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DRAGONFLIES & DAMSELFLIES IN CARMARTHENSHIRE 1995 - I K MORGAN

Typically, the large red damselfly *Pyrrhosoma nymphula* was the first species noted in spring, with one at the Dyfed Wildlife Trust's Ffrwd Fen reserve on 13 April. The blacktailed skimmer *Orthetrum cancellatum* was first noted at Machynys Pond 21/512980 on 28 June and this increasing species also was observed at a new locality in 1995 - Sandy Water Park, Llanelli 22/497004 (on 2 July) with at least 3 males at the stoney margined north-east corner of the lake. The influx of yellow-winged darters *Sympetrum flaveolum* has already been referred to (see DIG 31: 15-18) with two records from Carmarthenshire: near Penrhyngwyn, Machynys 21/515975 on 7 August (B Stewart, SJ Turner and IKM) and another the next day at Cors Goch, Llanllwch 22/363186 (S Lucas & L Gander). A 'new' site for the keeled skimmer *Orthetrum coerulescens* was a flushed pasture at Cae Cilymaenllwyd SSSI (22/648204), where a male was seen by Dawn Gray on 23 August. A very interesting August record was the ruddy darter *Sympetrum sanguineum* (of which there have been few recent records) observed by Andrew Lucas at Bevan's Pond near Kidwelly 22/413046 on the 11th of that month.

Acknowledgements:

Thanks are due to Jamie Bevan. Dawn Gray, George Hutchinson, Andrew Lucas and Graham Motley for submitting records.

DIPTERA RECORDING IN CARMARTHENSHIRE, 1995 - I K Morgan

Two *Brachypalpus laphriformis* were watched on an old, damaged maple at Dinefwr Park 22/611227 on 15 May; one individual was emitting a 'buzzing' noise - possibly courtship? A single *Criorhina floccosa* was shortly afterwards observed to land on the same tree.

Other noteworthy hoverfiies from Dinefwr Park were *Xylota xanthocnema* (basking on a *Rhododendron* leaf) and *Criorhina berberina* (investigating the base of an old oak) on 7 June. Early August witnessed an extraordinary invasion of *Episyrphus balteatus* throughout the county - for example in Stradey Woods 22/40 alone, I estimated thousands of individuals resting in herbaceous vegetation on an overcast but hot afternoon. The total number must have run into millions. Alan Stubbs paid a visit to Carmarthenshire in late May. At Dinefwr (on 18 May) he collected the RDB3 cranefly *Erioptera meigeni* from 'a small embayment with fine shingle' on the Tywi (22/603221), and also the local species *Pedicia littoralis* from spring-fed streams in the Deer Park (22/607225). Other captures included the local species *Hexatoma fuscipennis, Nephrotoma submaculosa* (shingle), *Tipula couchei* (probably a stray from the shingle) and *Gonomyia simplex* ('Bog Wood', 22/6132240) the latter species is judged to be scarce in Wales. At Banc Wernwgan (22/692189) and below Clogau-bach (22/720194) on Mynydd Du, moorland flushes yielded the notable sciomyzid *Dictya umbrarum.* Cae Maesyffynnon (flushed pasture) 22/661237 produced two local craneflies - *Gonomyia simplex* and *Limnophila submarmorata.* The next day (19 May) a visit to the shingle banks of the Afon Tywi at Llanwrda (22/719310) produced some more useful cranefly records:

Hexatoma bicolor	- 'either new to Wales or very few records'
H. fuscipennis	- an aquatic species.
Rhabdomastix edwardsi	- as above
Nephrotoma submaculosa	- terrestrial, drier semi barren shingle
Limnophila trimaculata	- taken on a grassy/sandy runnel
L. verrallii	- again collected at a sandy runnel at the landward margin of the shingle.

The rare horsefly *Tabanus micans* (a male) was noted resting on a gate NE of Cencoed-uchaf (22/487035) on 9 June. Most of the recent few British records of this distinctive (it is mostly black) large species actually come from Carmarthenshire. The much commoner *T. autumnalis* was abundant around cattle near 'Banc-y-Lord' (Pembrey Airfield, 22/393043) on 26 June, but none of the far more distinguished species of coastal grazing levels eg *Hybomitra muhlfeldi* (already known from this area) were seen. There is even the possibility that the especially rare *H. ciureai* (known from the Gwent Levels) may occur in the area.

COLEOPTERA RECORDING IN CARMARTHENSHIRE - I K Morgan

Early February produced an interesting record - that of the shingle specialist 5-spot ladybird *Coccinella quinquepunctata* reported by Jonathan Graham on top of a fence post adjacent to the Afon Tywi at Llandeilo 22/636222 on a warm, sunny day. This species was also noted at Llwyn-jack, Llandovery 22/753332 (a known site) on 3 May (RN Stringer). The same day the writer saw several individuals on stoney wasteground at Llandovery railway station 22/763345 - a rather interesting record as the species is known widely from dry wasteground habitats on the Continent whereas in Britain it is exclusively confined to river shingle. Mark Pavett also reported 5-spots from the shingle at Dinefwr (22/603220) on 30 May.

The new county record of the longhorn *Asemum striatum* at Abergorlech 22/5775355 (23 May) has already been announced (see DIG 31:11), whilst another longhorn record of note

was *Arhopalus rusticus* found beneath a pine log at Pembrey Burrows (21/414995) on 8 July. There was the first record away from the coast of the click beetle *Cidnopus aerrugineus* - on a sandy river bank at Glan-towy 22/533213 on 24 May.

The common 7-spot ladybird *Coccinella 7-punctata* was super-abundant in early August, for example, at Llanelli Beach 21/45995 it was so prevalent 'that people had to leave'! *Galeruca tanceti* was abundant in neutral pasture at Llwyn-bwch 22/684313 on 11 July and the uncommon ground beetle *Amara fulva* was again noted (by PM Pavett) at the Dinefwr (Tywi) shingle bank on 30 May.

The local water beetle *Enochrus bicolor* was reported by Barry Stewart from brackish ditches and pools at the Wildfowl and Wetlands Trust Centre at Penclacwydd, Llanelli 21/530973 on 12 September.

CARMARTHENSHIRE BUTTERFLIES & MOTHS, 1995

-I K Morgan & S Lucas

BUTTERFLIES (I K Morgan)

Weather wise, 1995 will be remembered for its cold late spring period, followed after late June by an almost uninterrupted stretch of dry sunny weather which only started to break in late August. With regard to butterflies, local naturalists will recall the ample springtime sightings of brimstones *Gonepteryx rhamni* and the late summer abundance of ubiquitous red admirals *Vanessa atalanta.*

Of the thirteen 1995 brimstone sightings, the first was a male in a garden at Erw-las, Llwynhendy 21/537993 on 13 March, perhaps lured there by a thriving buckthorn bush (one of the larval food plants). All the subsequent brimstone sightings were from within its known range in the SE of the county *(see Llanelli Nats. Newsl.* **59**:7-8). Of the thirteen records, two - at Llwyn-teg, Llannon 22/551083, J Crowden, 29 July and Rehoboth 22/478046, H Griffiths, 3 Aug. - were of the new brood. The other 1995 brimstone records are listed below:

SE of Lower Lliedi Res 22/520032, IKM, 12 Apr.
nr. Loughor Bridge 21/553984, B Stewart, 1 3 Apr.
Gelli Deg nr Cydweli 22/422105, T Crosby, 14 Apr.
Llwyn-teg, Llannon 22/551083, J Crowden. 1 7 Apr.
Furnace 22/503012, R H Davies, 28 Apr.
Ponthenri 22/484101, A Lucas, 2 May
NW of Tre-Cynllaeth 22/685145, IKM, 2 May
Cydweli Quay 22/397064, G Harper & C Jones, 3 May
Llwyn-teg 22/551084, JC, 6 May
Cross Hands 22/566122, JC, 23 May (male & female)
Penclacwydd 21/528985, B Stewart, 23 May
Rhos Cefn Bryn 22/555072, JC. 26 May

(R D Pryce also furnished three Glamorgan brimstone sightings: Blaengwrfach 22/860049, 14 Mar.; adjacent to Felindre sub-station 22/650012, 29 Mar. and ENE of Aberdulais 22/785001, 7 June.)

The green hairstreak *Calophrys rubi* is a markedly local species in Carmarthenshire, with populations found typically on the gorsey flanks of the hill country and on the rougher parts of the coastal dunes. A few were seen in Pembrey Forest 22/393012 on 5 May, and one was seen during the same period by Steve Lucas near Tirlan, Llwyn-teg 22/556075. Janet Crowden also noted this species on willow blossom at the Dyfed Wildlife Trust reserve at Rhos Cefn Bryn on 12 June, one the next day at the edge of a plantation at Llwyn-teg 22/551083, and another in Pembrey Country Park 22/40-99- on 18 June.

The coastal burrows also provided the only dark green fritillary *Argynnis aglaja* records of 1995 - along the 'Bee Orchid Ride' (to the east of Tywyn Burrows 22/373033, 15 July and a lone individual on Pembrey Burrows 21/41-99- two days earlier. There were only two sightings of silver-washed fritillaries *Argynnis paphia* - one at Carmel Woods 22/601165 on 11 Aug, and another, two days later, at Pembrey Forest 22/378026 (SL). There was a modest number of marsh fritillary *Eurodryas aurinia* and small pearl-bordered fritillary *Boloria selene* sightings; these are listed on the next page in the now customary manner of this annual report.

MARSH FRITILLARY

(i)	Myrtle Hill. Five Roads 22/51 1055	1 on 1 June, GS Motley & J Bevan
(ii)	Parc Matho, nr. Cydweli 22/443086	10 on 9 June
(iii)	Banc Mawr 22/553072	5 on 31 May "
(iv)	Craigbryn, Alltwalis 22/426329	1 on 23 June, S Andrews
(V)	" " 22/427328	5 on 18 June, A Lucas
(vi)	Nant y Garreg 22/374365	1 on 29 June
(vii)	Rhos Cefn Bryn 22/555072*	4 on 4 June, J Crowden
(viii)	" " "	<20 on 13 June
(ix)	Cwrt y Beynon, Pinged 22/434038	3 on 14 June
(X)	E. of Tycroes 22/609109	6 on 21 May, B Stewart & S Turner

* 72 larval webs counted at this DWT reserve in late Sept. by JC & Steve Lucas.

SMALL PEARL-BORDERED FRITILLARY

(i)	nr. Rhyd y Groes 22/776470	1 on 4 June, RD Pryce & G Hutchinson
(ii)	Llundain fach, Esgairdawe 22/613416	7 on - June, J Graham
(iii)	Ynys-tawela, Brynamman 22/707139	2 on 15 June, IKM
(iv)	Blaencothi 22/694485	1 on 26 June, AL
(v)	Craigbryn, Alltwalis 22/427328	2 on 18 June "
(vi)	Nant y Garreg 22/374365	1 on 29 June
(vii)	nr Gelli 22/484384	1 on 7 June, SA
(viii)	W. of Cwmcreigiau-fach 22/427327	3 on 23 June "
(ix)	Myrtle Hill 22/511055	3 on 31 May. GSM & JB

Twenty marbled whites *Melanargia galathea* were counted by GSM & JB near Drefach 22/533141 on 25 July and 18 were at Tycroes 22/609109, again in July (BS & ST). A July 1994 record was of 'several' near Cae'r Bryn (22/698143 to 601142).

Other sightings of interest include a small blue *Cupido minimus,* recorded by (JSM & J Murphy on the dunes at Llansteffan 22/352101 on 2 July, and the observation by B

Stewart & S Turner of many large white *Pieris brassicae* caterpillars on sea rocket *Cakile maritima* at Pembrey Burrows 21/42-99- on 8 July.

Again there was a dearth of comma *Polygonia c-album* and holly blue *Celastrina argiolus* records; indeed there were no reports of either butterfly, in contrast to only a few years ago when both species were frequently noted. There was only one record of a clouded yellow *Colias croceus* - at Cynnant, Cynghordy 22/810443 in the NE of the county, perhaps a little surprising in a summer which was good for other migratory insects. The sand dune populations of kidney vetch *Anthyllis vulneraria* (the food plant of the small blue) were completely desiccated and shrivelled, so it will be interesting to see if next summer's (1996) numbers of small blues are adversely affected.

One species, however, which did have a good year was the red admiral, which first appeared in mid April. This butterfly was truly widespread and abundant, particularly in September when, for example, 18 were feasting on ivy blossom near the Pwll entrance to Stradey Woods 22/487008 on 19 Sept. (IKM, GH) whilst an amazing 70+ bedecked the same plant growing on the walls of Furnace Primary School 22/499011 on 22 Sept. (R H Davies). Barry Stewart and Sandra Turner made the surprising nocturnal capture of red admirals in their moth trap at Erw-las, Llwynhendy 21/537992 on the nights of 14 and 19 Sept., presumably an indication of the heavy immigration then taking place. Painted ladies were around too (but in rather more modest numbers) from mid-July.

Note: Any unattributed records are those of the author.

Acknowledgements: Thanks are due to all recorders mentioned in the text who submitted records.

MOTHS (S. Lucas)

Another wealth of records have been received from several recorders. Barry Stewart (BS), and Sandra Turner (SJT), have recorded 409 species in Carmarthenshire (vc44). They have also been active in Glamorgan for where Barry is now the county recorder. The author (SL), who has now taken over as the Carmarthenshire county recorder from Ian Morgan, has also been busy working three main sites: Pembrey Forest, Tregyb Wood nr. Llandeilo, and at his home at Betws. Andrew Lucas (AL) has carried out useful work at a number of locations especially Coedydd y Garn nr. Drefach whilst others such as Ian Morgan (IKM), Nigel Stringer (RNS), Jamie Bevan (JB), Graham Motley (GM), A. Mitchell (AM) and Richard Pryce have provided interesting records from a variety of sites across the county. Initials are only given where specific records are referred to. For the first time, an annual review of microlepidoptera recorded in the vice-county is included; readers are also referred to Stewart (1993) and Lucas (1994).

Microlepidoptera

It is understandable why the microlepidoptera are generally ignored. This is a pity since there are several good publications available which cover the larger groups in their entirety, eg. British Pyralid Moths by B.Goater, British Tortricoid Moths Vols. 1 and 2 by Bradley, Tremewan & Smith. There is also the Moths and Butterflies of Great Britain and Ireland (MBGBI) series published by Harley of which volume 3 is to be published in May of this year. In addition, there are a number of other more general books which portray various species across the taxonomic spectrum. Any of these texts should enable the recorder to identify most of the commonly encountered microlepidoptera and both Barry Stewart or myself are available to assist if necessary.

A new National Recording Scheme for the *pyralids* and *pterophorids* (plume moths) has been recently established. Apart from providing a recording scheme, it should also help to stimulate interest in this group. This new database currently has some 6,500 records highlighting perhaps the distribution of recorders rather than species! Once the Carmarthenshire records have been updated then these will be forwarded, helping to fill an apparently large gap for Welsh records.

With the current species list numbering 423, it would not be unreasonable to expect several new records to be added annually. 1995 has seen the addition of 16 new county records:

1. Larvae of *Coleophora adjunctella,* at Penclacwydd 21/530984, (BS/SJT) 2/8
2. *Phtheochoa inopiana,* at Llwynhendy 21/537993, (BS/SJT) 12/6-1/8
3. *Cacoecimorpha pronuba,* carnation tortrix, at Llwynhendy 21/537993, (BS/SJT) 1/10
4. *Epiphyas postvittana,* light brown apple moth, at Llwynhendy 21/537993, (BS/SJT) 20/5-8/10; at Penclacwydd 21/530984, 27/7 (BS/SJT); and at Tycroes 22/610110,
   (BS/SJT) 30/9
5. *Acleris forsskaleana,* at Llwynhendy 21/537993, (BS/SJT) 29/7 and at Talley 22/649330, (SL) 29/7
6. *Calypha cespitana,* at Llwynhendy 21/537993, (BS/SJT) 29/6
7. *Gypsonoma acerana,* at Llwynhendy 21/537993, (BS/SJT) 26/7
8. *Epiblema foenella.* at Llwynhendy 21/537993, (BS/SJT) 1/7
9. *Pammene trauniana,* at Llwynhendy 21/537993, (BS/SJT) 29/6
10. *Acentria ephemeralla,* water veneer, at Llwynhendy 21/537993, (BS/SJT) 1/8
11. Larvae of *Mecyna asinalis.* madder pearl, **Nb**, at Pendine 22/233078, (BS/SJT) 8/10
12. *Platyptilla gonodactylla,* at Llwynhendy 21/537993, (BS/SJT) 29/6
13. *Lozotaeniodes formosanus,* at Pembrey Forest 22/393026, (SL) 20/7
14. *Stigmella alnetella,* at Pembrey Forest (BS/SJT) 29/10
15. *Phyllonorycter dubitella,* at Pembrey Forest (BS/SJT) 29/10
16. *Phyllonorycter froelichiella,* at Pembrey Forest (BS/SJT) 29/10
17.

Lozotaeniodes formosanus, whose larvae feed on Scot's Pine *Pinus sylvestris,* is now common in southern England and is spreading rapidly (pers. comm. E.M. Emmett). It is a distinctive and attractive species with reddish-yellow forewings which are broken up with characteristic longitudinal chestnut-brown markings termed 'fascia'. The hind wing is a light grey.

Acleris forsskaleana is another easily identifiable moth with bright yellow forewings which are conspicuously reticulated due to the darkened radial veins and fascial markings. The median fascia is acutely angled and may be thickened. The larvae are said to feed on field maple *Acer campestre,* and sycamore *A. pseudoplatanus.*

The water veneer, *Acentria ephemeralla,* is a pyralid which is unremarkable in appearance but has an interesting life style. The female of the species is sub-aquatic and swims by means of adaptations to the middle and hind legs. The larvae are also sub-aquatic feeding mainly on various pondweeds and algae.

Macrolepidoptera

The exceptionally warm weather experienced this year had the effect of both bringing forward the anticipated flight period of many species and in some instances, encouraged the production of second broods which would not otherwise generally occur. The commonly occurring heart and dart *Agrotis exclamationis.* can usually be found on the wing in June and July with occasional individuals being noted a week or so either side of these months. However, second broods were noted in late August through to mid September. Second

brooding can also account for the finding of the scarce tissue *Rheumaptera cervinalis,* a species that is regarded as being on the wing in late spring. Although described as nationally common, this is a first record for the county and was taken at Tregyb Wood SSSI.

Three new pugs were also added to the county list. The ling pug *Eupithecia f. goossensiata,* and the shaded pug *E. subumbrata,* are locally occurring species. The shaded pug was caught at Pembrey Burrows where many of the larval foodplants including ragwort *Senecio jacobaea,* occurs. The larval foodplant of the ling pug is said to be *Calluna* and *Erica spp., so* presumably these individuals were looking for new breeding areas. Haworth's pug *E. haworthiata,* was taken along the 'Bee Orchid Ride' in Pembrey Forest (22/372032) where traveller's joy *Clematis vitalba,* is abundant. It is described as a local species as is the yellow-barred brindle *Acasis viretata* whose larva feed on various shrubs including guelder-rose *Viburnum opulus.* The nationally common pine carpet *Thera firmata* was also recorded seemingly for the first time in the county which is a little surprising given the amount of forestry plantations in Carmarthenshire.

The addition of these six brings the county species list to 529.

A seventh (but provisional) new county record is the fen square-spot *Diarsia florida,* taken at Tycroes. Little is known about this species although it has been the subject of interest as some consider it to be closely related to the small square spot *D. rubi,* and some would argue that it is in the process of separating from the small square spot. The distribution map shown in Heath *et al* (1983) shows the fen square-spot to occur mainly in the north of England and into Scotland although a few 10 km square dots appear to provide records for Carmarthenshire!

New County Records:

1. *Rheumaptera cervinalis,* scarce tissue, at Tregyb Wood SSSI 22/641215, Common (SL) 15/8
2. *Eupithecia f. goossensiata,* ling pug, at Llwynhendy 21/537993, Local (BS/SJT) 20/7, 1/8
3. *Eupithecia subumbrata.* shaded pug, at Pembrey Burrows 21/40-99-, Local (BS/SJT) 9/7
4. *Eupithecia haworthiata,* Haworth's pug, at Pembrey Forest 22/372032, Local, (BS/SJT) 27/7
5. *Acasis viretata,* yellow-barred brindle, at Llwynhendy 21/537993, Local, (BS/SJT) 21/8 and 14/9
6. *Thera firmata,* pine carpet, at Tycroes 22/610110, Common. (BS/SJT) 30/9
7. *Diarsia florida,* fen square-spot, at Tycroes, 22/610110 Local (BS/SJT) 1/7 (Provisional Record)

Eleven species of Notable status have been recorded. Coedydd y Garn is a woodland along the limestone ridge close to Mynydd Cerrig. This site produced the Blomer's rivulet *Discoloxia blomeri,* and double line *Mythimna turca.* The latter is confined to the south west of England and south Wales although its range is said to be extending eastwards. Whilst both are woodland species, the larvae of double line feed on various woodland grasses whilst those of Blomer's rivulet occur on wych elm *Ulmus glabra.* The alder kitten *Furcula bicuspis,* is a second record for the county as is the small chocolate-tip *Clostera pigra.*

'Notable B' Species:

1. *Adscita statices.* the forester, at Goitre-wen 22/550070, (JB/GM) 1/6;

at Ammanford 22/635128, (SL) 13/6 -

2. *Scopula emutaria,* rosy wave, at Penclacwydd, 21/530984 (BS/SJT) 26/6
3. *Scopula emutaria,* rosy wave, at Llwynhendy, 21/537993 (BS/SJT) 29/6
4. *Lampropteryx otregiata,* Devon carpet, at Tregyb Wood SSSI 22/641215, (SL) 29/7
5. *Discoloxia blomeri,* Blomer's rivulet, at Coedydrd y Garn, Drefach 22/508147, (AL) 14/6
6. *Hydrelia sylvata,* waved carpet, at Tregyb Wood SSSI 22/640218, (SL) 16/6
7. *Furcula bicuspis,* alder kitten, at Tycroes, 22/610110 (BS/SJT) 7/5
8. *Clostera pigra.,* small chocolate-tip, at Pembrey Forest 22/393026, (SL) 27/7
9. *Agrotis trux,* crescent dart, at Penclacwydd, 21/530984 (BS/SJT) 27/7; at Llwynhendy. 21/537993 (BS/SJT) 20/7, 26/7, 1/8
10. *Agrotis ripae,* sand dart, at Cefn Sidan 22/378026, (SL) 8/6, 27/6, 13/7
11. *Mythimna turca,* double line, at Gelli Aur Country Park 22/591198, (SL) 15/7; at Tycroes. 22/610110 (BS/SJT) 16/7; at Carreg Dwfn 22/656175, (AL) 17/7; Dinefwr Deer Park 22/615221, (SL) 17/6
12. *Mythimna litoralis,* shore wainscot, at Cefn Sidan 22/378026, (SL) 8/6, 27/6, 13/7, 20/7

'Notable A' Species:

1. *Lasciocampa trifolii,* grass eggar, at Llwynhendy, 21/537993 (BS/SJT) 29/7
2. *Diachrysia chryson,* scarce burnished brass, at Penclacwydd, 21/530984 (BS/SJT) 5/7; at Llwynhendy, 21/537993 (BS/SJT) 20/7, 26/7; at Cefn Sidan 22/373026, (SL) 20/7

One species which is now missing from this list is the scarlet tiger *Callimorpha dominula.* The status of this very attractive day-flying moth has now been downgraded to 'local'. It has been recorded from some 51 tetrads within the county. Singletons were noted at Llwynhendy 21/537993, (BS/SJT) 29/6; Pembrey Forest 22/378026 (SL) 13/7, and at Llanelli 22/497004 (IKM) 2/7. Two were seen flying at the Dyfed Wildlife Trust's Cors Goch Nature Reserve 22/326184 (SL) 17/7.

Some other day flying moths not already mentioned are:

1. *Zygaena filipendulae*, six-spot burnet, nr. Llyn Llech Owain 22/563148. (JB/GM) 21/7
2. *Zygaeana trifolii ssp. decreta*, five-spot burnet, at Pembrey Forest 22/377035 (BS/SJT) 27/7; at Llanllwch 22/360177 (JB/GM) 28/6; at Syddyn-melyn nr. Trimsaran 22/447057 (JB/GM) 16/8; at Tir Philip 22/482186 (AL) 21/5; at Alltwalis 22/426327 (AL) 28/6; nr. Llyn Llech Owain 22/563148 (JB/GM) 21/7; at Gelli Aur Country Park 22/591198. (SL) 15/7; at Betws 22/642125 (SL) 25/6.
3. *Odezia atrata.* chimney sweeper, at Allt Rhyd-y-Groes 22/761483 (RNS) 13/7.
4. *Pseudopanthera macularia.* speckled yellow, at Abergorlech 22/575355 (IKM) 23/5.

Larvae/Pupae

Although only a handful of confirmed breeding records were reported, the observed occurence of larvae in general seemed to be high. Four larvae of scarlet tiger were noted on bramble at Cors Goch 22/326184 (SL 4/4). At the same site, larvae of the beautiful yellow underwing *Anarta myrtilli (*SL 8/8) and the emperor moth *Pavonia pavonia,* (SL 17/7) were seen. This was followed by observation of a cocoon of the latter species (SL 8/8). At another DWT reserve, Rhos Cefn Bryn 22/558081, larvae of the broom moth *Ceramica pisi,* and the fox moth *Macrothylacia rubi,* (SL 19/9) could be seen basking in the late summer

sunshine. The long hot summer undoubtedly forced many species to find alternative food sources as their preferred plants were consumed and withered in the prolonged drought. At Pembrey Burrows 21/419994, cinnabar *Tyria jacobaeae,* larvae were to be noted on coltsfoot *Tussilago farfara,* a seemingly unrecorded foodplant (BS/SJT) 8/7.

Migratory Species

The occurrence of migratory species appeared to be spasmodic in Carmarthenshire. Small migrations first started as early as March and April when the dark sword grass *Agrotis ipsilon,* first appeared on 23/3 (SL) and again on 6/4 (SL). It was not until well into July did this species regularly turn up in the traps and this continued into November when it was last recorded on 9th (BS/SJT). The silver-y *Autographa gamma,* also exhibited similar flight patterns as did the rush veneer *Nomophila noctuella.*

In August, a singleton humming-bird hawk-moth *Macroglossum stellatarum,* was reported in Llanelli 22/505005 (AM) 15/8 and the following month a second was noted feeding at the flowers of red valerian *Centranthus ruber,* on the cliffs at Pendine 22/233078 (IKM and G.Hutchinson) 19/9. During September, a convolvulous hawk-moth *Agrius convolvuli* was reported from Rhandirmwyn (22/74) (Tony Pickup, pers. comm.)

By early autumn, migration was reaching its zenith with a third record of *M. stellatarum* from Tycroes 22/610110 (D.Wiliams) 14/10 and influxes of the vestal *Rhodometra sacraria* at Llwynhendy 21/537993 (BS/SJT) on 14/10 and 20/10, and *Udea ferrugalis,* a well known migratory pyralid, also at Llwynhendy (BS/SJT) on 14/10, 29/10 and 31/10 and from Mynyddygarreg on 17/10.

Acknowledgements

I should like to express my gratitude to all those who have provided records. Gratitude must also be expressed to those people who have kindly given their consent for recorders to visit their homes and sites. In particular thanks goes to June and Doug Williams of Tycroes; Dr. and Mrs. Nakielny of Talley; and to Forest Enterprise at Pembrey Forest.

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ERRATUM

In the last issue of DIG 31: Autumn 1995, the incorrect table was given for Adrian Fowles' paper (*The Countryside Council for Wales 'Survey and Evaluation of Invertebrate Populations of Welsh Parklands: Dyfed').* The correct version is given below.

Also, in my *Provisional Notes on the Occurrence of Longhorn Beetles (Cerambycidae) in Carmarthenshire,* I referred to (p 11) a paper on longhorn beetles in Glamorgan by Mark Pavett. In the event it was decided not to publish this in the DIG Newsletter.

TABLE 1. SAPROXYLIC INDICATOR SPECIES RECORDED FROM THE VICE-COUNTIES AND SELECTED PARKLANDS OF DYFED

	DINEFWR DEER PARK	DAN-Y-PARC	OLD CILGWYN	PARC PONT FAEN	PARC NANTEOS	CARMS.	PEMBS.	CARDS.
Calosoma inquisitor (3)						44	-	46
Ptinella limbata (2)	*					44	-	-
Stenichnus bicolor (3)	*		*			44	-	46
Quedius aetolicus (3)						44	-	-
Quedius maurus (3)						-	-	46
Quedius scitus (3)	*					44	-	-
Sinodendron cylindricum (3)	*				*	44	45	46
Prionocyphon serricornis (2)						-	45	-
Stenagostus rhombeus (3)	*		*			44	-	46
Selatosomus bipustulatus (3)	*		*			44	-	46
Ctesias serra (3)	*		*			44	-	46
Dorcatoma chrysomelina (2)	*		*	*	*	44	45	46
Dorcatoma flavicornis (3)						-	-	46
Anitys rubens (1)				*		-	-	46
Ptinus subpilosus (2)						-	-	46
Phloiophilus edwardsi (3)					*	-	-	46
Thymalus limbatus (3)	*					44	-	-
Thanasimus formicarius (3)	*					44	-	-
Hylecoetus dermestoides (3)						-	-	46
Rhizophagus nitidulus (3)			*			-	45	46
Uleiota planata (1)						44	-	-
Pediacus dermestoides (3)	*		*			44	45	46
Biphyllus lunatus (3)	*					44	-	46
Triplax aenea (3)	*		*			44	-	46
Lathridius consimilis (1)						-	-	46
Mycetophagus atomarius (3)						-	-	46
Mycetophagus piceus (3)	*		*	*	*	44	-	46
Bitoma crenata (3)	*					44	-	-
Eledona agricola (3)	*					44	-	-
Prionychus ater (3)	*					44	-	-
Tetratoma ancora (3)						-	-	46
Tetratoma fungorum (3)					*	-	-	46
Pyrochroa coccinea (3)			*			-	-	46
Orchesia undulata (3)	*		*		*	44	-	46
Hypulus quercinus (2)						-	45	-
Melandrya caraboides (3)	*		*			44	-	46
Conopalpus testaceus (3)	*					44	-	-
Scraptia testacea (1)		*				44	-	-
Ischnomera caerulea (3)						-	-	46
Aderus oculatus (3)			*			-	-	46
Prionus coriarius (3)	*					44	-	-
Strangalia quadrifasciata (3)	*					44	45	46
Phymatodes testaceus (3)				*		-	-	46
Saperda scalaris (3)						-	-	46
Pentarthrum huttoni (3)						-	-	46
Mesites tardii (3)	*					44	-	46
Xyloterus domesticus (3)	*				*	44	-	46
Xyloterus lineatus (3)						44	-	-
Xyloterus signatus (3)	*				*	44	-	46
Xyloborus dryographus (3)	*					44	-	-
Platypus cylindrus (3)	*		*		*	44	-	46
Index of Ecological Continuity	29	3	15	7	10			

Nb: The 'ecological continuity' grade (Harding & Rose 1986) is given in brackets after the species name.

THE LITTORAL AND OPEN WATER ZOOPLANKTON OF TEN LAKES IN MID-WALES UK - C. A. Duigan[1] and J.M. Seda[2]

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Introduction

The zooplankton, comprised of mainly rotifers, cladocerans and copepods, is an important component of aquatic ecosystems. They occupy a crucial level in the foodweb because they feed mainly on phytoplankton but a few species are predatory. In turn, they form the diet of larger invertebrates and fish. They thereby make a substantial contribution to the overall biomass and productivity of lake systems. In addition, the structure and composition of zooplankton can be used as biological indicators of the trophic status of standing waters. Zooplankton community changes can be used to infer the degree of influence of processes such as acidification and eutrophication.

In 1994 ten standing waters in mid-Wales were subjected to comprehensive ecological surveys as part of a larger research project designed to record the range of physico-chemical and biotic variables exhibited by Welsh lakes. Data was collected on water chemistry, aquatic macrophytes. diatoms, zooplankton and littoral macroinvertebrates. The results of all analyses and subsequent interpretations can be found in Monteith (1995). This papers reports the composition of the littoral and open water zooplankton communities at the study sites. It is presented as a companion paper to Lancaster (1996) which describes the littoral macroinvertebrate assemblages at the same sites.

The study sites represent the diverse lakes types found in mid-Wales. They include upland oligotrophic systems such as Llyn Hir, the mesotrophic systems of Llyn Eiddwen and Llyn Fanod and the lowland, eutrophic Talley Lakes. Table 1 summarises the main physico-chemical characteristics of each site. This table should not be interpreted as a strict environmental gradient from oligotrophic to eutrophic sites, as this will vary according to the environmental parameter examined, but the site numbers correspond with those given in Lancaster (1996). The majority of the sites are within biological Sites of Special Scientific Interest.

No previously reported zooplankton records for these sites were found, with the exception of unpublished data for Llyn Hir (Anon., unpublished) and the Talley Lakes (Green 1994).

Methods

The littoral zooplankton communities were sampled at five sites around the lake shores. The samples were taken using a hand-held net (0.2mm mesh, 17cm diameter) which was moved for one minute over the substrate and through any vegetation present from the edge of the lake down to a depth of approximately 1m. Attempts were made to cover the range of substrates present at each site. Field notes and substrate classifications can be found in Monteith (1995).

The open water zooplankton was sampled by means ol vertical hauls from lake bottom to surface using an Apstein plankton net (0.2mm mesh, 20cm diameter). At least two hauls were carried out at three different sampling stations within each lake. The littoral and open water samples were collected on the same day at each site, between 26 July and 4 August 1994. The material collected in the field was preserved in formaldehyde.

Results and Discussion

Littoral Zooplankton: A total of 34 littoral cladoceran species have been recorded (Table 2). In several lakes, there was considerable variation in species composition and abundance between sampling sites on different substrates. Therefore only a summary presence/absence table is presented here (Table 2). The results of the separate analyses of the fifty samples collected can be found in Monteith (1995). *Acroperus harpae, Chydorus sphaericus, Eurycercus lamellatus* and *Pleuroxus truncatus* were most frequently found. No cladoceran taxon occurred in all the lakes surveyed. Bugeilyn had the most diverse assemblage with 18 taxa being recorded (Table 2).

Acantholeberis curvirostris was recorded only in West leuan and Llyn Hir. This species is known to occur in shallow acid waters over *Sphagnum* (Scourfield and Harding 1966; Fryer 1993). Its presence in these two lakes agrees with its known ecology because *Sphagnum* was recorded as a frequent component of the fringing flora of both sites (Monteith 1995). The chydorid *Alonella nana* was also only found in West leuan and it is consistent with its known association with lakes surrounded by peatlands in Ireland (Duigan 1992).

Some differences in taxon distribution between upland and lowland lakes are evident in the littoral dataset. The most diverse assemblage occurs in Bugeilyn, one of the most oligotrophic sites examined. West leuan appears remarkably taxon poor for an oligotrophic site, but this may be related to the lack of littoral habitat diversity (Monteith 1995). *Alonopsis elongata, Alonella excisa, A. nana and Alona rustica* do not occur in the lowland sites.

The littoral zooplankton communities of the Talley Lakes are quite distinct and characterised by the presence of *Alona costata, Ceriodaphnia pulchella*, *Pleuroxus trigonellus* and a diverse assemblage of *Daphnia* taxa. The former three species frequent lowland, relatively alkaline sites (Fryer 1993; Duigan and Kovach 1991). It is interesting to note the disparity in *Daphnia* community composition between these adjacent lakes.

Open Water Zooplankton: Altogether 25 crustacean species, 9 species of rotifers and 1 species of planktonic insect larvae (Chaoboridae) have been recorded (Table 3). There were no conspicuous differerences in the dominant zooplankton species between the samples taken at the deeper sampling stations and the shallower parts of the lakes. The analyse of the shallow water samples sometimes significantly enlarged the resulting species list recorded per lake, as was the case at Llyn Gynon and the Lower Talley Lake. However, not all of these additional species were truely planktonic.
None of the planktonic species presented in Table 3 were common to all ten study lakes. Bearing in mind the seasonality factor, the best candidate for species of a common occurrence amongst the true planktonic species listed in Table 3 could probably be *Diaphanosoma brachyurum* which was only absent from Llyn Eiddwen. The absence of a common diaptomid *Eudiaptomus gracilis* in Bugeilyn may not be seasonal, but related of the natural acido-dystrophic nature of this site. *Eudiaptomus gracilis* is reported to be an open-water species of wide occurrence, preferring alkaline conditions (Fryer 1993). The presence of *Holopedium gibberum* in Bugeilyn is of noteworthy because this relatively rare cladoceran is known to frequent waters with low ionic content and may be sensitive to eutrophication (Smyly 1968).

The seasonal influence is illustrated by data from the Upper and Lower Talley Lakes. Following a survey by Prof. J. Green, comparable zooplankton data for May 1994 was made available. Out of the 10 crustacean species listed by J. Green, only 7 were found in August. Nevertheless, the absence of 3 "spring species" was compensated by the finding of another three new species. Independent from the incidental occurrence of non-planktonic

taxa such as *Paracyclops affinis* and *Chydorus sphaericus,* the disappearance of *Daphnia longispina* from Lower Talley Lake and the presence of *Daphnia pulex* in Upper Talley Lake is probably seasonally linked.

It is difficult to judge the degree of similarity between the lakes purely on the basis on the species lists (Table 3), because 14 out of the 25 crustacean taxa had an incidental occurrence (i.e. rare species with relative abundance below 1%). Upper Talley was richest in planktonic species (15 species), while just 6 species were recorded in Llyn Hir (Table 3). Nevertheless, a trend of increasing species richness with increasing lake trophy is distinguishable and similar to the trends observed in the macroinvertebrate data (Lancaster 1996).

Acknowledgements

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Table 1. Summary of the major physico-chemical parameters for the ten study lakes in mid-Wales. Data extracted from Monteith (1995).

Lake number	1	2	3	4	5	6	7	8	9	10
Lake Name	Bugeilyn	West leuan	Hir	Gynon	Eiddwen	Fanod	Glanmerin	Maes-llyn	Upper Talley	Lower Talley
Grid Ref.	SN 822923	SN 795815	SN 789677	SN 800647	SN 605670	SN 603643	SN 755991	SN 693628	SN 632337	SN 633332
Altitude (m)	455.00	525.00	435.00	425.00	305.00	310.00	195.00	180.00	105.00	105.00
Max. depth (m)	2.10	8.70	8.80	11.00	7.20	8.70	3.10	5.50	4.20	4.30
pH*	5.17	4.92	5.57	5.43	6.55	6.71	6.50	7.31	6.99	6.81
Conductivity* (μScm^{-1})	31.00	35.00	35.00	33.00	57.00	56.00	66.00	109.00	100.00	93.00
Calcium* ($\mu eq\ l^{-1}$)	58.00	45.00	74.00	63.00	160.00	187.00	181.00	623.00	495.00	411.00
Total P* (μgPl^{-1})	18.00	5.00	6.80	7.70	20.50	18.10	14.70	52.60	51.00	69.00
Chlorophyll a* (μgl^{-1})	3.10	0.80	1.70	1.70	8.40	2.90	2.90	23.10	10.50	24.60

Footnote: * Values based on mean of four quarterly water samples.

Table 2. The littoral Cladocera of ten lakes in mid-Wales; ● = species present.

Lake number Sampling date	1 27-7	2 28-7	3 29-7	4 30-7	5 31-7	6 1-8	7 26-7	8 2-8	9 2-8	10 3-8
Acantholeberis curvirostris		●	●							
Acroperus harpae	●		●	●	●		●	●		●
Alona affinis	●						●	●		●
A. costata									●	●
A. quadrangularis	●									
A. rustica	●			●						
Alonopsis elongata	●	●	●	●	●	●	●			
Alonella excisa	●	●		●						
A. nana		●								
Bosmina longirostris var. *cornuta*					●					
Ceriodaphnia pulchella									●	●
C. quadrangula	●			●			●			
Chydorus piger			●	●	●		●			
C. sphaericus	●	●	●	●			●	●	●	●
Daphnia hyalina									●	
Daphnia hyalina var. galeata									●	
D. hyalina var. lacustris									●	
D. longispina						●	●	●	●	
D. pulex									●	
Diaphanosoma brachyurum	●					●	●	●	●	●
Disparalona rostrata					●					
Drepanothrix dentata			●	●	●		●			
Eubosmina longispina	●		●	●	●					
Eurycercus lamellatus	●		●	●	●	●	●	●	●	●
Graptoleberis testudinaria	●			●		●	●			
Holopedium gibberum	●									
Monospilus dispar	●			●						
Pleuroxus trigonellus									●	●
P. truncatus	●		●		●	●	●	●	●	●
Polyphemus pediculus	●		●	●						
Scapholeberis mucronata	●									
Sida crystallina	●									●
Simocephalus vetulus						●	●		●	●
Streblocerus serricaudatus					●					

Table 3. The open water zooplankton of ten lakes in mid-Wales: abundance in vertical net hauls (number of individuals 0.01 m^{-2}); ⊙ = rare species with relative abundance less than 1%; O = very rare species found at one site only.

Lake number	1	2	3	4	5	6	7	8	9	10
CLADOCERA										
Acroperus harpae				O						
Alona affinis							⊙			
Alonopsis elongata		⊙		O						
Bosmina longirostris							60			
Ceriodaphnia pulchella								O		140
Ceriodaphnia quadrangula	⊙		30	910			1300			
Chydorus sphaericus		⊙								
Daphnia hyalina var. *galeata*									210	O
D. longispina			⊙			1300	⊙	370		
D. pulex									⊙	
Diaphanosoma brachyurum	2100	50	180	1400		110	460	540	⊙	⊙
Drepanothrix dentata		⊙		⊙						
Eubosmina longispina	570	210		40	19500					
Eurycercus lamellatus	⊙			O					⊙	
Holopedium gibberum	140									
Polyphemus pediculus	⊙		⊙							
Simocephalus vetulus							⊙			
COPEPODA										
Acanthocyclops robustus										O
Cyclops abyssorum	⊙				90					
Eucyclops serrulatus								⊙		
Eudiaptomus gracilis		640	980	2500	640	1700	1100	1100	300	1300
Macrocyclops albidus				⊙	O		30		O	O
Megacyclops viridis				⊙						
Paracyclops affinis									O	
Thermocyclops dybowskii										⊙
OTHER PLANKTONICS										
Asplanchna sp.								110	⊙	20
Chaoborus sp. *larvae*						20	10	10	20	30
Conochilus sp.			12400	910	2500	1400	2300		140	
Kellicottia longispina					12500	360		60		
Keratella cochlearis						20	30	110	430	20
Keratella quadrata								60		
Nauplia					50		30	230	90	20
Rotifera sp.								20000		
Trichocerca								510	140	
Volvox					50	300	60	2300		70

AQUATIC MACROINVERTEBRATES OF SOME LAKES IN MID-WALES - J Lancaster

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Introduction

The aquatic macroinvertebrates that inhabit the littoral zone of lakes are often used in surveys and monitoring networks to gain insight into the chemical, nutrient, or biological status of lakes (e.g. Lancaster *et at.* 1996). These animals are relatively easy to sample and, for many groups, the taxonomy is straight forward with many good keys for identification. Rather than focusing on a single group (e.g. Coleoptera, Trichoptera) surveys usually consider the whole suite of species inhabiting the littoral zone, and incorporate what we know of their distribution and ecology to make inferences about the lake. As part of an ongoing project initiated by the Countryside Council for Wales to assess the conservation status of Welsh lakes, the littoral zone fauna of ten lakes in mid-Wales were sampled in autumn of 1994, and the results are presented here. This study is timely as information on the aquatic macroinvertebrates of these lakes is sparse [but see Jenkins (1979) and Palmer (1979) for some records from Llyn Eiddwen and Llyn Fanod; Fowles (1994) for Talley Lakes.] This is a companion paper to Duigan and Seda (1996) which describes the zooplankton assemblages of these same ten lakes; Montieth (1995) provides extensive details of the whole survey.

Methods

All samples were collected between 21 and 23 of September 1994. Autumn is perhaps the optimal season for sampling aquatic macroinvertebrate assemblages in the U.K. as this is when the most species are present and most individuals are large enough to be identified. A list of the sites, their location, and a qualitative description of the habitat at the sampling point are provided in Table 1. Further details on the physicochemical characteristics of these lakes are provided in Duigan and Seda (1996). Five semi-quantitative samples (30 second kick/sweep samples) were collected using a standard pond net (300//m mesh) from the littoral zone of each lake. Sampling was in the dominant habitat type in which it was feasible to collect replicate kick/sweep samples. This sampling regime does not necessarily census all the species occurring in a lake, but does provide a measure of the characteristic species and their relative abundances. In the field, all material was preserved in 4% formalin. In the laboratory, all macroinvertebrates in each sample were separated from the organic and inorganic material using a magnifying lamp, and then counted and identified to the lowest possible taxonomic group.

Results and Discussion

A list of the macroinvertebrate species found, and their abundances in each lake are shown in Table 2. Abundances have been standardised to mean abundance per one minute kick/sweep sample.

Macroinvertebrates were abundant in the littoral zones of all the lakes. Broadly speaking, the lakes can be divided into four groups based on their macroinvertebrate fauna: (1) upland, relatively species poor lakes (Bugeilyn, Llynnoedd leuan, Llyn Hir and Llyn Gynon). (2) lakes with intermediate species richness, but no Malacostraca (Llyn Eiddwen and Llyn Fanod). (3) lakes with intermediate species richness, dominated by Malacostraca (Llyn Glanmerin and Llyn

Maes-llyn), and (4) lakes with very high species richness (Upper and Lower Talley Lakes). The actual species count for Lower Talley Lake is conservative, owing to sampling difficulties in a lake that is essentially an alder carr. Virtually all the species found in the lower lake are also present in the upper lake. The proximity of these two lakes suggests that the species "missing" from the lower lake would almost certainly be present if it were possible to sample effectively.

(1) The upland, relatively species poor lakes were dominated by insect taxa that are fairly typical of nutrient poor, stony lake shores. The littoral food webs are likely based on the attached algae and fine detritus of the lake bottom. Leptophlebiid mayflies, the elmid beetles *Oulimnius* spp., and some of the cased caddisflies, such as *Agrypnia* spp., that feed on periphyton and detritus were common. Abundant taxa that are primarily predatory in their feeding habits included the net-spinning caddisfly *Polycentropus flavomaculatus* that lives on the benthos, and the free swimming Corixidae and some dytiscid beetles. Stoneflies (Plecoptera) are perhaps more commonly associated with running waters, but often occur on stony lake shores and particularly in upland lakes.

(2) The lakes with intermediate species richness were also dominated by insect taxa. but with some representatives of the Hirudinea and Mollusca, and these assemblages are characteristic of systems with moderately poor nutrient levels. Their littoral food webs are likely based on the attached algae and fine detritus of the lake bottom. The elmid beetles *Ou/imnius,* leptophlebiid and caenid mayflies that typically occur in the silt/mud between stones and that feed on periphyton and detritus, were common. The pea mussel *Pisidium,* which filters fine detritus from water near the substrate, was very abundant. The semi-sessile caddisfly *Tinodes waeneri* that builds galleries on stone surfaces and grazes attached algae was also characteristic of these lakes. The predatory species included various leaches and the caddisfly *Polycentropus flavomaculatus* that live in close association with the substrate, and some free swimming Corixidae and dytiscid beetles.

(3) Two lakes were characterised by moderately abundant and diverse assemblages of molluscs, leaches, Malacostraca and various insects, all typical of productive, eutrophic lakes. The dominant species, *Asellus* and/or *Gammarus,* shred decomposing plant parts and other detritus, and were extremely abundant in these lakes. Curiously, Llyn Maes-llyn was dominated by the common aquatic isopod *Asellus aquaticus,* whereas only the less common *A. meridianus* occurred in Llyn Glanmerin, but in great abundance. *Asellus aquaticus* is widely distributed throughout the British Isles; *A. meridianus* tends to be restricted to western and island areas, but the ecological differences between these two species is not clear (Williams 1979). The predatory invertebrates were well represented by abundant and diverse assemblages of Odonata, Corixidae, some Hirudinea and polycentropodid caddisflies.

(4) The two Talley Lakes had abundant and diverse assemblages of all the major groups of aquatic macroinvertebrates, typical of highly productive, eutrophic systems. The littoral food web is influenced to a great extent by the well developed macrophyte beds found in these lakes. The molluscs and mayflies graze periphytun growing on plants and other substrates. The haliplid beetles also live in close association with aquatic macrophytes and are herbivorous. The leaches are all predatory on invertebrates, primarily those living on substrate surfaces, with the exception of *Theromyzon tessulatum* which is parasitic on water fowl. The abundant Corixidae, Odonata and Dytiscidae are important free swimming predators, whereas the net-spinning polycentropodid caddisflies live and

feed in association with various substrates.

Virtually all the species identified in this survey are common in Great Britain. Obviously, specific identification of all individuals was not possible and species of note may be hidden in these groups. Wallace (1991) describes the threat category of the caddisfly *Beraeodes minutus* (found in Lower Talley Lake) as 'Local', but it is possible that this small species has simply been over-looked and under-recorded. Fowles (1994) suggests further that the Talley Lakes may support some other rare species, such as the beetle *Donacia obscura* Gyllenhal and the meniscus midge *Dixella amphibia* Loew which were classified as 'Vulnerable' and 'Rare', respectively, by Shirt (1987), although they were not encountered in this particular study.

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Table 1. List of site numbers, names, national grid references, vice-county number and habitat type at sampling sites. Habitat types are qualitative descriptions of water clarity, substrate, and macrophyte cover.

No.	Lake	Grid Reference	Vice-county	Habitat type
1	Bugeilyn	SN 822923	47	- "brown" water - shingle, some bare peat - some emergent & floating macrophytes (*Nuphar*)
2	Llynnoedd Ieuan	SN 795815	46	- clear water - shingle beach, some cobbles - extensive submerged, filamentous algae
3	Llyn Hir	SN 789677	46	- clear water - cobbles, some organic-rich sediments - abundant *Lobelia*, some submerged macrophytes
4	Llyn Gynon	SN 800647	46	- clear water - sand, shingle - *Lobelia*, some submerged macrophytes
5	Llyn Eiddwen	SN 605670	46	- clear water - cobbles, some sand - *Juncus* margin, some *Lobelia*
6	Llyn Fanod	SN 603643	46	- clear water - gravel/cobble under organic-rich sediments - *Juncus* margin, some *Lobelia* & *Potamogeton natans*
7	Llyn Glanmerin	SN 755991	47	- turbid water - large flat stones & organic-rich sediment - extensive emergent & submerged macrophytes
8	Llyn Maes-llyn	SN 693628	46	- clear water - cobbles - many submerged macrophytes
9	Upper Talley Lake	SN 632337	44	- turbid water - soft bottom, organic-rich sediments - extensive emergent macrophytes
10	Lower Talley Lake	SN 633332	44	- "brown" water - soft bottom - extensive emergent & submerged macrophytes

Table 2. Macroinvertebrate species present and abundance class per one minute kick/sweep sample in each of ten lakes, grouped according to faunal affinties. Abundance classes: ○ = 1-10; ⊙ = 11-100; ● = 101-1000; ✱ = ≥1001. See Table 1 for lake names and locations.

	Lake									
Species	1	2	3	4	5	6	7	8	9	10
TURBELLARIA										
Tricladida[1]	○	⊙	⊙		⊙	⊙	○	●	⊙	⊙
MOLLUSCA										
Lymnaea truncatula (Müller)									○	
L. peregra (Müller)					○			○	○	○
Physa fontinalis (L.)									⊙	⊙
Planorbis albus Müller								●	○	⊙
P. laevis Alder					○					
P. contortus (L.)								⊙		
Segmentina complanata (L.)									○	○
BIVALVIA										
Pisidium spp.			⊙	○	●	●	⊙	⊙	●	⊙
HIRUDINIA										
Theromyzon tessulatum (Müller)						○		○	○	○
Glossiphonia heteroclita (L.)									○	○
G. complanata (L.)					○	○		○	○	○
Batracobdella paludosa (Carena)									○	
Helobdella stagnalis (L.)					○		○	○	○	⊙
Haemopsis sanguisuga (L.)					○					
Erpobdella octoculata (L.)	○			○	○	○	⊙	⊙	⊙	⊙
MALACOSTRACA										
Asellus aquaticus (L.)							●			
A. meridianus Racovitza								✱		
Gammarus pulex (L.)								●	⊙	
EPHEMEROPTERA										
Baetidae[2]					○		⊙			
Cloeon dipterum (L.)									●	⊙
C. simile Eaton					○	⊙	⊙	●	⊙	
Leptophlebia sp.[2]	●		○	○	⊙	⊙	○		○	
Caenis horaria (L.)					●	⊙		●	⊙	○
C. luctuosa (Burmeister)					●	●		⊙	○	
PLECOPTERA										
Nemoura cinerea (Retzius)	○									
Leuctra nigra (Olivier)	○									
Siphonoperla torrentium (Pictet)		○								
ODONATA										
Zygoptera sp. - immatures[2]							○	⊙	○	○
Pyrrhosoma nymphula (Sulzer)									○	
Enallagma cyathigerum (Charpentier)		○	○			○	⊙		○	
Coenagrion sp.[2]									○	○
Aeshna juncea (L.)							○			

Table 2 cont.

Species	1	2	3	4	5	6	7	8	9	10
HEMIPTERA										
Notonecta glauca L.										○
Corixidae sp. - immatures[2]	○	⊙	○	○	○	○	⊙	⊙	○	
Cymatia bonsdorffi (Sahlberg)							⊙		○	
Glaenocorisa propinqua (Fieber)		○								
Callicorixa praeusta (Fieber)		○						○	○	
Corixa dentipes (Thomson)						○			○	
Hesperocorixa linnaei (Fieber)							○			
Arctocorisa germari (Fieber)		○								
Sigara dorsalis (Leach)	○				○			⊙		
S. distincta (Fieber)						○	⊙	○	●	○
S. falleni (Fieber)								○		
S. fossarum (Leach)							○		○	
S. scotti (Fieber)	○		○		⊙	○	●	○		
COLEOPTERA										
Haliplus confinis Stephens								○		
H. ruficollis group[4]								○	○	○
H. fulvus (Fabricius)							○		○	
H. flavicollis Sturm								○	⊙	○
Dytiscidae - larvae[3]	○	⊙		○	○	○	○	○	○	○
Potamonectes assimilis (Paykull)		○					○			
Nebrioporus depressus sensu lat.			○	○				⊙		
Stictotarsus duodecimpustulatus (Fabricius)					○	○		○		
Oreodytes sanmarkii (Sahlberg)						○				
Hydroporus sp.[4]		○								
Noterus clavicornis (DeGeer)									○	○
N. crassicornis (Müller)									○	○
Graptodytes pictus (Fabricius)							○		○	
Hyphydrus ovatus (L.)									⊙	○
Oulimnius spp.	○		○	⊙	⊙	⊙	○	⊙	○	
MEGALOPTERA										
Sialis lutaria (L.)	⊙			○	○	○	○	○	○	
TRICHOPTERA										
Polycentropus flavomaculatus (Pictet)	⊙	⊙	⊙	⊙	⊙	●	○			
Holocentropus dubius (Rambur)	○		○			○	⊙		○	○
H. picicornis (Stephens)							⊙		○	●
Tinodes waeneri (L.)					⊙	⊙		⊙		
Lype phaeopa (Stephens)									○	
Hydroptila sp.[3]					⊙					
Oxyethira sp.[3]	○	○		○						
Phryganea sp.[2]									○	○
Phryganea grandis (L.)							○		○	
Agrypnia varia/obsoleta	○	○	○	○	○	○	⊙			
Limnephilus sp.[2]	○		○	○	○	○		⊙	○	○
Limnephilus rhombicus (L.)							○			
L. lunatus Curtis					⊙					
L. vittatus (Fabricius)					⊙					
Chaetopteryx villosa (Fabricius)	○			○			○			
Leptoceridae sp. [2]					○	○				
Athripsodes aterrimus (Stephens)							○			
Mystacides longicornis (L.)	⊙							⊙	⊙	
Triaenodes bicolor (Curtis)							○		○	○
Silo pallipes (Fabricius)	○									
Beraeodes minutus Eaton									○	

Table 2 cont.

Species	1	2	3	4	5	6	7	8	9	10
Sericostoma personatum (Spence)	⊙			○	○			○	○	
DIPTERA										
Tipulidae[3]				⊙	○	○	○		○	○
Ceratopogonidae[3]					○	○			○	○
Chironomidae[4]	●	●	●	●	●	●	●	⊙	●	●
Species richness	19	12	12	15	28	26	32	32	49	30

1. It is not possible to identify triclads to species from preserved specimens.
2. These are small, immature individuals that cannot be identified accurately to species.
3. There are no identification keys to the larvae of these groups.
4. More specific identifications are difficult and beyond the scope of this project.