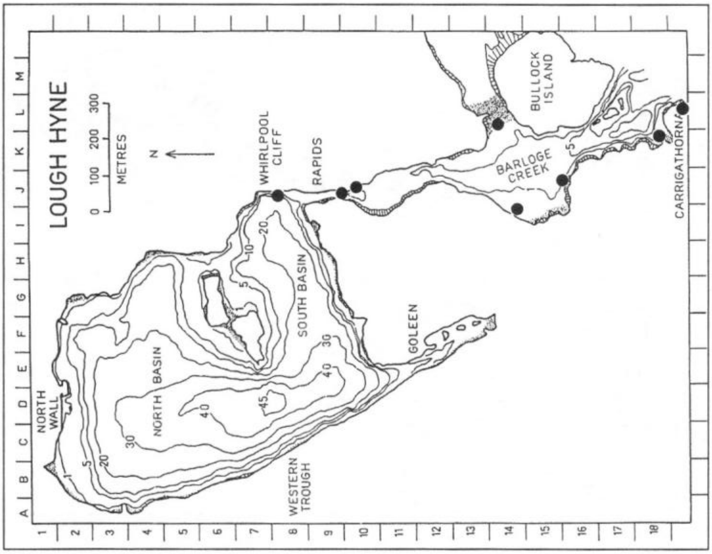


Turritella communis Risso, 1826

FIGURE 16. Distribution maps for *Lacuna pallidula* and *Lacuna parva*.

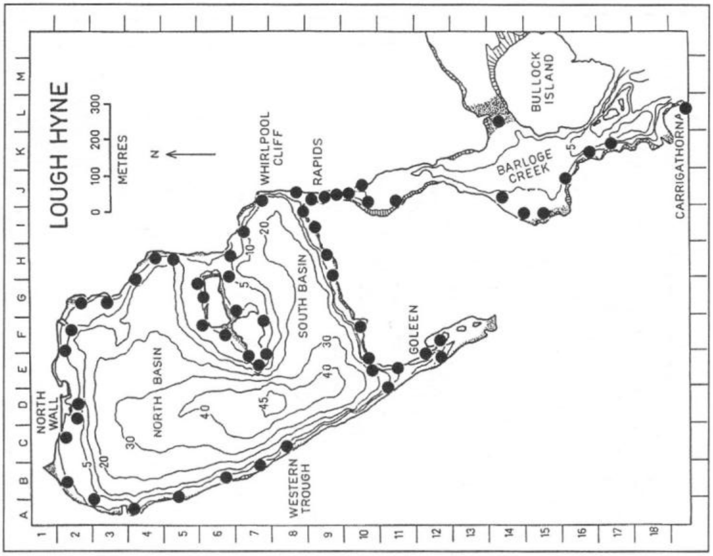


Lacuna parva (da Costa, 1778)

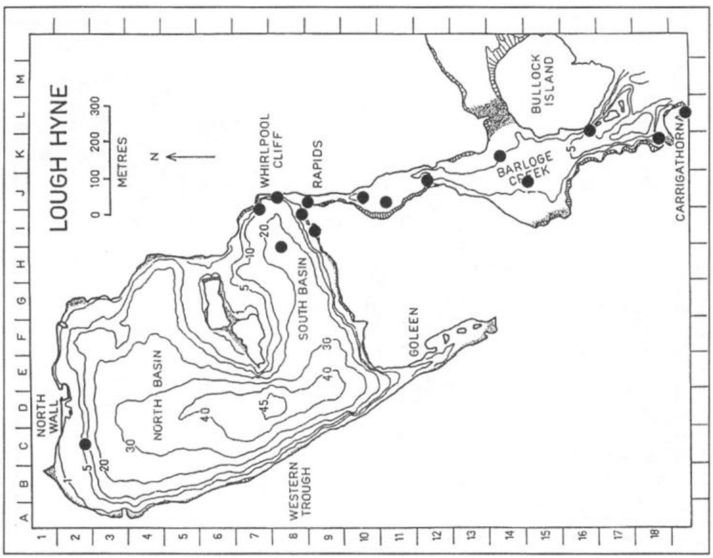


Lacuna pallidula (da Costa, 1778)

FIGURE 17. Distribution maps for *Lacuna vincta* and *Littorina littorea.*

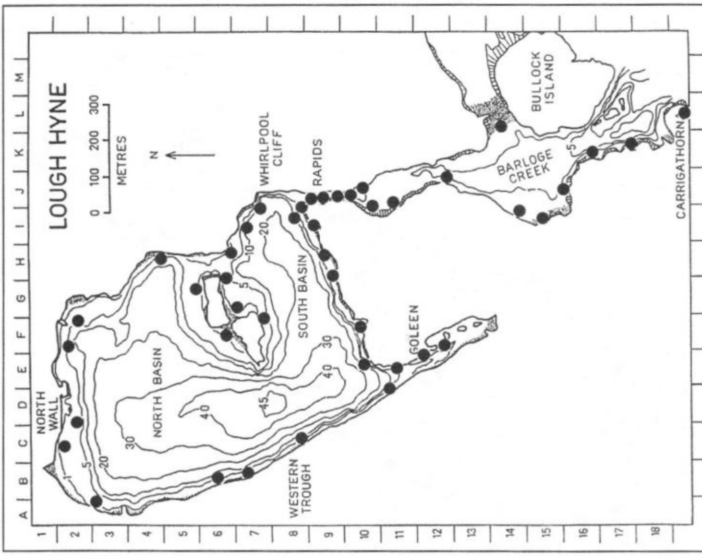


Littorina littorea (Linnaeus, 1758)

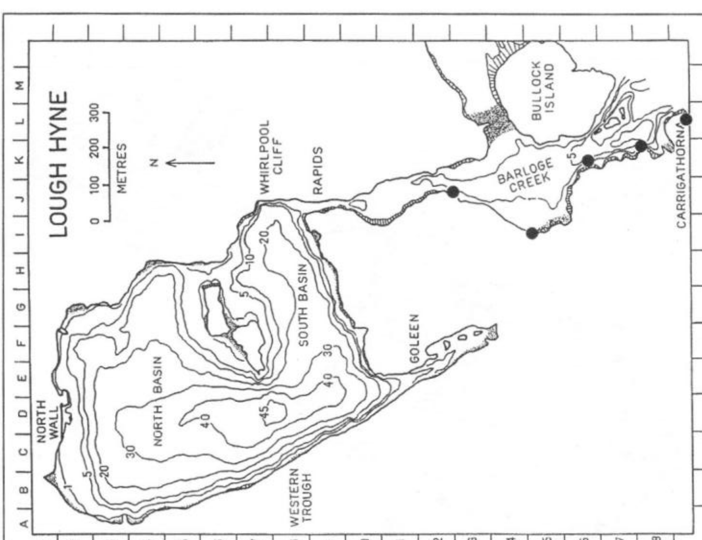


Lacuna vincta (Montagu, 1803)

FIGURE 18. Distribution maps for *Littorina arcana* and *Littorina fabalis*.

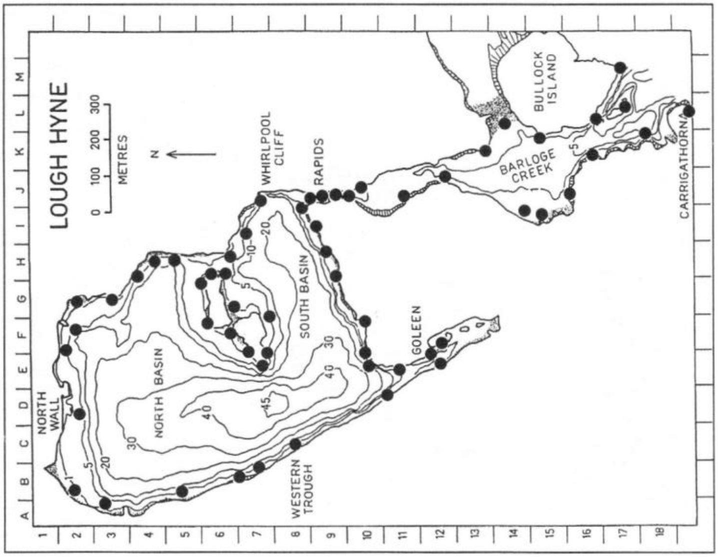


Littorina fabalis Turton, 1825

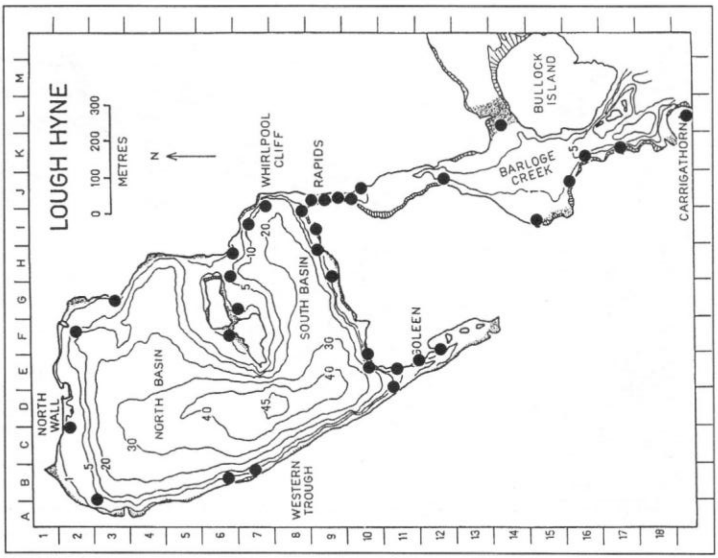


Littorina arcana Ellis, 1978

FIGURE 19. Distribution maps for *Littorina obtusata* and *Littorina saxatilis*.



Littorina saxatilis (Olivi, 1792)



Littorina obtusata (Linnaeus, 1758)

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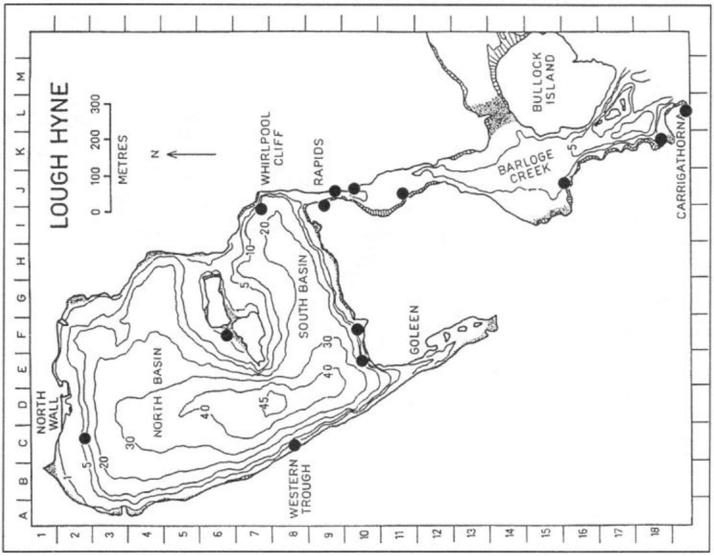
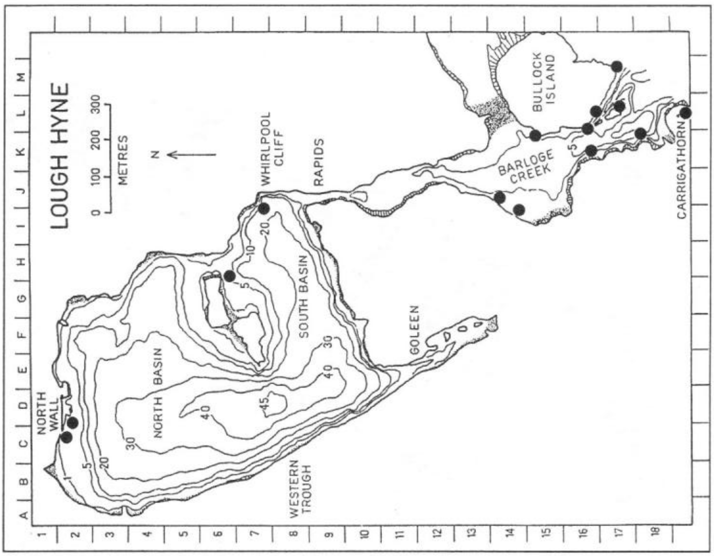
FIGURE 20. Distribution maps for *Melarhaphe neritoides* and *Skeneopsis planorbis*.



Skeneopsis planorbis (O Fabricius, 1780)



Melarhaphe neritoides (Linnaeus, 1758)

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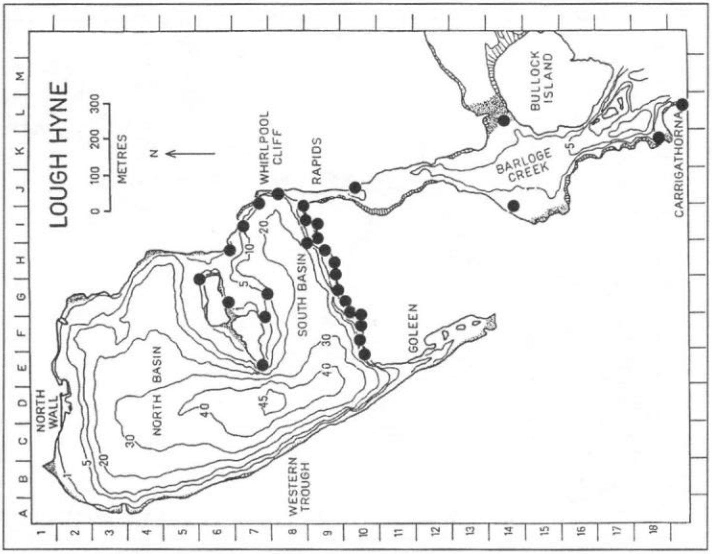
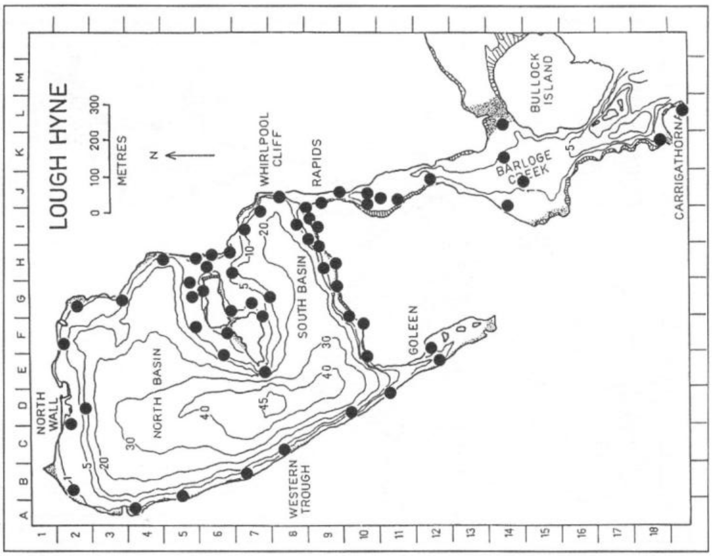
FIGURE 21. Distribution maps for *Eatonina fulgida* and *Barleeia unifasciata*.

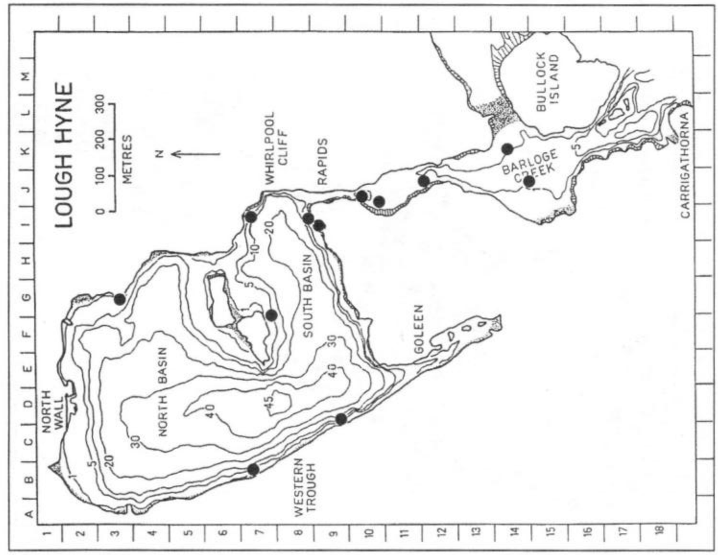


Barleeia unifasciata (Montagu, 1803)

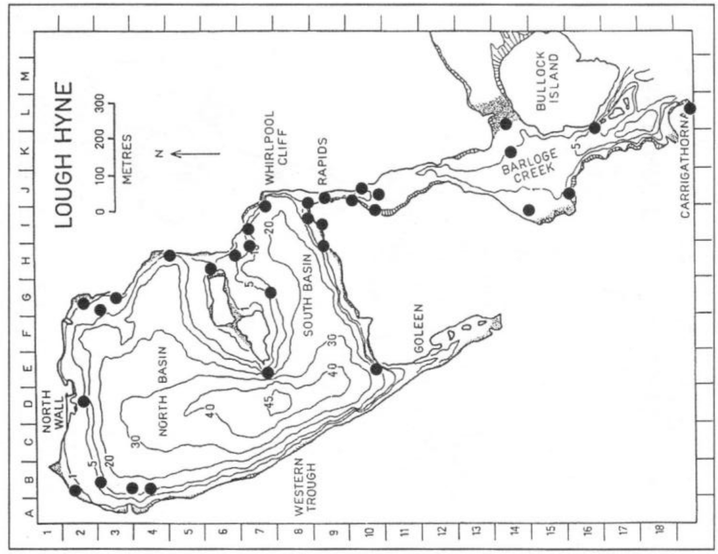


Eatonina fulgida (J Adams, 1797)

FIGURE 22. Distribution maps for *Rissoa interrupta* and *Rissoa lilacina*.

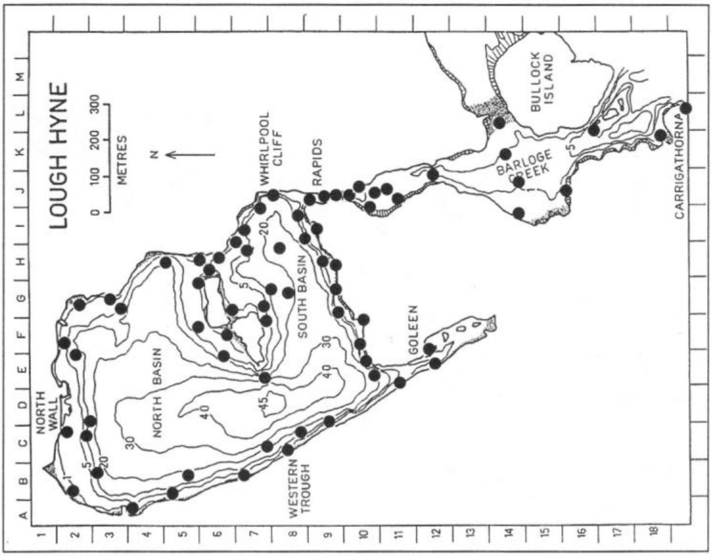


Rissoa lilacina Recluz, 1843

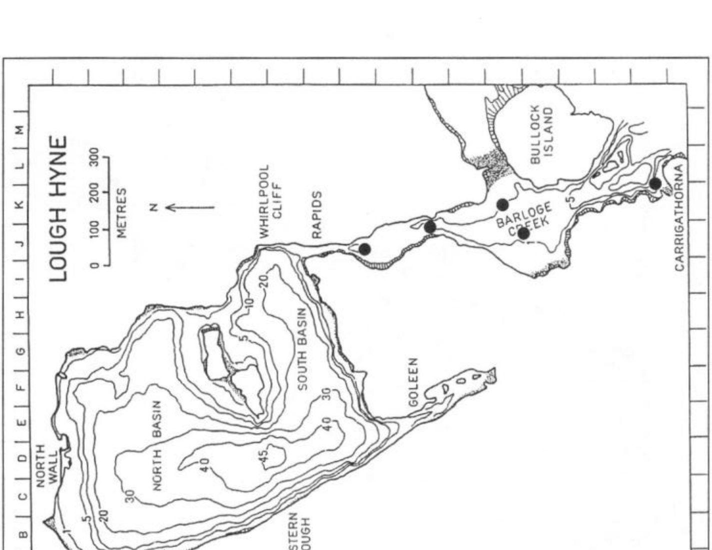


Rissoa interrupta (J Adams, 1800)

FIGURE 23. Distribution maps for *Rissoa membranacea* and *Rissoa parva*.

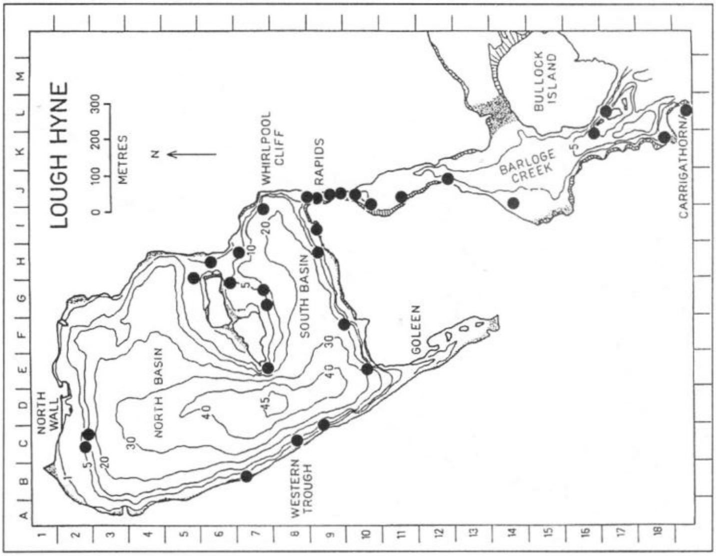


Rissoa parva (da Costa, 1778)

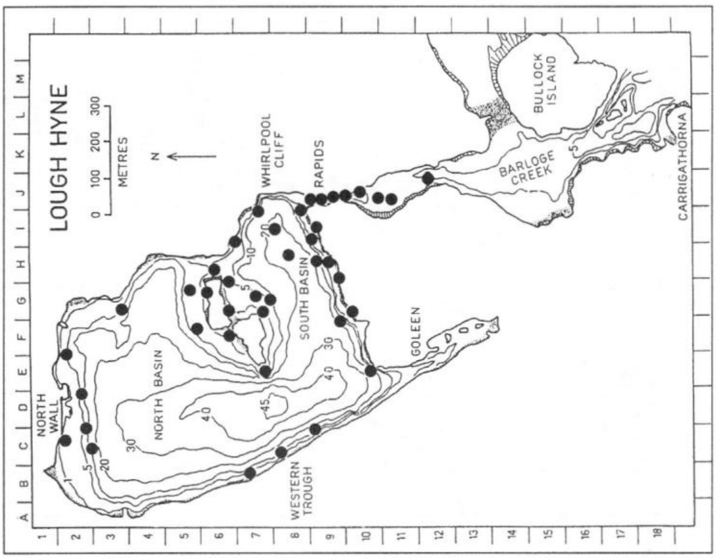


Rissoa membranacea (J Adams, 1800)

FIGURE 24. Distribution maps for *Alvania beanii* and *Alvania punctura*.

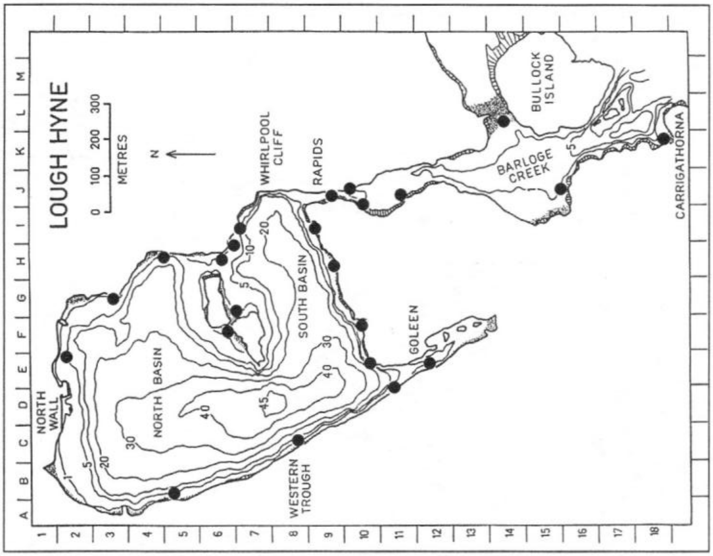


Alvania punctura (Montagu, 1803)

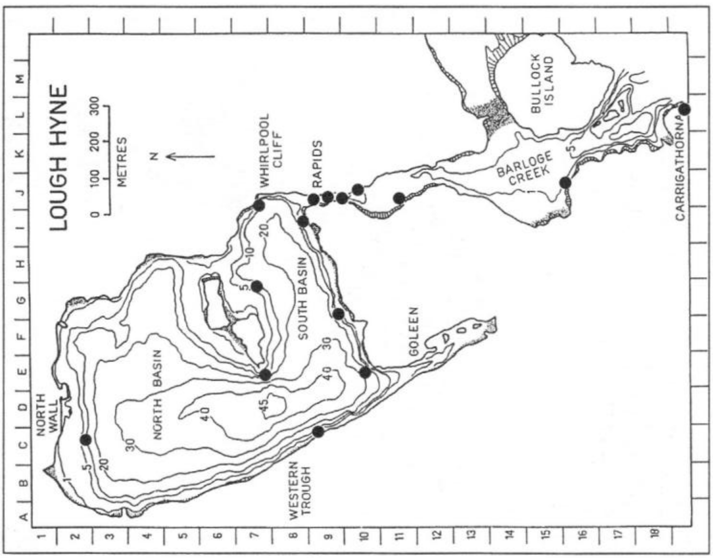


Alvania beanii (Hanley in Thorpe, 1844)

FIGURE 25. Distribution maps for *Alvania semistriata* and *Cingula cingillus*.

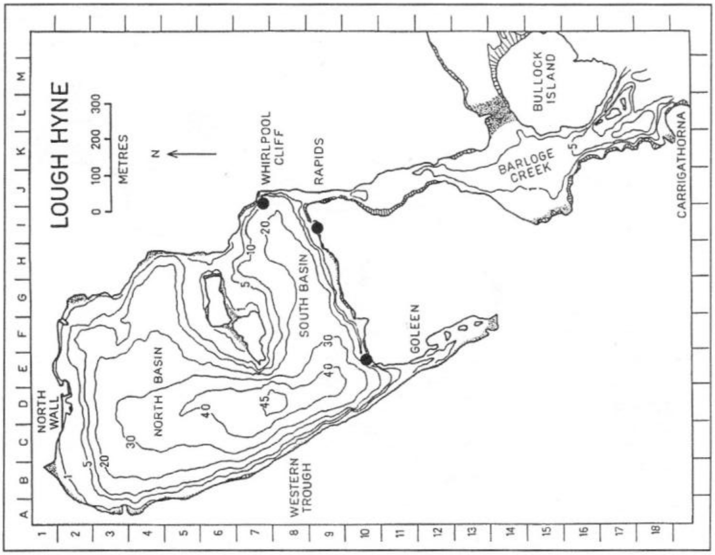


Cingula cingillus (Montagu, 1803)

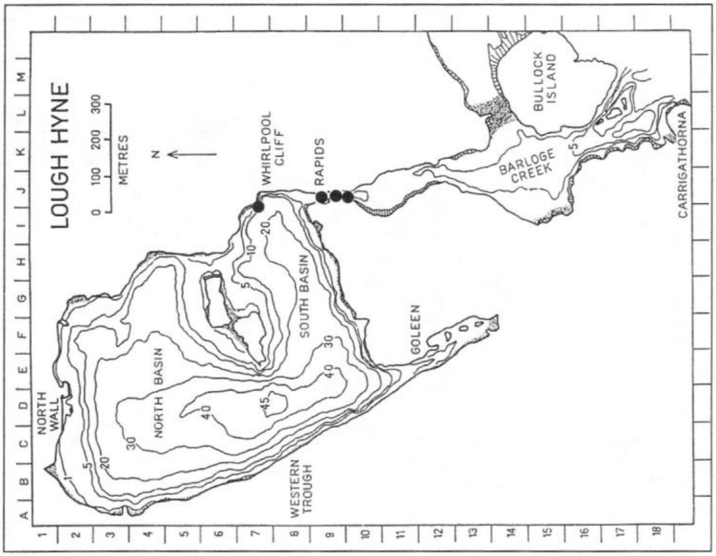


Alvania semistriata (Montagu, 1808)

FIGURE 26. Distribution maps for *Manzonia crassa* and *Onoba aculeus*.

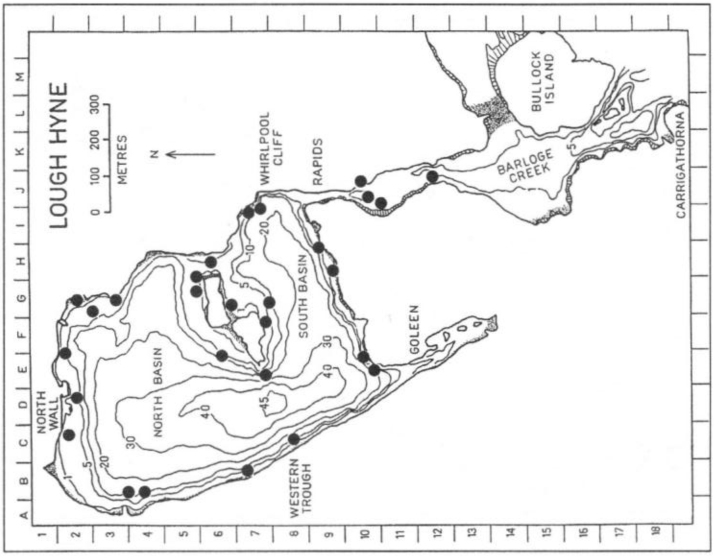


Onoba aculeus (Gould, 1841)

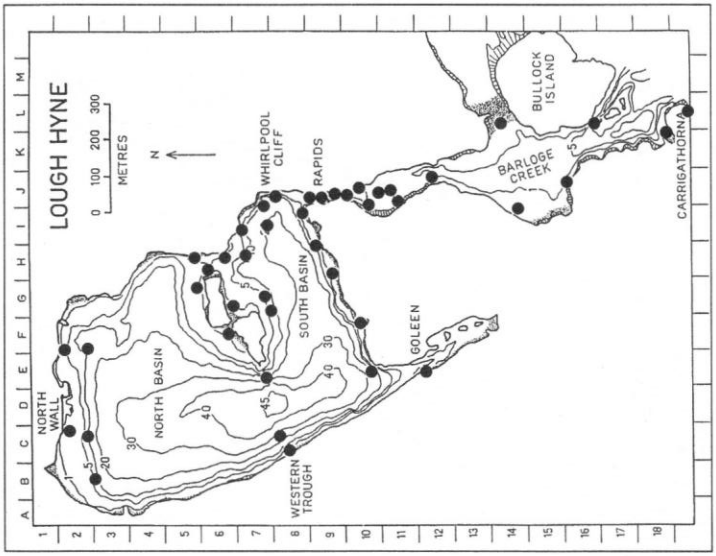


Manzonia crassa (Kanmacher in G Adams, 1798)

FIGURE 27. Distribution maps for *Onoba semicostata* and *Pusillina inconspicua.*

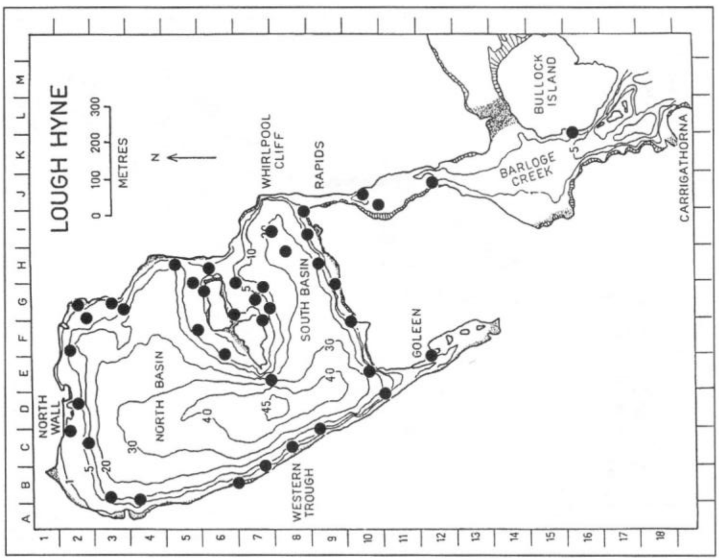


Pusillina inconspicua (Alder, 1844)

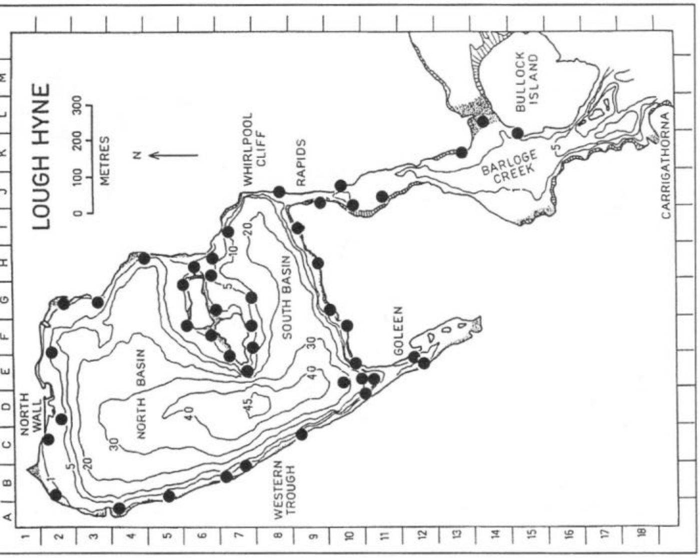


Onoba semicostata (Montagu, 1803)

FIGURE 28. Distribution maps for *Pusillina sarsi* and *Hydrobia ulvae*.

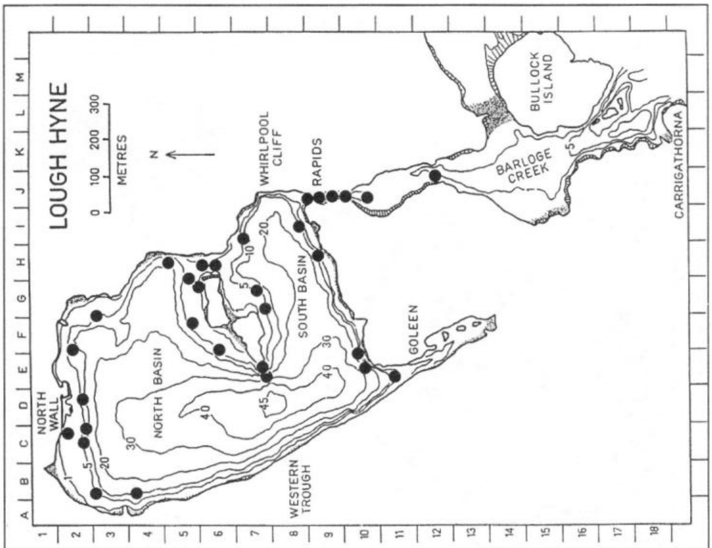


Pusillina sarsi (Lovén, 1846)

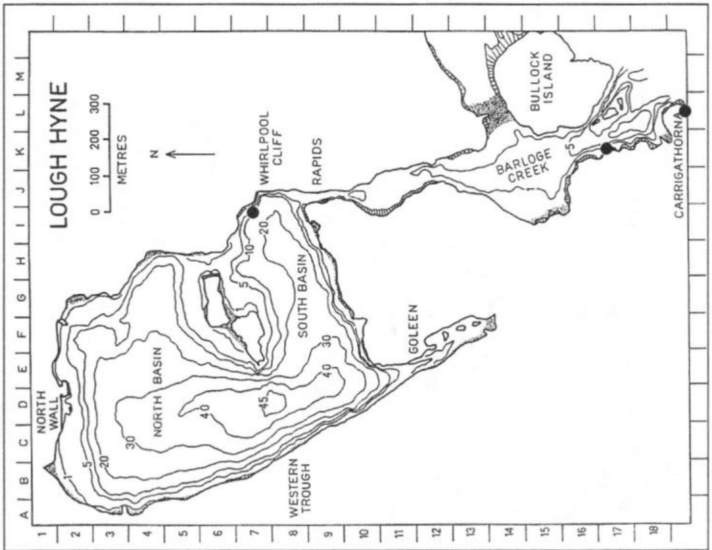


Hydrobia ulvae (Pennant, 1777)

FIGURE 29. Distribution maps for *Caecum glabrum* and *Simnia patula*.

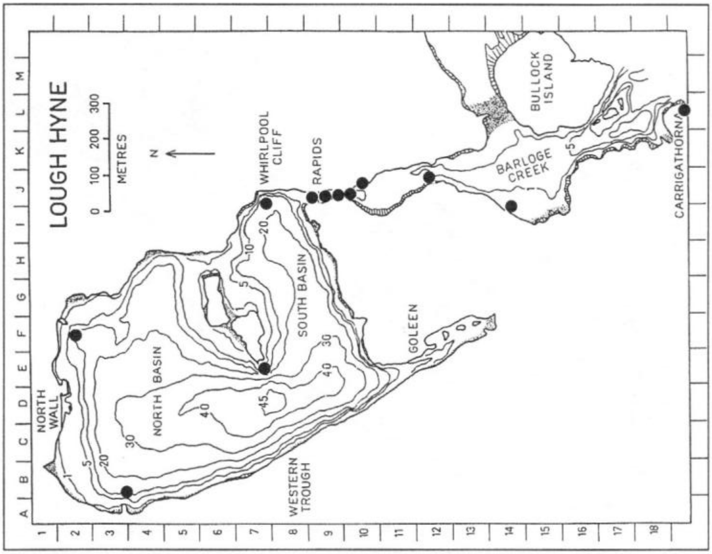


Caecum glabrum (Montagu, 1803)

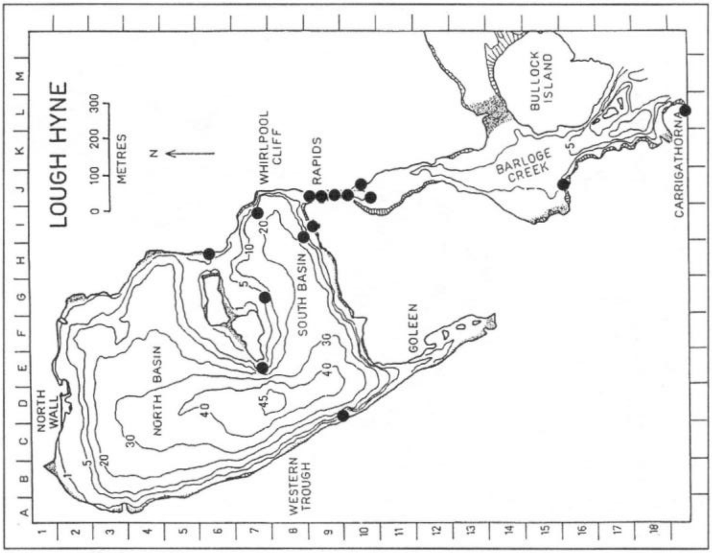


Simnia patula (Pennant, 1777)

FIGURE 30. Distribution maps for *Trivia arctica* and *Trivia monacha*.

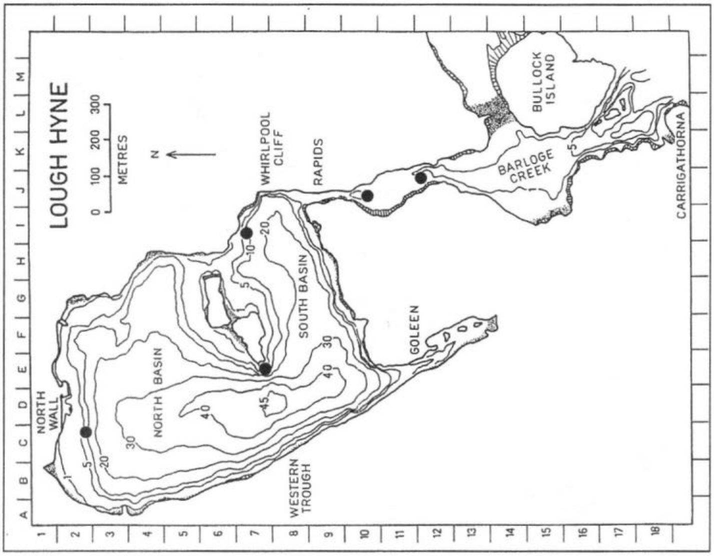


Trivia monacha (da Costa, 1778)

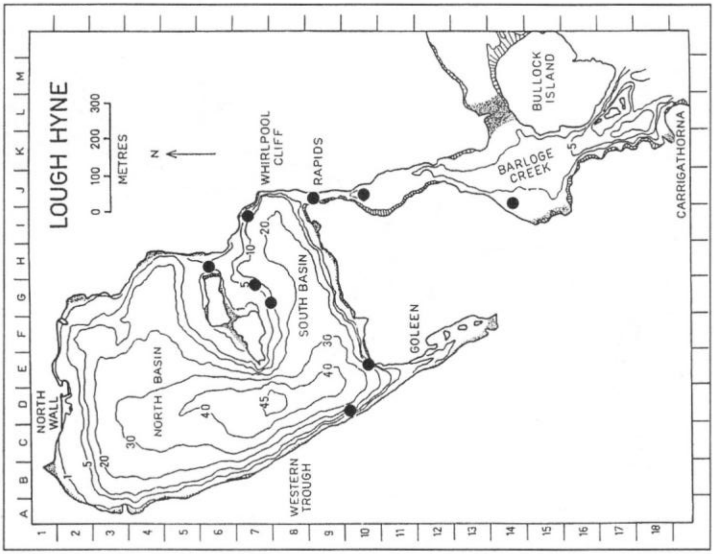


Trivia arctica (Pulteney, 1799)

FIGURE 31. Distribution maps for *Lamellaria latens* and *Polinices pulchellus*.



Polinices pulchellus (Risso, 1826)



Lamellaria latens (O F Müller, 1776)

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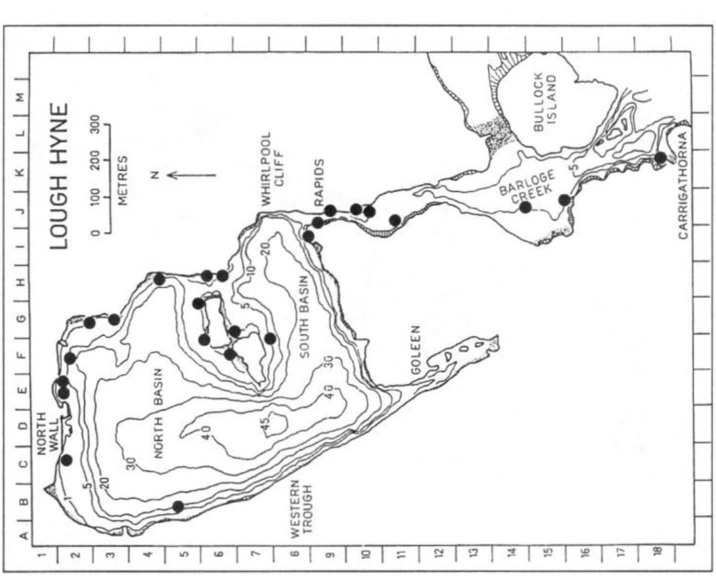
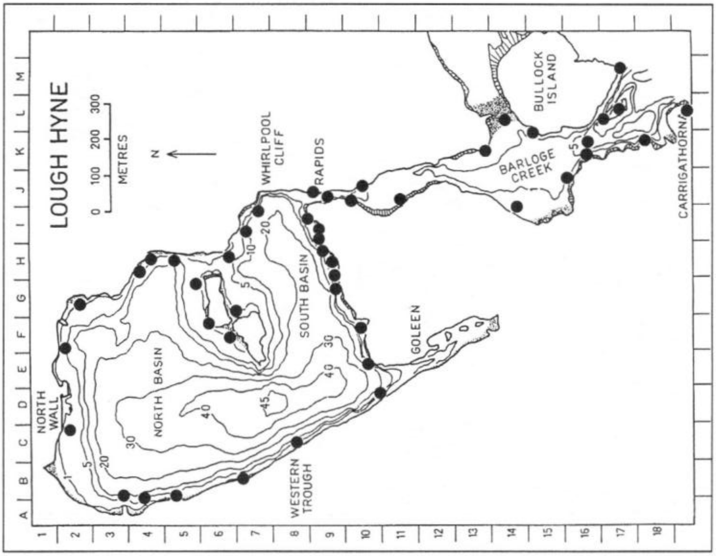
FIGURE 32. Distribution maps for *Ocenebra erinacea* and *Nucella lapillus*.

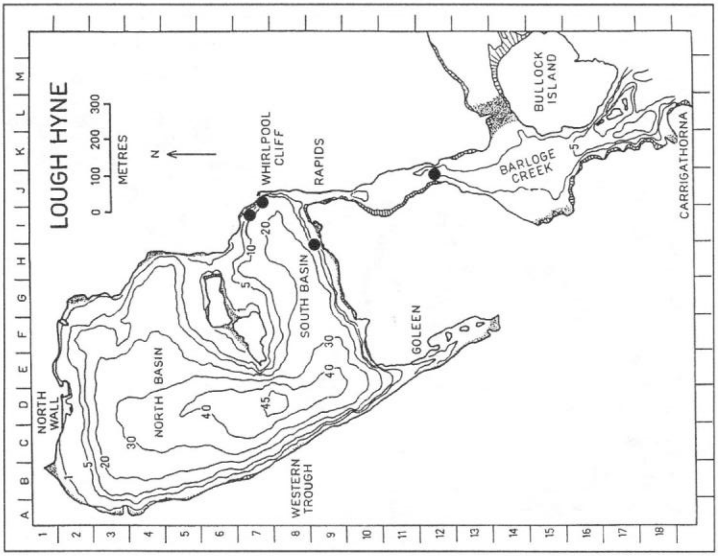


Ocenebra erinacea (Linnaeus, 1758)

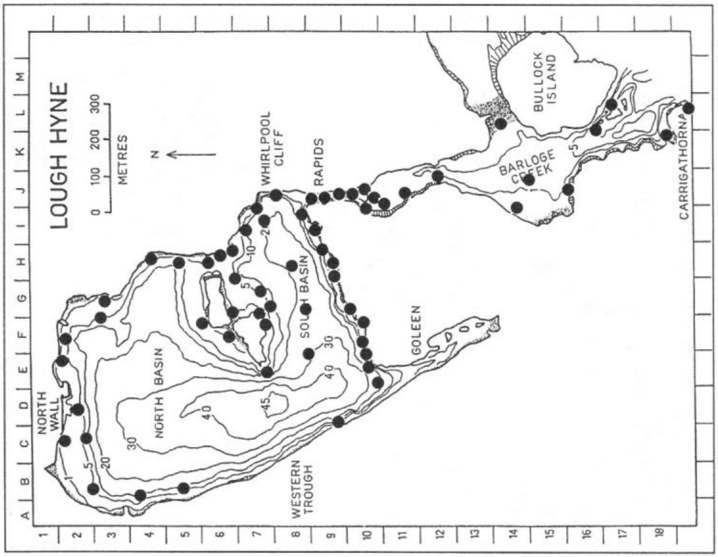


Nucella lapillus (Linnaeus, 1758)

FIGURE 33. Distribution maps for *Hinia incrassata* and *Haedropleura septangularis*.

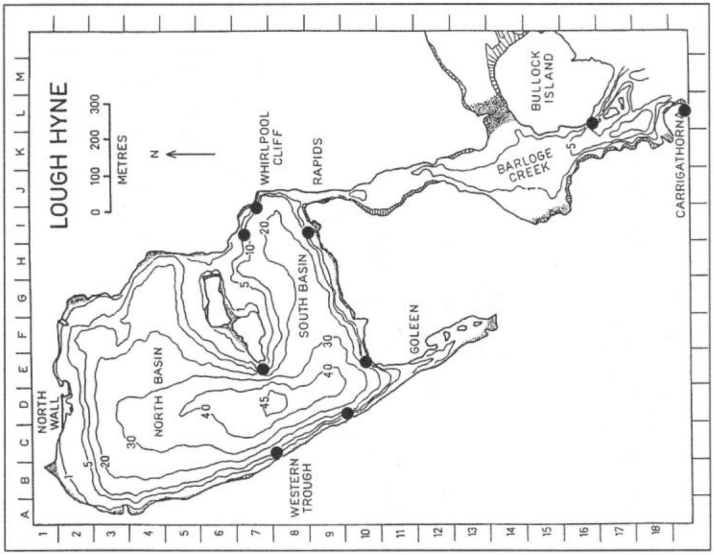


Haedropleura septangularis (Montagu, 1803)

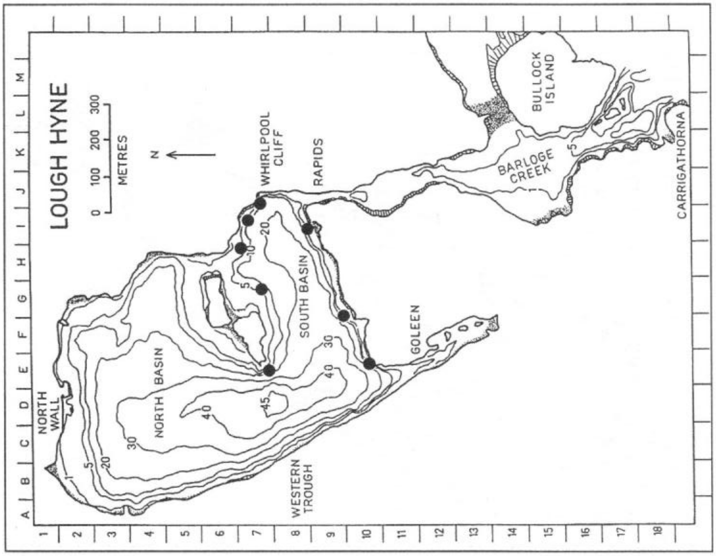


Hinia incrassata (Ström, 1768)

FIGURE 34. Distribution maps for *Mangelia coarctata* and *Raphitoma linearis.*

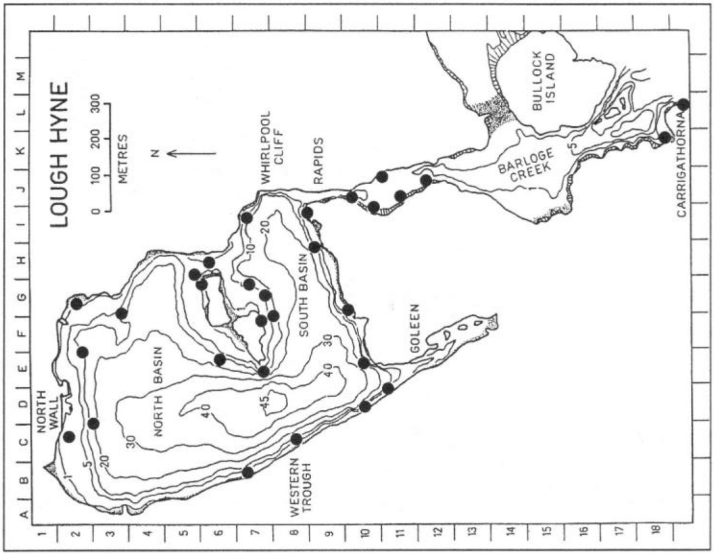


Raphitoma linearis (Montagu, 1803)

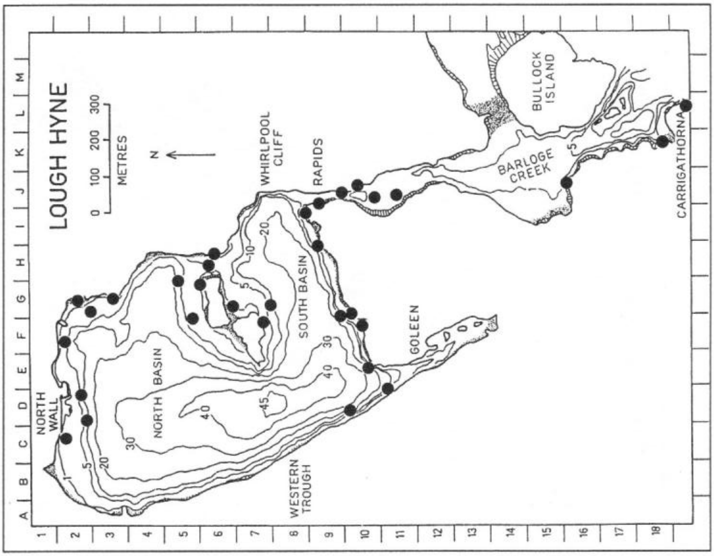


Mangelia coarctata (Forbes, 1840)

FIGURE 35. Distribution maps for *Rissoella diaphana* and *Rissoella opalina*.

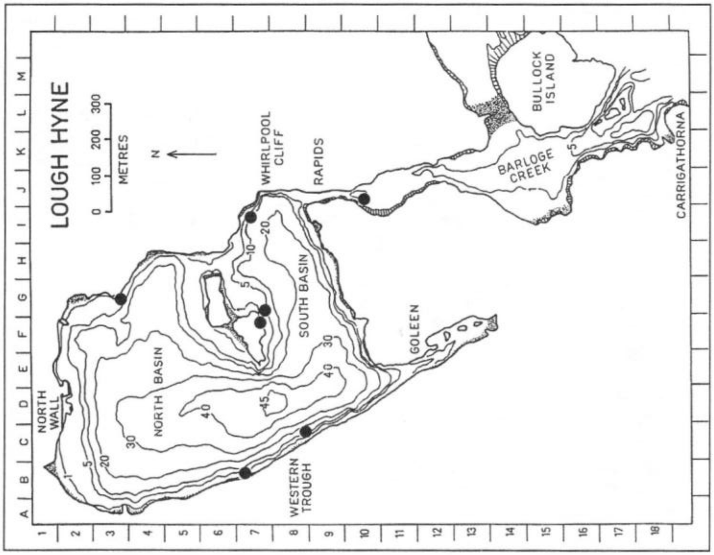


Rissoella opalina (Jeffreys, 1848)

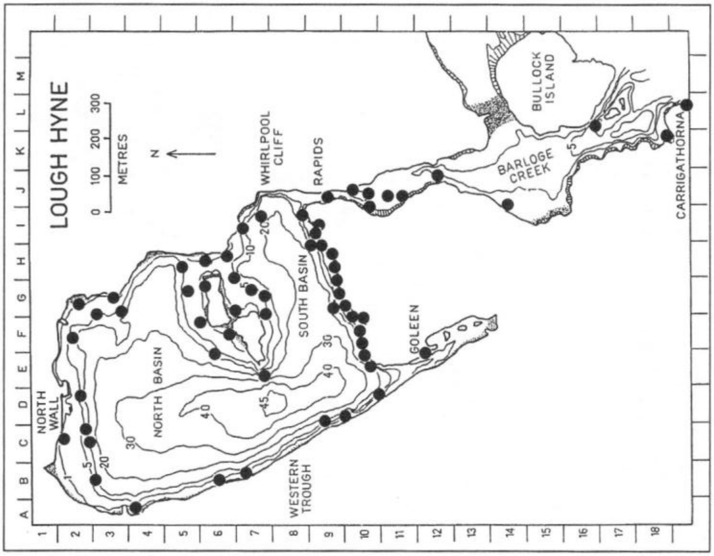


Rissoella diaphana (Alder, 1848)

FIGURE 36. Distribution maps for *Omalogyra atomus* and *Ammonicerina rota*.

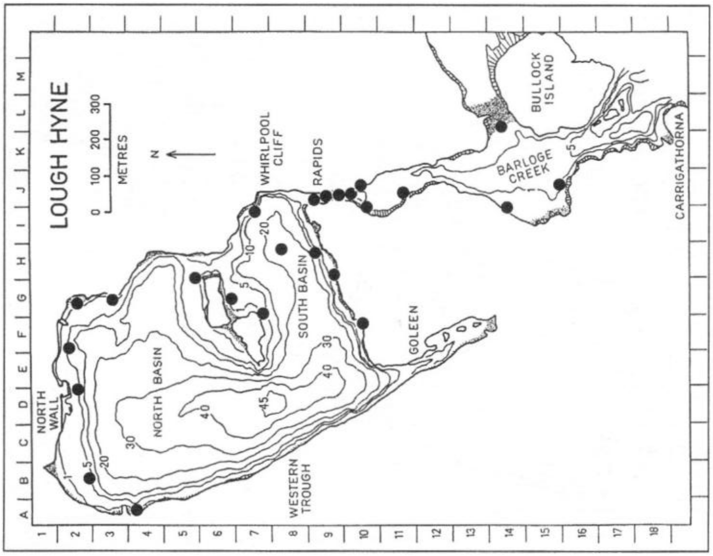


Ammonicerina rota (Forbes & Hanley, 1850)

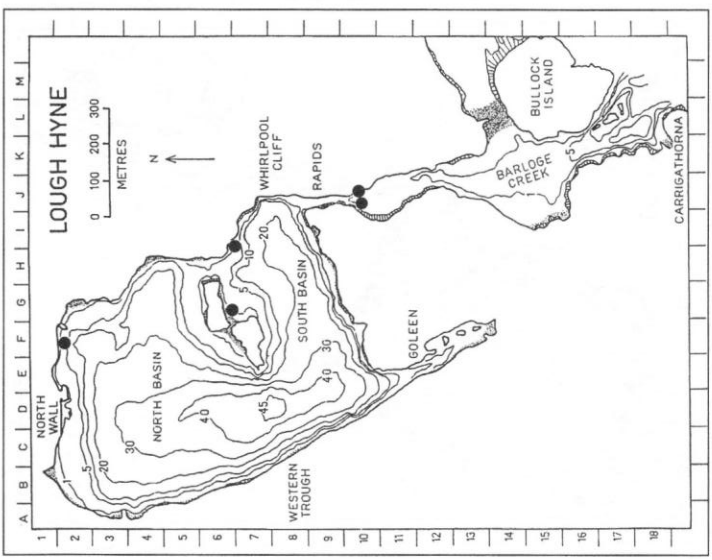


Omalogyra atomus (Philippi, 1841)

FIGURE 37. Distribution maps for *Odostomia plicata* and *Odostomia turrita*.

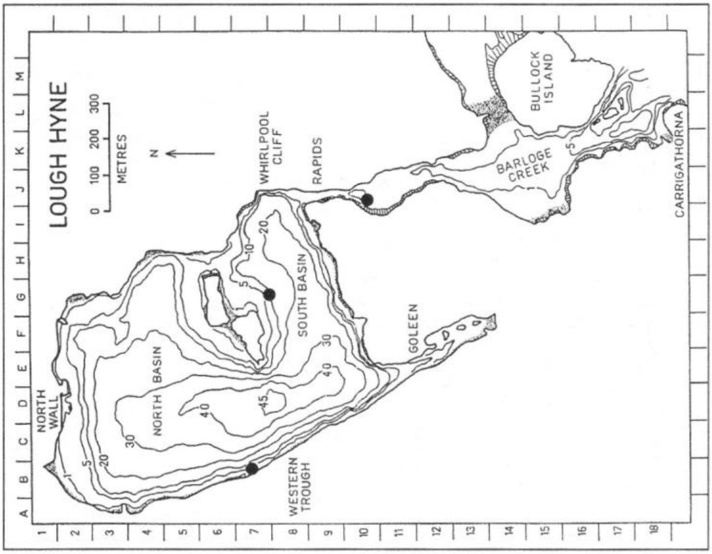


Odostomia turrita Hanley, 1844

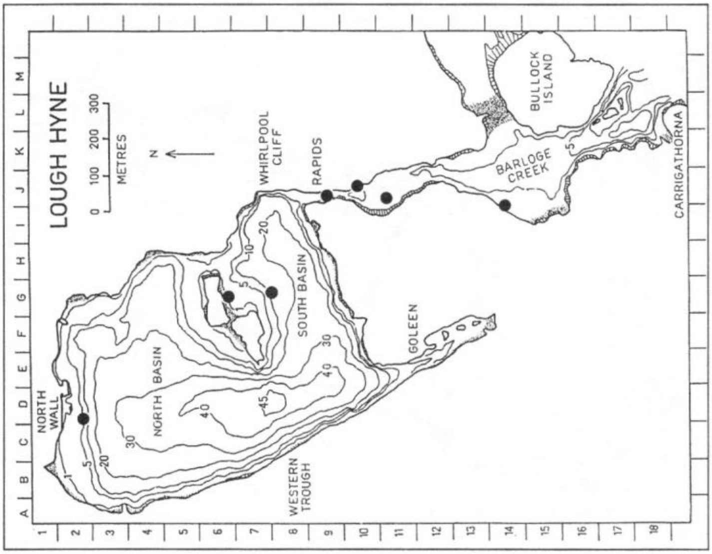


Odostomia plicata (Montagu, 1803)

FIGURE 38. Distribution maps for *Odostomia unidentata* and *Brachystomia carrozzai*.

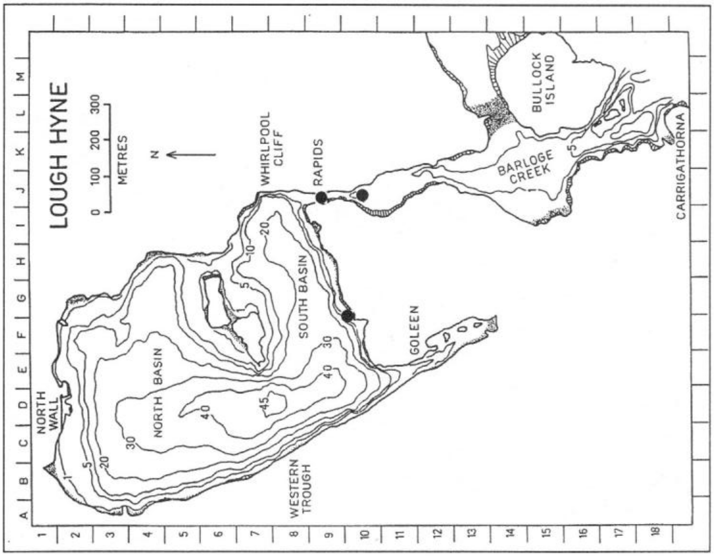


Brachystomia carrozzai (Aartsen, 1987)

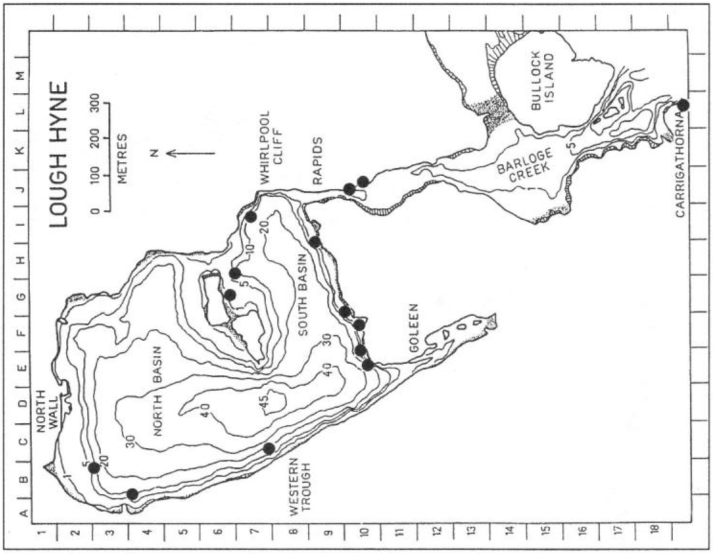


Odostomia unidentata (Montagu, 1803)

FIGURE 39. Distribution maps for *Brachystomia eulimoides* and *Brachystomia scalaris*.



Brachystomia scalaris (Macgillivray, 1843)



Brachystomia eulimoides (Hanley, 1844)

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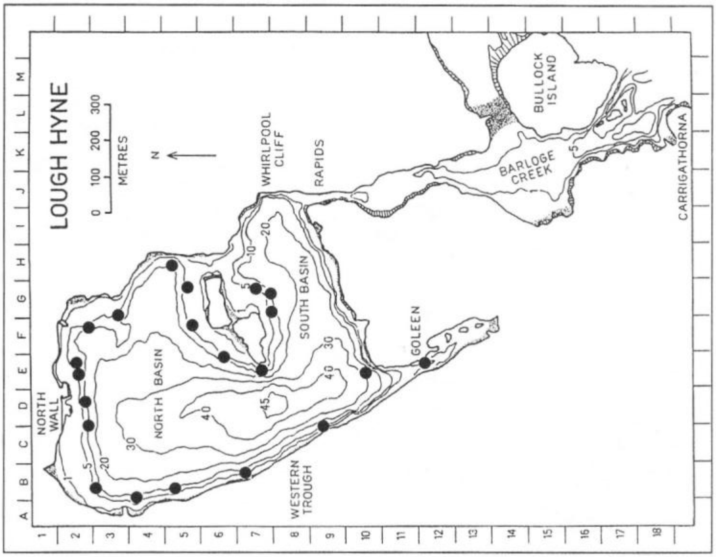
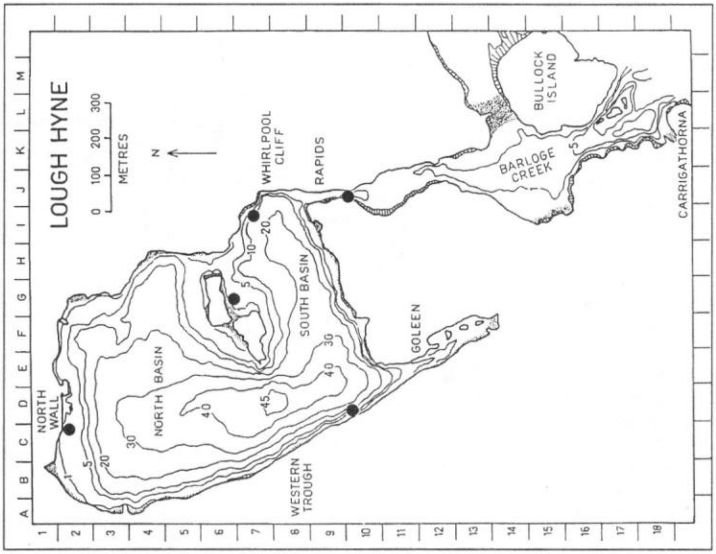
FIGURE 40. Distribution maps for *Partulida pellucida* and *Philine aperta*.

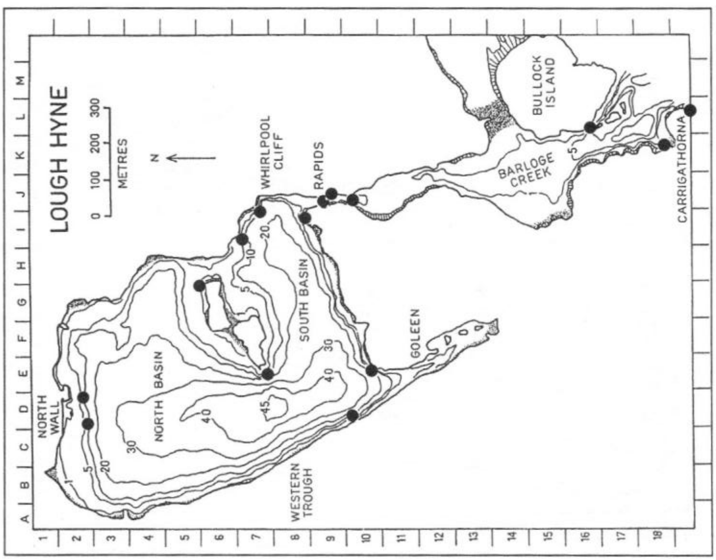


Philine aperta (Linnaeus, 1767)

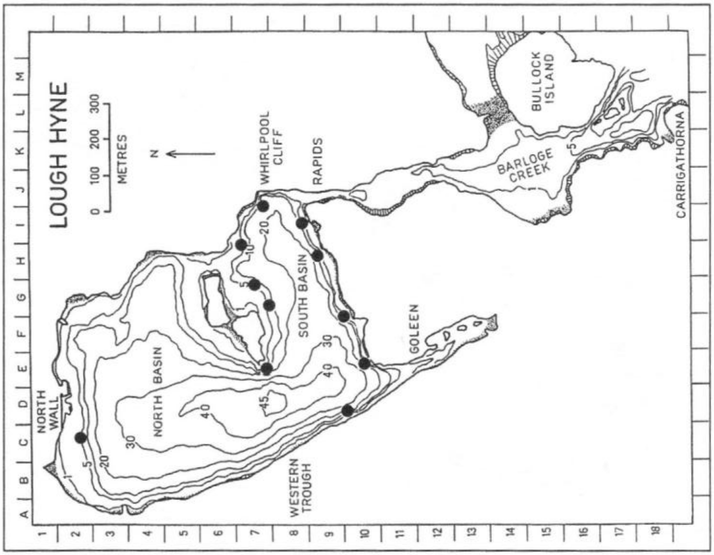


Partulida pellucida (Dillwyn, 1817)

FIGURE 41. Distribution maps for *Retusa truncatula* and *Runcina ferruginea*.

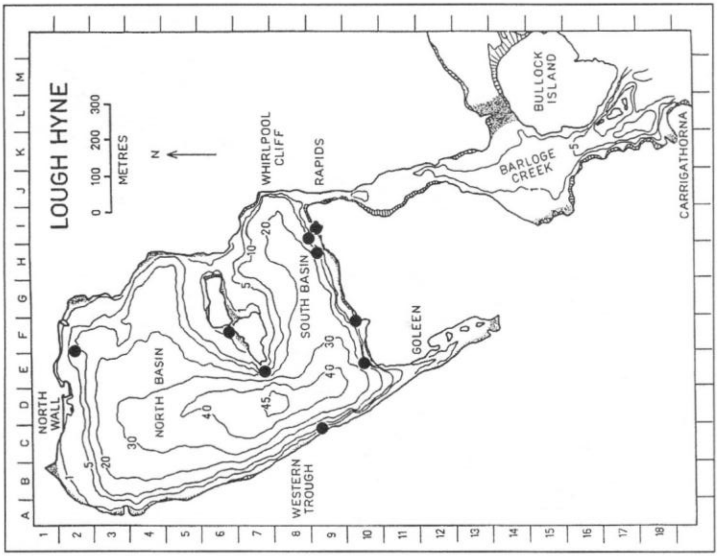


Retusa truncatula (Bruguière, 1792)

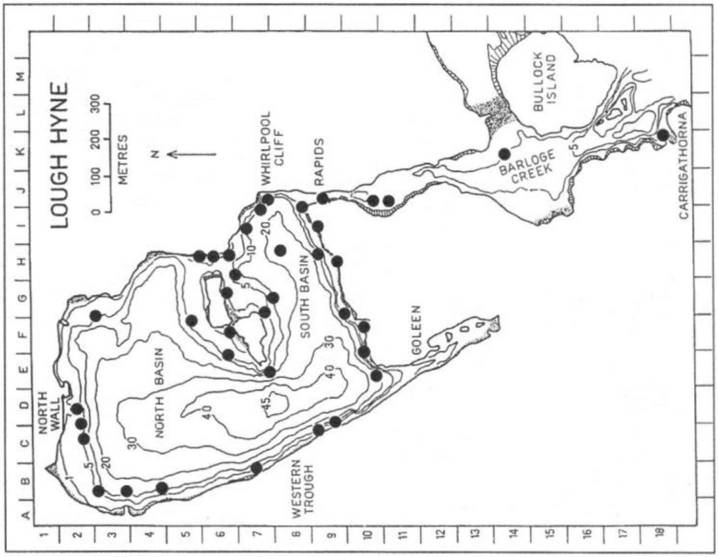


Runcina ferruginea Kress, 1977

FIGURE 42. Distribution maps for *Elysia viridis* and *Stiliger bellulus*.

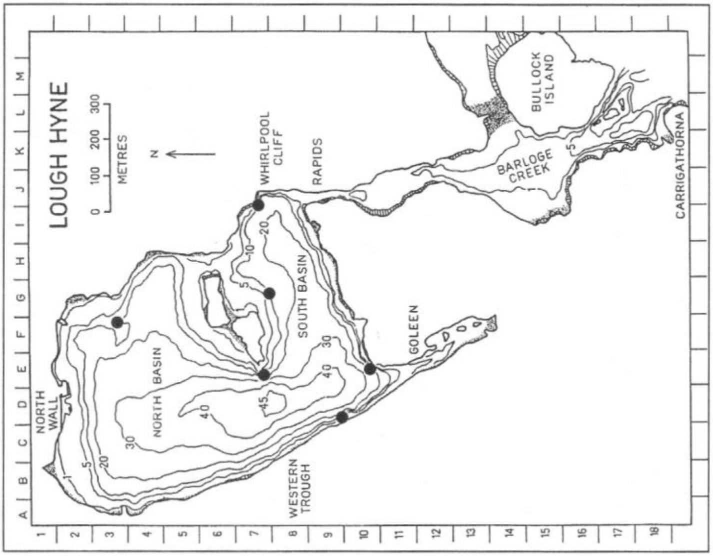


Stiliger bellulus (Orbigny, 1837)

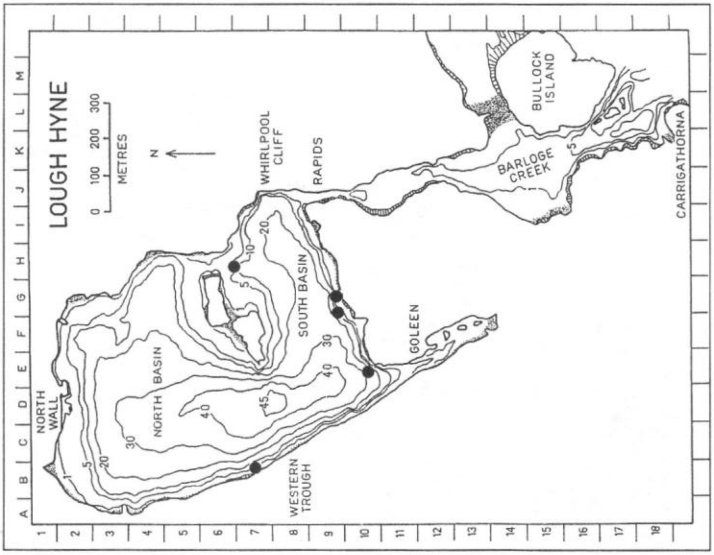


Elysia viridis (Montagu, 1804)

FIGURE 43. Distribution maps for *Placida dendritica* and *Hermaea bifida*.

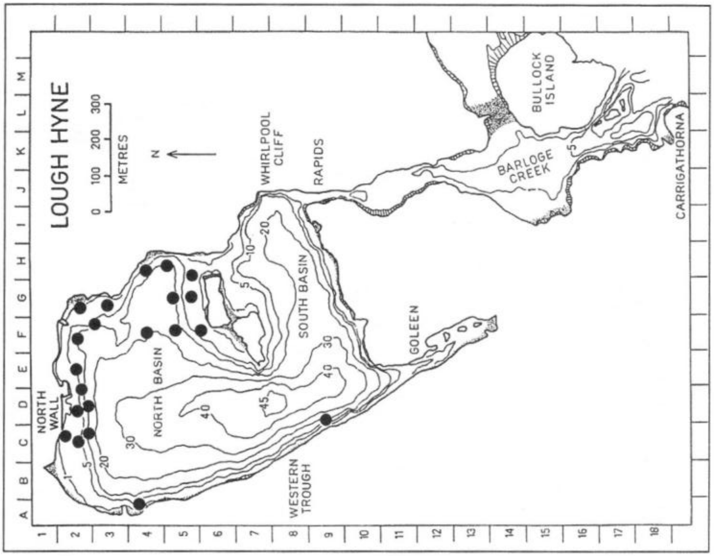


Hermaea bifida (Montagu, 1815)

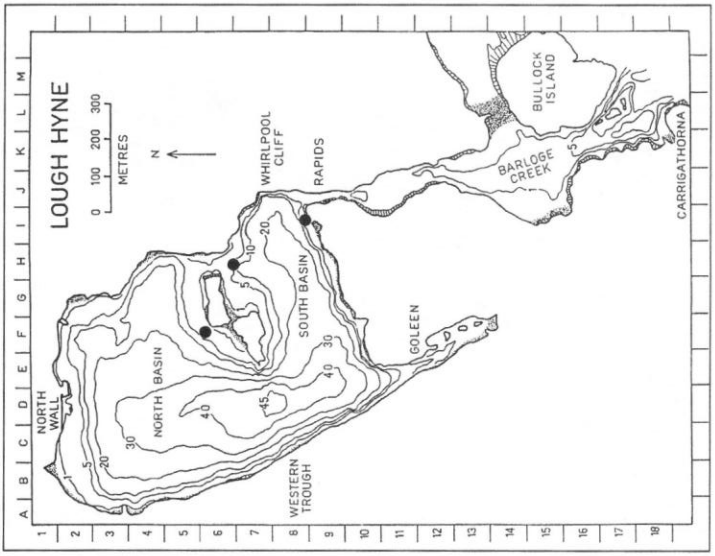


Placida dendritica (Alder & Hancock, 1843)

FIGURE 44. Distribution maps for *Limapontia capitata* and *Akera bullata*.

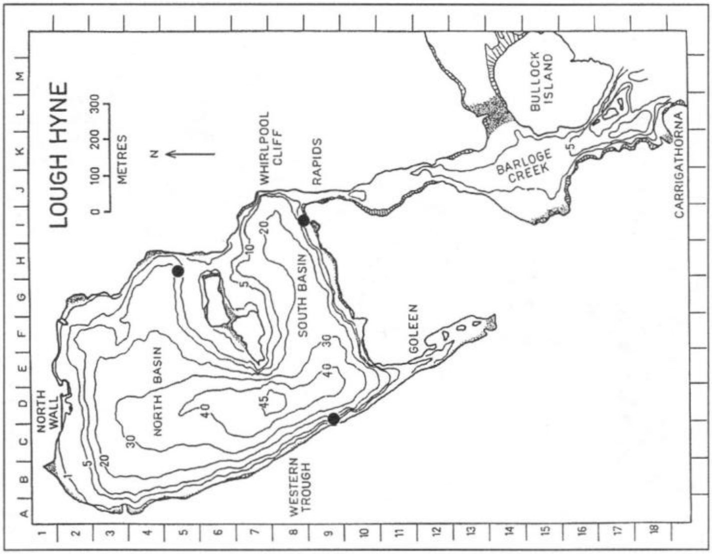


Akera bullata O F Müller, 1776

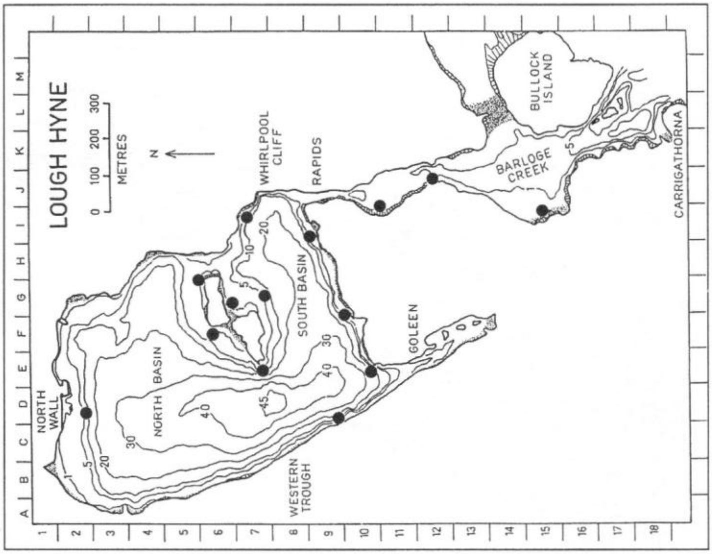


Limapontia capitata (O F Müller, 1774)

FIGURE 45. Distribution maps for *Aplysia punctata* and *Pleurobranchus membranaceus.*

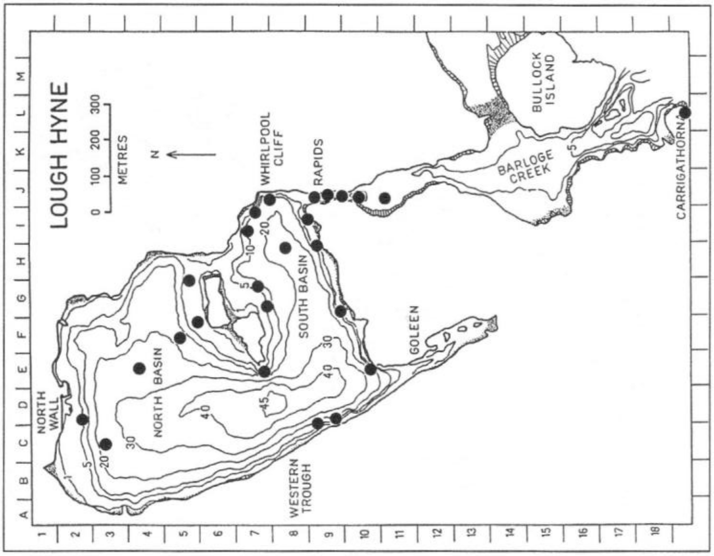


Pleurobranchus membranaceus (Montagu, 1815)

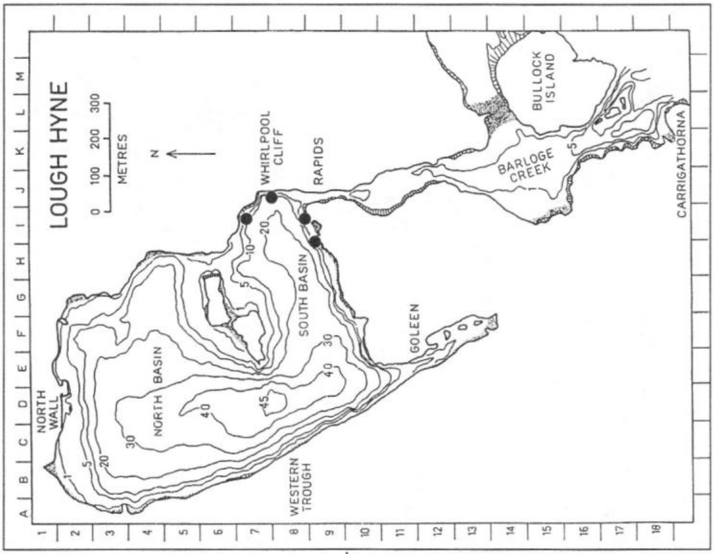


Aplysia punctata Cuvier, 1803

FIGURE 46. Distribution maps for *Berthella plumula* and *Doto coronata*.

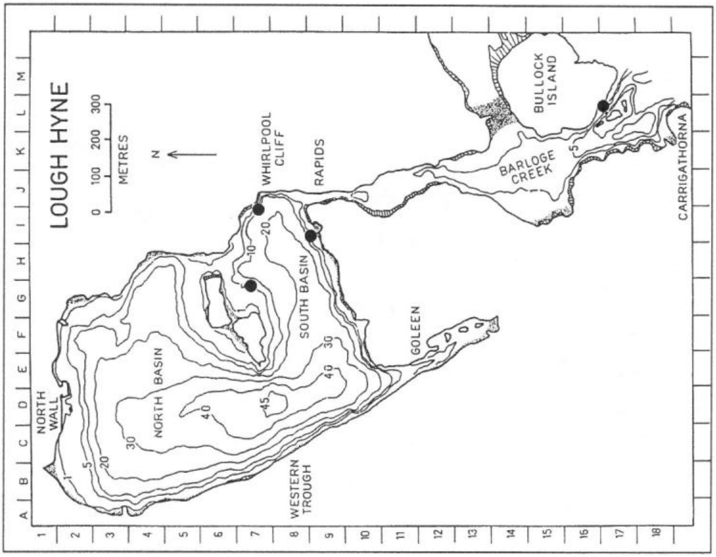


Doto coronata (Gmelin, 1791)

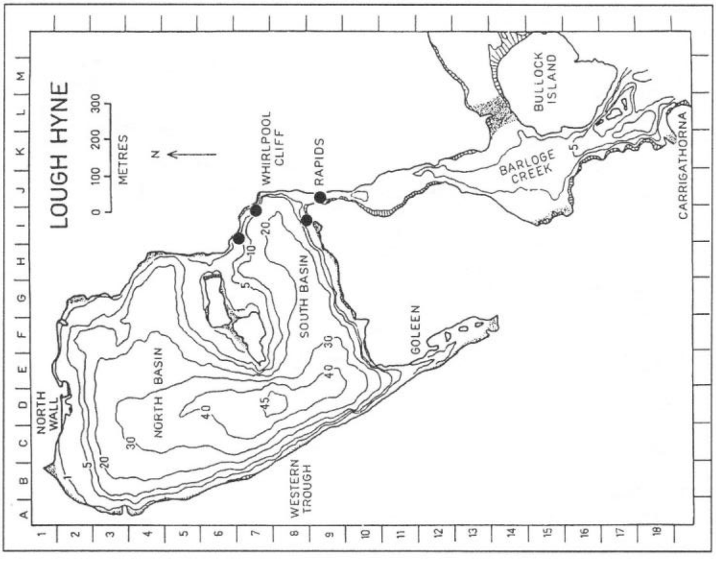


Berthella plumula (Montagu, 1803)

FIGURE 47. Distribution maps for *Onchidoris bilamellata* and *Diaphorodoris luteocincta*.

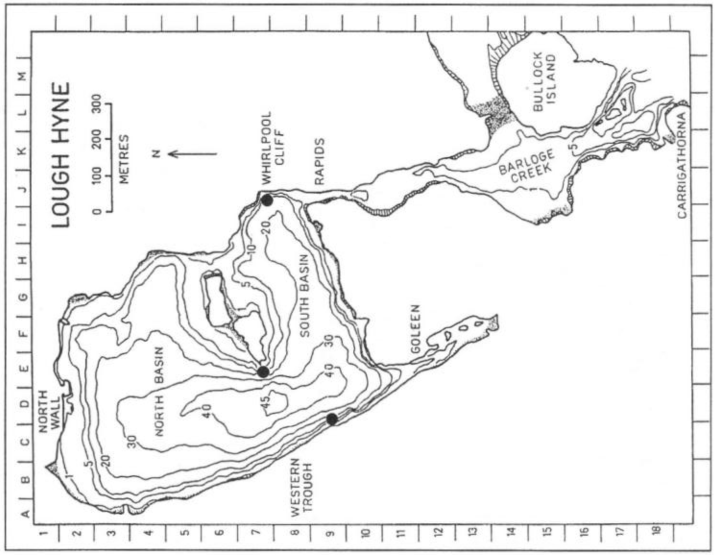


Diaphorodoris luteocincta (M Sars, 1870)

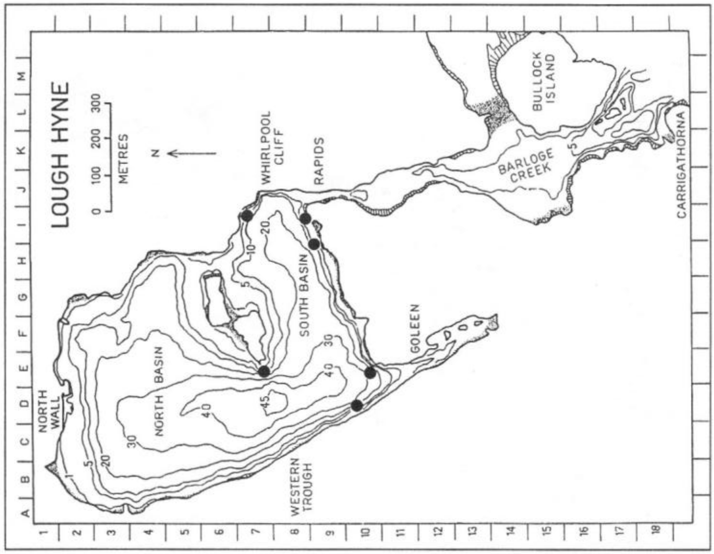


Onchidoris bilamellata (Linnaeus, 1767)

FIGURE 48. Distribution maps for *Aegires punctilucens* and *Polycera faeroensis*.

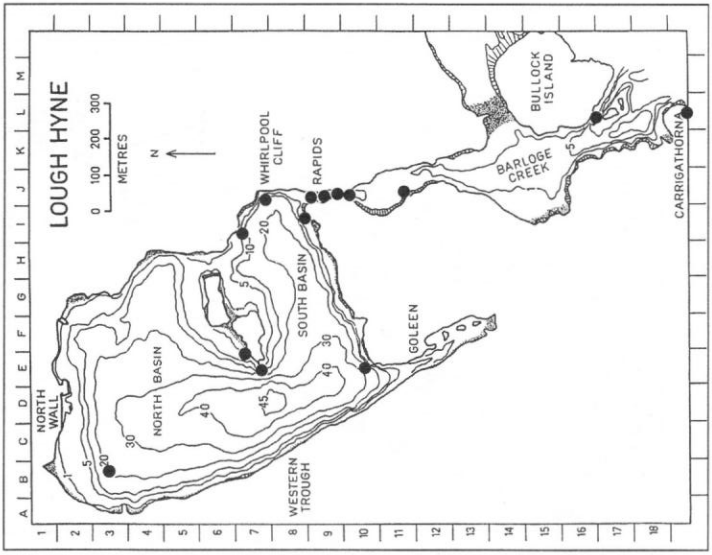


Polycera faeroensis Lemche, 1929

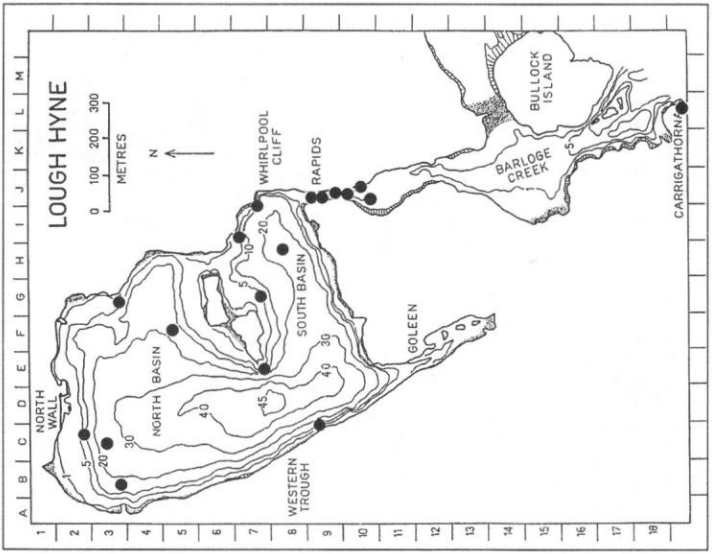


Aegires punctilucens (Ornigny, 1837)

FIGURE 49. Distribution maps for *Polycera quadrilineata* and *Limacia clavigera*.

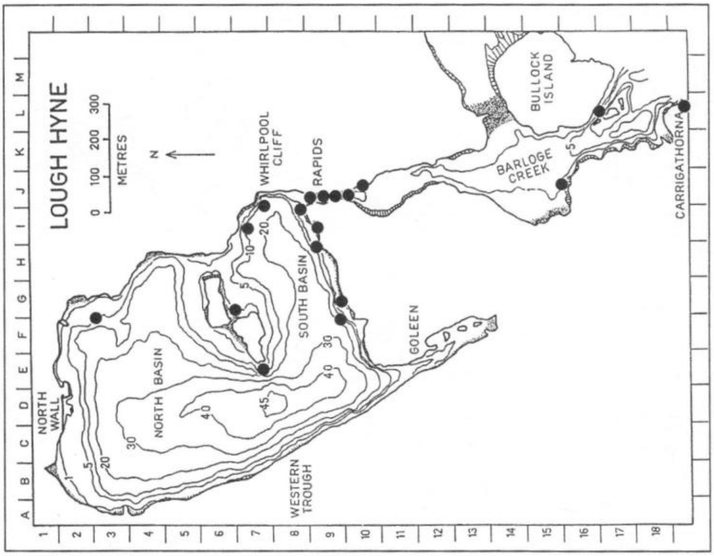


Limacia clavigera (O.F. Müller, 1776)

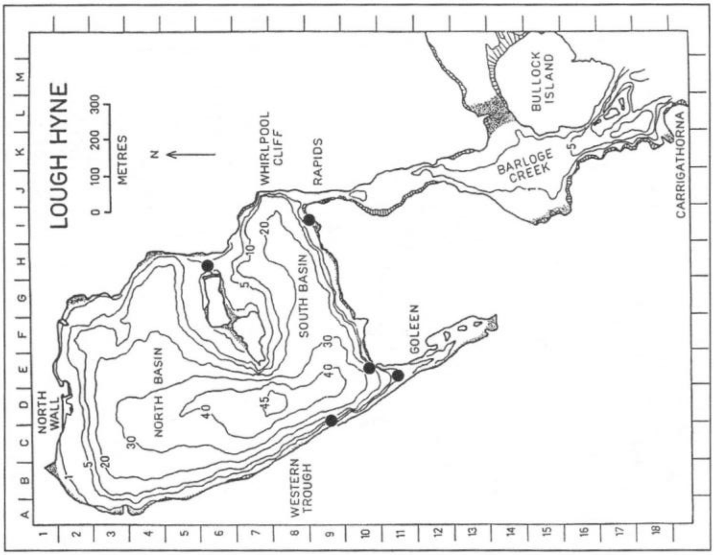


Polycera quadrilineata (O F Müller, 1776)

FIGURE 50. Distribution maps for *Archidoris pseudoargus* and *Geitodoris planata*.

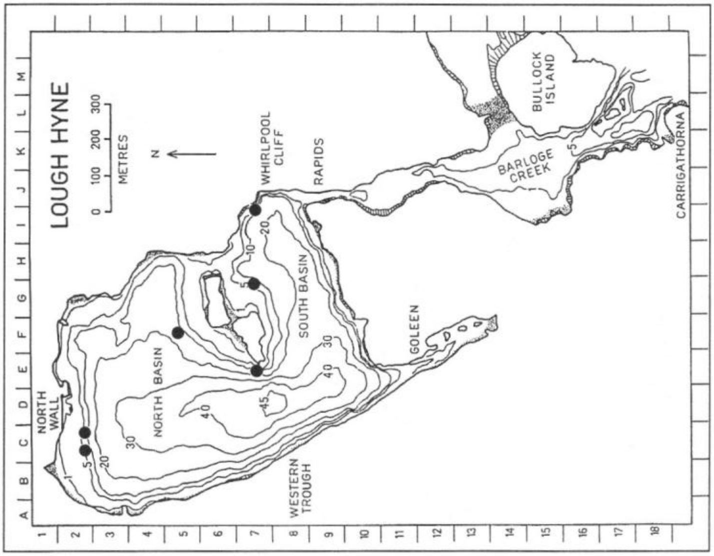


Archidoris pseudoargus (Rapp, 1927)

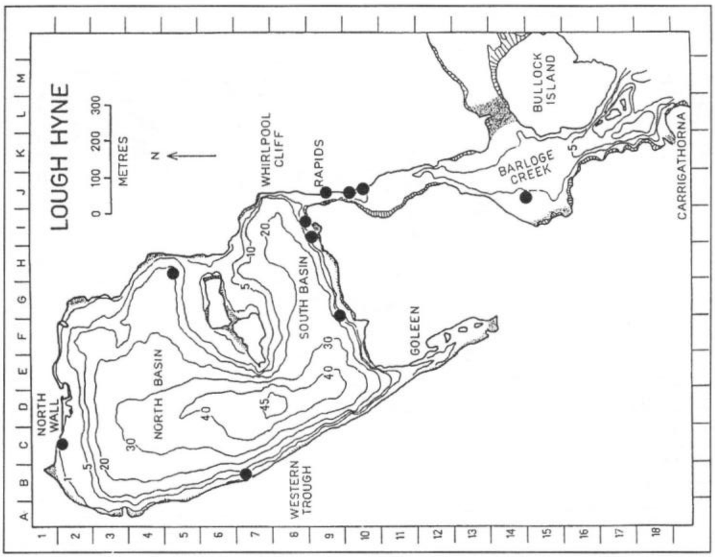


Geitodoris planata (Alder & Hancock, 1846)

FIGURE 51. Distribution maps for *Jorunna tomentosa* and *Janolus cristatus*.



Janolus cristatus (delle Chiaje, 1841)



Jorunna tomentosa (Cuvier, 1804)

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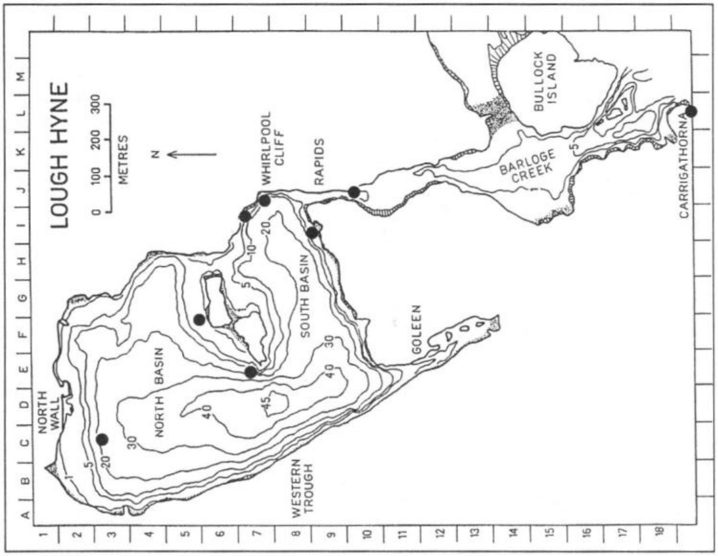
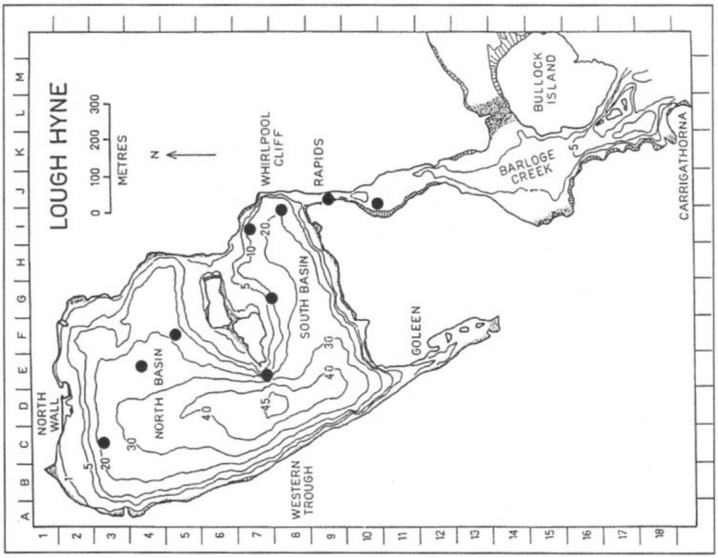
FIGURE 52. Distribution maps for *Janolus hyalinus* and *Coryphella lineata*.



Coryphella lineata (Lovén, 1846)



Janolus hyalinus (Alder & Hancock, 1854)

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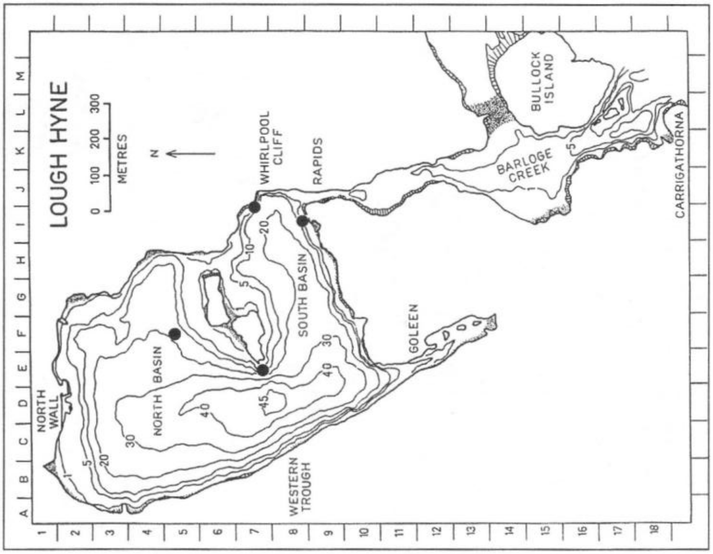
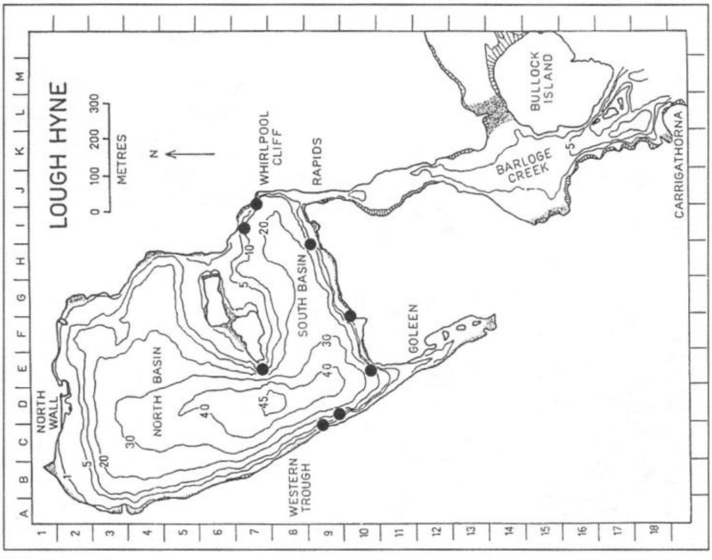
FIGURE 53. Distribution maps for *Flabellina pedata* and *Tergipes tergipes*.

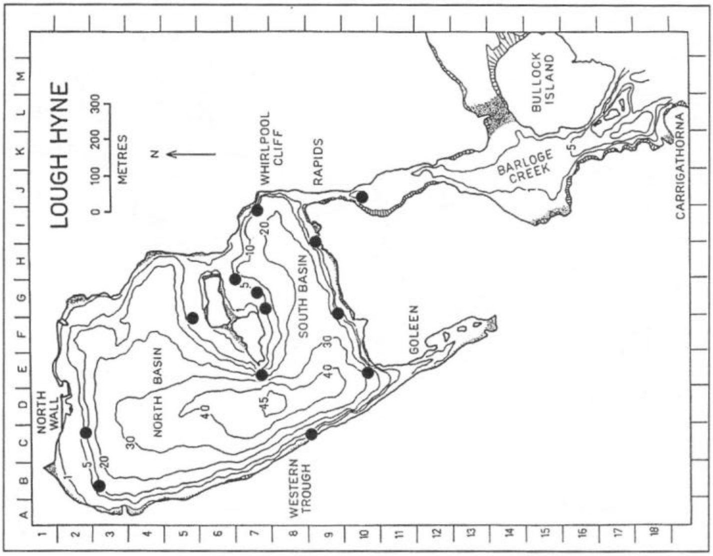


Tergipes tergipes (Forsskål, 1775)

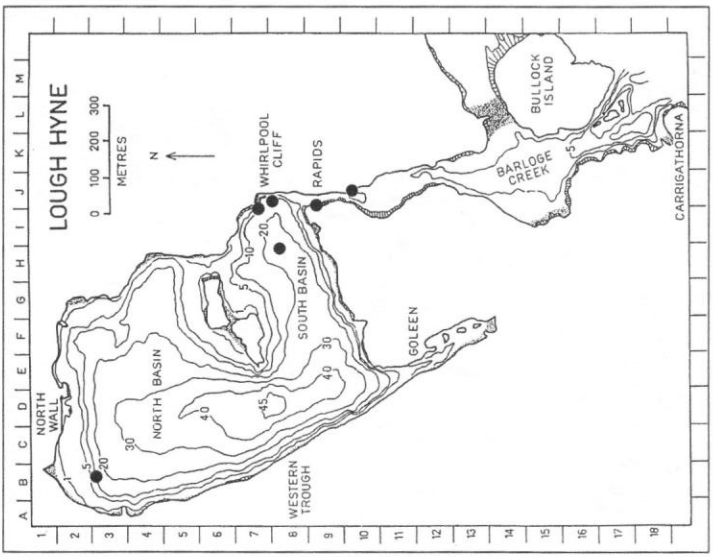


Flabellina pedata (Montagu, 1815)

FIGURE 54. Distribution maps for *Catriona gymnota* and *Cuthona genovae*.

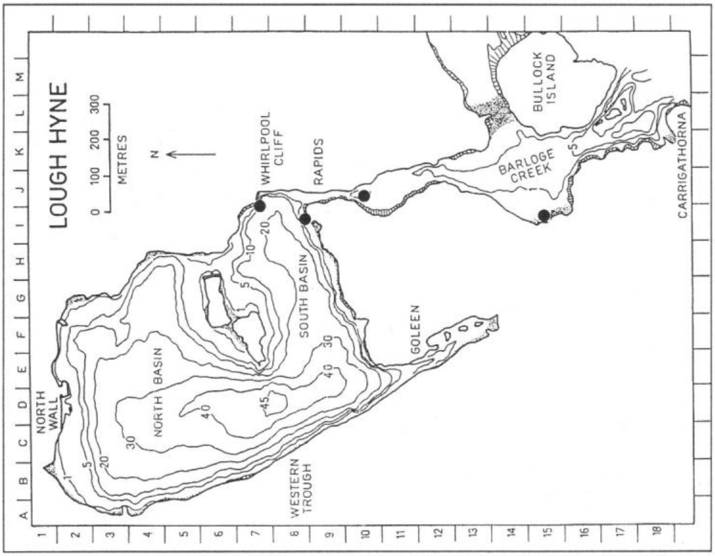


Cuthona genovae (O'Donoghue, 1926)

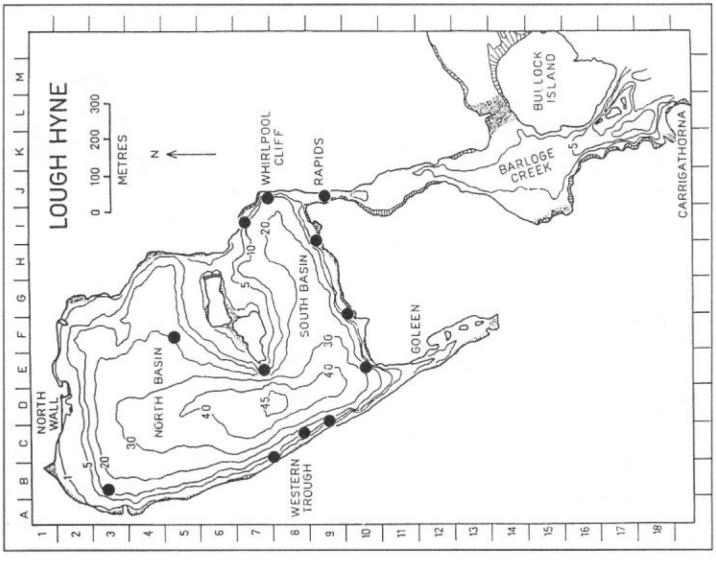


Catriona gymnota (Cuthouy, 1838)

FIGURE 55. Distribution maps for *Eubranchus exiguus* and *Eubranchus farrani*.

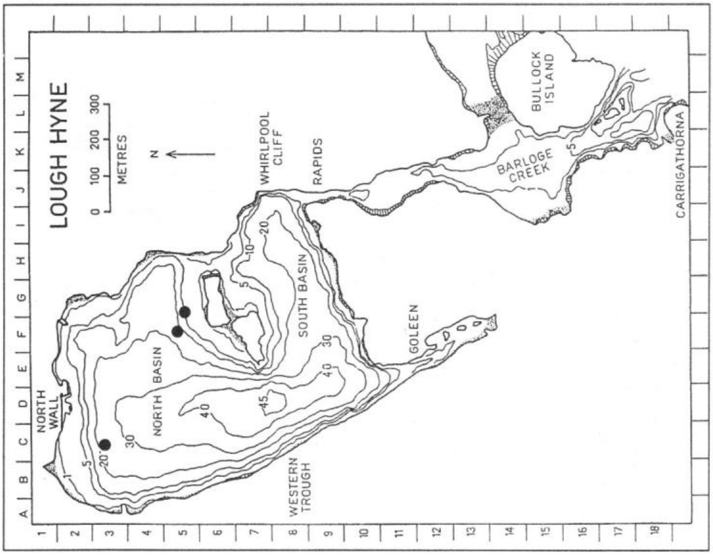


Eubranchus farrani (Alder & Hancock, 1844)

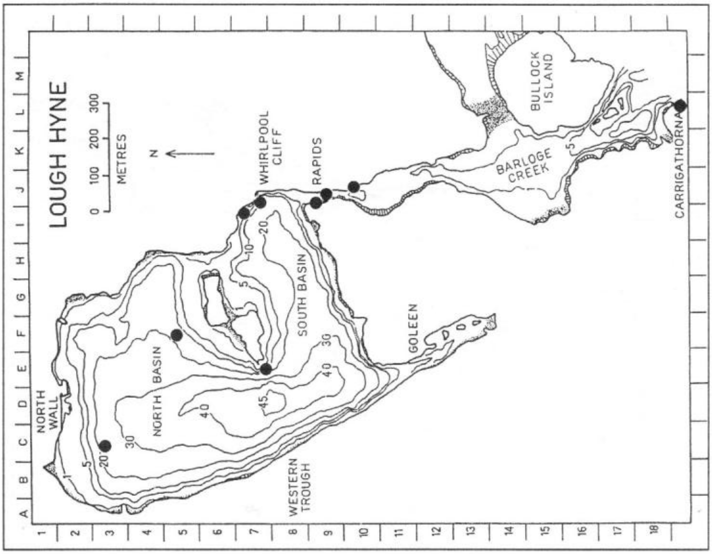


Eubranchus exiguus (Alder & Hancock, 1848)

FIGURE 56. Distribution maps for *Facelina auriculata* and *Facelina bostoniensis*.

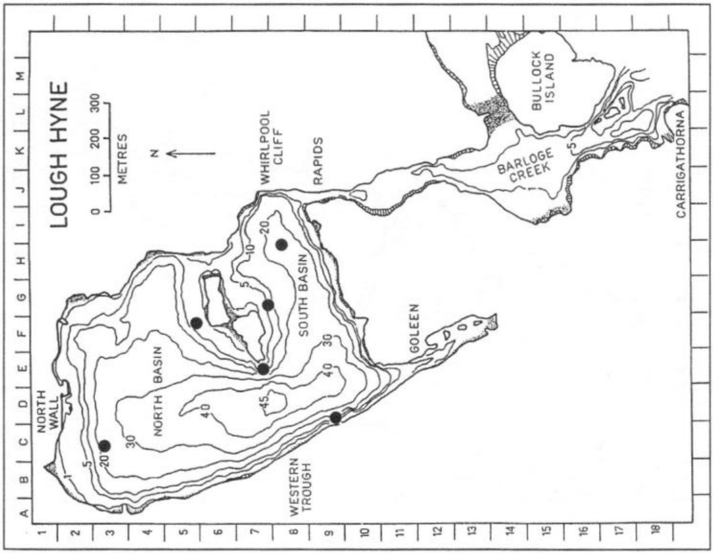


Facelina bostoniensis (Couthouy, 1838)

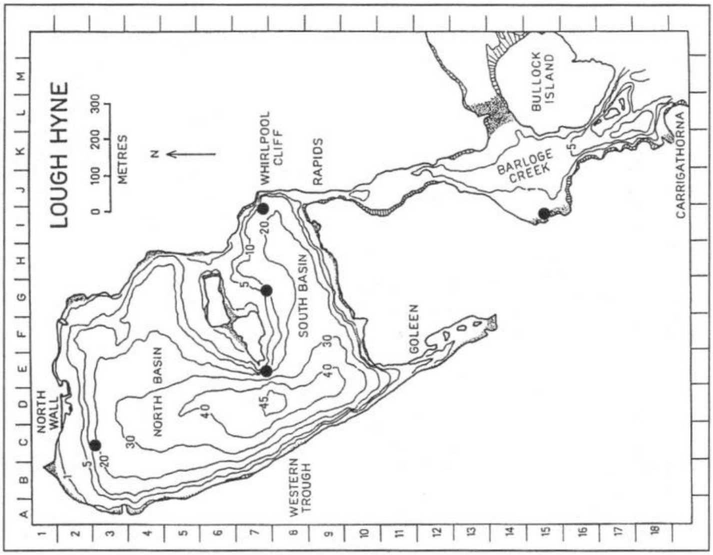


Facelina auriculata (O F Müller, 1776)

FIGURE 57. Distribution maps for *Facelina dubia* and *Favorinus branchialis*.



Facelina dubia Pruvot-Fol, 1949



Favorinus branchialis (Rathke, 1806)

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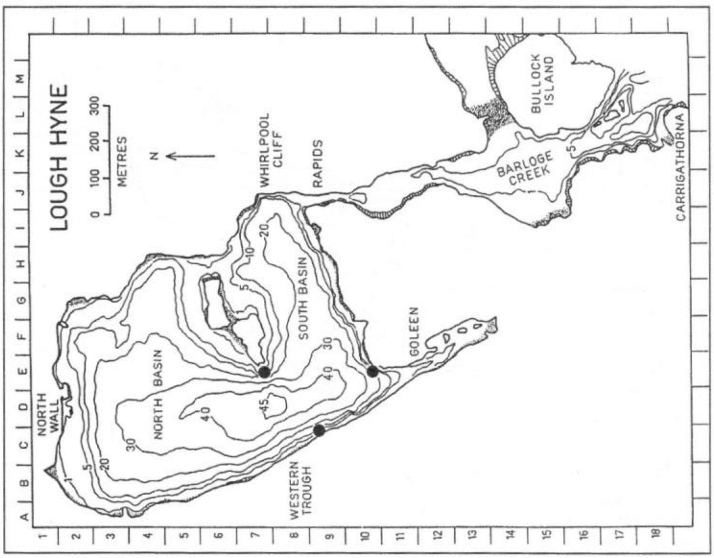
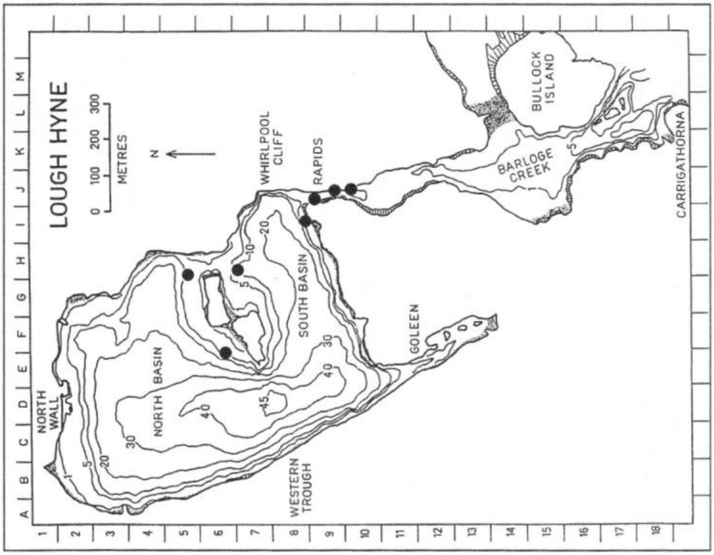
FIGURE 58. Distribution maps for *Dicata odhneri* and *Aeolidia papillosa.*

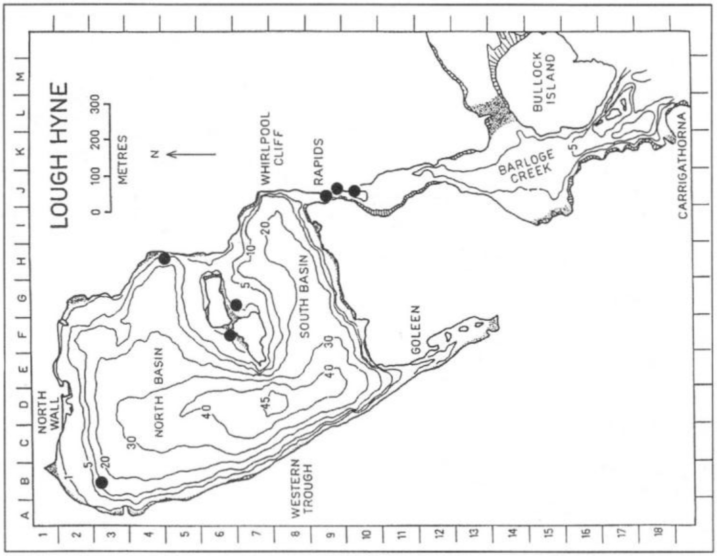


Dicata odhneri Schmekel, 1967

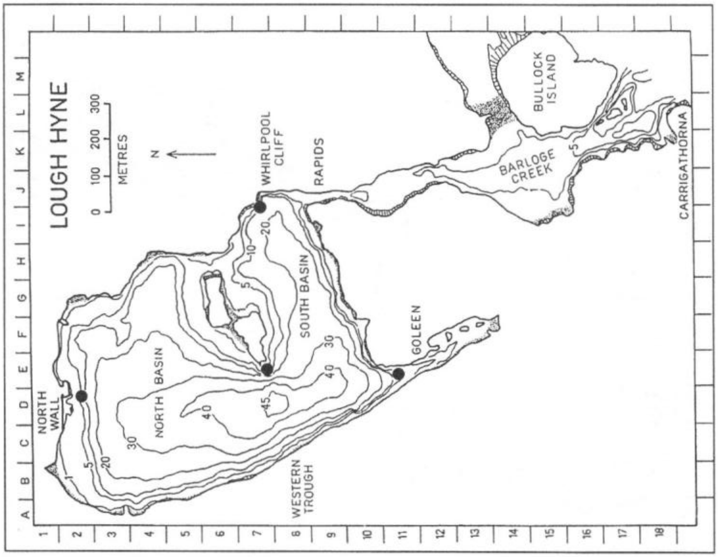


Aeolidia papillosa (Linnaeus, 1761)

FIGURE 59. Distribution maps for *Aeolidiella glauca* and *Aeolidiella sanguinea.*



Aeolidiella sanguinea (Norman, 1877)



Aeolidiella glauca (Alder & Hancock, 1845)

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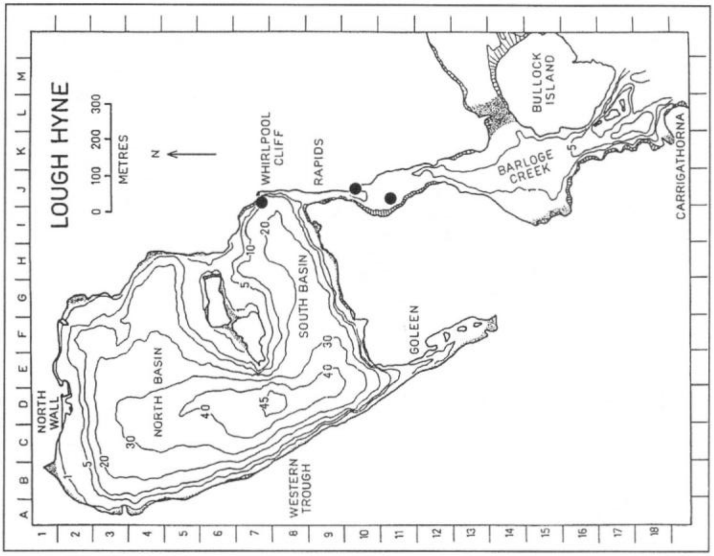
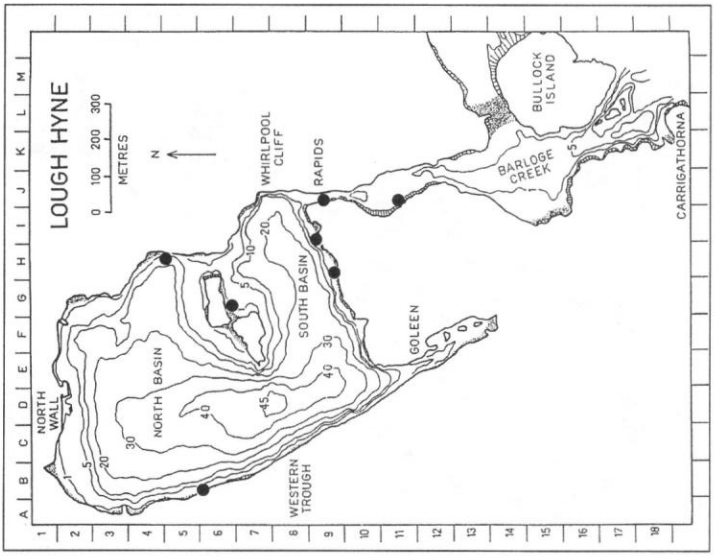
FIGURE 60. Distribution maps for *Leucophytia bidentata* and *Nucula nucleus*.

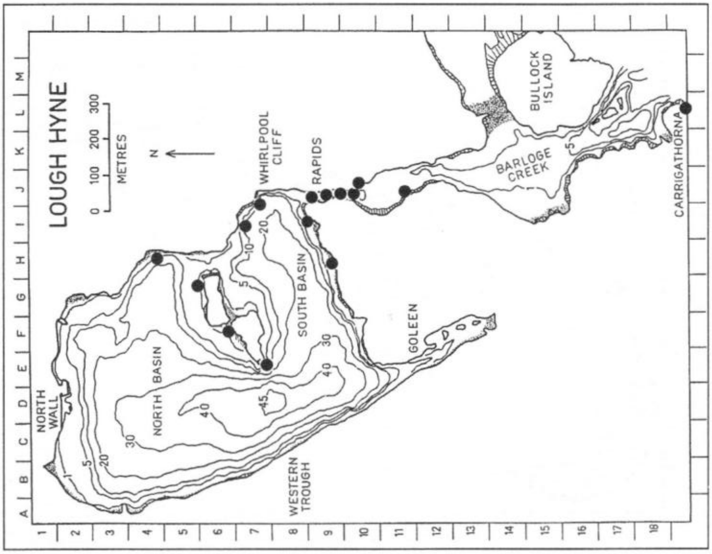


Nucula nucleus (Linnaeus, 1758)

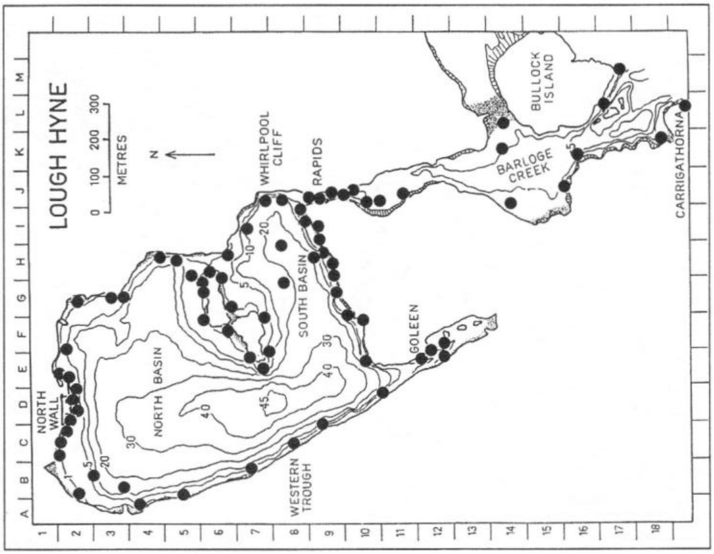


Leucophytia bidentata (Montagu, 1808)

FIGURE 61. Distribution maps for *Mytilus edulis* and *Modiolus modiolus*.

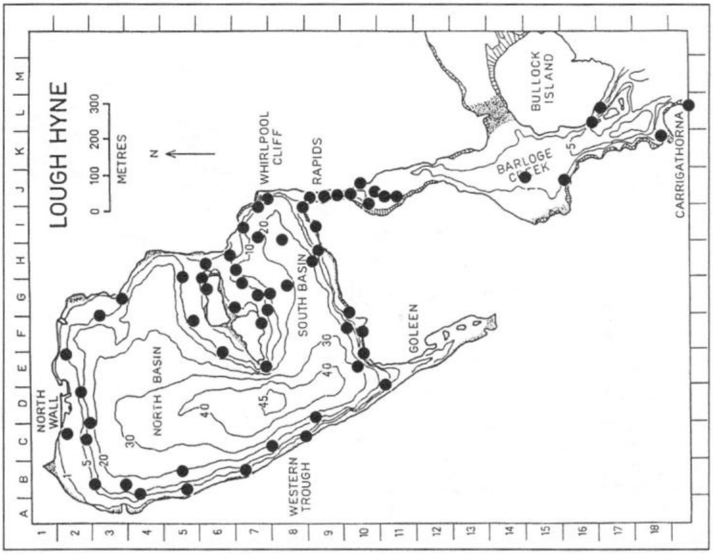


Modiolus modiolus (Linnaeus, 1758)

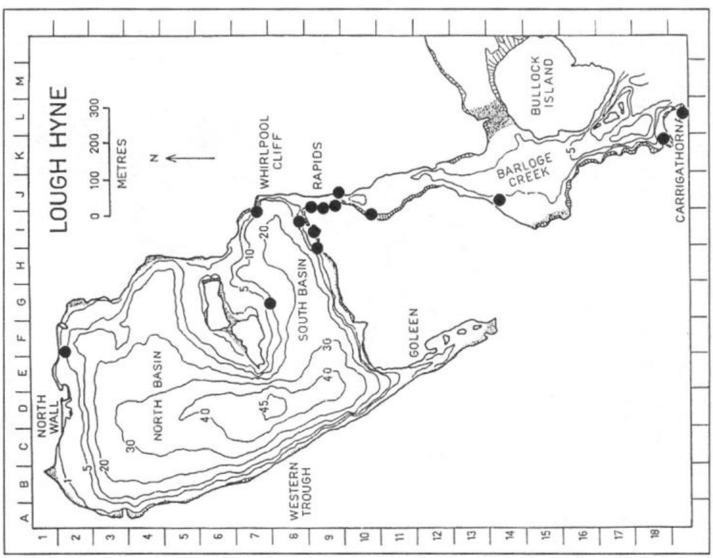


Mytilus edulis Linnaeus, 1758

FIGURE 62. distribution maps for *Modiolula phaseolina* and *Modiolarca tumida.*

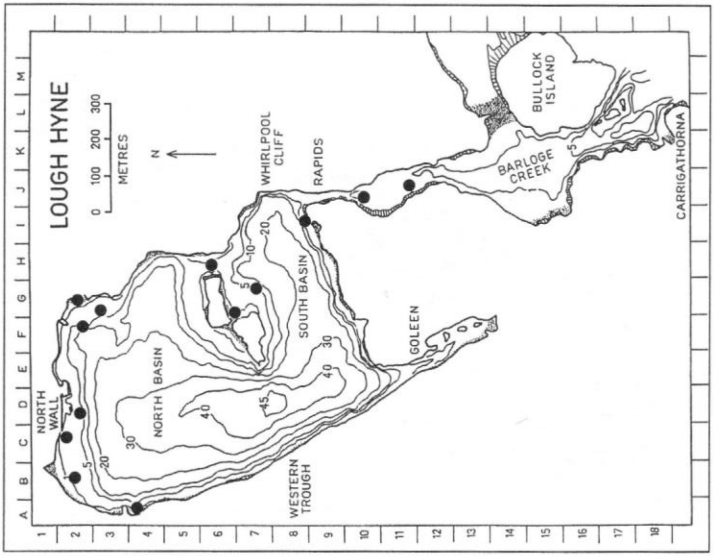


Modiolarca tumida (Hanley, 1843)

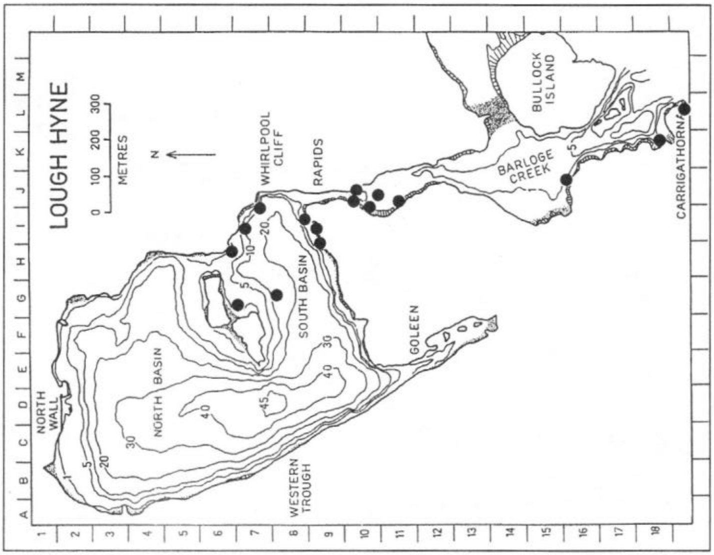


Modiolula phaseolina (Philippi, 1844)

FIGURE 63. Distribution maps for *Musculus discors* and *Ostrea edulis*.

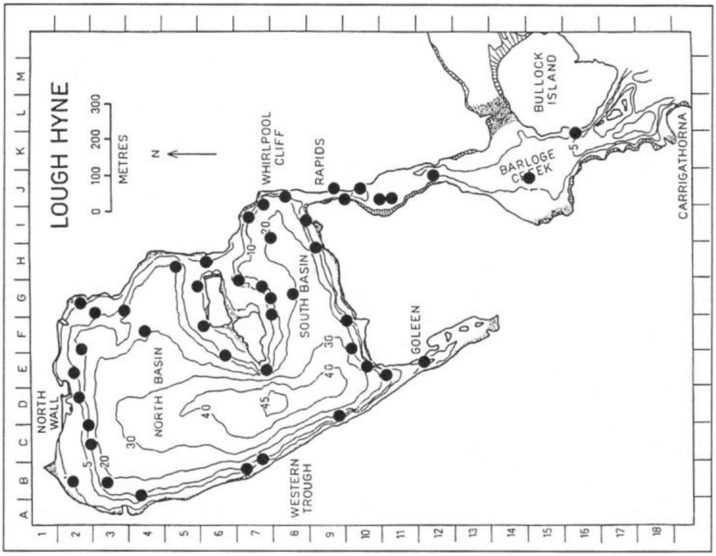


Ostrea edulis Linnaeus, 1758

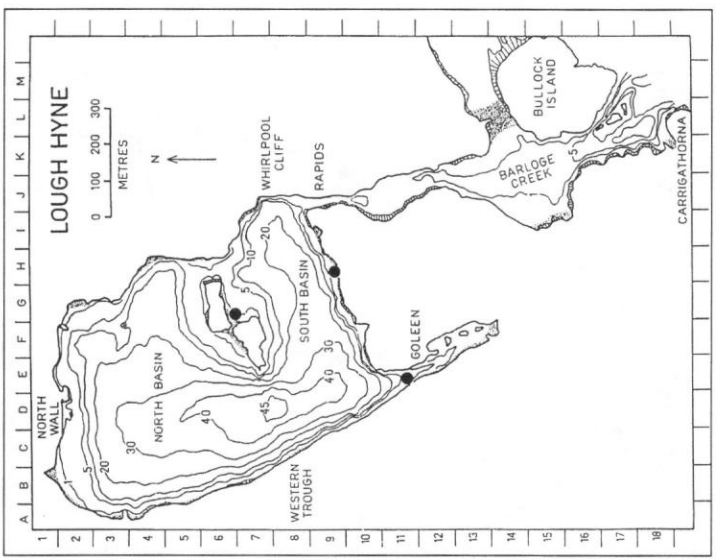


Musculus discors (Linaneus, 1767)

FIGURE 64. Distribution maps for *Crassostrea gigas* and *Pecten maximus*.

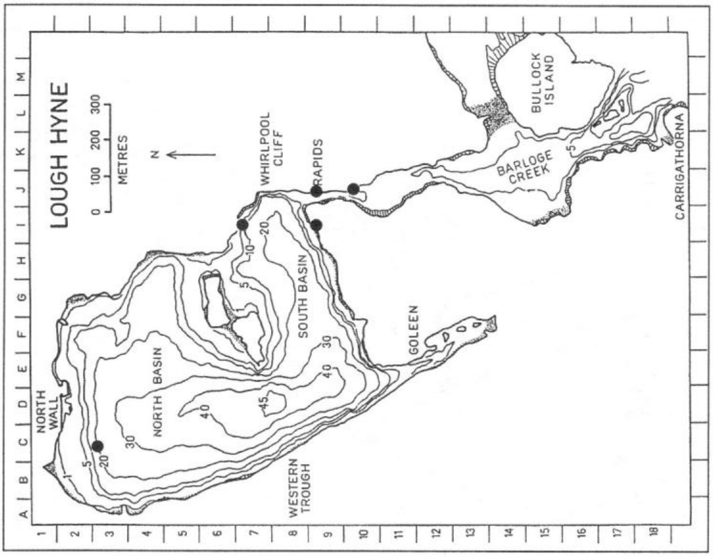


Pecten maximus (Linnaeus, 1758)

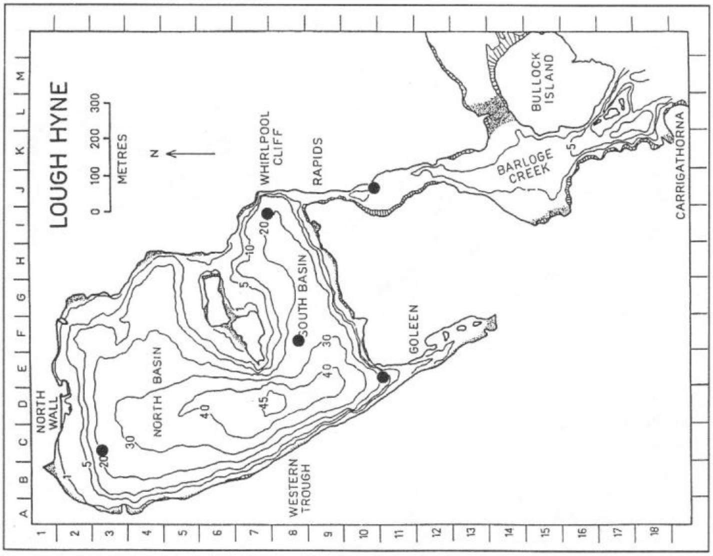


Crassostrea gigas (Thunberg, 1793)

FIGURE 65. Distribution maps for *Aequipecten opercularis* and *Chlamys distorta*.

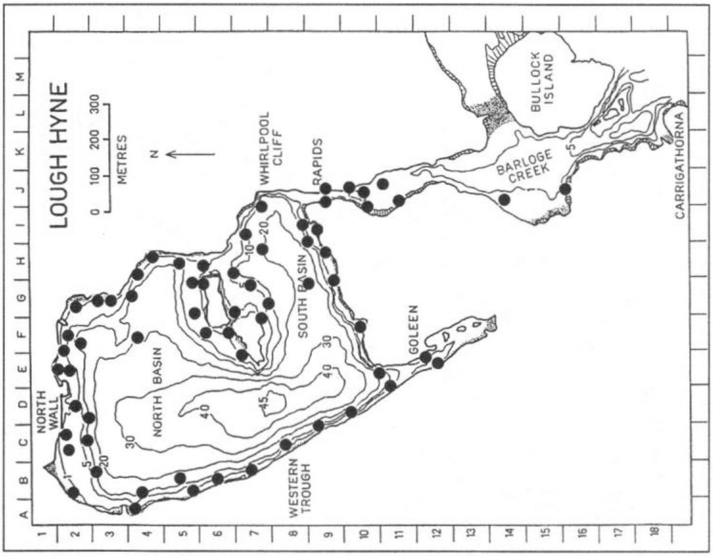


Chlamys distorta (da Costa, 1778)

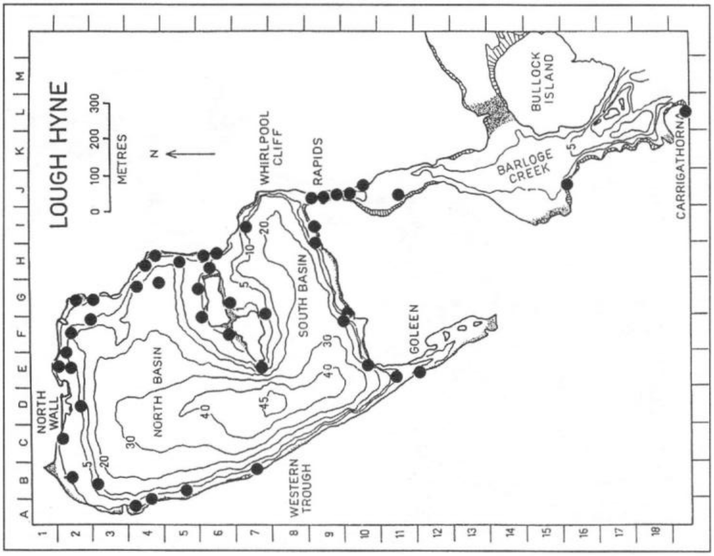


Aequipecten opercularis (Linnaeus, 1758)

FIGURE 66. Distribution maps for *Chlamys varia* and *Anomia ephippium*.

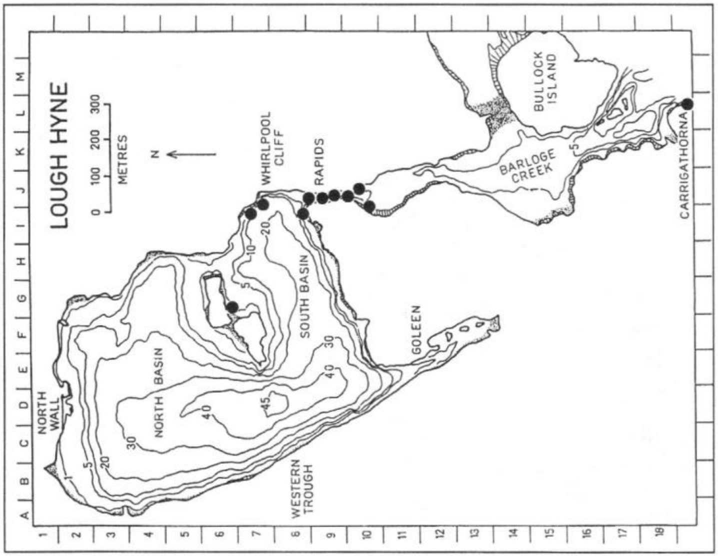


Anomia ephippium Linnaeus, 1758

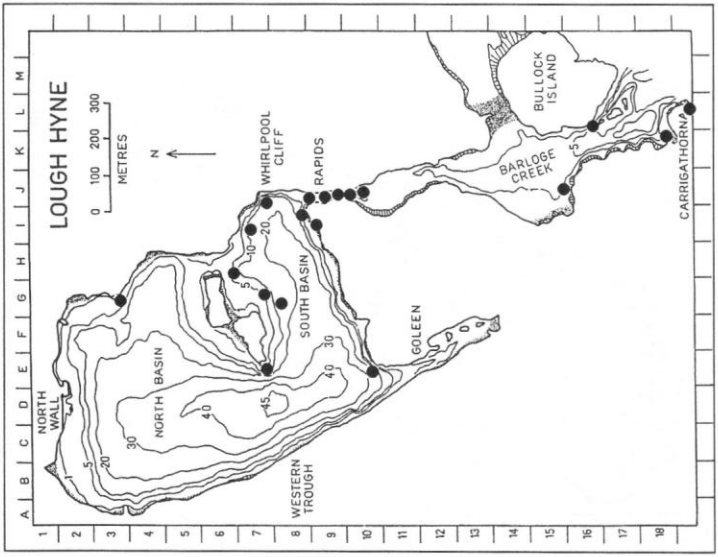


Chlamys varia (Linnaeus, 1758)

FIGURE 67. Distribution maps for *Heteranomia squamula* and *Pododesmus patelliformis*.

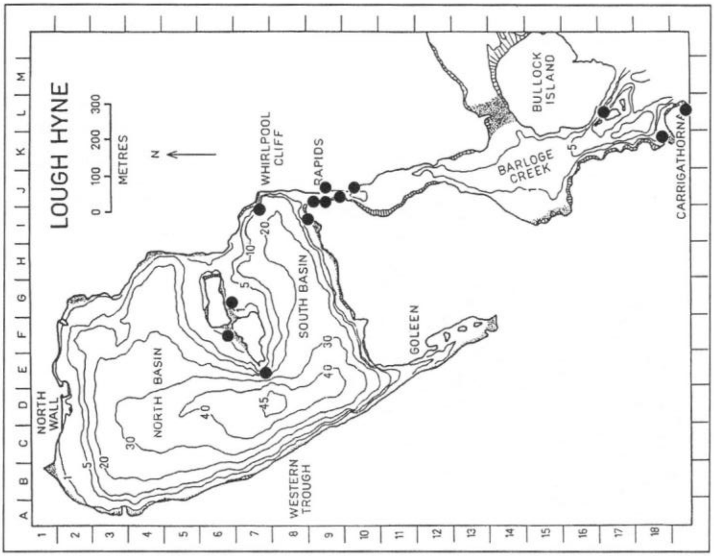


Pododesmus patelliformis (Linnaeus, 1761)

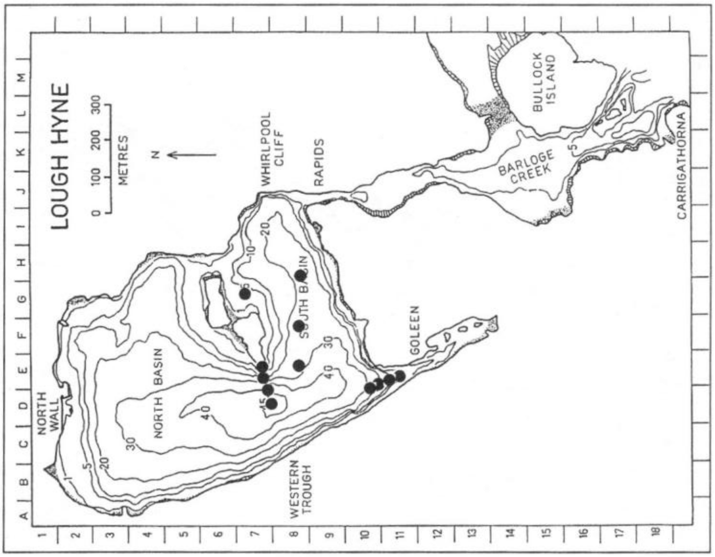


Heteranomia squamula (Linnaeus, 1758)

FIGURE 68. Distribution maps for *Thyasira flexuosa* and *Kellia suborbicularis*.

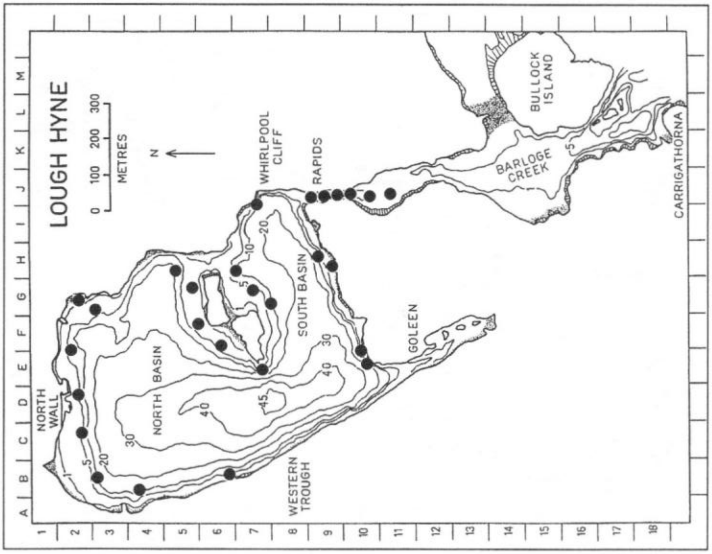


Kellia suborbicularis (Montagu, 1803)

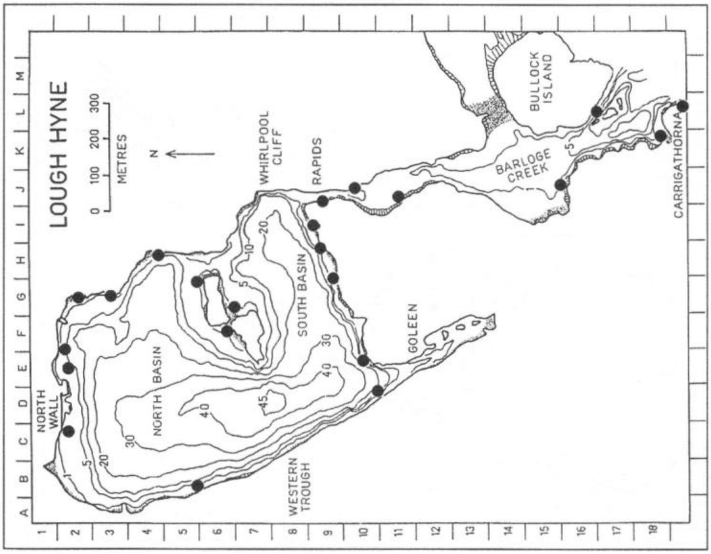


Thyasira flexuosa (Montagu, 1803)

FIGURE 69. Distribution maps for *Lasaea adansoni* and *Mysella bidentata*.

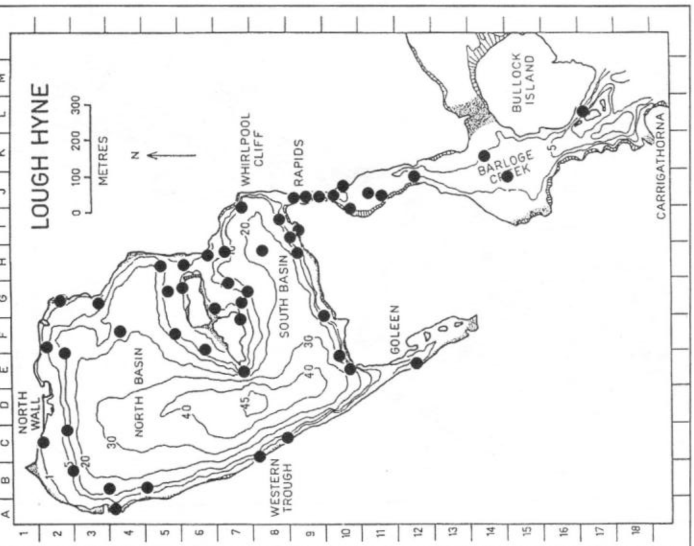


Mysella bidentata (Montagu, 1803)

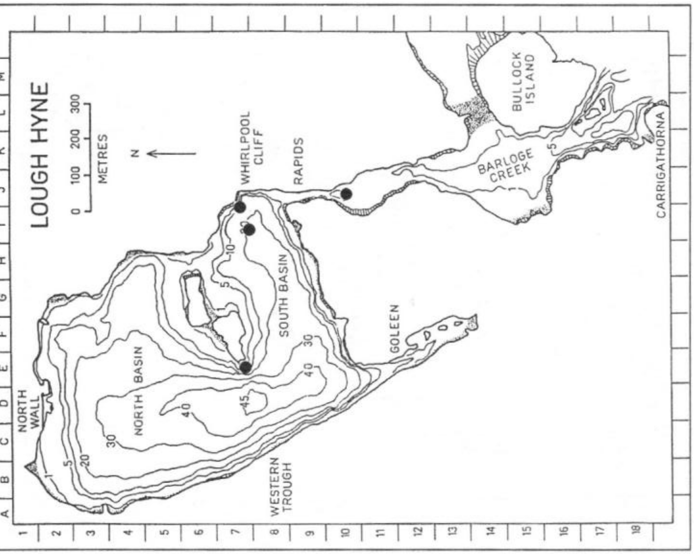


Lasaea adansoni (Gmelin, 1791)

FIGURE 70. Distribution maps for *Parvicardium exiguum* and *Parvicardium ovale*.

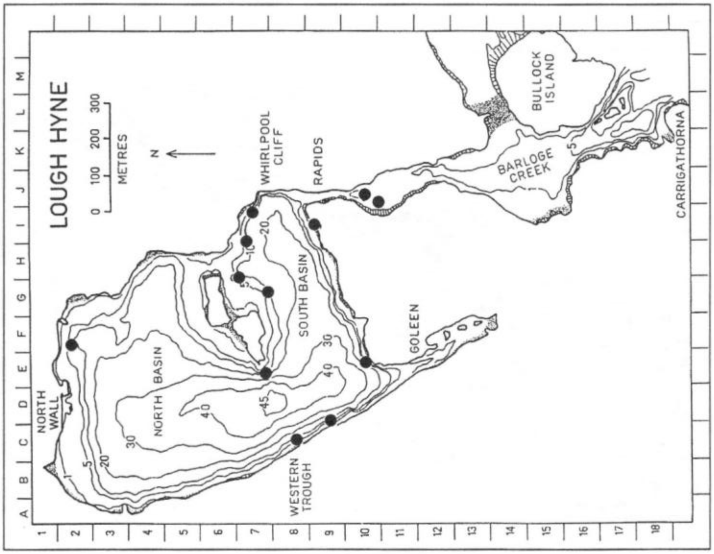


Parvicardium exiguum (Gmelin, 1791)

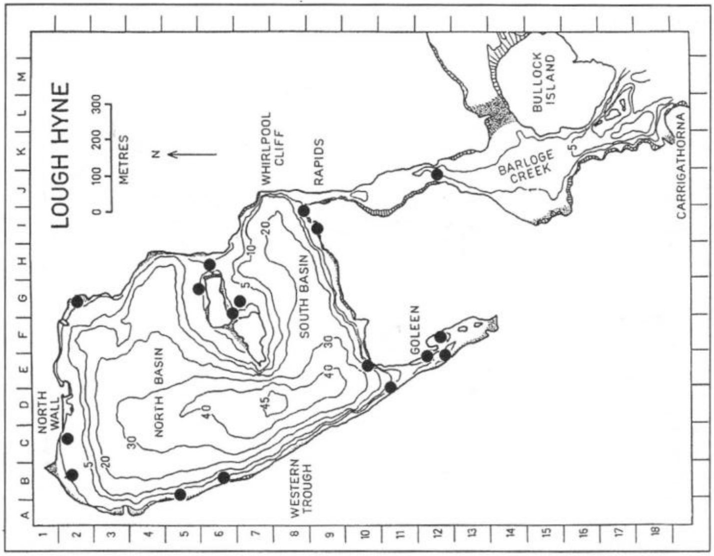


Parvicardium ovale (G B Sowerby II, 1840)

FIGURE 71. Distribution maps for *Parvicardium scabrum* and *Cerastoderma edule*.



Parvicardium scabrum (Philippi, 1844)



Cerastoderma edule (Linnaeus, 1758)

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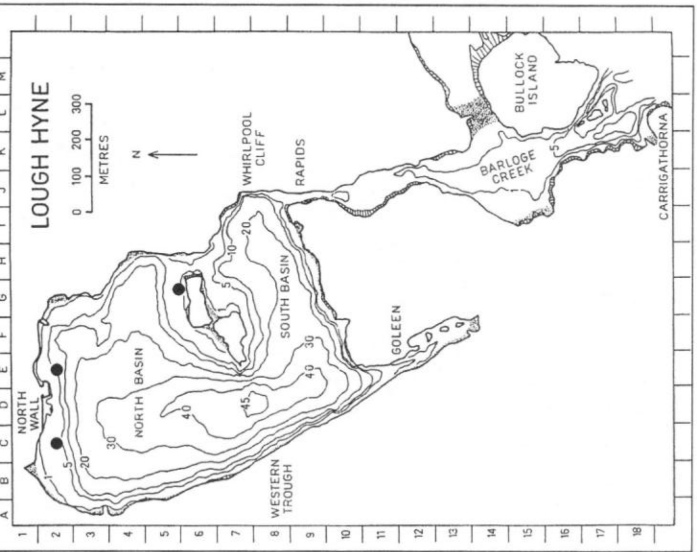
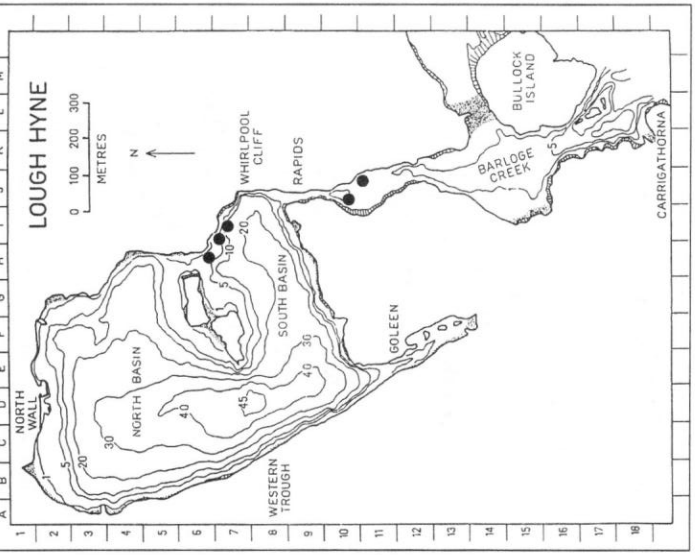
FIGURE 72. Distribution maps for *Lutraria angustior* and *Gari depressa.*

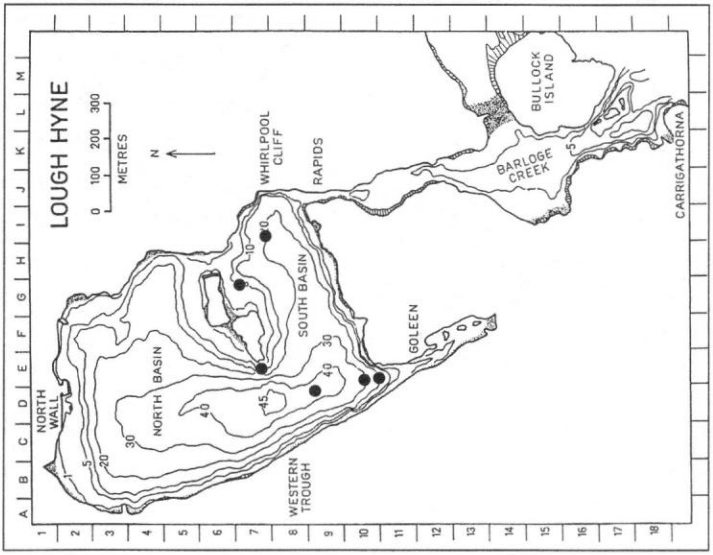


Gari depressa (Pennant, 1777)

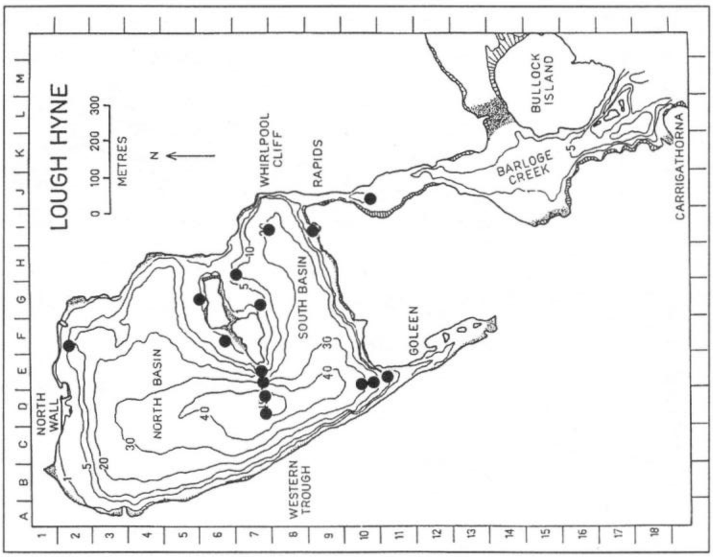


Lutraria angustior Philippi, 1844

FIGURE 73. Distribution maps for *Abra alba* and *Abra nitida*.

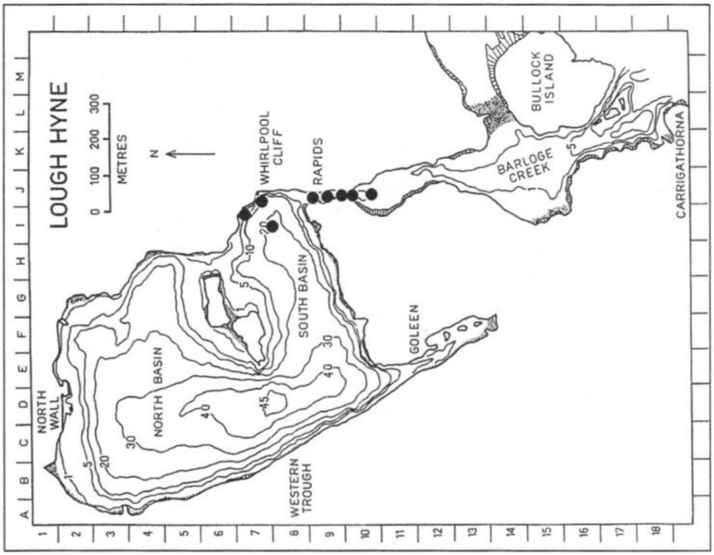


Abra nitida (O F Müller, 1776)

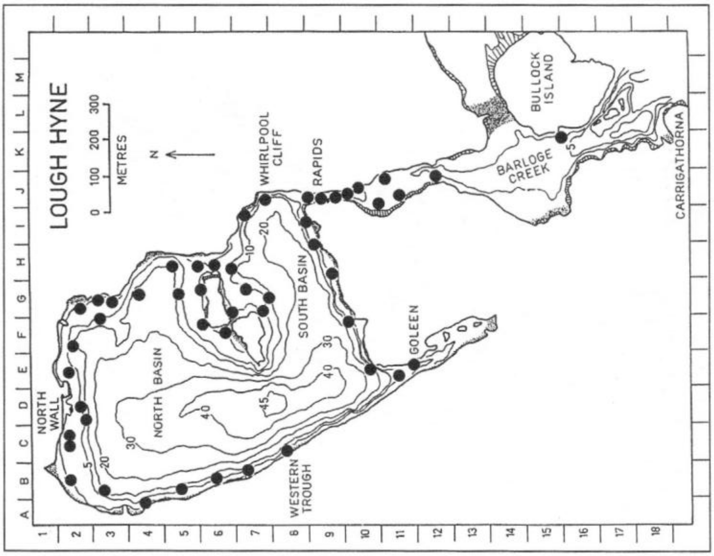


Abra alba (W Wood, 1802)

FIGURE 74. Distribution maps for *Venus verrucosa* and *Clausinella fasciata*.

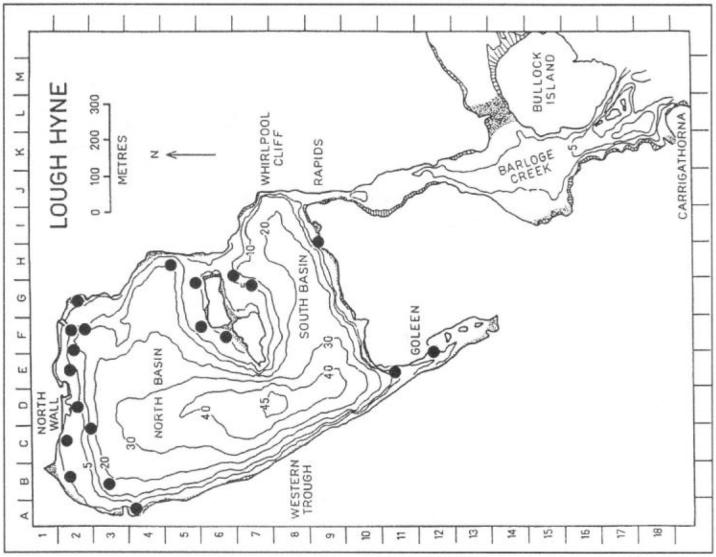


Clausinella fasciata (da Costa, 1778)

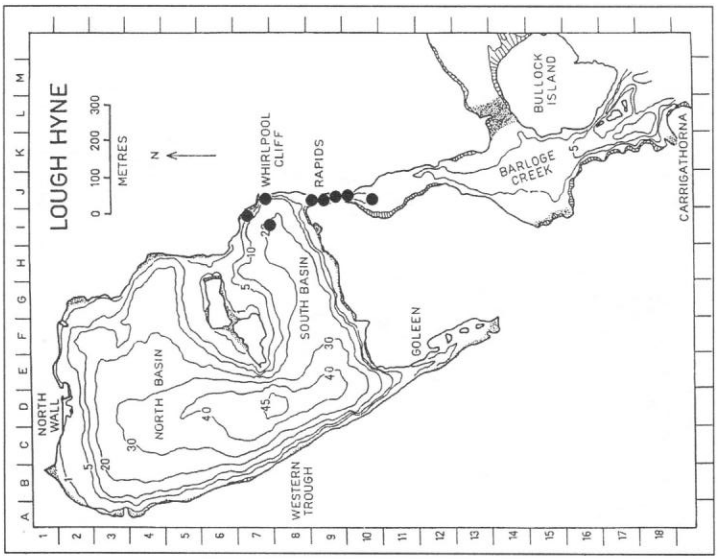


Venus verrucosa Linnaeus, 1758

FIGURE 75. Distribution maps for *Timoclea ovata* and *Tapes aureus*.

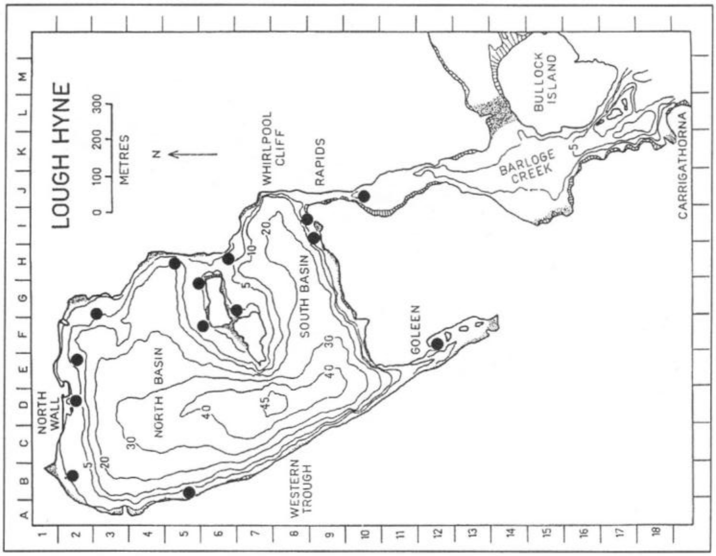


Tapes aureus (Gmelin, 1791)

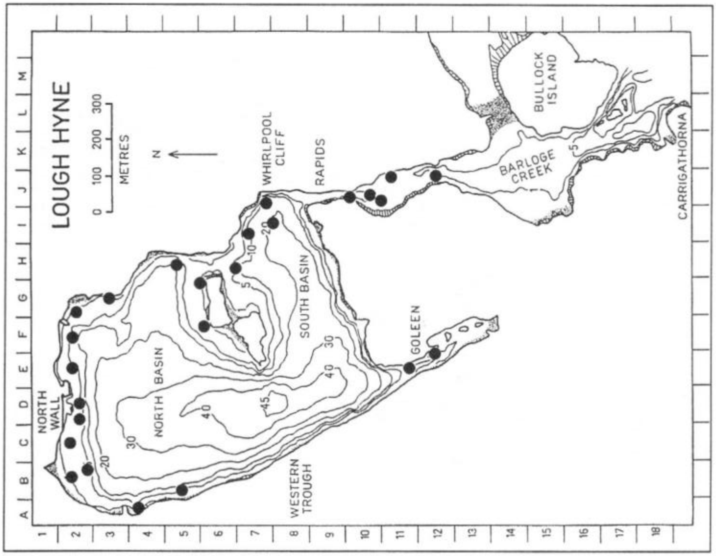


Timoclea ovata (Pennant, 1777)

FIGURE 76. Distribution maps for *Tapes decusssatus* and *Tapes rhomboides*.

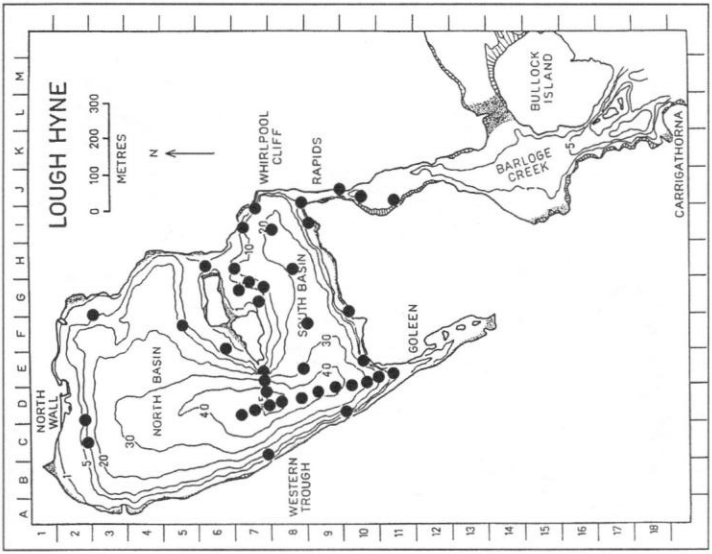


Tapes decussatus (Linnaeus, 1758)

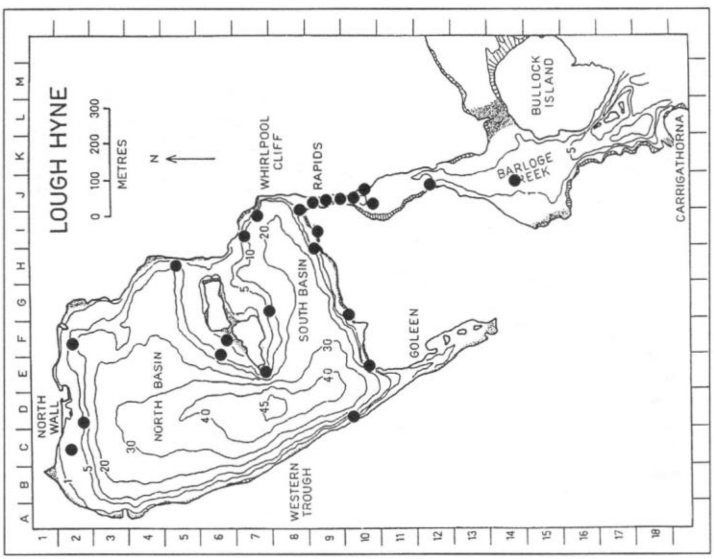


Tapes rhomboides (Pennant, 1777)

FIGURE 77. Distribution maps for *Venerupis senegalensis* and *Corbula gibba.*

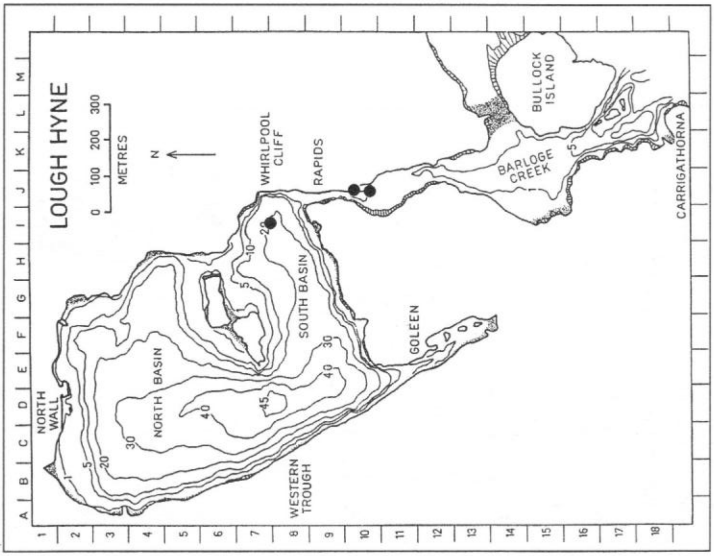


Corbula gibba (Olivi, 1792)

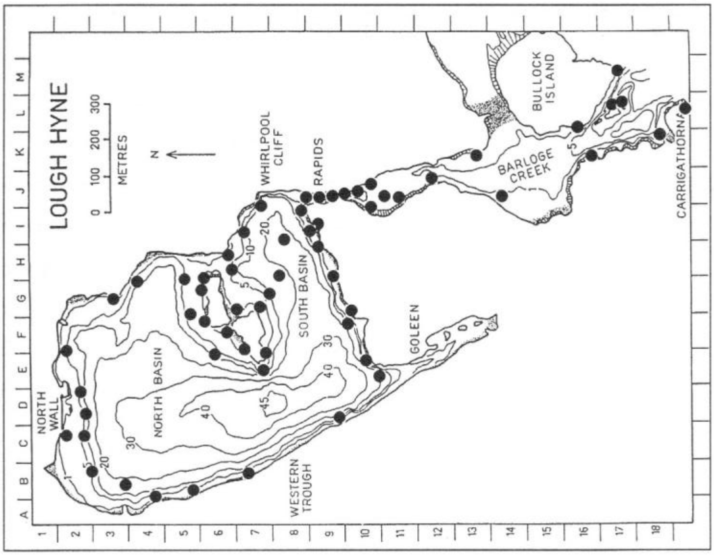


Venerupis senegalensis (Gmelin, 1791)

FIGURE 78. Distribution maps for *Hiatella arctica* and *Thracia villosiuscula.*

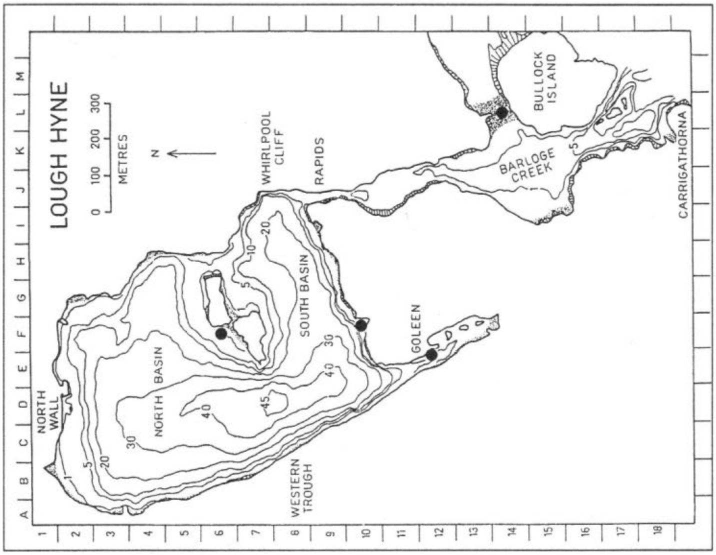


Thracia villosiuscula (Macgillivray, 1827)



Hiatella arctica (Linnaeus, 1767)

FIGURE 79. Distribution map for *Sepiola atlantica*.



Sepiola atlantica Orbigny in Ferussac & Orbigny, 1840

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NOTES ON SIX CHIRONOMIDAE (DIPTERA, INSECTA) NEW TO IRELAND FROM CO. MAYO

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Introduction

In a follow-up study of the Chironomidae of Clare Island (Murray and Murray, 2003) from the ongoing Royal Irish Academy's New Survey of Clare Island, fieldwork was undertaken in 2004, supported by a grant from the Praeger Committee of the Royal Irish Academy, to collect Chironomidae from the west Mayo mainland adjoining Clare Island. This investigation, along with examination of some samples collected previously in the region, has yielded the six new Irish faunal records reported here as adult male Chironomidae or pupal exuviae. Identifications are based on Langton and Visser (2003), Pinder (1978), Reiss (1969) and Sæther (1990, 2004, 2005). Voucher specimens of these species have been included in the recently prepared Heritage Council Collection of Irish Chironomidae (HCCIC) deposited in the National Museum of Ireland (NMI) (Murray, 2005). Each specimen in the collection has been assigned a unique number and the relevant numbers of the species/specimens reported in this paper are given in the text accompanying the records cited below.

Additions to the Irish faunal inventory

Limnophyes asquamatus Andersen, 1937

MAYO: Doo Lough (L835686), 22 August 2002, adult males caught on the wing, leg. D. and W. Murray. Voucher specimen #343 in HCCIC, NMI.

These specimens were found during examination of adult Chironomidae in aerial sweep net collections along the shoreline of Doo Lough made in 2002 contemporaneous with the study of Clare Island Chironomidae (Murray and Murray, 2003). Dettinger-Klemm (2001a) considers *L. asquamatus* to be a drought tolerant semi-aquatic / terrestrial species whose larvae occur in locations characterised by fluctuations in moisture content and temporary flooding. Such conditions clearly pertain along the margins of Doo Lough.

***Orthocladius* (*Eudactylocladius*) *olivaceus* (Kieffer, 1911)**

MAYO: Doo Lough (L834687), 22 August 2002, pupal exuviae, leg. D. and W. Murray. Voucher specimen #396 in HCCIC, NMI.

Eudactylocladius larvae often dominate the fauna of thin water films in temperate regions while in arctic regions they are also known to occur in innundated soil and lake margins. Langton and Visser (2003) consider *O. olivaceus* to be typical of northern and mountain lakes. Nine species of *Eudactylocladius* are known from the Holarctic, seven of which have a palaearctic distribution (Sæther, 2005). To date, only one other species of *Eudactylocladius, E. fuscimanus* (Kieffer), is on record from Ireland (Ashe *et al.*, 1998) which has also been recorded more recently by Langton (2002) and by Murray and Murray (2003).

***Orthocladius* (*Symposiocladius*) *holsatus* Goetghebuer, 1937**

MAYO: Lough Mallard (M121902), Castlebar, 30 September 2004, pupal exuviae, leg. D. and W. Murray. Voucher specimen #430 in HCCIC, NMI.

O. holsatus was transferred to the subgenus *Symposiocladius* by Sæther *et al.* (2000) prior to a comprehensive review of the subgenus by Sæther (2004). The first description of pupal exuviae *of S. holsatus* was provided by C. F. Humphries (Humphries, 1937) (as *Trichocladius holsatus*) from the single original reared type material from Saap See, Germany, on which Goetghebuer (1937) based his description of the adult male. The holotype adult material is missing and the single Saap See pupal exuviae, now deposited in Zoologische Staatssammlungen Munich, is the sole remaining integral part of the original type of Goetghebuer's

Orthocladius holsatus. A comprehensive description of all stages and both sexes has been given by Dettinger-Klemm (2001b). The species is believed to be eurythermous and is known from stagnant and flowing water. Larvae live in floating algal mats (*Nostoc* spp.).

***Psectrocladius (Psectrocladius) ventricosus* Kieffer, 1925**

MAYO: Carrokeel Lough, Murrisk (L921830), 5 August 2004, pupal exuviae, leg. D. and W. Murray. Voucher specimen #494 in HCCIC, NMI.

P. ventricosus is a brackish water species whose pupal exuviae key out together with the freshwater species *P. sordidellus* (Zetterstedt) in Langton and Viser *(op. cit.)*. Carrokeel Lough, where *P. ventricosus* was found, is a shallow coastal lagoon formed behind a sedimentary barrier through which sea water may percolate giving rise to slightly saline conditions in the lough.

***Dicrotendipes pallidicornis* (Goetghebuer, 1934)**

MAYO: Lough Furnace (L975965), on the pier / shore adjacent to the Salmon Research Agency Laboratory, Burrishoole, 7 July 1997. Adult male caught on the wing, leg. D. Murray. Voucher specimen #661 in HCCIC, NMI.

This species has a widespread distribution in Europe and is commonly found in freshwater and brackish pools. This record from the tidal Lough Furnace is in keeping with the known larval ecology of *D. pallidicornis*.

***Micropsectra attenuata* Reiss, 1969**

MAYO: 1st Order stream on the northern slope of Croagh Patrick at Cloonagh (L958814), Westport, 8 May 2003, adult male caught on the wing, leg. D. and W. Murray. Voucher specimen #841 in HCCIC, NMI.

Members of the *attenuata* group are amongst the smallest *Micropsectra* species known with winglengths of less than 2.0mm. Reiss (1969) considers larvae of *M. attenuata* to be cold stenothermic denizens of seepages and lentic regions in the upper courses of small streams.

Acknowledgements

Field work in 2004 was supported by a grant from the Praeger Committee of the Royal Irish Academy which is gratefully acknowledged. Compilation of the Heritage Council Collection of Irish Chironomidae was made possible by a 2005 Wildlife Grant from the Heritage Council. The authors acknowledge use of facilities of the UCD School of Biology and Environmental Science, made available by Professor T. Bolger, Head of School.

References

Ashe, P., O'Connor, J. P. and Murray, D. A. (1998) A checklist of Irish aquatic insects. *Occasional Publication of the Irish Biogeographical Society* **3**: 1-80.

Dettinger-Klemm, P. M. A. (2001a) Drought tolerance and parthenogenesis in the semiaquatic/terrestrial chironomid *Limnophyes asquamatus* Andersen, 1937 (Diptera: Chironomidae). *Deutsche Gesellschaft für Limnologie (DGL).* Tagunsbericht **2000**: 55-359.

Dettinger-Klemm, P. M. A. (2001b) The metamorphosis *of Orthocladius* (*Symposiocladius*) *holsatus* Goetghebuer, 1937, with the description of *Orthocladius* (*Symposiocladius*) *lunzensis* sp. n. (Diptera: Chironomidae). *Aquatic Insects* **23**: 45-62.

Goetghebuer, M. (1937) Quatre chironomides nouveaux d'Allemagne. *Archiv für Hydrobiologie* **31**: 508-510.

Humphries, C. F. (1937) Neue *Trichocladius*-Arten. *Stettin entomologische Zeitung* **98**: 185-195.

Langton, P. H. (2002) A preliminary survey of the non-biting midges (Diptera: Chironomidae) of Northern Ireland. *Bulletin of the Irish Biogeographical Society* **26**: 14-28.

Langton P. H. and Visser, H. (2003) *Chironomidae exuviae - a key to pupal exuviae of the West Palaearctic Region.* Interactive System for the European Limnofauna Biodiversity Centre of ETI, UNESCO Publishing, Paris.

Murray, D. A. (2005) Irish Chironomidae (Diptera: Insecta), reference collection and catalogue. Report to the Heritage Council and National Museum of Ireland. 67pp.

Murray, D. A. and Murray. W. A. (2003) A reassessment of Chironomidae (Diptera) of Clare Island, Co. Mayo, with first records of *Acamptocladius reissi* Cranston & Sæther and *Limnophyes angelicae* Sæther (Orthocladiinae) for the Irish faunal checklist. *Bulletin of the Irish Biogeographical Society* **27**: 255-269.

Pinder, L. C. V. (1978) A key to the adult males of British Chironomidae. *Scientific Publications of the Freshwater Biological Association* **37**: 1-189.

Reiss, F. (1969) Revision der Gattung *Micropsectra* Kieff., 1909 (Diptera, Chironomidae). 1: Die *attenuata*-Gruppe der Gattung *Micropsectra*. Beschreibung 5 neuer Arten aus Mitteleuropa und Nordafrika. *Deutsche entomologische Zeitschrift* **16**: 431-449.

Sæther, O. A. (1990) A review of the genus *Limnophyes* Eaton from the Holarctic and Afrotropical regions (Diptera: Chironomidae, Orthocladiinae). *Entomologica Scandinavica* **35**: 1-135.

Sæther, O. A. (2004) Three new species of *Orthocladius* subgenus *Eudactylocladius* (Diptera: Chironomidae) from Norway. *Zootaxa* **508**: 1-12.

Sæther, O. A. (2005) A new subgenus and new species of *Orthocladius* van der Wulp with a phylogenetic evaluation of the validity of the subgenera of the genus (Diptera: Chironomidae). *Zootaxa* **974**: 1-56.

Sæther, O. A., Ashe, P. and Murray, D. A. (2000) Family Chironomidae. Pp 113-334. *In* Papp, L. and Darvas, B. (eds) *Contributions to a manual of Palaearctic Diptera* (with special reference to the flies of economic importance). **A 6**. Science Herald, Budapest.

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FOUR CHIRONOMIDAE (DIPTERA, INSECTA) NEW TO IRELAND FROM REMOTE UPLAND LAKES

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Introduction

Skimming of surface waters with a hand-held net along leeward shorelines of lakes often yields copious specimens of the insect family Chironomidae. During the appropriate season of the year such collections yield pupal exuviae of recently emerged adults, regularly including mature pupae and occasionally containing partially emerged or intact adult specimens.

During a study supported by The Heritage Council on the ecology of thirteen remote upland (>300m altitude) oligotrophic Irish lakes, contemporaneous surface water collections on exposed shorelines were undertaken (JRB) in spring and summer 2005 to obtain chironomid pupal exuviae. Examination of material derived from these collections (DAM) during compilation of a slide-mounted voucher reference collection of Irish Chironomidae in a separate Heritage Council project, yielded material of taxonomic interest and the four species records new to the Irish faunal list reported in this paper. Collections and slide preparations of pupal exuviae were made following procedures outlined by Langton and Visser (2003). Slide preparations of adult males were made according to Pinder (1989). Voucher specimens of these species have been included in the above mentioned Heritage Council Collection of Irish Chironomidae deposited in the National Museum of Ireland and the unique voucher numbers assigned to the specimens are cited in the text for the new records reported here.

The following abbreviations are used: m = altitude in metres; ImM = adult male; pe = pupal exuviae; HCCIC = Heritage Council Collection of Irish Chironomidae; NMI = National Museum of Ireland, Dublin. For each record, the Irish Grid Reference is given (grid letter and six-figure number, e.g. G871886).

Chironomidae new to the Irish faunal checklist

Subfamily Orthocladiinae

***Cricotopus (Isocladius) brevipalpis* Kieffer, 1909**

DONEGAL: Carn Lough (G871886), 310m, 27 July 2005, pe (voucher specimen #266, HCCIC, NMI). **TIPPERARY**: Black Lough (R738771), 425m, 10 August 2005, pe. **KERRY**: Eagles Lough (V674728), 320m, 9 August 2005, pe.

Larvae of *C. brevipalpis* mine in the leaves of *Potamogeton natans* L. and the species is considered typical of streams and northern lakes (Langton and Visser, *op. cit.)*.

***Pseudosmittia angusta* (Edwards, 1929)**

TIPPERARY: Lough Curra (R867242), Galtymore Mountain, 574m, 10 August 2005, ImM, (voucher specimen #505, HCCIC, NMI).

Larvae of *Pseudosmittia* live in moist soils and semi aquatic habitats. *P. angusta* is common in northwestern and central Europe.

Subfamily Chironominae - Tanytarsini

***Micropsectra lindebergi* Säwedal, 1976**

KERRY: Lough Coomloughra (V783849), Caher Mountain range, 470m, 26 April 2005, pe. **TIPPERARY**: Lough Curra (R867242), Galtymore Mountain, 574m, 26 April 2005, pe. **WICKLOW**: Lough Ouler (O091023), Tonlagee Mountain, 565m, 19 May 2005 (voucher specimens #853 ImM and #854 pe, HCCIC, NMI).

Langton and Visser (*op. cit.*) consider *M. lindebergi* to be characteristic of northern lakes.

***Tanytarsus aberrans* Lindeberg, 1970**

TIPPERARY: Lough Curra (R867242), Galtymore Mountain, 574m, 10 August 2005 (voucher specimens #915, ImM and #916, pe, HCCIC, NMI).

Langton and Visser (*op. cit.*) consider *T. aberrans* to be characteristic of far northern lakes and tarns.

Comments on records

The lakes from which these four new country species records were obtained are located in remote upland regions of Ireland, accessible only by foot, and subjected to little anthropogenic disturbance. All lie above 300m altitude and two, Lough Curra and Lough Ouler, lie above 550m. While in a broader geographical context none of these lakes may be considered high altitude lakes they do, nevertheless, present freshwater habitats uniquely suitable for some macroinvertebrates. The discovery of four species hitherto not recorded in Ireland is not surprising, given the isolated locations and the undisturbed features of the lakes surveyed. *Pseudosmittia angusta* is a semi-terrestrial species in moist soils of central and northern Europe while the known ecological requirements of the other three species found lie broadly in the sphere of conditions pertaining in "northern and mountain lakes and streams" (Langton and Visser, *op. cit.*). The data obtained in this study enhance our knowledge of the reference conditions of remote, pristine, freshwater habitats in Ireland from which little biotic information has been previously collected.

Acknowledgements

The authors gratefully acknowledge support from 2005 Heritage Council Wildlife Grant (WLD/13974) to Dr M. Kelly-Quinn, U.C.D, for the study on remote upland lakes and (WLD/13985) to Dr D. A. Murray for compilation of The Heritage Council Collection of Irish Chironomidae and thank Professor T. Bolger, Head of School, for use of facilities in the U.C.D School of Biology and Environmental Science.

References

Langton, P. H. and Visser, H. (2003) *Chironomidae exuviae - a key to pupal exuviae of the West Palaearctic Region*. Interactive System for the European Limnofauna Biodiversity Centre of ETI, UNESCO Publishing, Paris.

Pinder, L.C.V. (1989) *The adult males of Chironomidae - introduction*. Pp 1-9. *In* Wiederholm, T. (ed.) Chironomidae of the Holarctic Region - keys and diagnoses. Part 3. Adult males. *Entomologica Scandinavica* Supplement **34**.

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COLEOPTERA, ARANEAE, AND AQUATIC HEMIPTERA RECORDED FROM THREE MOUNTAIN AREAS IN NORTHWESTERN IRELAND

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Summary

A considerable amount of data on the invertebrate fauna of Irish mountains, focussing on ground beetles, spiders and aquatic invertebrates was garnered from a survey of three Irish mountain ranges. A significant number of rarities were identified and three species added to the Irish lists. The fauna identified is discussed in the context of previous collecting efforts in Ireland at high altitudes. It is suggested that the invertebrate montane fauna of Ireland is composed of a number of elements, one of which is species genuinely restricted to montane environments.

Introduction

The coleopteran fauna of Irish mountains has been periodically documented (e.g. Alexander, 1993; Anderson, 1978, 1979, 2004; Halbert, 1895, 1896, 1898; Janson and Bonaparte Wyse, 1924; Johnson and Halbert, 1912). Surveys of these areas are usually undertaken during brief visits and provide a glimpse of the fauna present (Johnson and Halbert, 1912). The most complete report on beetles from an Irish mountain summit is given in Johnson and Halbert

(1912). They reported 42 species from the summit of Croagh Patrick, Co. Mayo (764m) and noted that these were the result of a few fleeting visits to the summit. Alexander (1993) made three visits to the summit of Slieve Donard, Co. Down (850m) over a period of nine days and observed a difference in the fauna that was perhaps due to different weather conditions. Similarly, Ireland's montane spider fauna has been studied very sporadically. Bristowe (1931) made a significant contribution to our knowledge of this fauna but nearly all other records of spiders from high altitude habitats were gathered during short visits by collectors (e.g. Carpenter, 1898; Cawley, 2001, 2004; Kew, 1910; Pack-Beresford, 1911, 1929). An exception to this trend is a study by Nolan (2002).

Study area

Three mountain ranges were selected on the basis of location, height, and accessibility. The areas studied were: the Mweelrea Mountains in West Mayo (H27), Benwiskin and Truskmore in Co. Sligo (H28), and Lavagh Beg and Lavagh More in the Bluestack Mountains in West Donegal (H35). In each mountain range, five sites were sampled with pitfall traps. Brief site descriptions and grid references are given in Table 1. The West Mayo sites were labelled M1-M5, the Sligo sites S1-S5, and the West Donegal sites D1-D5. All three mountain ranges are near the coast so the climate is highly oceanic, without lingering snow and subject to strong winds and frequent rain (Webb and Scannell, 1983). Geology and soils vary greatly both between and within each site. All sites are within Special Areas of Conservation.

The area of the Mweelrea mountains studied was the northeastern corrie and ridge close to the peak of Ben Bury. At 795m, this peak is the third highest in western and northwestern Ireland. The Mweelrea mountains are composed mainly of Ordovician sandstones and shales (Long and McConnell, 1995). Soils in the vicinity of M1, M2, and M3 were gravely and had very little organic matter due to the steep slope. At M4 and M5 a thin layer of peat was present and the area was littered with boulders with *Rhacometrium* and other bryophytes between.

At the Co. Sligo sites, the three lower altitude sites on Benwiskin: S1, S2, and S3, were on loosely compacted mineral soils derived from cherty limestone from the cliffs above. Both the higher altitude Sligo sites on Truskmore: S4 and S5 were on shallow peat overlying sandstone which forms the summit of the mountain (Harney *et al*., 1996).

The Bluestack Mountains in Co. Donegal, with a maximum elevation of 677m, are composed mainly of schists and quartzites (Long and McConnell, 1999). The areas investigated were the northern slopes and summits of Lavagh Beg and Lavagh More which rise to a height of 650m and 671m respectively. The northern slopes of these mountains have a relatively shallow incline and are covered in a greater depth of peat than other two mountain sites. The summits are rocky with shallow peat.

Materials and methods

In April and May 2004, pitfall traps were set in open habitats where vegetation was sparse or short (Table 1) and left in place for a period of between 22 and 37 days. Traps consisted of polythene drinking cups (7.5cm wide and 11cm deep), part-filled with a solution of antifreeze and a small amount of scentless detergent. Ten traps were set at five sampling stations on each mountain (Table 1). Water dwelling beetles and aquatic bugs were collected at sixteen sites using a 0.5mm mesh sieve and/or pond net. These locations are summarised in Table 2. Altitudes were estimated from Ordnance Survey maps. Specimens were collected and stored in alcohol and later identified to species where possible. Voucher specimens of many of the species were deposited in the National Museum of Ireland.

Nomenclature for beetles follows Anderson *et al*. (2005) and Ashe *et al*. (1998) for aquatic Hemiptera. Höregott and Jordan (1954) were used to identify females of *Arctocorisa carinata* Sahlberg. Spiders were identified using Roberts (1993), Locket and Millidge, (1953) and Locket *et al.* (1974). Specimens of *Meioneta mossica* Schikora were identified using Schikora (1993, 1995). Previous records of species were traced using van Helsdingen (1996a). Nomenclature is based on Merrett and Murphy (2000) but a number of synonyms are noted which are used in Platnick (2006) and may be adopted into the British Isles checklists. For the sake of clarity nomenclature in Table 4 follows Merrett and Murphy (2000) though species are listed alphabetically within family. New county records are also indicated on Table 4. Information on the habitat preferences of European spiders (Hänggi *et al.,* 1995) is used to broadly characterise the spider fauna of the mountains surveyed.

Results

In total, 3,208 beetles were caught in pitfall traps. The occurrence and abundance of species at the different sites is detailed in Table 3. Ninety-three species were identified and six individuals identified to genus level. The most abundant species overall were: *Nebria rufescens* Ström, *Quedius umbrinus* Erichson, *Paranchus albipes* (Fabricius), *Trechus obtusus* Erichson, and *Pterostichus rhaeticus* Heer. These species accounted for 50% of the total number of individuals. Thirty-seven species were recorded from a single or just two individuals. The Sligo sites were the most species-rich with a total of 72 species recorded. The Donegal and Mayo sites both had 48 species. Twenty-four species were recorded from all three mountain ranges while 42 species were recorded at only one of the mountain ranges. Seventy-four species occurred at or above 600m.

In total 918 adult spiders were captured, 678 males and 240 females. Four families were represented, the Linyphiidae (56 species), the Theridiidae (two species), Lycosidae (four species) and Dictynidae (one species). Table 4 summarises the abundance of species occurring at each site and shows also the numbers of each gender captured. In all, 63 species were identified. Six species constituted 47.13% of the catch: *Centromerita concinna* (Thorell) (10.89%), *Walckenaeria clavicornis* (Emerton) (9.58%), *Monocephalus fuscipes* (Blackwall) (9.25%), *Hilaira frigida* (Thorell) (7.18%), *Erigone atra* Blackwall (5.22%), and *Robertus lividus* (Blackwall) (5.01%). No other species composed more than 5% of the catch. Numbers of species captured at each site ranged between seven and twenty-six with S4 and S5 each producing twenty-six. Sligo sites together produced 45 species while Donegal and Mayo respectively offered 32 and 29. Eleven species occurred in all three counties while 30 were found only in one of them. 25.39% of species (n=16) were represented by a single specimen and a further 7.93% (n=5) by two specimens. Forty-nine species identified appeared at stations above 600m.

The aquatic sites examined were mainly on Lavagh Beg and Lavagh More and on a plateau immediately to the south of those peaks. Twenty-six beetle species were recorded, all of which are widespread and commonly found in upland habitats (Table 4). Four species: *Agabus arcticus* (Paykull), *Hydroporus longulus* Mulsant and Rey, *Hydroporus morio* Aubé, and *Stictotarsus multilineatus* (Falkenström) are upland specialists however they are all widespread in Irish mountains (Nelson *et al.*, 1997). Similarly, most of the aquatic Hemiptera recorded were typical of upland and acid lakes.

Notable records

Coleoptera

***Choleva fagniezi* Jeannel New to Ireland**

This beetle was recorded from Donegal and Sligo between 450m and 780m at sites with mosses and loose rocks (Table 3). These appear to be the first Irish records of this species. Like other members of the genus, it is subterranean, living in burrows, under boulders, and in moss (Kevan, 1946).

***Leistus montanus* Stephens**

Two individuals were trapped near the summit of Ben Bury. There is one recent record of this species from Co. Galway (McCormack, 2004) but there are old records from mountains over much of Ireland (Anderson *et al.*, 2000).

***Lesteva monticola* Kiesenwetter**

This species was recorded from the summits of Truskmore and Ben Bury (Table 3).

Anderson (1997) notes that it this species has previously been recorded from two localities in Ireland at Mount Brandon, Co. Kerry and Lugnaquilla, Co. Wicklow. In the present survey it was recorded from the summits of Truskmore and Ben Bury (Table 3).

***Nebria nivalis* (Paykull) New to Ireland**

A single individual of *Nebria nivalis*, the first Irish record, was trapped from near the summit of Ben Bury (Table 3) along with several hundred specimens of the similar *N. rufescens* (Ström). For this reason, it may have been previously overlooked. *N. nivalis* occurs on mountains in Scotland, northwest England and Wales, Scandinavia and northern Russia (Luff, 1998).

***Omalium septentrionis* Thomson**

One specimen of *O. septentrionis* was trapped at an altitude of 450m on the north slope of Lavagh Beg, Co. Donegal (Table 3). The only previous record of this species is from Lough Gill, Co. Sligo (Hammond, 1980). In central Europe, it is a montane species (Freude *et al.*, 1964).

***Oxypoda procerula* Mannerheim**

This species occurred at three sites: the lower slope and summits of Lavagh More and also at Truskmore. Anderson (1997) notes two earlier Irish records of this species from flood refuse in Co. Kerry and a wooded marsh in Co. Down. It is often found in damp moss and has a generally northern and western distribution in Britain (Boyce, 2004).

***Oxypoda tirolensis* Gredler**

This beetle has been recorded previously from two localities in Ireland with one recent record from *Rhacometrium* moss near the summit of Slieve Donard (Anderson, 2004). In this study, it was found at the summits of Lavagh More (six individuals) and Ben Bury (26 individuals) (Table 3).

***Parabolitobius inclinans* (Mannerheim)**

Another rarity, the species was previously recorded in Ireland from Glencar, Co. Kerry and

Maulin, Co. Wicklow (Anderson, 1997; O'Mahony, 1932). Several individuals were trapped on Ben Bury and Lavagh More at sites over 600m (Table 3). It is not an upland species but in Britain it has been found at high and low altitudes in rotting wood and compost (Fowler, 1888).

***Patrobus septentrionis* Dejean**

This species was trapped near the summit of Ben Bury and has been recorded only once previously in Ireland. Janson and Bonaparte Wyse (1924) recorded a single individual on the summit of Carrantouhill, Co. Kerry. It occurs in Britain in the Scottish Highlands and there are a few records from mountains in northern England and Wales (Luff, 1998).

***Tachinus elongatus* Gyllenhal**

This is an uncommon species but with a few widely scattered records in Irish lowland and upland situations (Anderson, 1997; Johnson and Halbert, 1902). In central Europe, it is found in high mountains (Freude *et al*., 1964). In this study, one was trapped at 600m in the Mweelrea mountains.

Araneae

***Agyneta olivacea* (Emerton)**

The occurrence and distribution of this species in Ireland was discussed in Nolan (2002) where the species was recorded from montane blanket bog at an altitude of 630m. Its preference for bog habitats was noted and recently the species has been recorded from fenland in Co. Tyrone (Nelson, 2005). The present records reinforce its association also with high altitudes. Station D1, the only site where it was recorded, was one of the lower altitude sites (450m) however and the only one with tall vegetation. The species may have a preference for well vegetated areas.

***Diplocentria bidentata* (Emerton)**

The first Irish record by Kew (1910) (= *Centromerus rivalis*) was found "some way from the summit" of Mangerton, Co. Kerry in 1909. This find is noted by Pack-Beresford (1911)

(= *Tmeticus rivalis*). The second Irish record was taken by Bristowe (1931) at around 700m on Mount Brandon in June 1929. Bristowe notes Kew's find (= *D. torrentum*) but refers to the wrong paper *i.e. The Irish Naturalist* 1899: p. 216 instead of 1910: p. 73. The present records seem to represent the third find of the species in Ireland.

***Hilaira (Oreoneta) frigida* (Thorell)**

This species has now been recorded from a significant number of upland/montane sites in Ireland. The first record was by Kew (1910) (= *Hilaira montigena*) from the summit of Mangerton, Co. Kerry. Subsequent records are as follows: the summits of Tonelagee and Lugnaquilla both in Co. Wicklow (Pack-Beresford, 1929); on Brandon and Carrantouhill (both Co. Kerry) (Bristowe, 1931); Three Lakes, Co. Wicklow (Nolan, 2002); the summit of King's mountain, Co. Sligo (Cawley, 2001); Glenaprehane, Co. Cork (Cawley, 2004). All the records were from above 450m. During the present survey, the species was recorded from all three counties, always above 450m and was most abundant at stations above 600m. It may be considered a common species in Ireland at the appropriate altitude. Other than the British Isles, the species is confined to Norway, Sweden, Poland and Iceland in Europe.

***Jacksonella falconeri* (Jackson)**

The first Irish records were from wet moss on Clara Bog and from moss hummocks on Mongan Bog (both Co. Offaly) (Higgins, 1990). The next ones were by Cawley (2004) from lowland blanket bog in Co. Leitrim. The present captures were from two of the lower altitude sites (300 and 400m) though at the latter, the species was abundant (n=10). The substrate at both sites was almost bare of vegetation and characterised by loose stony soil and fine scree respectively. It may be the case that the species finds the interstitial spaces offered by these exposed substrates to be structurally similar to the mosses with which it has been associated at lower altitudes in Ireland.

***Latithorax (Semljicola) faustus* (O. P.-Cambridge)**

These records represent the second find of the species in Ireland. The only indication of a previous Irish record is on a distribution map in Locket *et al.* (1974) from Co. Kerry. No information is offered as to its provenance. There is no record of the species from Ireland in Bristowe (1971) and thus it may have been first recorded between 1971 and 1974. It is considered in Britain to be an upland species associated with damp open habitats and low vegetation and the present records would support this. Its occurrence in the three counties surveyed significantly increases its known range in Ireland.

***Lepthyphantes (Mughiphantes) whymperi* F. O. P.-Cambridge**

Bristowe (1931) first recorded this species in Ireland from above 900m on Carrantouhill, Co. Kerry. It seems not to have been recorded since. It has Nationally Scarce status (Notable B) in the United Kingdom and it is widespread there on mountains, especially in Scotland, but very local and never numerous. It has a very limited Northern European distribution where, apart from the British Isles, it is found in Norway, Sweden, Finland and Northern Russia.

***Maro minutus* O. P.-Cambridge**

Although first found in Ireland in damp dune grassland in Co. Wexford in 1980, this record was not published until twenty years later (Nolan, 2000). The species was also found by Cawley (2004) in Co. Sligo on a lake-side heath hillock and amongst moss on sand dunes. The present records thus represent the third find of the species in Ireland. It is relatively widespread but uncommon in Britain occurring in a variety of habitats.

***Maro sublestus* Falconer**

Yet another species that was added to the Irish list recently, *M. sublestus* was found for the first time in Ireland in the unimproved meadows and callows of the Shannon floodplain at Clonmacnoise, Co. Offaly (van Helsdingen, 1996b). The only other Irish record of this rare species was from a *Phragmites* stand and open *Carex* marsh also on the Shannon banks at Carrick-on-Shannon in Co. Leitrim (Cawley, 2004). This species is far less widespread in Europe than its congener *M. minutus* O. P.-Cambridge . In Britain, the spider has Nationally Scarce (Notable A) status and is generally associated with wet habitats, including fen, wet heath and wet woodland. The species' occurrence at 600m in Ireland suggests a higher tolerance of inhospitable conditions than records presently indicate and it may be prove to be far more widespread in Ireland.

***Mecynargus morulus* (O. P.-Cambridge)**

This species, like *H. frigida*, may be regarded as relatively common in upland and montane situations in Ireland and there is a good degree of coincidence between the papers reporting occurrences of both species. The first Irish specimens were reported by Carpenter (1898) from Slieve Donard, Co. Down. Subsequent records are also from mountains: Mangerton, Co. Kerry (Kew, 1910); Co. Antrim from below 340m (McFerran, 1997); Three Lakes, Co. Wicklow (Nolan, 2002); Ben Bulben in Co. Sligo (Cawley, 2001); Farbreaga, Co. Waterford and Glenaprehane, Co. Cork (Cawley, 2004). Its occurrence in Britain echoes strongly this upland distribution though it is occasionally recorded there at lower altitudes.

***Meioneta gulosa* (L. Koch)**

There is only one previous record of this species in Ireland – a single female – recorded from grazed moorland in Co. Antrim (McFerran, 1993). The specimen was identified to species with difficulty and females have sometimes been identified solely by association with the males. All but one specimen from the present survey were males, confirming the presence of the species in Ireland. It is associated with open stony upland areas in Britain but is not an obligatory upland species and can be found in lowland coastal situations in Scotland.

***Meioneta mossica* Schikora**

This recently described species was recorded for the first time in Ireland during the present survey and a note was published describing the find of specimens from Co. Sligo (Nolan and McCormack, 2004). The species' preferred habitat and distribution were discussed therein. The two male specimens from Co. Donegal were identified subsequent to this publication and were also from the mountain summit.

***Oreonetides vaginatus* (Thorell)**

There have been only two previous finds of this species in Ireland. Pack-Beresford (1929) found a male on the summit of Lugnaquilla, Co. Wicklow in 1924 and Bristowe (1931) took another specimen near the summit of Mount Brandon, Co. Kerry in 1929. All the specimens taken on the present survey were from above 650m and most of these were from Co. Donegal. It is uncommon in Britain where it is strongly associated with montane situations and occurs most abundantly in north-west Scotland.

***Porrhomma pallidum* Jackson**

Bristowe (1931) was responsible for the first Irish record of this species which he found near the summit of Carrauntoohill, Co. Kerry. *P. pallidum* was not recorded again until some time later (McFerran *et al.,* 1994, 1995) when it was recorded from upland grass and wet heath in Co. Antrim. The next record was again taken at high altitude, this time in Co. Wicklow (Nolan, 2002) and Cawley (2004) found it in hazel woodland in Fermanagh. While there are few records of this species to date, it is strongly associated with woodland in Britain and is probably more common in Ireland than these few records indicate.

***Walckenaeria clavicornis* (Emerton)**

First recorded as Irish by McFerran (1993), the species occurred in relatively small numbers on upland grasslands and heathlands in Co. Antrim (McFerran *et al.*, 1994, 1995). The present records constitute the second cluster of records of the species in Ireland and suggest that it has a preference for far more elevated situations with most of the specimens taken above 650m.

***Theonoe minutissima* (O. P.-Cambridge)**

The first records of this tiny theridiid spider are from Leenane Mountain, Co. Galway and from Co. Donegal (Carpenter, 1898). It was found subsequently in the Burren, Co. Clare (Mackie, 1970) and on heathland in Co. Antrim (McFerran *et al.*, 1995). Its status as a bog associate was discussed by Nolan (2002) for it was found at Three Lakes, Co. Wicklow. Another recent record from the summit of Glenaprehane, Co. Cork (Cawley, 2004) serves to confirm that it frequents mountains in Ireland.

Aquatic Hemiptera

***Arctocorisa carinata* Sahlberg**

This species was recorded from small pools on Lavagh More in Co. Donegal and from a shallow pool near the summit of Truskmore in Co. Sligo. *A. carinata* was not included on the Irish list (Ashe *et al.*, 1998). However, there is a record mentioned in Whilde (1994) dating from the early 1970s from a lake at 485m near the summit of Lugnabrick, on the Galway/Mayo border. This record has not been verified and there are no voucher specimens in the Natural History Museum in Dublin. SM had the opportunity to examine a putative female specimen of *A. carinata* labelled "Donegal 1894" in the National Museum of Ireland which proved to be *A. germari* (Fieber). SM has also found the species in a shallow pool on Maumtrasna, (H16) (L9663) on 6 July 2004.

Discussion

Sampling

Except for Nolan (2002), previous sampling of terrestrial, ground-dwelling invertebrates of Irish mountains has been sporadic and usually by means of hand collecting, sieving moss, etc. In this study, pitfall traps were used in order to sample the fauna over a longer period of time. They have the advantage of operating day and night over an extended period and are less time consuming than hand-collecting. The variation in sampling dates and length of sampling time contributed to the variation in the number of beetle species recorded at each site. Most of the pitfall traps were in short or very sparse vegetation which would have influenced the composition of the catch. The most species rich sites for carabid and staphylinid beetles, were S4 and S5 with 33 and 30 species, respectively (Table 3). These sites were also the richest for the spiders, each producing 26 species. They were sampled slightly later in the year and for longer than any other sites (Table 1) and this may explain why they had the greatest species richness of any of the sites.

Species composition

The coleopteran species recorded show a range of affinities for high altitudes in Ireland. Those species which are restricted to mountain habitats in Ireland have been highlighted in Table 3. The first group marked with an asterisk are the most restricted in distribution being confined to high altitudes and usually summits. This group includes: *Leistus montanus*, *Nebria nivalis*, *Patrobus septentrionis*, *Eucnecosm brachypterum* (Gravenhorst), *Lesteva monticola*, *Oxypoda tirolensis*, and *Othius subuliformis* Stephens (Table 3). Outside of Ireland, they occur across the arctic-montane or boreo-arctic montane, or alpine biomes (Anderson *et al*., 2000). The mountain summits in Sligo and Donegal each had three of these species. At the highest points in this study at Ben Bury (M4 and M5) all seven of these mountain specialist species were found. Three of these, *Leistus montanus*, *Nebria nivalis*, and *Patrobus septentrionis*, were only found there.

A second group of beetles occur predominantly in mountains habitats in Ireland but they also occur in habitats at lower altitude (Anderson, 1997; Anderson *et al*., 2000). This group includes: *Nebria rufescens*, *Carabus arvensis* Herbst, *C. problematicus* Herbst, *Bembidion atrocoeruleum* (Stephens), *Patrobus assimilis* Chaudoir, *Pterostichus adstrictus* Eschscholtz, and *Mniusa incrassata* (Mulsant and Rey). These species tend to be more abundant in habitats of mountain slopes such as stream edges or heath. Their latitudinal range extends from the Arctic into temperate regions (Anderson *et al*., 2000).

About half the carabid and staphylinid beetles species not mentioned above are associated with wetland habitats (Lott, 2003) and occur at high and low altitude e.g. *Elaphrus cupreus* Duftschmid, *Olophrum piceum* (Gyllenhal), *Lesteva sicula* (Ganglbauer), *Pselaphus heisei* Herbst, *Boreophila eremita* (Rye), and *Quedius maurorufus* (Gravenhorst). The remaining species are almost all eurytopic occurring in a range of habitats in Ireland over a wide range of altitudes.

Information on the European distribution of spider species was taken from van Helsdingen (2006) and information on their habitat preferences within Europe derived from Hänggi *et al.* (1995). Habitat preferences and distribution in Britain are described in Harvey *et al.* (2002) and the latter was also used to verify that all species found occur in each of England, Scotland and Wales.

A broad pattern may be suggested to emerge from a consideration of the data in these volumes whereby Ireland's upland/montane spider fauna may be characterised as being composed of groups of species, some of which are more usually associated with rather different habitat types. A small number of the species recorded have a very limited distribution in Europe. *H. frigida* and *L. whymperi* are properly restricted montane species and have the narrowest distribution in Europe, being confined essentially to Scandinavia and the British Isles and in the latter area are restricted to high altitudes.

A second grouping consists of species which occur in the Alps and display an upland distribution in the British Isles: *M. morulus*, *O. vaginatus*, *W. clavicornis*, *D. bidentata*, *L. faustus* and *M. gulosa*. These species are not necessarily restricted to montane habitats across Europe.

A third large grouping may be suggested on the basis of a strong association with forest and bog habitats, the first eleven species especially with the former: *Agyneta subtilis* (O. P.-Cambridge), *Lepthyphantes tenebricola* (Wider), *Centromerus dilutus* (O. P.-Cambridge), *Cryphoeca silvicola* (C. L. Koch), *Dicymbium tibiale* (Blackwall), *J. falconeri, M. fuscipes*, *Microneta viaria* (Blackwall), *P. pallidum*, *T. minutissima*, *Walckenaeria cuspidata* Blackwall, *Dismodicus bifrons* (Blackwall), *Dicymbium nigrum* (Blackwall), *Minyriolus pusillus* (Wider), *Taranucnus setosus* (O. P.-Cambridge), and *Walckenaeria nudipalpis* (Westring). *Agyneta olivacea* and *M. mossica* are both also strongly associated with bog habitats. These species were however respectively added to the European fauna and described recently and may prove to have a wider range of habitat affiliations.

A fourth grouping consists of species with a strong coastal distribution or an association with very wet inland situations: *Diplocephalus permixtus* (O. P.-Cambridge), *Hypomma bituberculatum* (Wider), *Lepthyphantes ericaeus* (Blackwall), *Lophomma punctatum* (Blackwall), *M. sublestus*, *Oedothorax fuscus* (Blackwall) *and Oedothorax retusus* (Westring) fall into this category. These species are not limited by altitude in Ireland probably on account of the very moist conditions and the generally mild climate. Of these species it is worth noting that both *Oedothorax* species are also highly associated with cultivated habitats and this association with disturbance is possibly significant. It is perhaps also worth adverting to the observation in Nolan (2002) that the common occurrence of *L. ericaeus* and *D. permixtus* in both montane blanket bog and at coastal sites in Ireland is significant.

Conservation

A number of the species found during this study are not only rare in Ireland but in the British Isles as a whole. Of the seven beetle species in this study that are restricted to high altitudes in Ireland (Table 3), three carabid species (*L. montanus*, *N. nivalis*, and *P. septentrionis*) and one staphylinid species (*O. tirolensis*) are listed in the review of the scarce and threatened Coleoptera of Great Britain (Hyman and Parsons, 1992, 1994). Within Ireland, the same four species are extremely rare (Anderson *et al.*, 2000; Anderson, 2004). Two of the spider species identified (*L. whymperi* and *M. sublestus*) have Nationally Notable status in Britain (Harvey *et al.*, 2002). Further research into the distribution of these species, however, may show them to be more widely distributed than is presently known. The presence of a rare spider species with a very limited European distribution, *L. whymperi*, in Cos Kerry and Mayo strongly suggests a countrywide distribution. While two spider species (*L. faustus* and *W. clavicornis*) found at the study sites in Mayo, Sligo, and Donegal were not found at Three Lakes, Co. Wicklow (Nolan, 2002), the fact that the former species was found previously in Co. Kerry also suggests the possibility of a countrywide distribution. The recorded distribution of *Arctocorisa carinata*, a large, conspicuous and easily captured corixid, now covers Donegal, Sligo and Galway. Considering all the data from the last hundred years, it would appear that there is a high degree of homogeneity to the invertebrate fauna of high altitudes. The present records greatly increase the known range of a number of uncommon, rare, and under-recorded species. The three new Irish records from this study show that there are many unrecorded species in Ireland.

It is difficult to assess how rare some of the species recorded actually are. It can be roughly estimated that, including the present study, no more than perhaps 3000 spider specimens have been collected on Irish mountains above an altitude of 600m (*inter alia* Bristowe, 1931; Cawley, 2004; Nolan, 2002). If this is a fair estimate then some of the rare species, even on the basis of very few records, could be described as being perhaps locally common. Although this upland fauna may be more widely distributed than is presently known, only about 0.3% (240km^2) of Ireland can be considered montane habitat (over 600m) (Cabot, 1999) and this habitat is by its nature isolated and highly fragmented. Therefore, populations of high altitude specialist invertebrates are probably very small and most definitely isolated making them vulnerable to environmental change. Predicted climate change may impact on these communities. It will probably result in the shifting or disruption of carabid beetle communities (Butterfield, 1996), and the high altitude specialists are likely to be adversely affected and prone to local extinctions. Some montane species may already be in decline. For example, there are nine pre-1924 records for the carabid beetle, *Leistus montanus*, and only two recent records (McCormack, 2004). However, baseline data on the distribution, ecology, and relative rarity of spiders and beetles in Ireland is fundamentally impoverished and it is difficult to assess whether or not the upland/montane fauna has changed significantly over the last century.

There is also little understanding of the habitat requirements of montane invertebrates. Previous work on blanket bog at 170m-300m shows that overgrazing could have detrimental impact on the carabid beetle community (McDonnell *et al.*, 2002). Future studies of montane habitats should attempt to cover the range of available microhabitats at a given site in order to discover the niche preferences of the various species. Only by doing this can comprehensive species lists be attained, the habitat quality of various sites assessed, and effective management plans put in place. Although much more research needs to be conducted, it may be hypothesised that many of the species discussed in this study are present on all Irish mountains of significant altitude, where suitable habitats exist. However, even if these species are widely distributed, their fragmented populations may be vulnerable to local and regional environmental changes.

Conclusions

The spider and beetle montane fauna of these mountain ranges is composed of a number of elements. While there is a distinct group of montane species, other species are generally more characteristic of forest, bog, wetland, or coastal habitats. This suggests that mountains in Ireland provide a range of microhabitats (for example, moss, scree and gravel) and climatic conditions (for example, cold, wet, exposed) similar to those in lowland habitats.

Despite the paucity of knowledge of the Irish montane invertebrate fauna, it must be concluded that the summits and slopes of the Mayo, Sligo, and Donegal mountains provide habitats for a number of rare beetle, bug, and spider species. Of the sites studied, the summit area of Ben Bury in Co. Mayo holds a ground dwelling beetle and spider assemblage of the most montane character. Whether this is due to height and climatic conditions or particular microhabitat characteristics remains to be shown.

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References

Alexander, K. N. A. (1993) Observations from an Irish mountain summit. *The Coleopterist* **2**: 42-44.

Anderson, R. (1978) *Stenus glacialis* Heer (Col., Staphylinidae) new to Ireland. *Entomologist's Monthly Magazine* **113**(1977): 156.

Anderson, R. (1979) *Stenus glacialis* Heer (Col., Staphylinidae) in west Donegal. *Entomologist's Monthly Magazine* **114**: 20.

Anderson, R. (1997) Northern Ireland species inventories. Rove Beetles (Coleoptera: Staphylinidae). *Environment and Heritage Service Research and Development Series* **No. 97/11**: 1-78.

Anderson, R. (2004) A recent record of *Oxypoda tirolensis* Gredler (Staphylindae). *The Coleopterist* **13**: 162-166.

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

Anderson, R., Nash, R. and O'Connor, J. P. (2005) *Checklist of Irish Coleoptera*. InvertebrateIreland Online. Ulster Museum, Belfast and National Museum of Ireland, Dublin.

Ashe, P., O'Connor, J. P. and Murray, D. A. (1998) A checklist of Irish aquatic insects. *Occasional Publication of the Irish Biogeographical Society* **3**: 1-79.

Boyce, D. C. (2004) A review of the invertebrate assemblages of acid mires. *English Nature Research Report* No. **592:** 1-109.

Bristowe, W. S. (1931) A contribution to the knowledge of the spider fauna of south-west Ireland and, in particular, the islands off the coast. *Proceedings of the Zoological*

Society of London **1931**: 17-29.

Bristowe, W. S. (1971) *The world of spiders*. Collins, London.

Butterfield, J. (1996) Carabid life-cycle strategies and climate change: a study on an altitude transect. *Ecological Entomology* **21**: 9-16.

Cabot, D. (1999) Ireland. *A natural history*. Harpercollins Publishers, London.

Carpenter, G. H. (1898) A list of the spiders of Ireland. *Proceedings of the Royal Irish Academy* **5**: 128-210.

Cawley, M. (2001) Distribution records for uncommon spiders (Araneae) including five species new to Ireland. *Bulletin of the Irish Biogeographical Society* **25**: 135-43.

Cawley, M. (2004) Some further records for uncommon spiders in Ireland (Araneae), including four species new to Ireland. *Bulletin of the Irish Biogeographical Society* **28**: 207-228.

Fowler, W. W. (1888) *The Coleoptera of the British Isles*. Volume **II**. Reeve, London.

Freude, H., Harde, K. W. and Lohse, G. A. (1964) Staphylinidae 1. *Die Käfer Mitteleuropas*. **4**. Goecke and Evers. Krefeld.

Halbert, J. N. (1895) Irish Field Club Union. Report of the Conference and Excursion held at Galway, July 11-17th, 1895. Coleoptera. *Irish Naturalist* **4**: 259-262.

Halbert, J. N. (1896) Insects collected on Lugnaquilla and in Glenmalur valley, Co. Wicklow. *Irish Naturalist* **5**: 210-211.

Halbert, J. N. (1898) Impressions of Achill. *Irish Naturalist* **7**: 137-138.

Hammond, P. (1980) Staphylinidae in Ireland, 1: Micropeplinae, Proteininae, Omaliinae, and Piestinae. *Irish Naturalists' Journal* **20**: 133-140.

Hänggi, A., Stöckli, E. and Nentwig, W. (1995) Lebensräume Mitteleuropäischer Spinnen. Habitats of central European spiders. *Miscellanea Faunistica Helvetiae* **4**. Centre Suisse de cartographie de la faune.

Harney, S., Long, C. B. and MacDermot, C. V. (1996) *Bedrock Geology 1:100,000 Scale Map Series, sheet 7, Sligo-Leitrim*. Geological Survey of Ireland.

Harvey, P. R., Nellist, D. R. and Telfer, M. G. (eds) (2002) *Provisional atlas of British spiders (Arachnida, Araneae). Volumes 1 and 2.* Biological Records Centre, Huntingdon.

Helsdingen, P. J. van (1996a) The county distribution of Irish spiders, incorporating a revised catalogue of the species. *Irish Naturalists' Journal Special Zoological Supplement* 1-92.

Helsdingen, P. J. van (1996b) The spider fauna of some Irish floodplains. *Irish Naturalists' Journal* **25**: 285–93.

Helsdingen, P. J. van (2006) Araneae. *In* Fauna Europaea Database (Version 2006.1). (http://www.european-arachnology.org)

Higgins, D. G. (1990) Four additions to the Irish spider (Araneae) fauna. *Irish Naturalists' Journal* **23**: 279-80.

Höregott, H. and Jordan, K. H. C. (1954) Bestimmungstabelle der Weibchen deustscher Corixiden (Heteroptera: Corixidae). *Beiträge zur Entomologie* **4**: 578-594

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

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

Janson, O. E. and Bonaparte Wyse, L. H. (1924) Coleoptera from South Kerry. *Irish Naturalist* **33**: 125-131.

Johnson, W. F. and Halbert, J. N. (1902) A list of the beetles of Ireland. *Proceedings of the Royal Irish Academy* **6**(3): 535-827.

Johnson, W. F. and Halbert, J. N. (1912) Clare Island Survey. 28. Terrestrial Coleoptera. *Proceedings of the Royal Irish Academy* **31**(28): 1-24.

Kevan, D. K. (1946) The sexual characters of the British species of the genus *Choleva* Lat., including *C. cisteloides* Fröhl. new to the British list (Col., Cholevidae). *Entomologist's*

Monthly Magazine **82**: 122-130.

Kew, H. W. (1910) A holiday in south-western Ireland. *Irish Naturalist* **19**: 64–73.

Locket, G. H. and Millidge, A. F (1953) *British spiders* **2**. Ray Society, London.

Locket, G. H., Millidge, A. F and Merrett, P. (1974) *British spiders* **3**. Ray Society, London.

Long, C. B. and McConnell, B. J. (1995) *Bedrock Geology 1:100,000 Scale Map Series, Sheet 10. Connemara*. Geological Survey of Ireland

Long, C. B. and McConnell, B. J. (1999) *Bedrock Geology 1:100,000 Scale Map Series, Sheet 3 and part of Sheet 4, South Donegal*. Geological Survey of Ireland.

Lott, D. A. (2003) An annotated list of wetland ground beetles (Carabidae) and rove beetles (Staphylinidae) found in the British Isles including a literature review of their ecology. *English Nature Research Reports* **No. 488**: 1-85.

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

Mackie, D. W. (1970) Spiders and harvestmen from the west of Ireland. *Irish Naturalists' Journal* **16**: 334–8.

McCormack, S. (2004) Recent records of two uncommon ground beetles (Coleoptera: Carabidae) from West Galway (H16): *Leistus montanus* Stephens and *Chlaenius vestitus* (Paykull). *Irish Naturalists' Journal* **27**: 356.

McDonnell, R. J., Fahy, O. L. and Gormally, M. J. (2002) Ground beetle (Coleoptera: Carabidae) and plant communities of Atlantic blanket bog in Connemara, Ireland. *Bulletin of the Irish Biogeographical Society* **26**: 83-105.

McFerran, D. (1993) Three additions to the Irish spider fauna. *Irish Naturalists' Journal* **24**: 262.

McFerran, D. (1997) Species Inventory for Northern Ireland: Spiders (Arachnida). *Environment and Heritage Research and Development Series*. No. **97/10**: 1-58.

McFerran, D. M., Montgomery, W. I. and McAdam, J. H. (1994) The impact of grazing on communities of ground-dwelling spiders (Araneae) in upland vegetation types. *Proceedings of the Royal Irish Academy* **94B**: 119-26.

McFerran, D. M., McAdam, J. H. and Montgomery, W. I. (1995) The impact of burning and grazing on heathland plants and invertebrates in County Antrim. *Proceedings of the Royal Irish Academy* **95B**: 1–17.

Merrett, P. and Murphy, J. (2000) A revised check list of British spiders. *Bulletin of the British Arachnological Society* **11**: 345-58.

Nelson, B. (2005) Surveys of the insects, spiders and other invertebrates of fens in counties Armagh, Down and Tyrone, Northern Ireland. *Bulletin of the Irish Biogeographical Society* **29**: 3-85.

Nelson, B., Foster, G., Weyl, R. and Anderson, R. (1997) The distribution of aquatic Coleoptera in Northern Ireland. Part 1. families Haliplidae, Hygrobiidae, Noteridae, Dytiscidae and Gyrinidae. *Bulletin of the Irish Biogeographical Society* **20**: 176-296.

Nolan, M. (2000) A provisional list of spiders (Araneae) from Lesley Gibson's survey (1979-1982) of Carnsore Point, Co. Wexford, including one species new to Ireland *Maro minutus* (O.P.-Cambridge, 1906) (Linyphiidae). *Bulletin of the Irish Biogeographical Society* **24**: 159–67.

Nolan, M. (2002) Spiders (Araneae) of montane blanket bog in Co. Wicklow, Ireland. *Bulletin of the Irish Biogeographical Society* **26**: 39-59.

Nolan, M. and McCormack, S. (2004) First Irish record of *Meioneta mossica* Schikora, 1993 (Araneae, Linyphiidae). *Bulletin of the Irish Biogeographical Society* **28**: 204-206.

O' Mahony, E. (1932) *Bryocharis inclinans* Gr. in Ireland. *Entomologist's Monthly Magazine* **68**: 85.

Pack-Beresford, D. R. (1911) Some new Irish spiders. *Irish Naturalist* **20**: 173-177.

Pack-Beresford, D. R. (1929) Report on recent additions of the Irish fauna and flora. Araneida. *Proceedings of the Royal Irish Academy* **39B**: 41–52.

Platnick, N. I. (2006) The world spider catalog, version 6.5. American Museum of Natural History, online at http://research.amnh.org/entomology/spiders/catalog/index.html

Roberts, M. J. (1993) *The spiders of Great Britain and Ireland*. Compact edition I-III. Harley Books, Colchester.

Schikora, H.-B. (1993) *Meioneta mossica* sp. n., a new spider close to *M. saxatilis* (Blackwall) from northern and central Europe (Araneae: Linyphiidae). *Bulletin of the British Arachnological Society* **9**: 157-163.

Schikora, H.-B. (1995) Intraspecific variation in taxonomic characters, and notes on distribution and habitats of *Meioneta mossica* Schikora and *M. saxatilis* (Blackwall), two closely related spiders from northern and central Europe (Araneae: Linyphiidae). *Bulletin of the British Arachnological Society* **10**: 65-74.

Webb, D. A. and Scannell, M. J. P. (1983) *The flora of Connemara and the Burren*. Royal Dublin Society and Cambridge University Press, Cambridge.

Whilde, T. (1994) *The natural history of Connemara*. IMMEL. London.

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TABLE 1. Location and description of pitfall trap sites April – May 2004.

Site Code	Site description	Altitude (m)	Grid reference	Date
Mweelrea Mountains, Co. Mayo				
M1	North face of corrie, eroding stream bank with sparse grassy tufts on loose stony soil.	350	L817677	22.iv.-21.v.04
M2	North face of corrie on steep slope by stream with 5cm grass tufts on loose stony soil with large boulders.	450	L816644	22.iv.-21.v.04
M3	Base of cliff in loosely compacted stony soil with sparse *Nardus stricta.*	600	L807675	23.iv.-21.v.04
M4	Near summit Ben Bury, scree on shallow peat with *Rhacometrium* sp. and closely cropped *Calluna vulgaris*.	780	L802683	23.iv.-21.v.04
M5	Near summit Ben Bury in north facing scree on shallow peat with sparse low *Calluna vulgaris* and mosses.	780	L800682	23.4.-21.v.04
Benwiskin and Truskmore, Co. Sligo				
S1	Northwest slope of Benwiskin, on a recent slippage of stream bank with sparse grassy tufts on loose stony soil.	300	G724494	10.iv.-2.v.04
S2	Grassy northwest slope of Benwiskin below cliffs on loosely compacted clay in c.10cm tall grasses.	350	G725493	10.iv.-2.v.04
S3	Northwest slope of Benwiskin in gully in limestone cliffs with no vegetation and fine loose scree.	400	G725493	10.iv.-2.v.04
S4	Truskmore, level bare peat with exposed rocks and sparse *Calluna vulgaris* and *Juncus squarrosus.*	600	G760470	11.v.-16.vi.04

TABLE 1 (continued)

Site Code	Site description	Altitude (m)	Grid reference	Date
S5	Truskmore, near summit in c.5cm dense sward of *Calluna vulgaris*, *Juncus squarrosus* and *Rhacometrium.*	640	G760473	11.v.-16.vi.04
Bluestack Mountains, Co. Donegal				
D1	North slope of Lavagh Beg in tall *Calluna vulgaris*, *Agrostis* sp. and *Carex* sp. on very wet peat	450	G929919	3.v. - 29.v.04
D2	North slope of Lavagh Beg in closely cropped grasses on shallow peat with protruding scree.	500	G925916	3.v. - 29.v.04
D3	Near summit Lavagh Beg in short grassy sward on shallow peat.	650	G926916	3.v. - 29.v.04
D4	Lavagh More near summit in very rocky shallow peat with stubby *Calluna vulgaris* and *Nardus stricta*.	650	G934912	3.v. – 29.v.04
D5	Lavagh More by a mossy seepage over scree with some shallow peat and low sward of grasses.	650	G933912	3.v. - 29.v.04

TABLE 2. Sampling locations and dates for aquatic Coleoptera and Hemiptera.

	Location and habitat	Altitude (m)	Grid ref	Date
Mayo				
1	Shallow *Sphagnum* pool	640	L793675	21.5.04
2	Spring	600	L808676	21.5.04
Sligo				
3	Shallow pool at summit	640	G759473	11.5.04
4	Shallow pool at summit	640	G759473	16.6.04
Donegal				
5	Steep-sided lake at summit	640	G925915	3.5.04
6	*Sphagnum* pool at summit	670	G935910	3.5.04
7	*Sphagnum* pool	650	G926915	3.5.04
8	*Sphagnum* pool	400	G932918	3.5.04
9	*Sphagnum* pool	650	G935910	3.5.04
10	Stony-bottomed pool	660	G935910	3.5.04
11	L. Asgartha	460	G925901	4.5.04
12	L. Nabrackbautia	460	G923905	4.5.04
13	*Sphagnum* pool	580	G923913	4.5.04
14	*Sphagnum* pool, mountain top	670	G935910	4.5.04
15	Stream	450	G913897	4.5.04
16	Lake near L. Nabrackbautia	460	G924904	4.5.04

TABLE 3. Occurrence and abundance of beetle species in pitfall traps from three mountain ranges in Ireland. * species confined to high altitudes in Ireland. † species found predominantly in mountains in Ireland.

Site codes: M=Mayo; S=Sligo; D=Donegal	M1	M2	M3	M4	M5	S1	S2	S3	S4	S5	D1	D2	D3	D4	D5
Species Altitude (m)	350	450	600	780	780	300	350	400	600	640	450	500	650	650	650
Carabidae															
Abax parallelepipedus (Piller & Mitterpacher)	6	32	15	.	.	5	1	1	20	3	.	.	.	.	3
Agonum fuliginosum (Panzer)	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Agonum muelleri (Herbst)	.	.	.	.	1	48	3	.	5	1	.	.	.	.	.
Bembidion atrocoeruleum (Stephens) †	3	.	.	.	.	.	4	.	.	.	.	.	.	.	.
Bembidion deletum Audinet-Serville	.	.	.	.	.	1	9	.	.	.	.	.	.	.	.
Carabus arvensis Herbst †	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Carabus problematicus Herbst †	2	.	1	.	2	.	.	.	2	5	7	1	1	1	.
Clivina fossor L.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Elaphrus cupreus Duftschmid	.	.	.	.	.	.	.	.	4	1	.	.	.	.	.
Leistus montanus Stephens *	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Leistus terminatus (Hellwig)	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.
Loricera pilicornis (Fabricius)	1	.	.	.	.	.	.	.	6	.	3	.	1	2	.
Nebria brevicollis (Fabricius)	.	.	.	1	.	3	2	.	.	.	.	.	.	.	.
Nebria nivalis (Paykull) *	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Nebria rufescens (Ström) †	7	17	187	213	234	.	.	1	12	5	12	12	9	17	20
Nebria salina Fairmaire & Laboulbène	.	.	5	12	9	.	2	.	35	34	.	.	.	2	.
Notiophilus aquaticus (L.)	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Notiophilus biguttatus (Fabricius)	3	2	9	1	2	2	8	1	31	6	.	1	.	1	.
Notiophilus germinyi Fauvel	5	.	.	.	.	.	1	1	5	14	2	.	2	.	3
Olisthopus rotundatus (Paykull) †	.	.	1	.	.	.	.	.	3	.	.	.	.	.	.
Paranchus albipes (Fabricius)	41	.	.	.	.	177	.	.	.	.	.	.	.	.	.
Patrobus assimilis Chaudoir †	.	.	.	1	9	.	.	.	14	74	1	.	4	6	2
Patrobus septentrionis Dejean *	.	.	.	2	14	.	.	.	.	.	.	.	.	.	.
Pterostichus adstrictus Eschscholtz †	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.
Pterostichus diligens (Sturm)	.	.	.	.	.	.	.	.	.	.	4	1	6	.	.
Pterostichus madidus (Fabricius)	.	.	.	.	.	6	2	5	.	.	.	.	.	.	.
Pterostichus melanarius (Illiger)	.	.	.	.	.	5	1	1	.	.	4	.	.	.	.
Pterostichus niger (Schaller)	1	.	.	.	.	.	.	.	1	.	3	.	.	.	.
Pterostichus nigrita (Paykull)	.	.	.	.	.	54	5	.	.	.	.	1	.	.	.
Pterostichus rhaeticus Heer	.	.	.	.	.	.	4	8	7	79	79	5	7	3	7
Trechus obtusus Erichson	29	8	15	4	6	.	.	.	63	70	2	.	.	.	3
Leiodidae															
Agathidium sp (Paykull)	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Choleva agilis (Illiger)	.	2	1	2	.	.	.	.	.	1	.	.	.	.	.
Choleva fagniezi Jeannel	.	.	.	8	4	.	.	.	.	.	1	2	.	.	.
Scydmaenidae															
Stenichnus collaris (Müller & Künze)	.	.	.	.	.	.	.	.	.	1	.	.	1	.	.
Silphidae															
Phosphuga atrata (L).	.	.	.	.	.	.	1	.	.	.	2	.	.	.	1
Staphylinidae															

TABLE 3 (continued)

Acidota crenata (Fabricius)	.	.	1	.	.	.	.	.	.	.	.	1	.	1	.
Acrotona aterrima (Gravehorst)	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
Alaobia trinotata (Kraatz)	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Aloconota gregaria (Erichson)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Anotylus rugosus (Fabricius)	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.
Boreophilia eremita (Rye)	.	1	5	3	.	.	.	.	.	1	1	.	3	2	1
Bryaxis bulbifer (Reichenbach)	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Cypha laeviuscula (Mannerheim)	.	.	1	.	.	.	.	.	4	11	2	22	23	20	14
Datomicra celata (Erichson)	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Dimetrota atramentaria (Gyllenhal)	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.
Eucnecosum brachypterum (Gravenhorst) *	.	.	.	.	4	.	.	.	1	3	.	.	3	6	6
Ischnosoma sp.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Ischnosoma splendidum (Gravenhorst)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Lathrobium brunnipes (Fabricius)	.	1	.	.	.	.	.	.	4	4	.	.	.	.	.
Lathrobium fulvipenne (Gravenhorst)	7	5	2	5	9	3	4	6	4	2	3	1	4	1	6
Lesteva monticola Kiesenwetter *	.	.	2	2	1	.	.	.	13	20	.	.	.	.	.
Lesteva sicula (Ganglbauer)	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.
Microdota sp.	.	.	.	1	.	.	.	.	2	.	.	.	.	.	.
Mniusa incrassata (Mulsant & Rey) †	.	.	.	.	.	.	.	.	4	4	.	.	2	1	.
Mocyta amplicollis (Mulsant & Rey)	.	.	.	.	.	.	.	.	12	7	.	.	.	1	.
Ocalea picata (Stephens)	.	2	2	4	12	.	.	.	.	.	.	.	1	.	1
Ocypus olens (Müller)	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
Olophrum piceum (Gyllenhal)	.	4	.	.	.	.	.	.	.	.	.	.	.	2	.
Omalium caesum Gravenhorst	.	.	.	.	.	.	.	1	.	.	1	.	.	.	.
Omalium septentrionis Thomson	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
Othius angustus Stephens	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.
Othius punctulatus (Goeze)	1	21	6	.	.	.	3	6	1	3	17	12	11	1	2
Othius subuliformis Stephens *	.	.	.	.	1	.	.	.	1	10	.	.	.	1	1
Oxypoda brevicornis (Stephens)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Oxypoda procerula Mannerheim	.	.	.	.	.	.	.	.	.	1	.	1	.	.	1
Oxypoda tirolensis Gredler *	.	.	.	3	23	.	.	.	.	.	.	.	.	6	.
Parabolitobius inclinans (Gravenhorst)	.	.	3	2	1	.	.	.	.	.	.	.	.	.	1
Philhygra elongatula (Gravenhorst)	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Philhygra sp.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Philonthus decorus (Gravenhorst)	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
Pselaphus heisei Herbst	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Quedius boopoides Munster	8	4	.	.	.	.	.	.	8	15	.	.	.	4	.
Quedius boops (Gravenhorst)	.	.	.	.	2	.	.	1	.	3	.	19	22	27	13
Quedius curtipennis Bernhauer	2	7	.	.	.	.	1	3	.	.	17	4	.	.	.
Quedius maurorufus (Gravenhorst)	.	2	.	.	2	.	.	.	.	.	.	.	.	.	.
Quedius molochinus (Gravenhorst)	.	.	1	.	.	.	.	.	.	4	.	3	3	2	7
Quedius nitipennis (Stephens)	.	.	.	.	.	1	2	.	.	.	.	.	.	.	10
Quedius umbrinus Erichson	.	21	.	.	1	.	.	3	8	39	11	48	49	22	28
Staphylinus erythropterus (L.)	.	.	.	.	.	20	20	5	.	.	.	.	.	.	.
Stenus brevipennis Thomson	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Stenus guttula Müller	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Stenus impressus Germar	.	.	1	3	.	.	.	.	.	.	.	.	.	.	.

TABLE 3 (continued)

Stenus nitidiusculus Stephens	.	1	.	.	.	.	.	.	.	1	1	.	.	2	2
Tachinus elongatus Gyllenhal	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Tachinus signatus (Gravenhorst)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Tachyporus chrysomelinus (L.)	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.
Hydrophilidae															
Anacaena globulus (Paykull)	1	1	2	.	.	3	.	.	.	.	2	.	.	.	1
Elateridae															
Aplotarsus incanus (Gyllenhal)	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.
Ctenicera cuprea (Fabricius)	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Hypnoidus riparius (Fabricius)	2	.	21	2	6	7	4	6	1	.	9	26	13	68	13
Monotomidae															
Rhyzophagus dispar (Paykull)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
Chrysomelidae															
Lochmaea caprea (L.)	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.
Altica oleracea (L.)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Curculionidae															
Dryocoetes autographus (Ratzeburg)	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Hylurgops palliatus (Gyllenhal)	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.
Otiorhynchus nodosus (Müller)	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.
Number of specimens	119	134	283	273	345	343	78	52	290	430	187	161	166	200	147
Number of species	16	18	22	21	21	21	20	18	42	35	25	18	20	25	24

TABLE 4. Occurrence and abundance of species (male/female) found in pitfall traps at the study sites. * = new county record, the solidus / is used to indicate counties from which a species is not a n.c.r.

M=Mayo; S=Sligo; D=Donegal	M1	M2	M3	M4	M5	S1	S2	S3	S4	S5	D1	D2	D3	D4	D5
Species Altitude (m)	350	450	600	780	780	300	350	400	600	640	450	500	650	650	650
Linyphiidae															
Agyneta decora (O.P.-Camb.)	.	.	.	.	.	.	.	.	1/0	33/0	.	.	.	.	.
Agyneta olivacea (Emerton)*	.	.	.	.	.	.	.	.	.	.	12/0	.	.	.	.
Agyneta subtilis (O.P.- Camb.)*	.	.	.	.	.	.	.	.	.	.	0/1	.	.	.	.
Bathyphantes gracilis (Blackwall)	.	.	.	.	.	.	.	1/0	0/1	1/1	0/1	.	0/4	3/2	.
Centromerita concinna (Thorell)/*/	0/4	0/1	0/4	0/2	0/2	0/2	0/3	0/1	0/21	0/21	0/4	0/8	0/13	0/9	0/5
Centromerus dilutus (O.P.-Camb.)*	.	.	.	.	0/1	.	.	.	.	.	.	.	.	.	.
Centromerus prudens (O.P.-Camb.)/*/	.	1/0	.	1/0	.	.	.	.	.	0/1	.	.	.	.	.
Ceratinella brevipes (Westring)//*	.	.	.	.	.	.	2/0	.	1/0	2/0	.	.	1/0	2/0	.
Dicymbium nigrum (Blackwall)	.	.	.	.	.	.	3/0	.	1/0	.	.	.	.	.	.
Dicymbium tibiale (Blackwall)*//	.	6/2	.	.	.	.	.	.	.	.	.	1/3	1/3	4/1	1/0
Diplocentria bidentata (Emerton)**	.	.	.	1/0	.	.	.	.	.	.	.	3/0	.	18/1	.
Diplocephalus permixtus (O.P.-Camb.)	.	.	.	.	.	0/1	.	.	.	.	.	.	.	.	.
Diplostyla concolor (Wider)	.	.	.	.	.	5/2	1/0	.	.	.	.	.	.	.	.
Dismodicus bifrons (Blackwall)**	.	.	.	.	.	.	.	.	.	1/0	.	.	2/1	.	.
Erigone atra Blackwall	.	.	.	.	.	.	1/0	.	16/4	18/5	.	.	0/1	3/0	.
Erigone dentipalpis (Wider)	.	.	.	.	.	.	.	.	2/0	5/0	.	.	.	2/0	.
Erigone promiscua (O.P.-Camb.)/*/	.	.	.	.	.	.	.	.	2/2	6/0	.	.	1/0	2/0	.
Erigonella hiemalis (Blackwall)*	.	.	.	.	.	13/0	3/0	2/0	.	.	.	.	.	.	.
Gongylidiellum vivum (O.P.-Camb.)	.	.	.	.	.	.	.	.	1/0	.	.	.	.	2/0	.
Hilaira frigida (Thorell)*/*	.	.	5/1	5/2	16/4	.	.	.	3/1	3/0	1/0	0/1	6/4	7/2	3/2
Hypomma bituberculatum (Wider)	.	.	.	.	.	.	.	.	0/1	1/0	.	.	.	.	.
Jacksonella falconeri (Jackson)*	.	.	.	.	.	2/0	.	10/0	.	.	.	.	.	.	.
Latithorax faustus (O.P.-Camb.)***	.	.	4/2	2/0	.	.	1/0	.	.	.	.	4/0	4/0	7/7	.
Lepthyphantes ericaeus (Blackwall)//*	1/0	1/1	.	.	.	2/0	0/1	.	0/1	0/1	.	.	.	.	1/0
Lepthyphantes mengei Kulczynski	.	.	.	.	.	.	.	.	.	2/0	.	.	.	.	.
Lepthyphantes tenebricola (Wider)*	.	.	.	.	.	.	.	.	.	.	.	.	1/0	.	.
Lepthyphantes tenuis (Blackwall)//*	.	.	.	0/1	0/1	1/0	.	.	2/1	0/1	.	.	.	0/1	.
Lepthyphantes whymperi F.O.P.-Camb.*	.	.	.	1/0	.	.	.	.	.	.	.	.	.	.	.
Lepthyphantes zimmermanni Bertkau	1/0	3/0	.	0/1	1/1	.	.	0/1	1/2	0/1	.	.	.	.	.
Lophomma punctatum (Blackwall)//*	.	.	.	.	.	3/0	.	.	.	.	1/0	.	.	.	.
Maro minutus O.P.-Camb.	.	.	.	.	.	.	.	.	.	5/0	.	.	.	.	.
Maro sublestus Falconer*	.	.	5/0	.	.	.	.	.	.	.	.	.	.	.	.
Mecynargus morulus (O.P.-Camb.)*/*	.	.	.	2/1	0/1	.	.	.	.	.	.	.	2/0	.	.
Meioneta gulosa (L.Koch)*	.	.	.	.	.	.	0/1	.	10/0	.	.	.	.	.	.
Meioneta mossica Schikora//*	.	.	.	.	.	.	.	.	.	2/0	.	.	2/0	.	.
Micrargus herbigradus (Blackwall)***	2/0	1/0	.	.	.	.	.	.	0/1	.	2/0	.	.	.	.
Microlinyphia pusilla (Sundevall)/*/	.	.	.	.	.	.	.	.	.	1/0	.	.	.	.	.
Microneta viaria (Blackwall)	.	.	.	.	.	1/0	.	.	.	.	.	.	.	.	.
Minyriolus pusillus (Wider)*	.	.	.	.	.	1/0	.	.	.	.	.	.	.	.	.
Monocephalus castaneipes (Simon)	1/0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Monocephalus fuscipes (Blackwall)	9/0	21/1	.	1/0	.	7/0	5/0	2/0	0/1	2/0	3/1	14/6	7/0	2/1	2/0
Oedothorax fuscus (Blackwall)	.	.	.	.	.	.	.	.	.	0/2	.	.	.	1/0	.
Oedothorax retusus (Westring)//*	0/1	.	.	.	.	.	.	.	.	.	.	.	2/0	.	.

TABLE 4 (continued)

M=Mayo; S=Sligo; D=Donegal	M1	M2	M3	M4	M5	S1	S2	S3	S4	S5	D1	D2	D3	D4	D5
Species Altitude (m)	350	450	600	780	780	300	350	400	600	640	450	500	650	650	650
Oreonetides vaginatus (Thorell)**	.	.	.	.	3/0	.	.	.	.	.	.	.	0/1	7/0	4/0
Peponocranium ludicrum (O.P.-Camb.)*	.	.	.	.	.	.	.	.	1/0	2/0	.	.	.	.	.
Poeciloneta variegata (Blackwall)	1/0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Porrhomma pallidum Jackson**	.	.	0/1	.	.	.	.	0/1	.	.	.	.	.	.	.
Saaristoa abnormis (Blackwall)	0/1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tapinocyba pallens (O.P.-Camb.)	.	.	.	.	.	.	.	.	0/1	.	.	.	.	.	.
Taranucnus setosus (O.P.-Camb.)**	.	.	1/0	.	.	.	.	.	.	.	.	.	.	1/0	.
Walckenaeria acuminata Blackwall	0/1	0/2	.	0/1	.	.	0/1	.	0/2	0/3	.	.	.	.	0/2
Walckenaeria antica (Wider)	.	.	.	.	.	.	0/1	.	.	.	.	.	.	.	.
Walckenaeria clavicornis (Emerton)***	.	.	.	.	2/0	.	.	.	1/0	9/1	.	8/1	18/1	34/1	11/1
Walckenaeria cuspidata Blackwall***	.	2/0	9/1	12/2	11/2	.	.	.	.	2/0	.	.	.	3/0	.
Walckenaeria nudipalpis (Westring)/*/	.	.	1/2	0/1	2/0	.	.	.	0/1	.	.	.	.	.	.
Walckenaeria unicornis O.P.-Camb.	.	.	.	.	.	.	.	.	12/1	.	.	.	.	.	.
Theridiidae															
Robertus lividus (Blackwall)	4/0	11/0	3/0	1/0	.	.	.	.	6/0	9/0	.	1/1	2/0	3/1	3/1
Theonoe minutissima (O.P.-Camb.)*	1/0	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lycosidae															
Alopecosa pulverulenta (Clerck)*	.	.	.	.	.	.	.	.	1/0	.	.	.	.	.	.
Pardosa pullata (Clerck)	.	.	.	.	.	.	.	.	.	1/1	.	.	.	.	.
Pirata piraticus (Clerck)	.	.	.	.	.	.	.	.	.	.	.	.	.	0/1	.
Trochosa terricola Thorell	.	.	.	.	.	14/4	1/0	.	1/0	.	5/0	2/0	.	2/0	1/0
Dictynidae															
Cryphoeca silvicola (C.L. Koch)	1/0	.	9/0	25/1	5/0	.	.	.	.	.	.	.	.	.	.
Number of specimens	28	53	48	63	52	58	24	18	103	143	31	53	77	130	37
Number of species	13	10	10	15	11	12	13	7	26	26	9	9	17	21	10

TABLE 5. Aquatic Hemiptera and Coleoptera recorded from sites on the Mweelrea Mountains, Truskmore, and the Bluestack Mountins. Numbers after names refer to site numbers in Table 2.

Species	Site numbers
Callicorixa wollastoni (Douglas & Scott)	1,3,4,7,16
Velia caprai Tamanini	3,5,11
Arctocorisa carinata Sahlberg	3,4,5,7,10
Sigara distincta (Fieber)	16
Sigara dorsalis (Leach)	12
Sigara nigrolineata (Feiber)	7
Sigara scotti (Douglas and Scott)	12,16
Sigara venusta (Douglas & Scott)	16
Hesperocorixa castanea (Thomson)	3,4,8,
Notonecta glauca L.	12,
Gerris lacustris (L.)	4,
Gyrinus substriatus Stephens	1,3,12,16
Haliplus fulvus (Fabricius)	4,
Haliplus sibiricus Motschulsky	16
Agabus arcticus (Paykull)	1,5,7,10,11,12,16
Agabus bipustulatus (L.)	1,3,5,8
Agabus guttatus (Paykull)	6,8
Agabus sturmii (Gyllenhal)	1
Rhantus suturellus (Harris)	16
Dytiscus marginalis (L.)	3
Hydroporus erythrocephalus (L.)	10
Hydroporus gyllenhalii Schiødte	1,3,6,7
Hydroporus longulus Mulsant & Rey	2
Hydroporus morio Aubé	13
Hydroporus nigrita (Fabricius)	4,8,15
Hydroporus obscurus Sturm	1,6,8,10,16
Hydroporus palustris (L.)	12,16
Hydroporus pubescens (Gyllenhal)	1,3,5,6,9,13,14,15
Hydroporus tristis (Paykull)	1,5,6,8,9,11,13,14,16
Nebrioporus assimilis (Paykull)	16
Stictotarsus multilineatus (Falkenström)	4
Limnebius truncatellus (Thunberg)	3
Helophorus flavipes Fabricius	1,3,6
Helophorus grandis Illiger	3
Anacaena globulus (Paykull)	2,8,9,11,13,16
Hydrobius fuscipes (L.)	3,9,15
Plateumaris discolor (Panzer)	6,8,12,16

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RECORDS OF HOVERFLIES (DIPTERA: SYRPHIDAE) FROM COUNTIES CLARE AND CORK, IRELAND

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Introduction

Species lists tend to get used at one or more of three different geographical scales: the entire State i.e. national level, the region e.g. county level and the individual site e.g. National Park or other protected area, or a property proposed for development. While national Irish lists are now available for many groups of organisms, county lists are a much rarer commodity, particularly in published form. Only for flowering plants is there a sustained and concerted effort to both establish, maintain and publish Irish county lists, through the efforts of the BSBI. On the invertebrate front, publication of county lists has largely been ignored in favour of 10km "spot maps", which do not provide usable information on county distribution. A recent example is provided by the comprehensive account of Irish dragonflies produced by Nelson and Thompson (2004), which does not include county lists.

County species lists for Irish Syrphidae have been published (Speight, 2000), but the records on which those lists are based have mostly not been published. The present text updates the syrphid lists for counties Clare and Cork, at the same time providing at least one record for each species from each county for which it is listed. Counties Clare and Cork were chosen as the topic for this text because the authors have on-going projects that are centred on these counties and based on syrphids. The intention is to provide county lists that can then be used in subsequent publications. Speight (2002a, 2004) provides examples of use of county lists for syrphids in previous issues of this journal.

Methods

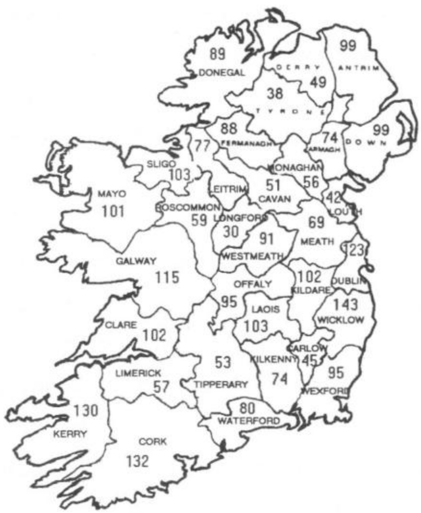
The records listed are derived from both published sources and the collecting activities of the authors and others. In cases where a record has been published previously, publication details are cited. Where possible, records cited refer to specimens in the collections of the National Museum of Ireland. For each species included, at least one record is provided to confirm the occurrence of the species in the county. Where available, additional records of species regarded as decreasing or threatened (see below) are also included. In addition, all available records for one locality of interest in each county have been incorporated into the text so this text has a secondary function of providing *de facto* syrphid lists for these two localities. For Co. Clare the locality selected is Dromore Nature Reserve. For Co. Cork the locality selected is the Glengarriff area, including Glengarriff Forest Nature Reserve and its immediate vicinity, and an outlying area of overmature woodland (Glengarriff Castle). All previously unpublished records cited are based on specimens identified by one or other of the authors. The records given are from within the period 1900 to 2005. The nomenclature used follows that of the most recent version of the StN database (Speight *et al.*, 2006). For literature used to determine the species see Speight (2006).

The number of asterisks inserted after the name of a listed species indicates degree of perceived threat at national level (see below). Absence of an asterisk indicates an absence of recognised threat. In the previously unpublished records, locality names are followed, where possible, by Irish 10Km grid reference and, in brackets, by UTM 50Km grid reference. Date of collection is then given (for specimens caught in Malaise traps the trapping period is indicated), followed by gender of specimen(s). Each record ends with the name of the collector, except where a voucher specimen is available in the National Museum of Ireland, in which case the letters NMI terminate the record. For previously published records only authors' names and date of publication are given - all such cited references are listed in the reference section.

Results

The species lists for counties Clare and Cork are given in Appendix 1. Of the 180 syrphid species known from Ireland, 102 are now recorded from Co. Clare and 132 from Co. Cork. While further survey work would doubtless add further syrphid species, both lists now represent significant bodies of information on the syrphid fauna of their respective counties. Indeed, Figure 1 shows that knowledge of the Clare and Cork syrphid faunas now compares favourably with what is known of the syrphid faunas of other Irish counties.

FIGURE 1. Map of Ireland showing the number of species of Syrphidae (Diptera) known from each county (May, 2006).



APPENDIX 1. Records of Syrphidae from counties Clare and Cork (Ireland).

Abbreviations and symbols used

D = Dromore, R3487 (NU1); G = Glengarriff Forest Nature Reserve and vicinity, V9157/9256/9356 (MT4) and Glengarriff Castle, V9455 (MT4); JO'C = J. P. O'Connor; NMI = National Museum of Ireland; MS = Martin C. D. Speight; TG = Tom Gittings.

* = species regarded as decreasing in Ireland: ** = species regarded as threatened in Ireland; *** = species regarded as extinct in Ireland.

Records of Syrphidae from Co. Clare

Anasimyia lineata* (Fabricius, 1787)**: D, 3.vii.1976, ♀, MS. ***Anasimyia lunulata* (Meigen, 1822): R3391 (MU3), 4.vii.1976, ♂♂♀♀, MS. ***Anasimyia transfuga* (Linnaeus, 1758)***: D, 3.vii.1976, ♂♂♀♀, MS. ***Arctophila superbiens* (Müller, 1776)**: Ennistimon, 17.vii.1924, ♀, NMI. ***Baccha elongata* (Fabricius, 1775)**: D, 19.vi.1976, MS. ***Brachyopa scutellaris* Robineau-Desvoidy, 1843***: Nash and Speight (1976); D, 29.v.1978, ♂, MS. ***Cheilosia ahenea* (von Roser, 1840)***: Speight (1978). ***Cheilosia albipila* Meigen, 1838**: Nash and Speight (1976). ***Cheilosia albitarsis* (Meigen, 1822)**: Speight, Chandler and Nash (1975); D, 29.v.1976, ♂♂♀♀, MS. ***Cheilosia antiqua* (Meigen, 1822)**: Speight, Chandler and Nash (1975); D, 29.v.1976, ♂♂♀♀, MS. ***Cheilosia bergenstammi* Becker, 1894**: Speight, Chandler and Nash (1975); D, 29.v.1976, ♀, MS. ***Cheilosia latifrons* (Zetterstedt, 1843)**: Nash and Speight (1976). ***Cheilosia nebulosa* (Verrall, 1871)***: Slieve Carran, M3204 (MU3), 9.v.1981, M. de Courcy Williams. ***Cheilosia pagana* (Meigen, 1822)**: D, 9.iv.1976, ♀, MS. ***Cheilosia psilophthalma* Becker, 1894****: Speight (1996a). ***Cheilosia scutellata* (Fallén, 1817)**: D, 4.ix.1978, ♀, MS. ***Cheilosia variabilis* (Panzer, 1798)**: D, 21.vi.1975, ♂♂, MS. ***Cheilosia vernalis* (Fallén, 1817)**: M0801 (MU3), 4.viii. 1980, ♀, MS. ***Chrysogaster coemiteriorum* (Linnaeus, 1758)***: Lough Bunny, R3696 (NU1), 12.viii.1979, M. de Courcy Williams. ***Chrysogaster solstitialis* (Fallén, 1817)**: Ennistimon, R1288 (MU3), 9.vii.1981, ♀, JO'C, NMI. ***Chrysotoxum bicinctum* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 3.vii.1976, MS. ***Chrysotoxum***

fasciatum* (Müller, 1764)**: D, 22.viii.1979, ♀, MS. ***Chrysotoxum festivum* (Linnaeus, 1758)**: D, 6.vii.1978, ♂, MS. ***Criorhina berberina* (Fabricius, 1805)**: D, 20.vi. 1977, ♀, MS. ***Dasysyrphus albostriatus* (Fallén, 1817)**: D, 29.v.1976, ♂, MS. ***Dasysyrphus venustus* (Meigen, 1822)**: Speight, Chandler and Nash (1975). ***Doros profuges* (Harris, 1780)**/**: Speight, Chandler and Nash (1975). ***Epistrophe eligans* (Harris, 1780)**: Speight, Chandler and Nash (1975); D, 19.iv.1976, ♂♂, MS. ***Episyrphus balteatus* (DeGeer, 1776)**: D, 28.viii.1983, MS. ***Eristalinus aeneus* (Scopoli, 1763)**: Polsallagh, M0903 (MU3), 10.vii.1984, M. de Courcy Williams. ***Eristalinus sepulchralis* (Linnaeus, 1758)**: Knockalough, R1463 (MU4), 22.v.1990, ♀, MS. ***Eristalis abusiva* Collin, 1931**: D, 6.vii.1978, ♀, MS. ***Eristalis arbustorum* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 20.iv.1976, ♀, MS. ***Eristalis interrupta* (Poda, 1761)**: D, 6.vii.1978, ♂, MS. ***Eristalis intricaria* (Linnaeus, 1758)**: D, 20.iv.1976, MS. ***Eristalis lineata* (Harris, 1776)**: D, 6.vii.1978, ♂, MS. ***Eristalis pertinax* (Scopoli, 1763)**: Speight, Chandler and Nash (1975); D, 20.iv. 1976, MS. ***Eristalis tenax* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975). ***Eupeodes corollae* (Fabricius, 1794)**: R2991 (MU3), 29.v.1976, ♀, MS. ***Eupeodes latifasciatus* (Macquart, 1829)**: 6.vii. 1978, ♂, D. N. Dowling. ***Eupeodes luniger* (Meigen, 1822)**: D, 3.vii.1976, MS. ***Ferdinandea cuprea* (Scopoli, 1763)**: D, 20.iv.1976, MS. ***Helophilus hybridus* Loew, 1846**: D, 3.vii.1978, MS. ***Helophilus pendulus* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 20.iv.1976, MS. ***Heringia heringi* (Zetterstedt, 1843)**: D, 12.viii.1979, M. de Courcy Williams. ***Lejogaster metallina* (Fabricius, 1781)**: Speight, Chandler and Nash (1975). ***Lejogaster tarsata* (Meigen, 1822)*/****: Lough Atedaun, R2988 (MU3), 14.vii.1984, ♀, M. de Courcy Williams. ***Leucozona glaucia* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 3.vii.1976, MS. ***Leucozona laternaria* (Müller, 1776)**: Speight, Chandler and Nash (1975); D, 4.ix.1978, ♀, MS. ***Leucozona lucorum* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 27.v.1976, MS. ***Melangyna arctica* (Zetterstedt, 1838)**: Dooglaun, R5391 (NU1), 11-31.vii. 2001, ♀♀, TG. ***Melangyna lasiophthalma* (Zetterstedt, 1843)**: D, 20.iv.1976, MS. ***Melangyna umbellatarum***

(Fabricius, 1794): D, 4.ix.1978, ♂, MS. ***Melanogaster aerosa* (Loew, 1843)***: Carran, R2899 (MU3), 16.vi.1994, ♂♂♀♀, MS. ***Melanogaster hirtella* (Loew, 1843)**: Speight, Chandler and Nash (1975); 6.vii.1978, ♀, D. N. Dowling. ***Melanostoma mellinum* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 3.vii.1978, M. de Courcy Williams. ***Melanostoma scalare* (Fabricius, 1794)**: Speight, Chandler and Nash (1975); D, 20.iv.1976, MS. ***Meliscaeva auricollis* (Meigen, 1822)**: Dooglaun, R5391 (NU1), 11-31.vii. 2001, ♂, TG. ***Meliscaeva cinctella* (Zetterstedt, 1843)**: Speight, Chandler and Nash (1975); D, 20.iv.1976, MS. ***Microdon mutabilis* (Linnaeus, 1758)***: Nash and Speight (1976); Schönrogge *et al*. (2002); Speight, Chandler and Nash (1975). ***Myathropa florea* (Linnaeus, 1758)**: D, 6.vii.1978, ♂, M. de Courcy Williams. ***Neoascia podagrica* (Fabricius, 1775)**: Speight, Chandler and Nash (1975). ***Neoascia tenur* (Harris, 1780)**: D, 27.v.1976, MS. ***Paragus constrictus* Simic, 1986****: Speight and Chandler (1995). ***Paragus haemorrhous* Meigen, 1822**: by Slieve Carran, M3404 (NU1), 23.v.1998, ♂, MS. ***Parasyrphus punctulatus* (Verrall, 1873)**: D, 20.iv.1976, MS. ***Parhelophilus consimilis* (Malm, 1863)***: Knockalough, R1463 (MU4), 22.v.1990, ♂, MS. ***Pipiza noctiluca* Linnaeus, 1758**: Speight, Chandler and Nash (1975). ***Pipizella viduata* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975). ***Platycheirus albimanus* (Fabricius, 1781)**: Speight, Chandler and Nash (1975); D, 20.iv.1976, MS. ***Platycheirus amplus* Curran, 1927****: Gittings *et al*. (2005). ***Platycheirus angustatus* (Zetterstedt, 1843)**: by Lough Gealin, R3294 (MU3), 16.vi.1994, ♂♂♀♀, MS. ***Platycheirus clypeatus* (Meigen, 1822)**: M1809 (MU3), 18.viii.1980, ♂, MS. ***Platycheirus granditarsus* (Forster, 1771)**: D, 27.v.1976, MS. ***Platycheirus manicatus* (Meigen, 1822)**: Speight, Chandler and Nash (1975). ***Platycheirus nielseni* Vockeroth, 1990**: Dooglaun, R5391 (NU1), 18.vi.-11.vii. 2001, ♂♂, TG. ***Platycheirus occultus* Goeldlin, Maibach and Speight, 1990**: Ballyea, R2083 (MU3), 8-30. vii. 2002, ♀, TG. ***Platycheirus rosarum* (Fabricius, 1787)**: Speight, Chandler and Nash (1975). ***Platycheirus scambus* (Staeger, 1843)**: R3368 (NU2) 3.x.1980, ♀, MS. ***Platycheirus scutatus* (Meigen, 1822)**: Dooglaun, R5391 (NU1), 31. vii.-20.viii. 2001, ♂, TG. ***Portevinia maculata* (Fallén,**

1817): Slieve Carran, M3204 (MU3), 7.vi.1985, ♂♂, MS. ***Rhingia campestris*** **Meigen, 1822**: Speight, Chandler and Nash (1975); D, 20.iv.1976, MS. ***Scaeva pyrastri*** **(Linnaeus, 1758)**: D, 29.viii.1983, MS. ***Sericomyia lappona*** **(Linnaeus, 1758)**: Dooglaun, R5391 (NU1), 18.vi.-11.vii. 2001, ♀, TG. ***Sericomyia silentis*** **(Harris, 1776)**: Speight, Chandler and Nash (1975); D, 4.ix.1978, ♂, MS. ***Sphaerophoria fatarum*** **Goeldlin, 1989**: R3294 (MU3), 15.vi.1994, ♂, MS. ***Sphaerophoria interrupta*** **(Fabricius, 1805)**: D, 29.viii.1983, MS. ***Sphaerophoria philantha*** **(Meigen, 1822)**: Speight, Chandler and Nash (1975). ***Sphaerophoria scripta*** **(Linnaeus, 1758)**: D, 29.viii.1983, MS. ***Sphegina clunipes*** **(Fallén, 1816)**: Speight, Chandler and Nash (1975); D, 28.vi.1980, M. de Courcy Williams. ***Syritta pipiens*** **(Linnaeus, 1758)**: R3294 (MU3), 15.vi.1994, ♂, MS. ***Syrphus ribesii*** **(Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 20.iv.1976, MS. ***Syrphus torvus*** **Osten-Sacken, 1875**: D, 4.ix.1978, ♂♀, MS. ***Syrphus vitripennis*** **Meigen, 1822**: D, 20.iv.1976, MS. ***Trichopsomyia flavitarsis*** **(Meigen, 1822)**: M1505 (MU3), 22.vi.1977, ♂♂♀♀, MS. ***Tropidia scita*** **(Harris, 1780)**: D, 29.viii.1983, MS. ***Volucella bombylans*** **(Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 27.v.1976, MS. ***Volucella pellucens*** **(Linnaeus, 1758)**: D, 3.vii.1976, MS. ***Xanthogramma citrofasciatum*** **(DeGeer, 1776)****: Nash and Speight (1976). ***Xylota segnis*** **(Linnaeus, 1758)**: Speight, Chandler and Nash (1975); D, 27.v.1976, MS. ***Xylota sylvarum*** **(Linnaeus, 1758)**: D, 3.vii.1976, MS. ***Xylota tarda*** **Meigen, 1822****: Speight *et al.* (1979).

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Anasimyia contracta **Claussen and Torp, 1980***: Cloheen Strand Intake, W3738 (NT2), 29.vi.-19.vii.2003, ♀♀, TG. ***Anasimyia lineata*** **(Fabricius, 1787)**: Speight (2001); Speight, Chandler and Nash (1975). ***Anasimyia transfuga*** **(Linnaeus, 1758)***: Kilkerran, W3333 (NT2), 15.vi.1997, ♀♀, MS. ***Arctophila superbiens*** **(Müller, 1776)**: G, 26.vii.1977, ♂, MS. ***Baccha elongata*** **(Fabricius, 1775)**: Speight (2001); Speight, Chandler and Nash (1975); G, 12.vii.1985, ♀, JO'C, NMI. ***Brachyopa insensilis*** **Collin, 1939****: Ballyannan Wood, W8772, 11.v.2006, ♂, TG. ***Brachypalpoides lentus* (Meigen, 1822)***: Ballyannan Wood, W8872 (NT3), 1.vi.-25.vi.2003, ♀, TG; G, 15.v.-20.vi.2005, ♀, TG. ***Chalcosyrphus nemorum* (Fabricius, 1805)***: G, 15.v.-20.vi.2005, ♀, TG. ***Cheilosia albipila* Meigen, 1838**: Speight (2001): G, 6.v.1991, ♂, MS. ***Cheilosia albitarsis* (Meigen, 1822)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, MS. ***Cheilosia antiqua* (Meigen, 1822)**: Speight (2001); G, 24.iv.1981, M. de Courcy Williams. ***Cheilosia bergenstammi* Becker, 1894**: Speight (2001); Speight, Chandler and Nash (1975); G, 3.vi.2004, ♂♂♀♀, MS. ***Cheilosia chrysocoma* (Meigen, 1822)***: G, 6.v.1991, ♀, MS. ***Cheilosia illustrata* (Harris, 1780)**: Speight (2001). ***Cheilosia impressa* Loew, 1840**: Lough Hyne, W0929 (MT4), 15.vii. 1983, ♂♂, MS. ***Cheilosia latifrons* (Zetterstedt, 1843)**: Glinny, Riverstick, W6658 (NT2),1.vii.-1.viii.2002, ♀♀, MS. ***Cheilosia pagana* (Meigen, 1822)**: Speight (2001); G, 6.vi.1975, ♂, MS. ***Cheilosia scutellata* (Fallén, 1817)**: G, 26.vii.1976, ♀, MS. ***Cheilosia semifasciata* Becker, 1894**: Nash and Speight (1976); Speight (2001); G, 17.iv.1975, ♂♂, MS. ***Cheilosia variabilis* (Panzer, 1798)**: Uragh Wood, V8260 (MT2), 16.vii.1989, ♂♂, MS; G, 8.vii.-13.viii.2005, ♂, TG. ***Cheilosia vernalis* (Fallén, 1817)**: Speight (2001). ***Chrysogaster coemiteriorum* (Linnaeus, 1758)***: Glinny, Riverstick, W6658 (NT2), 15.v.-26.vi.2004, ♀, MS. ***Chrysogaster solstitialis* (Fallén, 1817)**: Speight (2001); G, 15.v.05, ♂, TG. ***Chrysogaster virescens* Loew, 1854***: Speight, Chandler and Nash (1975); G, 6.v.1991, ♂, MS. ***Chrysotoxum bicinctum* (Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 25.vii.1976, MS. ***Chrysotoxum fasciatum* (Müller, 1764)**: G, 8.vii.-13.viii. 2005, ♀, TG. ***Chrysotoxum festivum* (Linnaeus, 1758)**: Speight, Chandler and Nash (1975); G, 29.vii.1986, M.de Courcy Williams. ***Criorhina berberina* (Fabricius, 1805)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.v.1991, ♂, MS. ***Criorhina floccosa* (Meigen, 1822)***: Ballyannan Wood, W8872 (NT3), 16.v.2004, ♀, TG; G, 15.v.-20.vi.2005, ♀, TG. ***Dasysyrphus albostriatus* (Fallén, 1817)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂, MS. ***Dasysyrphus tricinctus* (Fallén, 1817)**: Speight, Chandler and Nash (1975). ***Dasysyrphus venustus* (Meigen, 1822)**: G, 6.v.1991, ♂♂♀♀, MS. ***Didea fasciata*** **Macquart, 1834**: G, 27.vii.1976, MS. ***Epistrophe eligans*** **(Harris, 1780)**: Speight (2001); Speight, Chandler and Nash (1975); G, 8.v.2005, ♀, TG. ***Epistrophe grossulariae*** **(Meigen, 1822)**: G, 6.viii.1989, ♂, T. Lavery. ***Episyrphus balteatus*** (DeGeer), 1776: Speight (1996b); Speight (2001); Speight, Chandler and Nash (1975); G, 17.iv.1975, ♀, MS. ***Eriozona syrphoides*** **(Fallén, 1817)**: G, 4.vi.2004, ♂, MS. ***Eristalinus aeneus*** **(Scopoli, 1763)**: Speight, Chandler and Nash (1975). ***Eristalinus sepulchralis*** **(Linnaeus, 1758)**: Speight (2001). ***Eristalis abusiva*** **Collin, 1931**: Speight (2001). ***Eristalis arbustorum*** **(Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 25.vii.1976, MS. ***Eristalis cryptarum*** **(Fabricius, 1794)*****: Andrews (1914). ***Eristalis interrupta*** **(Poda, 1761)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂♂, MS. ***Eristalis intricaria*** **(Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 18.iv.1975, MS. ***Eristalis lineata*** **(Harris, 1776)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂, MS. ***Eristalis pertinax*** **(Scopoli, 1763)**: Speight (2001); Speight, Chandler and Nash (1975); G, 18.iv.1975, MS. ***Eristalis tenax*** **(Linnaeus, 1758)**: Speight (2001). ***Eumerus strigatus*** **(Fallén, 1817)**: Speight (2001). ***Eupeodes bucculatus*** **(Rondani, 1857)**: Carrigagulla, W3883 (NT1), 3.vii.-23.vii 2003, ♂, TG. ***Eupeodes corollae*** **(Fabricius, 1794)**: Speight (2001); Speight (1996b); G, 15.v.-20.vi.2005, ♀, TG. ***Eupeodes latifasciatus*** **(Macquart, 1829)**: Speight (2001); G, 6.vi.1975, ♂, MS. ***Eupeodes luniger*** **(Meigen, 1822)**: Speight (2001); Speight, Chandler and Nash (1975). ***Ferdinandea cuprea*** **(Scopoli, 1763)**: G, 6.v.1991, ♂, MS. ***Helophilus hybridus*** **Loew, 1846**: Speight (2001). ***Helophilus pendulus*** **(Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 18.iv.1975, MS. ***Helophilus trivittatus*** **(Fabricius, 1805)***: Speight (2001); Cloheen Strand Intake, W3738 (NT2), 19.vii.-24.viii.2003, ♂♀, 24.viii.-1.x.2003, ♂, TG. ***Heringia vitripennis*** **(Meigen, 1822)**: Ballyannan Wood, W8871 (NT4) and W8872 (NT3), 4.vii.-1.vii.2004, ♀♀, TG. ***Lejogaster metallina*** **(Fabricius, 1781)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♀, MS. ***Lejogaster tarsata*** **(Meigen, 1822)*/****: Cloheen Strand Intake, W3738 (NT2), 19.vii.-24.viii.2003, ♀, TG. ***Leucozona glaucia* (Linnaeus, 1758)**: Glinny, Riverstick, W6658 (NT2), 6.viii.2003, ♂, MS. ***Leucozona laternaria* (Müller, 1776)**: Speight (2001); Speight, Chandler and Nash (1975); G, 25.vii.1976, MS. ***Leucozona lucorum* (Linnaeus, 1758)**: Speight (2001); G, 6.viii.1989, T. Lavery. ***Melangyna arctica* (Zetterstedt, 1838)**: G, 6.v.1991, ♂♂♀♀, T. Lavery. ***Melangyna lasiophthalma* (Zetterstedt, 1843)**: Speight (2001); G, 18.iv.1975, MS. ***Melangyna umbellatarum* (Fabricius, 1794)**: Ballyannan Wood, W8872 (NT3), 26.vii.-20.viii.2003, ♂, TG. ***Melanogaster hirtella* (Loew, 1843)**: Speight (2001); Speight, Chandler and Nash (1975); G, 7.vii.1977, MS. ***Melanostoma mellinum* (Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 25.vii.1976, MS. ***Melanostoma scalare* (Fabricius, 1794)**: Speight (2001); Speight, Chandler and Nash (1975); G, 18.iv.1975, MS. ***Meligramma cincta* (Fallén, 1817)**: Speight (2001). ***Meliscaeva auricollis* (Meigen, 1822)**: Nash and Speight (1976); Speight (2001); G, 6.vi.1975, ♂, MS. ***Meliscaeva cinctella* (Zetterstedt, 1843)**: Speight (2001); Speight, Chandler and Nash (1975); G, 25.vii.1976, MS. ***Merodon equestris* (Fabricius, 1794)**: Kilkerran, W3333 (NT2), 15.vi.1997, ♀, MSG, 15.v.2005, ♀, TG. ***Microdon analis* (Macquart, 1842)****: G, 18.iv.1975, MS; G, 8.v.2005, ♀, 8-15.v.2005, ♂, 15.v.2005, ♂, 15.v.-20.vi.2005, ♂, TG. ***Microdon myrmicae* Schönrogge *et al.*, 2002*/****: Speight (2002b); G, 3.vi.2004, ♂♂♀♀, MS. ***Myathropa florea* (Linnaeus, 1758)**: Speight (2001); G, 6.vi.1975, ♂, MS. ***Neoascia geniculata* (Meigen, 1822)***: Cloheen Strand Intake, W3738 (NT2), 29.vi.-19.vii.2003, ♀, 19.vii.-24.viii.2003, ♀, 24.viii.-1.x.2003, ♀, TG. ***Neoascia podagrica* (Fabricius, 1775)**: Speight (2001); G, 6.vi.1975, ♀, MS. ***Neoascia tenur* (Harris, 1780)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♀, MS. ***Orthonevra geniculata* (Meigen, 1830)***: Speight (2001). ***Orthonevra nobilis* (Fallén, 1817)***: Nash and Speight (1976); Speight (2001); G, 6.vi.1975, ♂, MS; Ballyannan Wood, W8772 (NT3), 1.vi.-25.vi.2003, ♂, TG. ***Paragus haemorrhous* Meigen, 1822**: G, 6.vi.1975, ♂, MS. ***Parasyrphus annulatus* (Zetterstedt, 1838)**: Bantry, V94, date of collection unknown, female, NMI. ***Parasyrphus malinellus* (Collin, 1952)**: G, 6.v.1991, ♂, T.

Lavery. ***Parasyrphus nigritarsis* (Zetterstedt, 1843)****: G, 8.v.2005, ♂, 8-15.v.2005, ♂♂, TG. ***Parasyrphus punctulatus* (Verrall, 1873)**: G, 6.v.1991, ♂♂♀♀, T. Lavery. ***Parhelophilus consimilis* (Malm, 1863)***: W0929 (MT4), 13.vii.1983, ♂♂♀♀, MS. ***Pipiza austriaca* Meigen, 1822**: Glenfield North, R4414 (NT1), 18.vi.-8.vii.2004, ♀♀, TG. ***Pipiza luteitarsis* Zetterstedt, 1843**: Glinny, Riverstick, W6658 (NT2), 29.iv.-16.v.2005, ♀, MS. ***Pipiza noctiluca* Linnaeus, 1758**: Speight, Chandler and Nash (1975). ***Pipizella viduata* (Linnaeus, 1758)**: Reanahoun, R2619 (MT3), 11.vi.-2.vii.2003, ♀, TG. ***Platycheirus albimanus* (Fabricius, 1781)**: Speight (2001); Speight, Chandler and Nash (1975); G, 18.iv.1975, MS. ***Platycheirus ambiguus* (Fallén, 1817)**: Speight (2001). ***Platycheirus angustatus* (Zetterstedt, 1843)**: Speight (2001); G, 20.vi.-8.vii.2005, ♀, TG. ***Platycheirus clypeatus* (Meigen, 1822)**: Speight (2001); G, 8-15.v.2005, ♂♀, TG. ***Platycheirus fulviventris* (Macquart, 1829)**: G, 7.vii.1977, MS. ***Platycheirus granditarsus* (Förster, 1771)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂, MS. ***Platycheirus manicatus* (Meigen, 1822)**: Speight (2001). ***Platycheirus nielseni* Vockeroth, 1990**: Clydaghroe, W1883 (MT3), 9.vii.-2.viii.2001, ♂♂♀♀, TG. ***Platycheirus occultus* Goeldlin, Maibach and Speight, 1990**: Speight (2001); Speight and Goeldlin (1990); G, 15.v. 2005, ♂, TG. ***Platycheirus peltatus* (Meigen, 1822)**: Bridgetown Abbey, W6999 (NT1), 13.vi.1989, ♂♂, MS. ***Platycheirus perpallidus* Verrall, 1901**: Kilkerran, W333 (NT2), 15.vi.1997, ♂, MS. ***Platycheirus rosarum* (Fabricius, 1787)**: Speight (2001); Speight, Chandler and Nash (1975); G, 5.vii.1976, MS. ***Platycheirus scambus* (Staeger, 1843)**: Speight (2001). ***Platycheirus scutatus* (Meigen, 1822)**: Speight (2001). ***Portevinia maculata* (Fallén, 1817)**: Gearagh, W2970 (MT4), 2.vi.1985, ♂♂♀♀, M. de Courcy Williams. ***Rhingia campestris* Meigen, 1822**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, MS. ***Riponnensia splendens* (Meigen, 1822)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.viii.1989, ♂, T. Lavery. ***Scaeva pyrastri* (Linnaeus, 1758)**: Speight (2001). ***Scaeva selenitica* (Meigen, 1822)**: Nash and Speight (1976); G, 6.vi.1975, ♂♀, MS. ***Sericomyia lappona* (Linnaeus, 1758)**: G, 6.vi.1975, ♂, MS.

Sericomyia silentis* (Harris, 1776)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, MS. ***Sphaerophoria batava* Goeldlin, 1974**: G, 6.vi.1975, ♂, MS. ***Sphaerophoria fatarum* Goeldlin, 1989**: G, 25.vii.1976, MS. ***Sphaerophoria interrupta* (Fabricius, 1805)**: Speight (2001); G, 3.vi.2004, ♂♂, MS. ***Sphaerophoria philantha* (Meigen, 1822)**: G, 6.vi.1975, ♂♂, MS. ***Sphaerophoria scripta* (Linnaeus, 1758)**: Speight (2001). ***Sphegina clunipes* (Fallén, 1816)**: Speight (2001); Speight, Chandler and Nash (1975); G, 18.iv.1975, MS. ***Sphegina elegans* Schummel, 1843**: Speight (2001); G, 8.vii.-13.vii.2005, ♂, TG. ***Syritta pipiens* (Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂, MS. ***Syrphus rectus* (Osten-Sacken, 1877)**: Glinny, Riverstick, W6658 (NT2), 17.viii.-4.ix.2001, ♀, MS. ***Syrphus ribesii* (Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 18.iv.1975, MS. ***Syrphus torvus* Osten-Sacken, 1875**: Speight (2001); G, 18.iv. 1975, MS. ***Syrphus vitripennis* Meigen, 1822**: Speight (2001). ***Trichopsomyia flavitarsis* (Meigen, 1822)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂♂♀♀, MS. ***Tropidia scita* (Harris, 1780)**: Ballyvergan, X0975 (NT3), 15.vi.1989, ♂, MS. ***Volucella bombylans* (Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂, MS. ***Volucella pellucens* (Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 25.vii.1976, MS. ***Xanthandrus comtus* (Harris, 1780)*: G, 25.vii.1976, MS. ***Xylota florum* (Fabricius, 1805)****: Dunmanway, W2452 (MT4), 10.vii.1997, ♂♀, TG. ***Xylota jakutorum* Bagatshanova, 1980**: Nash and Speight (1976); G, 6.vi.1975, ♂, MS. ***Xylota segnis* (Linnaeus, 1758)**: Speight (2001); Speight, Chandler and Nash (1975); G, 6.vi.1975, ♂♂♀♀, MS. ***Xylota sylvarum* (Linnaeus, 1758)**: Speight (2001); G, 6.vi.1975, ♂, MS.

References

Andrews, H. W. (1914) Notes on some Diptera taken in the south of Ireland. *Irish Naturalist* **23**: 136-143.

Gittings, T., Giller, P. and O'Halloran, J. (2005) Notable Irish hoverfly (Diptera: Syrphidae) records, 2001 and 2002. *Irish Naturalists' Journal* **28**: 132-133.

Nash, R. and Speight, M. C. D. (1976) Records of, and notes on, some rare Irish hoverflies (Dipt., Syrphidae) including a first record of *Criorhina ranunculi. Irish Naturalists' Journal* **18**: 351-356.

Nelson, B. and Thompson, R. (2004) *The natural history of Ireland's dragonflies.* National Museums and Galleries of Northern Ireland, Belfast. 454pp.

Schönrogge, K., Barr, B., Wardlaw, J. C., Napper, E., Gardner, M. G., Breen, J., Elmes, G. W. and Thomas, J. A. (2002a) When rare species become endangered: cryptic speciation in myrmecophilous hoverflies. *Biological Journal of the Linnean Society* **75**: 291-300.

Speight, M. C. D. (1978) *Cheilosia laskai* sp. n. (Dipt. Syrphidae) from Western Ireland. *Irish Naturalists' Journal* **19**: 217-222.

Speight, M. C. D. (1996a) A mass migration of *Episyrphus balteatus* and *Eupeodes corollae* arriving in the south-west and remarks on other migrant hoverflies (Diptera: Syrphidae) in Ireland. *Irish Naturalists' Journal* **25**: 182-183.

Speight, M. C. D. (1996b) *Cheilosia psilophthalma* and *Odinia boletina*, insects new to Ireland and *Sapromyza sexpunctata* confirmed as an Irish species (Diptera: Syrphidae, Odiniidae and Lauxaniidae). *Irish Naturalists' Journal* **25**: 178-182.

Speight, M. C. D. (2000) Irish Syrphidae (Diptera), Pt.1: species accounts and distribution maps. *In* Speight, M. C .D., Castella, E., Obrdlik, P. and Ball, S. (eds) *Syrph the Net, the database of European Syrphidae* **18**. Syrph the Net publications, Dublin. 215 pp.

Speight, M. C. D. (2001) Farms as biogeographical units: 2, the potential role of different parts of the case-study farm in maintaining its present fauna of Sciomyzidae and Syrphidae (Diptera). *Bulletin of the Irish Biogeographical Society* **25**: 248-278.

Speight, M.C.D. (2002a) An annotated list of the Syrphidae (Diptera) of Pollardstown Fen, Co.Kildare, Ireland. *Bulletin of the Irish Biogeographical Society* **26**: 196-210.

Speight, M. C. D. (2002b) Two controversial additions to the Irish insect list: *Microdon* *myrmicae* Schönrogge *et al.* and *Pipiza festiva* Meigen (Diptera: Syrphidae). *Bulletin of the Irish Biogeographical Society* **26**: 143-153.

Speight, M. C. D. (2004) Insect records from the Connemara (Co.Galway) and Mayo (Co. Mayo) National Parks, Western Ireland. *Bulletin of the Irish Biogeographical Society* **28**: 31-60.

Speight, M. C. D. (2006) Species accounts of European Syrphidae (Diptera), Ferrara 2006. *In* Speight, M. C. D., Castella, E., Sarthou, J.-P. and Monteil, C. (eds) *Syrph the Net, the database of European Syrphidae*. **54**. Syrph the Net publications, Dublin. 252 pp.

Speight, M., Castella, E., Sarthou, J.-P. and Monteil, C. (eds) (2006) Syrph the Net on CD. Issue **5**. *The database of European Syrphidae*. ISSN 1649-1917. Syrph the Net Publications, Dublin.

Speight, M. C. D. and Chandler, P .J. (1995) *Paragus constrictus, Pteromicra pectorosa* and *Stegana similis*: insects new to Ireland and *Stegana coleoptrata*, presence in Ireland confirmed (Diptera). *Irish Naturalists' Journal* **25**: 28-32.

Speight, M. C. D., Chandler, P. and Nash, R. (1975) Irish Syrphidae (Diptera): notes on the species and an account of their known distribution. *Proceedings of the Royal Irish Academy* **75B**: 1-80.

Speight, M. C. D. and Goeldlin de Tiefenau, P. (1990) Keys to distinguish *Platycheirus angustipes, P. europaeus, P. occultus* and *P. ramsarensis* (Dipt., Syrphidae) from other *clypeatus* group species known in Europe. *Dipterists Digest* **5**: 5-18.

Speight, M. C. D., Williams, M. de C. and Withers, P. (1979) *Pachygaster minutissima*, *Psacadina zernyi* and *Xylota tarda*: insects new to Ireland. *Irish Naturalists' Journal* **19**: 354-355.

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IRISH NON-MARINE MOLLUSCS – AN EVALUATION OF SPECIES THREAT STATUS

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Summary

A list of the Irish non-marine Mollusca whose conservation status could be considered to be threatened is presented. Twenty five of the one hundred and sixty two Irish taxa are considered to be under threat at present.

Introduction

Apart from the freshwater pearl mussels *Margaritifera margaritifera* (L.) and *Margaritifera margaritifera durrovensis* Phillips, no other non-marine mollusc is listed specifically under Irish law for protection. A further four species are protected under the auspices of Annex II of the Habitats Directive, Geyer's whorl snail *Vertigo geyeri* Lindholm, Des Moulin's whorl snail *V. moulinsiana* (Dupuy), the narrow-mouthed whorl snail *V. angustior* Jeffreys and the Kerry slug *Geomalacus maculosus* Allman. The administrative and scientific efforts that have been required to fulfil the requirements of the Habitat's Directive have concentrated conservation efforts towards these six taxa, in some cases at the expense of species that are equally, and in some cases more deserving of conservation effort. This text is an attempt to redress this issue, and to introduce a list of species that are worthy of conservation effort. The categorisation of a species as threatened here is based on available distribution data, habitat association information, and habitat availability and status information. The taxa have been designated a threat status under the IUCN threat status system (IUCN, 2001), using recommended application at regional level (Gärdenfors *et al.*, 2001).

In compiling this list, use was made of the Irish non-marine molluscan records database, and the Molluscan database (Falkner *et al*., 2001). Nomenclature follows that of Anderson (2005) except *M. margaritifera durrovensis* is distinguished from *M. margaritifera*.

Threatened Irish non-marine molluscs

The list of molluscan species that are considered to be threatened in Ireland is given in Table 1. The individual species are then discussed.

TABLE 1. List of molluscan species that are considered to be threatened in Ireland, and the most likely threats to the species.

The species that are listed for protection under the Habitat's Directive are shown. Threats are denoted as follows: UG = under grazing, OG = over grazing, AP = air pollution, CC = climate change, WM = inappropriate woodland maintenance, CF = coniferous forestry, D = drainage, ILU = intensification of land use, RM = river (or canal) modification, WQD = water quality decline, TDP = Tourism & Development pressure, EX = competition or direct mortalities due to exotic species.

IUCN threat categories are denoted as follows: CR = critically endangered, EN = endangered, VU = vulnerable. These are followed by the hierarchical alphanumeric system of criteria and sub criteria on which the categorisation has been based. These are explained in full in IUCN (2001).

Threatened Irish Non-Marine Mollusca (nomenclature follows Anderson, 2005)	**IUCN category applicable**	**Habitat's Directive Annex II species**	**Most likely threats to species**
FAMILY POMATIIDAE			
Pomatias elegans	**CR** B2ab(iii)		**TDP**

TABLE 1 (continued)

FAMILY HYDROBIIDAE			
Ventrobia ventrosa	**VU** B2ab(iii)		**TDP/ CC**
Hydrobia acuta neglecta	**EN** B2ab(iii)		**TDP/ CC**
Mercuria cf. similis	**EN** B2ab(i)(ii)(iii)(iv)		**RM / WQD**
FAMILY TRUNCATELLIDAE			
Truncatella subcylindrica	**EN** B2ab(iii)		**TDP/ CC**
FAMILY LYMNAEIDAE			
Omphiscola glabra	**CR** B2ab(iii)		**WQD / D**
Myxas glutinosa	**VU** Bab(iii)		**WQD**
FAMILY PLANORBIDAE			
Gyraulus laevis	**VU** A2c		**D/ CC**
FAMILY SUCCINEIDAE			
Succinella oblonga	**VU** A2c		**RM / D/ WQD / CC**
Quickella arenaria	**EN** B2ab(iii)		**ILU / D/ OG / CC / UG**
FAMILY VERTIGINIDAE			
Vertigo pusilla	**VU** B2ab(iii)		**ILU / TDP / OG / CC / UG**
Vertigo moulinsiana	**VU** A2c	•	**ILU / TDP / OG / UG / D**
Vertigo lilljeborgi	**VU** A2c		**ILU / WQD / TDP / D**
Vertigo geyeri	**VU** A2c	•	**D / CF/ OG/ UG/ TDP / CC/ ILU**
Vertigo angustior	**VU** A2c	•	**D / CF/ OG/ UG/ TDP/ CC / ILU**
FAMILY LIMACIDAE			
Limax cinereoniger	**VU** A2c		**ILU / WM**
FAMILY CLAUSILIIDAE			
Cochlodina laminata	**VU** A2c		**ILU / WM**

TABLE 1 (continued)

FAMILY HELICIDAE			
Arianta arbustorum	**VU** A2c		**ILU / WM**
Helicigona lapicida	**CR** B2ab(iii)		**ILU / AP**
FAMILY MARGARITIFERIDAE			
Margaritifera margaritifera margaritifera	**CR** A3c	•	**ILU / CF / WQD / RM / D / TDP/ OG / CC**
Margaritifera margaritifera durrovensis	**CR** A4c	•	**ILU / CF / WQD / RM / D / OG / CC**
FAMILY UNIONIDAE			
Anodonta cygnea	**VU** A3e		**EX / WQD / RM**
Anodonta anatina	**VU** A3e		**EX / WQD / RM**
FAMILY SPHAERIIDAE			
Pisidium moitessierianum	**EN** B2ab(iii)		**WQD / RM /**
Pisidium pseudosphaerium	**VU** B2ab(iii)		**D / WQD / RM**

***Pomatias elegans* (O. F. Müller, 1774) Land winkle**

Habitat in Ireland: limestone pavement.

Microhabitat in Ireland: fissures in limestone pavement or associated loose stones with some short vegetation growth and mossy cushions.

P. elegans has a Mediterranean and West European distribution, and is only known living from one Irish site, in County Clare (Platts, 1977). The origins of the population are unclear. A survey in 2000 showed the population to be quite restricted, and threats from ribbon development in the area were noted (Platts *et al.,* 2003). Kerney (1999) lists this species as endangered in Ireland, and Platts *et al.* (2003) agree that this categorization is justified. Its single location and habitat threat places it in the IUCN category of critically endangered.

***Ventrosia ventrosa* (Montagu, 1803)**

Habitat in Ireland: lagoons.

Microhabitat in Ireland: quiet lagoons with salinity 5-25 parts per thousand (Kerney, 1999).

The Irish habitat is not common, and is threatened by interference, increasing demand for coastal development, and potentially by long term climate change. Lagoon system communities can undergo severe disturbance when actively managed, as has been demonstrated at Lady's Island Lake in Co. Wexford (Healy, 1997).

***Hydrobia acuta* (Draparnaud, 1805) subspecies *neglecta* (Muus, 1963)**

Habitat in Ireland: lagoons.

Microhabitat in Ireland: quiet lagoons with salinity 10-33 parts per thousand (Kerney, 1999).

H. acuta neglecta has rarely been reported here, and may be under recorded, as it may be mistaken for other species. However, it is likely to be at best localised in distribution. Its particular salinity requirements – favouring drains and sheltered lagoons with strongly brackish conditions (10-33 parts per thousand) – makes it vulnerable in coastal areas that are coming under developmental pressure and potentially by long term climate change.

***Mercuria cf. similis* (Draparnaud, 1805) Swollen spire snail**

(synonym *Mercuria confusa*)

Habitat in Ireland: tidal sections of rivers.

Microhabitat in Ireland: soft muddy substrates that are exposed during low tides, and at high tides covered by water that is almost fresh, with salinities of 1-5 parts NaCl per thousand (Kerney, 1999). It is associated with *Phragmites* stands in sheltered areas of rivers.

M. cf. similis is another brackish water species with very specific habitat requirements. This estuarine situation is particularly vulnerable to river modification and flood relief works, and to water quality deterioration. Kerney (1999) lists this species as endangered in Great Britain and Ireland.

***Truncatella subcylindrica* (Linnaeus, 1767) Looping snail**

Habitat in Ireland: upper shore brackish water.

Microhabitat in Ireland: under boulders embedded in brackish seepage (Nunn *et al.*, 2005).

T. subcylindrica is another semi-marine snail that has only rarely and recently been recorded in Ireland (Nunn *et al.*, 2005), existing in a habitat that is vulnerable to change, both natural and man-made.

Omphiscola glabra **(O. F. Müller, 1774) Mud pond snail**

(synonym *Lymnaea glabra*)

Habitat in Ireland: ponds and seepages.

Microhabitat in Ireland: clean ponds and seepages in low calcium conditions on acid or sandy soils. These water bodies can dry out occasionally.

The habitat of *O. glabra* is very vulnerable, and is threatened by nutrient enrichment and drainage. The last record of this species in Ireland was by Hurley (1981), who noted that the site was destroyed by drainage. Kerney (1999) considered this species to be endangered here.

Myxas glutinosa **(O. F. Müller, 1774) Glutinous snail**

Habitat in Ireland: clean canals and lakes.

Microhabitat in Ireland: very clean calcareous still water, such as large ponds, lakes and canals, on relatively hard substrate with macrophytes such as *Nuphar lutea*.

M. glutinosa is particularly threatened by nutrient enrichment. The quality of water it requires has not yet been determined but appears to be very high. It has undergone a considerable decline in its North European range, and the populations left in Ireland are internationally important. While some new sites have been found in recent years (Holyoak, 2004), its decline in other sites continues (Moorkens and Killeen, 2005). In Ireland, the species vulnerability is borderline but it must be considered threatened based on current knowledge. It is of particular conservation importance in the context of its international decline (Whitfield *et al*., 1998).

Gyraulus laevis **(Alder, 1838) Smooth ram's horn**

Habitat in Ireland: clean ponds.

Microhabitat in Ireland: very clean, often coastal ponds that can dry out occasionally.

This snail is considered to be a pioneering species, but may have reduced powers of colonisation when suitable water bodies fall in number and density. Loss of the overall pond network and the nutrient enrichment of those left are probably the key reasons for its decline. Increased drying of ephemeral ponds may also be caused by climate change.

***Succinella oblonga* (Draparnaud, 1801) Small amber snail**

Habitat in Ireland: bare muddy habitats at the edges of rivers, ditches and lakes.

Microhabitat in Ireland: damp mud in open situations with little vegetation cover. These tend to be either in the flood plain or water's edge areas, or in areas of high ground water.

S. oblonga is threatened by floodplain management, drainage, nutrient enrichment and climate change.

***Quickella arenaria* (Potiez and Michaud, 1835) Sand-bowl snail or sand amber snail**

(synonym *Catinella arenaria*)

Habitat in Ireland: sand dune slacks and spring seepages.

Microhabitat in Ireland: damp hollows in bare situations in calcareous coastal sand dunes, or open situations with little vegetation cover in calcareous seepages.

Q. arenaria is restricted to a small number of isolated sites in Western Europe. The rarity and vulnerability of these habitats throughout Europe have contributed to the species international decline. The few known Irish sites are of international importance and require conservation protection. These are threatened by drainage, development, nutrient enrichment, over–grazing and trampling, and by climate change.

***Vertigo pusilla* O. F. Müller, 1774 Wall or wry-necked whorl snail**

Habitat in Ireland: fixed sand dunes, woodland and walls.

Microhabitat in Ireland: damp narrow grasses with humus layer in fixed (grey) dunes, and the accumulated humus in old wall and deciduous woodland edges.

A total of five of the eight Irish *Vertigo* species could be considered to be threatened. *V. pusilla* is widespread but locally distributed throughout its European range. Ireland marks the extreme western edge of its range, where it is the rarest of the *Vertigo* species. Although known as the wall snail, the most recent Irish records have been from dune systems. It is threatened by potential development that could remove old walls and woodland fragments, by overgrazing and possibly by climate change in coastal dunes.

***Vertigo moulinsiana* (Dupuy, 1849) Des Moulin's whorl snail**

Habitat in Ireland: calcareous fens and ditches, margins of rivers, lakes and canals.

Microhabitat in Ireland: strong sedge and grass vegetation in saturated calcareous wetland, with a deep litter layer. Very humid conditions, often enhanced by open water evaporation during the spring to autumn over which the vegetation often hangs. The snails climb the vegetation in the summer, and return to the litter layer in winter (Cameron *et al*., 2003).

V. moulinsiana is protected in Ireland under Annex II of the Habitat's Directive. It remains a rare species, although its protection in Europe has resulted in work leading to the discovery of a number of new populations across its range, including Ireland. However, its requirement for high, even hydrogeology makes it vulnerable to drainage and development pressure, and it remains threatened here. Flooding would be equally problematic, with the consequent removal of the winter litter refuge. This species does best in situations where there is a penetrable habitat that varies between micro-habitat that suits both wet and dry years, and is essential in areas where hydrology is not effectively constant. It is not unusual for it to be restricted to a linear drain in a dry summer and then spread over a fen with short vegetation during a persistent wet episode.

***Vertigo lilljeborgi* (Westerlund, 1871) Lilljeborg's whorl snail**

Habitat in Ireland: lake edges and saturated vegetation in swamps.

Microhabitat in Ireland: litter layer of decaying vegetation in reed and sedge swamps or decaying vegetation at a high water mark at non-calcareous lake shores.

V. lilljeborgi is a rare species with a restricted distribution in Scandinavia, Northern Europe, Great Britain and Ireland. In Ireland, it is mainly found at the edges of western oligotrophic lakes. It is threatened by nutrient enrichment, drainage, and by tourist and other developmental pressure.

***Vertigo geyeri* Lindholm, 1925 Geyer's whorl snail**

Habitat in Ireland: calcareous fens and flushes.

Microhabitat in Ireland: decaying and saturated sedge and moss vegetation in springs and seepages, often tufaceous in nature (Cameron *et al.*, 2003).

V. geyeri is another Annex II species, and has very restricted habitat needs, requiring very even hydrogeology, with surface saturation normally attained by the presence of continuous calcareous seepages. This species can only survive in the long term where there is a penetrable area of occupation that varies between habitat that suits both wet and dry years. All Irish populations are vulnerable, conservation management needs to be ongoing, and grazing levels can be critical. This species is threatened by drainage, flooding, overgrazing, and undergrazing, by development pressure in scenic sites and potentially by long term climate change.

***Vertigo angustior* Jeffreys, 1830 Narrow-mouthed whorl snail**

Habitat in Ireland: fixed sand dunes and wetlands, particularly *Iris* marshes.

Microhabitat in Ireland: living and feeding in decaying and damp narrow grass and moss litter in fixed (grey) dunes, and in damp decaying leaves of marsh vegetation (often *Iris*), which is sitting over the saturated marsh habitat (Cameron *et al.*, 2003).

The third Annex II whorl snail is *V. angustior*. This is a widespread but locally distributed European species. In Ireland, it occurs mainly in western damp dune systems, and occasionally in inland *Iris* marshes, particularly where they are over free draining gravels. While individual populations can sometimes hold large numbers, drainage and adverse land management can cause rapid decline and population extinctions. Connectivity between wetland and duneland in coastal situations, and a gradual sloping transition in the inland marsh situations provide a habitat in both wet and dry years. Coastal erosion, over grazing, under grazing, fertilisation of dune farmland and coastal development are all threats to this species, and climate change may exacerbate these threats. The removal or disconnection of the optimal habitat in either wet or dry conditions is not conducive to long term survival of a population.

***Limax cinereoniger* Wolf, 1803 Ash-black slug**

Habitat in Ireland: old deciduous woodland.

Microhabitat in Ireland: grazes lichen and fungi by or on trees, shelters by day under fallen timber.

L. cinereoniger is a characteristic species of old deciduous woodland. It has a very scattered and fragmented distribution. Threats include over-tidy management of woodlands resulting in the removal of invertebrate habitats such as old logs and rocks.

***Cochlodina laminata* (Montagu, 1803) Plaited door snail**

Habitat in Ireland: old deciduous woodland.

Microhabitat in Ireland: fallen timber and litter in old deciduous woodlands. Emerging at night or in damp weather to climb trees where it grazes on algae and lichens.

C. laminata is a rare woodland species here. It has a higher calcium requirement than *Limax cinereoniger*, but it similarly requires fallen timber of various ages to remain in place. It is threatened by woodland removal and inappropriate management.

***Arianta arbustorum* (Linnaeus, 1758) Copse snail or tree snail**

Habitat in Ireland: deciduous woodland, roadside vegetation and river margins, coastal cliffs.

Microhabitat in Ireland: shelters among tall herbs and litter in damp situations, particularly in old deciduous woodland.

A. arbustorum is a European species that is likely to be native to Ireland (it regularly features in archaeological deposits), but is rare at this westerly edge of its range. It is sensitive to temperature increases, and may be threatened by climate change. The species would also be threatened by inappropriate woodland management.

***Helicigona lapicida* (Linnaeus, 1758) Lapidary snail**

Habitat in Ireland: Limestone castle wall and limestone rock outcrop.

Microhabitat in Ireland: free draining limestone with deep crevices.

There is only one Irish record of a living population of *H. lapicida*, from Fermoy, Co. Cork

(Phillips, 1914). The discovery of a fossil specimen in nearby Castletownroche and the fact that the living population lies on one of the few suitable habitats not affected by the last glaciation suggests that this is a relict population in Ireland. While the snail is widespread in more northerly parts of western and central Europe, the Irish population is of great interest and conservation value. It feeds on epiphytic lichens associated with unpolluted situations, and the population would be threatened by any damage to this food supply.

***Margaritifera margaritifera* (Linnaeus, 1758) Freshwater pearl mussel**

Habitat in Ireland: exceptionally clean and naturally acid rivers.

Microhabitat in Ireland: Clean gravel beds and boulders with highly oxygenated clean water running between them in naturally oligotrophic rivers.

Of all the molluscan species that are threatened in Europe, and indeed, in this case, throughout their entire Holarctic range, the best studied and the most endangered group must be the freshwater pearl mussels. The pearl mussel *M. margaritifera* was once widespread in Irish rivers with natural acidity and very high water quality. Its continued living presence as presented in the most recent distribution publications (Kerney, 1999; Moorkens, 1999) belie that its future is in most serious jeopardy. Of the remaining living populations of this long-lived species, only a handful are still recruiting young, and at least 90% of the remaining Irish populations have such depleted water quality and river bed conditions that they will never breed successfully again without artificial intervention (Moorkens, 1999). The demise of the pearl mussel is due to its demand for high water quality. The species requires very clean, unsilted rivers, cleaner than the current requirements for human drinking water or salmonid waters (Moorkens, 2000), and of higher quality than the median levels associated with EPA Q5 waters, currently the highest quality described in Ireland. A desk study of historical water quality data of pearl mussel rivers have shown that the levels of soluble Phosphate and Nitrate that limit *Margaritifera* recruitment are even lower than previously thought. In particular, a molybdate reactive phosphorus (MRP) level of 0.005mg/l is likely to be closer to the required reproducing habitat than the previous estimate of 0.06mg/l of Moorkens (2000). This represents a clean oligotrophic system that has no effective artificial nutrient input. Other nutrient levels that are compatible with reproducing *Margaritifera* rivers are given in Table 2.

TABLE 2. Median levels of nutrients in sites given an EPA rating of Q5 (EPA, 1997), and median rates of *Margaritifera* rivers capable of reproduction.

Parameter	**EPA Q5** **Median values**	**Reproducing *Margaritifera*** **Median values**
Median Ortho-Phosphate (mg P/ l)	0.015	0.005
Median Oxidised Nitrogen (mg N /l)	0.54	0.125
Median Ammonia (mg N /l)	0.03	0.01

Pearl mussels are threatened by any activity that causes river bed siltation, as this leads to oxygen depletion, which smothers the juvenile mussels that must spend their first five years within the river bed gravels. The mussels are equally threatened by any elevation of the low nutrients in its pristine environment, with the extreme case of a river bed algal bloom causing widespread adult mortality and juvenile extirpation. Phosphate sources depend on the river locations, in agricultural areas the threat is mainly from agricultural fertiliser. In remote acid peat areas, the main threat is likely to be conifer forestry on peat soils, both at planting and other fertilising times, and at clear-felling, where ortho-phosphate release can be very high. Harvesting MRP levels of up to 4.164mg/l were found in drains emanating from a clearfelled forest catchment during a forestry impact study (Cummins and Farrell, 2003). This represents over 450 times the pre-felling MRP concentration in that drain, and over 800 times the proposed reproducing pearl mussel level of MRP.

Most recent surveys indicate increasingly depleted populations. A study of south-east Ireland pearl mussel populations produced no evidence of recent recruitment and major adult mortality (Moorkens, Killeen and Kurz, 2004). Catchment wide policies to reduce nutrient and silt load in rivers with declining mussel populations, and extreme protection measures to guard against decline in rivers that are still recruiting young (whose Q rating could perhaps be defined as "Q6") are essential if this species is not to become extinct in this country in the coming years.

***Margaritifera margaritifera durrovensis* Phillips, 1928 Nore pearl mussel**

Habitat in Ireland: hard water lowland river (River Nore).

Microhabitat in Ireland: gravel bed substrate in River Nore.

The only known living population of *M. m. durrovensis* remaining worldwide is in the Nore River, mainly between Poorman's Bridge and Ballyragget. The status of *M. m. durrovensis* is critically endangered. It faces imminent extinction due to depressed river bed and water quality in its habitat (Moorkens and Costello, 1994). The reasons for its decline are the same as those of the last species, the levels of silt and nutrients in its river bed habitat are not only preventing effective reproduction, but they are causing high levels of adult mortality. The results of a recent survey estimated an adult mortality rate of least 50% over the last five years, with 100% mortality of juvenile mussels.

The Nore pearl mussel is listed in the EU Habitat's Directive (Directive 97/62/EEC), which updated and modified the original Annex lists. On this new list *M. m. durrovensis* has been listed as *Margaritifera durrovensis* (*Margaritifera margaritifera*), making it the only Irish endemic animal with European protection. The only way to prevent extinction of this mussel at this stage will be to successfully captive breed it and sufficiently improve its habitat quality.

***Anodonta cygnea* (Linnaeus, 1758) Swan mussel**

Habitat in Ireland: lowland lake or slow moving river and canals.

Microhabitat in Ireland: muddy or silty beds in areas of still or slow flow.

The swan mussel has had a relatively wide distribution in Ireland, although older records may have at times been incorrectly attributed records of *A. anatina* (Kerney, 1999). Over the last ten years, this species has suffered from the spread of the zebra mussel *Dreissena polymorpha* (Pallas), whose spat settles on hard surfaces, including living *Anodonta.* The zebra mussel has free living larva, compared with the native *Anodonta* mussels, which require an intermediary fish host for larvae. This gives the zebra mussel a competitive advantage, and had has resulted in the loss of many species of native mussels in areas of the American Great Lakes and river systems (Ricciardi *et al.*, 1995; Schloesser *et al.*, 1995; Strayer and Smith,1996). The decline of *A. cygnea* and *A. anatina* in the Shannon-Boyle navigation (Minchen *et al.*, 2002), and the decline in these species within the two canal systems in recent years (Moorkens and Killeen, 2005) suggests that the zebra mussel has been the cause of a serious recent decline in both species.

***Anodonta anatina* (Linnaeus, 1758) Duck mussel**

Habitat in Ireland: lowland rivers, canals and lakes.

Microhabitat in Ireland: muddy or silty beds in areas with water flow.

The situation of the duck mussel *A. anatina* is similar to that of *A. cygnea* as the spread of the zebra mussel through a considerable proportion of its Irish distribution in Ireland has resulted in a similar decline (see entry above).

***Pisidium moitessierianum* Paladilhe, 1866 Pygmy pea mussel**

Habitat in Ireland: clean canals and lakes.

Microhabitat in Ireland: mud and fine sediments, sometimes in gritty sand in calcareous areas of canal or lake with high water quality.

P. moitessierianum was considered to be extinct in Ireland (Kerney, 1999) until it was rediscovered in the Grand Canal in 2002 after an absence of records for 78 years (Killeen and Moorkens, 2003). It had been previously recorded from six 10km squares including the Shannon system and the Suir/Barrow system. In 2003, it was also found in the Royal Canal

(Moorkens and Killeen, 2005). It is a European species, which is in decline across much of its range, but may be a recent introduction to North America (Grigorovich *et al.,* in press).

This diminutive species (shell width <2mm) generally lives in calcareous, relatively unpolluted habitats. The decline in the quality of freshwater habitats and dredging operations pose the biggest threat.

***Pisidium pseudosphaerium* J. Favre, 1927 False orb pea mussel**

Habitat in Ireland: overgrown canals and swampy fens.

Microhabitat in Ireland: clean standing water with a muddy substrate, richly vegetated.

P. pseudosphaerium lives in swampy habitats with clean, standing water and a muddy substrate, such as overgrowing canal branches and swampy fens. Recent records from the main channels of the Grand and Royal canals and from two swamps in Westmeath (Moorkens, 2004; Moorkens and Killeen, 2005) confirm its continued presence, but both habitats are vulnerable. Threats include drainage, pollution and dredging activities.

Discussion

This list of threatened molluscan species is based on evidence of decline or rarity in the Irish distributions alongside the recent evidence of actual or likely particular threats that could contribute to further decline in their range or health. There are a number of species that are rarely recorded in Ireland, but are unlikely to be threatened. Some are found only rarely because they remain underground. The three subterranean carnivorous slugs *Testacella haliotidea* Draparnaud, 1801, *T. maugei* Férussac, 1819 and *T. scutulum* Sowerby, 1820 have a paucity of records here but when they are recorded, they are usually from urban habitats. All three species are most likely to be old introductions, and in the absence of a focused survey must be considered to have no evidence of threat. Similarly, *Cecilioides acicula* (Müller, 1774) is a subterranean species that is also rarely recorded, and a suitable survey would be required to assess its distribution. The eccentric snail, *Candidula gigaxii* (L. Pfeiffer, 1850) is likely to be another old introduction that did not spread to any great extent, and has few records (Stelfox, 1958). It is most likely to be restricted to dry, warm sunny sites. The rare milacid *Tandonia rustica* (Millet, 1843) was recoded in Cork by Cawley (1996), but he points out that the descriptions of similar slugs by Stelfox (1911) suggest that this species may be a long term resident in Co. Cork. There is no evidence that it is threatened but it remains an interesting curiosity. Similarly, the Pyrenean glass snail *Semilimax pyrenaicus* (Férussac, 1821) is of interest as it is found only in the Pyrenees and Ireland. However, records for this species continue to increase in number, and it appears to be in no way threatened, and is more likely to be spreading in distribution.

There are a number of other species whose status may change in the near future, or where changing conditions are likely to negatively affect their conservation status. The swamp orb mussel *Sphaerium nucleus* (Studer, 1820) was recently recorded as new to Ireland (Moorkens and Killeen, 2005). The richly vegetated swampy habitat that it was found in is the sort of habitat that is vulnerable to dredging and clearing. In continental Europe, it is recorded from peat bog pools and thus there may be a possibility that it is more widespread in Ireland.

The Kerry slug, *Geomalacus maculosus* is listed in Annex II of the Habitat's Directive. However, it is widespread in Kerry and West Cork, and does not meet the conditions required to place it within a threatened IUCN category. However, the restricted world wide distribution of this species places a responsibility on Ireland to ensure its conservation into the future, and tourism development pressure combined with the recent upsurge in coniferous forestry may already have encroached into the overall size of potential and actual habitat for this species. At present, considerable areas of habitat for *Geomalacus* are maintained within the National Park and cSACs for the species, but the slug could be more vulnerable if there was any removal of protection from these sites.

The lesser bulin *Merdigera obscura* (synonym *Ena obscura*) (Müller, 1774) is a European species with its western limit in Ireland. It is a characteristic species of old, calcareous deciduous woodlands and occasionally hedgerows in Ireland. While the threats to these woodlands may appear to be low, the protection of this species' required invertebrate habitats within the woodlands it inhabits are important in its maintenance, and some sites appear to have been lost through management changes.

A suite of freshwater species that are rare, and may become increasingly threatened by the general decline of once-widespread habitats are the ear pond snail *Radix auricularia* (L.) (lakes and slower areas of rivers, richly vegetated), the capped orb mussel *Musculium lacustre* (Müller, 1774) (swamps, ponds, vegetated margins of rivers and canals) and the iridescent pea mussel *Pisidium pulchellum* Jenyns, 1832 (small rivers and streams, disused canals, clean ditches, lakes).

The alpine pea-clam *Pisidium conventus* Clessin, 1866 has a Holarctic distribution, but is restricted to cold water, either in circumpolar areas, or at high elevations. There have been very few records of this species in Ireland, and these are generally from higher and therefore colder lakes. An old record for Mount Brandon was resurveyed in 2004 (Moorkens, 2005) and a living population was found. It is unlikely that these lakes are under threat from pollution or drainage, but their water temperature may be adversely compromised by future climate change.

A total of twelve threat categories were identified, and the numbers of species that are considered to be threatened by each category are shown in Figure 1.

The threat level with the highest number of species was that concerning the intensification of land use. This was considered to be in the context of rural and agricultural land where in the recent past extensive grazing was likely to occur without a regime of fertilisation, and now has come under pressure due to higher grazing numbers, added fertiliser, or a change of crop to coniferous forestry or other uses. This trend, along with developmental pressure in a country that has had expanding infrastructural, commercial and tourism industries, combines to place increasing areas of rural habitat under threat.

The list of threatened Irish Mollusca can be compared with the general Irish molluscan fauna to see if species that are characteristic of some habitats have more species that are considered threatened than others. The molluscan database of Falkner *et al.* (2001), modified to include Irish slugs and bivalves, was used for this purpose.

Figure 2 shows the numbers of species threatened in Ireland by habitat. As some species occur in more than one habitat, each of which may be threatened, the total number comes to more than the 25 species under threat.

The 25 threatened species comprise one of the 32 species of slugs, 11 of the 61 (18%) aquatic molluscs, including six of the 22 bivalves (27%) and 13 of the 69 (19%) terrestrial snails. Of particular note is that 100% of our large bivalves are under threat. The one threatened slug has a restricted woodland habitat, but most slugs have a wide range of possible habitats. The slugs were therefore excluded from further habitat analyses. The remaining species were placed into habitat categories, and the percentage of the number of species from each habitat type that was considered to be threatened is given in Figure 3. This demonstrates that 75% of the few lagoon species can be considered to be threatened, and that over 10% of species from each of the habitat categories: rivers, canals, lakes, wetlands, woodlands, walls and limestone pavements can be considered to be threatened.

The species that are most threatened are those whose habitat requirements are most restricted, i.e. lagoons, rivers of a particular salinity, rivers and other water bodies of very high water quality, and species of wetlands where hydrological niche requirements are narrow and must be highly stable. In order to conserve such threatened species effectively, these restricted habitats must be protected and future developments and changes in management practice should ensure that these habitat needs are safeguarded for the future. This can be difficult in the context of Habitat's Directive SAC boundaries, which do not allow for buffer zones.

The remaining species fall into the categories Near Threatened (NT) and Least Concern (LC), but our understanding of threats and likely future conservation status would benefit from greater data. As with all IUCN based lists, reviews should be carried out within a reasonable time and when better information presents itself.

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References

Anderson, R. (2005) An annotated list of the non-marine Mollusca of Britain and Ireland. *Journal of Conchology* **38**: 607-638.

Cameron, R. A. D., Colville, B., Falkner, G., Holyoak, G. A., Hornung, E., Killeen, I. J., Moorkens, E. A., Pokryszko, B. M., Proschwitz, T. von, Tattersfield, P. and Valovirta, I. (2003) Species accounts for snails of the genus *Vertigo* listed in Annex II of the Habitats Directive. Pp 151-170. *In* Speight, M. C. D., Moorkens, E. A. and Falkner, G. (eds) "Proceedings of the Workshop on Conservation Biology of European Vertigo Species". Dublin, 2002. *Heldia* **5**.

Cawley, M. (1996) *Tandonia rustica* (Millet) (Mollusca: Gastropoda) new to Ireland. *Irish Naturalists' Journal* **25**: 302.

Cummins, T. and Farrell, E. P. (2003) Biogeochemical impacts of clearfelling and reforestation on blanket peatland streams. 1. Phosphorus. *Forest Ecology and Management* **180**: 545-553.

EPA (1997) *Environmental quality objectives and environmental quality standards. The aquatic environment. A discussion document.* Environmental Protection Agency, Ireland.

Falkner, G., Obrdlik, P., Castella, E. and Speight, M. C. D. (2001) *Shelled Gastropoda of western Europe*. Friedrich Held, München. 267pp.

Gärdenfors, U., Hilton-Taylor, C., Mace, G. and Rodríguez, J.P. (2001) The application of IUCN Red List Criteria at regional levels. *Conservation Biology* **15**: 1206-1212.

Grigorovich, I. A., Colautti, R. I., Mills, E. L., Holeck, K. H., MacIsaac, H. J., (in press (a)) Ballast- mediated animal introductions in the Laurentian Great Lakes: retrospective and prospective analyses. *Canadian Journal of Fisheries and Aquatic Sciences*.

Healy, B. (1997) Long-term changes in a brackish lagoon. *Biology and Environment. Proceedings of the Royal Irish Academy* **97B**: 33-51.

Holyoak, G. A. (2004) *Myxas glutinosa* (Gastropoda: Lymnaeidae) in Irish lakes. *Journal of Conchology* **38:** 459-460.

Hurley, J. (1981) A history of the occurrence of *Lymnaea glabra* (Gastropoda: Pulmonata) in Ireland. *Irish Naturalists' Jounal* **20**: 284-287.

IUCN (2001) *IUCN Red List Categories and Criteria: Version 3.1*. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK. 30pp.

Kerney, M. (1999) *Atlas of the land and freshwater Molluscs of Britain and Ireland.* Harley, Essex. 261pp.

Killeen, I. J. and Moorkens, E. A., (2003) *Pisidium moitessierianum* Paladilhe, 1866, rediscovered in Ireland. *Journal of Conchology* **38**: 94.

Minchen, D., Lucy, F. and Sullivan, M. (2002). Monitoring of zebra mussels in the Shannon-Boyle navigation, other navigable regions and principal Irish lakes, 2000 & 2001. *Marine Environment and Health Series* **5**. 17pp.

Moorkens, E. A. (1999) Conservation management of the Freshwater Pearl Mussel *Margaritifera margaritifera.* Part 1: biology of the species and its present situation in Ireland. *Irish Wildlife Manuals* No. **8**.

Moorkens, E. A. (2000) Conservation management of the Freshwater Pearl Mussel *Margaritifera margaritifera.* Part 2: water quality requirements. *Irish Wildlife Manuals* No. **9**.

Moorkens, E. A. (2004) Non-marine Mollusca: new and notable records for Ireland. *Bulletin of the Irish Biogeographical Society* **28**: 189-198.

Moorkens, E. A. (2005) News from Ireland. *Mollusc World* **7**: 8-9.

Moorkens, E. A. and Costello, M. J. (1994) Imminent extinction of the Nore freshwater pearl mussel *Margaritifera durrovensis* Phillips: a species unique to Ireland. *Aquatic Conservation: Marine and Freshwater Ecosystems* **4**: 363-365.

Moorkens, E. A. and Killeen, I. J. (2005) The aquatic mollusc fauna of the Grand and Royal Canals, Ireland. *Bulletin of the Irish Biogeographical Society* **29**: 143-193.

Moorkens, E. A., Killeen, I. J. and Kurz, I. (2004) *A survey of freshwater pearl mussels in the South Eastern river basin district.* A report for the Heritage Council.

Nunn, J. D., Smith, S. M. and Anderson, R. (2005) Status of *Truncatella subcylindrica* (Linnaeus, 1767) in Ireland. *Journal of Conchology* **38**: 599-600.

Phillips, R. A. (1914) *Helicigona lapicida* in Ireland. *Irish Naturalist* **23**: 37-38.

Platts, E. A. (1977) The land winkle *Pomatias elegans* (Muller) confirmed as an Irish species. *Irish Naturalists' Journal* **19**: 10-12.

Platts, E., Bailey, S., McGrath, D. and McGeough, G. (2003) A survey of the land winkle *Pomatias elegans* (Muller, 1774) in the Burren, Co. Clare. *Biology and Environment. Proceedings of the Royal Irish Academy* **103B**: 197-201.

Ricciardi, A., Whoriskey, F. G. and Rasmussen, J. B. (1995) Predicting the intensity and impact of *Dreissena* infestation on native unionid bivalves from *Dreissena* field density. *Canadian Journal of Fisheries and Aquatic Sciences*, **52**: 1449-1461.

Schloesser, D. W., Nalepa, T. F. and Mackie, G.L. (1995) Infestation of unionid bivalves (Unionidae) in North America. *American Zoologist* **36**: 300-310.

Stelfox, A. W. (1911) A list of the land and freshwater mollusks of Ireland. *Proceedings of the Royal Irish Academy* **29B**: 65-164.

Stelfox, A. W. (1958) A short history of the known occurrences of *Helicella gigaxi* (L.

Pfeiffer) in Ireland. *Journal of Conchology* **24**: 283-284.

Strayer, D. L. and Smith, L. C. (1996) Relationships between zebra mussels (*Dreissena polymorpha*) and unionid clams during the early stages of zebra mussel invasion of the Hudson River. *Freshwater Biology* **36**: 771-779.

Whitfield, M., Carlsson, R., Biggs, J., Walker, D., Corfield, A., Fox, G. and Williams, P. (1998) The ecology and conservation of the glutinous snail *Myxas glutinosa* (Muller) in Great Britain: a review. Pp 209-222. *In* Killeen, I. J., Seddon, M. B. and Holmes, A. M. (eds) Molluscan conservation: a strategy for the 21st Century. *Journal of Conchology Special Publication* **2**.

FIGURE 1. Numbers of species considered to be vulnerable in each threat category.

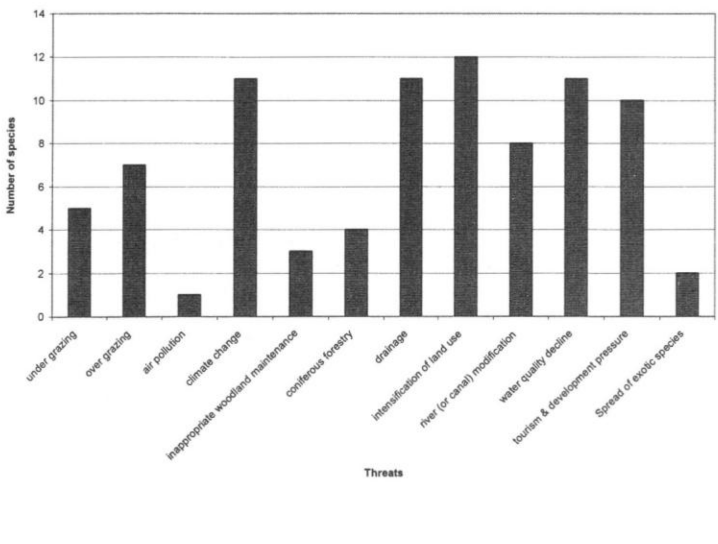


FIGURE 2. Numbers of species threatened in each habitat.

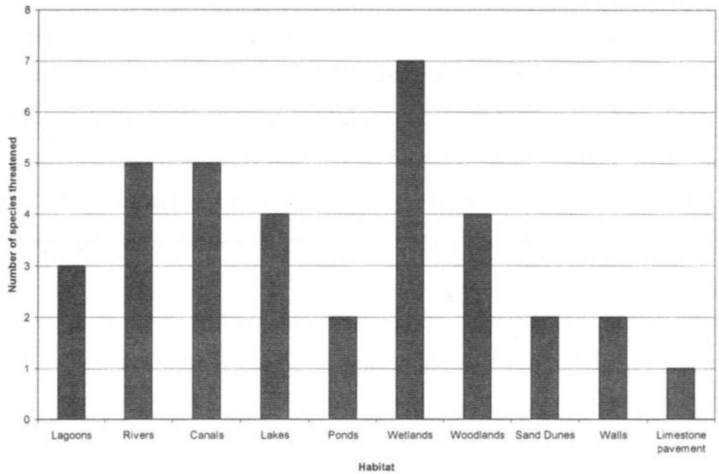
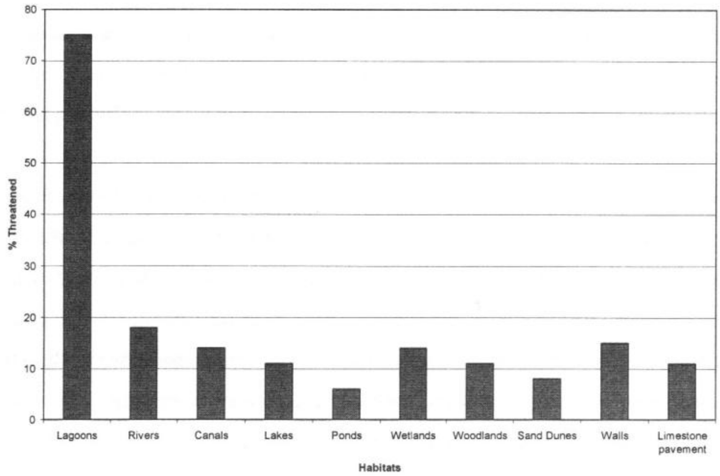


FIGURE 3. Percentage of species of each habitat type threatened in Ireland.



Memoir

Arthur Went 1910-1980

The sudden death of Arthur Went on 8 December 1980 was a tragic loss for his children and grandchildren, his innumerable friends and for fisheries science and for professional and amateur enthusiasts in a remarkably wide swathe of interests, from stamp collecting to local history.

He was a youthful septuagenarian and his passing was as dramatic and public as much of his life had been. He collapsed and died in the headquarters of the Office of Public Works on St Stephen's Green in the centre of Dublin. In some respects it was a good way to go, at the height of his powers and fired up to take part in an arbitration hearing on the finer points of a dispute over compensation to be paid for an eel fishery destroyed by drainage operations on the River Blackwater. I was due to be his opponent and it would have been an interesting confrontation between an 'expert' and his former director. While the outcome can never be known, it is certain that our friendship would not have suffered. He was a magnanimous individual.

Went had retired five years previously from his official post as Inspector and Scientific Adviser in the Department of Agriculture and Fisheries, which he had held since the retirement of G. P. Farran in 1946. Farran had held the more senior position of Chief Inspector of Fisheries. Went was the victim of a most unfortunate decision to abolish it, effectively downgrading the influence of the scientific arm of the fisheries service. So he remained at a relatively low level in the senior administration for 29 years without any formal recognition of his exceptional ability or his devotion to duty. The opposition must have been strong – Went had been a leading activist in the Institute of Professional Civil Servants and was a doughty fighter for the rights of his peers in all government departments.

Arthur Edward John Went was born in London, within the sound of Bow Bells, in 1910 and retained his Cockney accent and wit to the end, uninfluenced by spending more than half his life in the country of his adoption. He left school at l5 years old to work as a technician in a chemical laboratory. During this period he studied for the London Matriculation and in 1930 entered Imperial College, from which he graduated in 1934 with an honours degree in Zoology. His lifelong interest in fisheries was nurtured at this time. He saw something of the fishing industry from its lowest regions, on vacation as a stoker on trawlers in Icelandic waters. His undergraduate thesis was a study on herring, carried out in association with the Plymouth Laboratory.

Having taken up a travelling studentship to Oslo University, he made a gruelling journey by sea and land from a trawler off Norway to attend the interview in Dublin, which led to his appointment as an Assistant Inspector of Fisheries in the Department of Agriculture in 1936. He remained with the Fisheries service from then until his retirement 39 years later in 1975. He was promoted to the Inspector and Scientific Adviser post in 1946. In the 29 years of his tenure of this office, the graduate staff increased from four to twelve.

For all this time Went worked in dismal surroundings: first in a decaying Georgian town house in Kildare Place. It had, the story goes, been condemned as unfit for use, but given an additional lease of life as an economy measure for the Boer War. Tradition also tells that it was finally evacuated when a door lintel collapsed, confining the Minister to his room. The 'laboratory' then moved to a 1920s concrete office block in Cathal Brugha Street. In spite of these privations, excellent work was carried out by Went and his colleagues. Before he retired, the decision to move the research section of the Fisheries administration to a specially designed new laboratory at Abbotstown, Co. Dublin, had been taken and he lived to see its establishment.

One of his early research projects, undertaken in partnership with another expatriate, Winifred E. Frost, was a survey of the River Liffey. This was a pioneering work in the biology of stream and river fish and made a significant contribution to understanding the differences in growth rate between fish in waters of high and low lime content. Went's contribution (1940), in the series of four papers published on the survey, dealt in particular with the salmon, the species to which he devoted most of his professional life and on which he became an acknowledged world authority.

After this early work on juvenile salmon, Went concentrated on the adult fish and most of his subsequent studies were directed towards two aspects of its life history: longevity and migration. The former was based on interpretation of the scales, the latter on extensive tagging experiments.

The scale material lead to the classification of Irish salmon into a number of categories, depending on the length of time spent at sea. Of these, the small summer-caught fish, known as *grilse* or *peal,* proved to have spent just over one year at sea while the majority of the larger *spring fish,* caught in the early months of the year, had spent two full growing seasons at sea. In addition, there were several scarcer types which had spent rather longer periods of absence from freshwater. Salmon which had spawned previously on one, two or even three occasions were also recognised.

Within Went's term of office, these data served to show interesting changes in the habits of some salmon populations. They were also of considerable significance in the controversy which developed over the Greenland salmon fishery. The relatively small numbers of Irish salmon caught off Greenland were all potential spring fish while the grilse, which provide the bulk of the Irish catch, were not affected. The great collection of age determinations made by Went has since been of value in interpretations of trends in salmon populations. In this, as in other cases, his enthusiasm for rapid publication of his results has been of lasting benefit to his successors. The scale data were presented mainly as a series of appendices to the annual *Sea and Inland Fisheries* reports of the relevant Government department.

They were summarised in the invaluable book *Irish Salmon* (1955), based on the series of lectures given during his year of tenure of the office of Buckland Professor. This honour is awarded annually by the UK Buckland Foundation, established by Frank Buckland, a 19th

century Inspector of Fisheries in England and the author of many books on popular science. Like Buckland, Went possessed a wide knowledge of natural history and was an enthusiast for sharing it. As well as publishing his results rapidly and in great detail, Went also reviewed the earlier papers and a more recent assessment of the salmon data is included in the text of a subsequent lecture tour in North America (1970) made at the invitation of the Atlantic Salmon Foundation.

Systematic salmon tagging began in Ireland in 1899 and Went published an account of the early work in the *Proceedings of the Royal Irish Academy* (1947). This was the first of a long series of papers on the subject and dealt mainly with the tagging of kelts released from hatcheries. It established beyond any doubt the accuracy with which salmon could locate their spawning rivers: of 490 recaptures, all but four were made in the river of tagging. A little later, smolt tagging was also documented in minor papers. In 1948 Went initiated the very much more ambitious scheme of tagging salmon caught at sea. This was part of an international programme which had been agreed by the International Council for the Exploration of the Sea (Salmon and Trout Committee).

The first seasons were based at Achill and, in later years, all the major sea-based fisheries for salmon were investigated. Specimens removed from the nets in good condition were bought from the fishermen on the spot, tagged and released. The sea-caught salmon, known to be fasting and on their return journey to their natal rivers, were shown to approach the Irish coast at considerable distances from their eventual destinations. While the majority of those caught in inshore waters were recovered after short periods in nearby rivers, substantial numbers were recovered from distant rivers in Ireland, Wales, Scotland and Sweden. This discovery, greatly refined by subsequent more extensive work, has led to a still-raging controversy on the right of Irish fishermen to capture salmon which, on the basis of their birthplace, properly belong to other nations. As in the case of the age-determination material, details of the tagging results were published as the investigations were completed and have been summarised in the papers of 1955 and 1970.

Two other species received special attention: the sea trout and the char. The sea trout work was based mainly on age determinations and built on earlier studies by G. H. Nall. Went published a Review of the investigations in 1962, which included data from a total of seventeen rivers. The char work was mainly concerned with recording the distribution of the isolated populations of the Irish varieties.

Although deeply involved in the direction of research on commercial species, Went's principal interest in marine fisheries was the recording of unusual species and the maintenance of a series of reports on 'rare or interesting" specimens – his use of the adjective 'interesting' was perhaps unfortunate having the implication that the commercial species were uninteresting. From 1958 until his retirement he contributed an annual paper on this subject to the *Irish Naturalists' Journal*. Went had succeeded, against the odds, in setting up a scheme of rewards payable to fishermen who sent in specimens. The size of the reward varied according to the rarity of the species. These lists, although idiosyncratic in some ways, were a major contribution to Irish biogeography and have come to be of considerable interest in the context of climate change. In 1957 he compiled the authoritative *National Museum List of Irish Fishes* which was revised in collaboration with his friend Michael Kennedy for a new edition of 1969.

His output within the field of fisheries biology, achieved in the face of abysmal working conditions, chronic under-funding and a substantial load of administrative duties, was a token to his energy, physical and intellectual. Academic recognition came first in the form of a Ph.D. from Imperial College in 1942 for a thesis on the biology of salmon in the River Shannon and the Ballysadare River. In 1948 the same institution awarded a D.Sc. for his published works.

Even before the higher degrees came, Went had been elected, in 1942, to membership of the Royal Irish Academy: at 32 years of age one of the youngest members in its history. The Academy membership was a tribute to his exceptionally wide interests in fisheries work, the achievements in biology being almost equalled by his spare-time studies of the history of Irish fisheries. This interest was first developed through official work on fisheries litigation and grew to appear in numerous publications in antiquarian journals. Once again, salmon was the principal species but many other studies were undertaken. In the course of time important review papers appeared, in particular *The pursuit of Irish salmon* (1964). His prowess as an historian led to his being invited to write a history of the International Council for the Exploration of the Sea on the occasion of its seventieth anniversary. This appeared as a work of 252 pages in 1972 under the title *Seventy years a-growing.*

This Council, the oldest international scientific organisation in the world, was one of Went's greatest interests and he served it zealously from 1938, when he first attended as a delegate for Ireland. Between 1952 and 1966 he chaired either the Council's Salmon and Trout Committee or of its Consultative Committee. In 1966 he became President of the Council, a tribute both to his knowledge of fisheries and to his enthusiasm for and effectiveness in committee work.

In an autobiographical note in *Seventy years a-growing* Went listed the Councils of the Royal Irish Academy, Royal Dublin Society, Royal Zoological Society of Ireland and An Taisce as particular interests: rather surprisingly he omitted two of his great loves: the Salmon Research Trust of Ireland and the Irish Specimen Fish Committee. He was a founding father of both and served for many years as a very active council or committee member. He was also one of the founders of the Institute of Biology of Ireland.

His last major paper was a characteristic work, embodying interests in fisheries science, fisheries history and the history of science in Ireland - with a generous addition of comments on natural history in general. This was the chapter on *Fisheries* in the Royal Dublin Society's 250th anniversary history (1981).

Such was Went, the scientist and scientific organiser. Went the man was an ebullient character of endless conversation, kindness and wit. His opinions on many matters were strong and forcefully expressed. He loved his work and his subject and laboured unceasingly to improve everybody's knowledge of science. Thousands of children enjoyed his conducted tours of the Dublin Zoo. Unknown numbers of fishing enthusiasts were regaled by his R.D.S. Extension Lectures or read his numerous contributions to newspapers and angling magazines. At all times he was approachable and friendly and ready to place his encyclopaedic knowledge at the disposal of those who sought it.

CHRISTOPHER MORIARTY

Select bibliography

1940 (with Winifred E. Frost). River Liffey Survey III. The growth and food of young salmon. *Proc. R. Ir. Acad.* **46B**: 53-80.

1947 Salmon marking in Ireland. *Proc. R. Ir. Acad.* **51B**: 173-195.

1955 *Irish salmon and salmon fisheries.* Edward Arnold, London. 93pp.

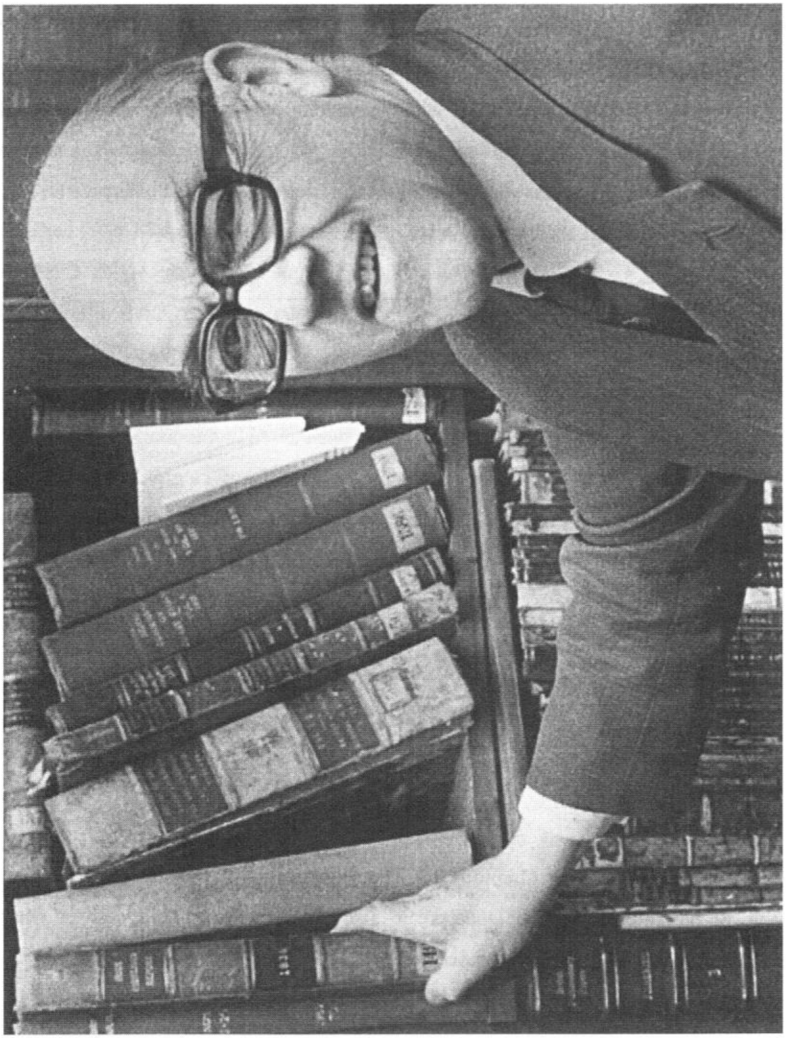
1962 Irish sea trout, a review of investigations to date. *Sci. Proc. R. Dubl. Soc.* **10**: 265-296.

1970 *Atlantic Salmon Association Centennial Award Fund. Series of lectures.* Atlantic Salmon Association, Montreal. 36 pp.

1972 Seventy years a-growing. *Rapp. P.-v. Reun. Cons. int. Explor. Mer.* **165**: 252 pp.

1981 *Fisheries*. Pp 142-153. *In* Meenan, J. and Clarke, D. (eds) *The Royal Dublin Society 1731-1981*. Gill and Macmillan, Dublin.

PLATE 1. Arthur Went 1910-80.



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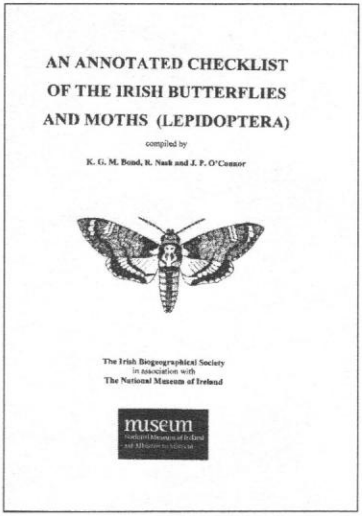

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