Survey of the caddisfly *Limnephilus tauricus* at Cors Erddreiniog NNR in 2022

Natur am Byth! Evidence Report No. 003

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1. Crynodeb gweithredol

Cynhaliwyd arolwg o Warchodfa Natur Genedlaethol (GNG) Cors Erddreiniog er mwyn diweddaru gwybodaeth am statws a dosbarthiad y pryf pric prin iawn *Limnephilus tauricus* – rhywogaeth nad yw ond yn hysbys ar y warchodfa hon yng Nghymru. Roedd yr arolwg hefyd yn gobeithio lleoli'r pryf pric *Limnephilus pati* sydd hyd yn oed yn brinnach ac nad yw wedi'i gofnodi o'r blaen yn y warchodfa (nac yng Nghymru) ond sy'n bresennol mewn cynefinoedd tebyg o fewn yr un cyfnod hedfan. Cynhaliwyd yr arolwg drwy osod trapiau golau mewn lleoliadau dethol ar draws y warchodfa ar naw achlysur gwahanol rhwng 16 Mehefin a 12 Awst 2022. Gan y byddai'r trapiau golau hyn hefyd yn denu gwyfynod, cynhaliwyd arolwg o facro- a micro-wyfynod yn y warchodfa hefyd.

Cafodd un *L. tauricus* gwryw llawn dwf ei ddal yn SH46568193 ar 28 Gorffennaf yn agos i'r man lle'r oedd y rhywogaeth wedi'i chanfod yn wreiddiol gan Ian Wallace (a'i chofnodi ddiwethaf yn 2008). Cafodd ail bryf gwryw ei ddal ar 4 Awst mewn lleoliad newydd ar gyfer y rhywogaeth (SH47398175) gryn bellter i ffwrdd ar ochr arall y warchodfa. Roedd y ddau safle ar dir corsiog gyda llaciau calchaidd. Dyma gadarnhad pwysig fod y pryf pric prin iawn hwn yn parhau i fod yn bresennol yn GNG Cors Erddreiniog ac na chafwyd hyd i *L. pati* yng Nghymru.

2. Executive summary

A survey of Cors Erddreiniog National Nature Reserve (NNR) was carried out in order to update knowledge of the status and distribution of the very rare caddisfly *Limnephilus tauricus* – a species known only from this reserve in Wales. The survey also aimed to locate the even rarer caddisfly *Limnephilus pati*, which hasn't been previously recorded at the reserve (or in Wales) but is present in similar habitats within the same flight period. The survey was conducted by placing light traps at selected locations across the reserve on nine separate occasions between 16th June and 12th August 2022. Since these light traps would also attract moths, a survey of macro- and micro-moths was also conducted at the reserve.

A single male adult of *L. tauricus* was trapped at SH46568193 on 28th July close to where the species had originally been found by Ian Wallace (and last recorded in 2008). A second male was trapped on 4th August at a new location for the species (SH47398175) some distance away on the opposite side of the reserve. Both sites were on boggy ground with calcareous flush. This is significant confirmation that this very rare caddisfly remains present at Cors Erddreiniog NNR and within Wales. *L. pati* was undetected.

3. Introduction

This work forms part of an extensive programme funded through the Natur am Byth! project. It is a Wales-wide species recovery project that is being developed by a number of eNGOs and is planning species recovery work for 66 species at risk in Wales from coastal waters to upland crags. More information on the project can be found at Natural Resources Wales / Natur am byth!

Cors Erddreiniog NNR is an extensive area of fenland, marshland, woodland and heath, situated on Anglesey, extending some 2km from south to north occupying a broad valley between Capel Coch to the west and Brynteg to the east.

There are extensive areas of *Phragmites* and *Myrica gale*, intermixed with abundant herbs such as *Filipendula ulmaria*, *Lythrum salicaria* and *Potentilla palustris*. In the wetter areas there are stands of *Iris pseudacorus* and *Typha latifolia*. Over the marsh and fen, *Salix cinerea* is the dominant shrub.

The caddisfly *Limnephilus tauricus* was first recorded from Cors Erddreiniog NNR in July 2006, when several adults were found, followed by five in 2007 and another seven in 2008 (Howe, 2020). These were recorded from an area of spring-fed fen to the north of the entrance to the reserve from Capel Coch and were confined to this locality. Subsequent searches in 2016, 2017, and 2019 failed to detect adults or larvae and some concerns were raised that the species may have been lost from the site. The cause of its possible disappearance from Cors Erddreiniog NNR was believed to be linked to a decline in water quality at the original locality associated with iron flocculence (Ian Wallace, personal communication); Ian remained pessimistic about the prospect of rediscovering the species here, especially as this pollution was still apparent during this survey, with rusty discolouration of standing water.

L. tauricus is a very rare insect in Britain, with sporadic records from scattered localities in England, Wales and Ireland (Table 1). Cors Erddreiniog NNR is the only known Welsh site for this species.

Table 1. Previous records of *Limnephilus tauricus* from Britain and Ireland.

Site name	Date	Comment
Chippenham Fen (Cambridgeshire)	23/07/1892 - 14/08/1892	4 adult records
Redgrave Fen (Suffolk)	05/07/1915	1 adult record
Woolhampton Reed Bed (Berkshire)	24/03/1969	1 larval record
Leckford (Hampshire)	12/07/2003 – 20/07/2003	1 adult Malaise trap record
Cors Erddreiniog (Anglesey)	08/07/2006; 04/08/2007; 21/07/2008; 23/07/2008	multiple adult records
The Patch, Hollesley (Suffolk)	07/08/2017	1 light-trapped adult
Market Weston Fen (Suffolk)	26/09/2021; 01/01/2022; 20/03/2022	multiple larval records

Site name	Date	Comment
Market Weston Fen (Suffolk)	09/06/2022 – 10/06/2022	14 adults, mainly males, at Actinic light trap
an Irish site	28/06/1994	1 light-trapped adult

Previous light trapping for moths at Cors Erddreiniog NNR has mainly focussed on the central heath and woodland margin with limited trapping on the fen, although mercury vapour (MV) light traps were operated from the limestone ridge (at SH471816) in July 2003 which would potentially have drawn moths from the fen. One of the more notable records from this session was Minor Shoulder-knot *Brachylomia viminalis*, a woodland species which appears to be scarce on Anglesey. Striped Wainscot *Mythimna pudorina*, a fenland species, was also recorded on the same night.

4. Methods

4.1. Objectives

Charles Aron and Steve Palin were commissioned by Buglife to carry out a light-trapping survey at Cors Erddreiniog NNR in order to update knowledge of the status and distribution of the very rare caddisfly *Limnepilus tauricus* and possibly also detect the presence of the even rarer *L. pati*. Another aim was to record the macro- and micro-moth species encountered during the survey.

4.2. Desk study

Baseline information on *Limnephilus tauricus* centred on previous survey work carried out by Ian Wallace (Wallace et. al. 2010; Wallace et. al. 2016). Records of Lepidoptera were sourced using Graham (2020).

4.3. Field study

The survey period was between 16th June and 12th August 2022, with an additional session on 22nd August aimed at recording late summer and heathland moths only. Four light traps were operated on each survey night: a 125W Robinson MV trap, 125W Skinner MV trap, 20W black light trap, and 8W actinic Heath trap. The aim was to run the traps on calm (especially given the exposure on the fen), warm, cloudy, and moonless nights. These conditions have always given rise to optimum moth catches and it was presumed that such conditions would also be good for caddisflies, although it has subsequently been found that wet nights yield large numbers of caddisflies but make operating and recording more difficult. It was fortunate that

weather conditions during the summer of 2022 were mostly favourable for light trapping.

The traps were located in areas were *Limnephilus tauricus* had either been recorded previously or were deemed promising locations for this species; most of these sites had been pre-selected by Ian Wallace (Appendix 2). All trap locations were on bog or fen (except those on 22/08/2022), often close to tall fen vegetation. On some nights traps were placed at two separate locations on the reserve, while on other nights trapping was confined to a single locality.

The traps were set at dusk, left overnight, and then emptied the following morning. In addition to trapping, some sweeping of the surrounding vegetation was carried out, although this proved to be generally unproductive. From each trap, at least one specimen of each caddisfly species was retained if possible. These specimens were then sent to Ian Wallace for identification; some caddisfly species, including *L. tauricus*, can only be positively determined by examination of their genitalia. Moth species and numbers were recorded from each trap, while those moths that could not be identified in the field were retained for closer examination. The location of each trap was recorded using a hand-held GPS unit (Garmin eTrex) and notes were made on the vegetation surrounding each trap.

4.4. Limitations

One of the recommended trapping locations for *L. tauricus* could not be visited as it was invariably frequented by grazing cattle which posed too great a risk to the survey equipment.

It was sometimes not possible to carry the heavier equipment to the more distant areas of the reserve away from the tracks, especially with the ground being wet and the terrain uneven. In most case, however, access was made easier by the unusually dry conditions prevailing during the summer of 2022.

Windy nights were avoided as the reserve is very exposed and strong winds could have damaged the equipement as well as reduced the catch.

5. Results

5.1. *Limnephilus tauricus*

The target species, *Limnephilus tauricus*, was recorded at two widely separated locations on the reserve, firstly at SH46568193 (close to the original locality) on 28th July and then at SH47398175 on 4th August (Figure 1). These sites, over 800 metres (m) apart indicate the presence of separate colonies of this caddisfly (Ian Wallace, pers. comm.). These results are very encouraging given that it was feared that this very rare insect could be extinct at Cors Erddreiniog NNR and in Wales. *L. tauricus* is a rather small, slightly speckled caddisfly that can only be separated from *L. hirsutus* and *L. pati* by examination of the genitalia. Figure 2 shows two confirmed specimens of *L. tauricus* from this survey.

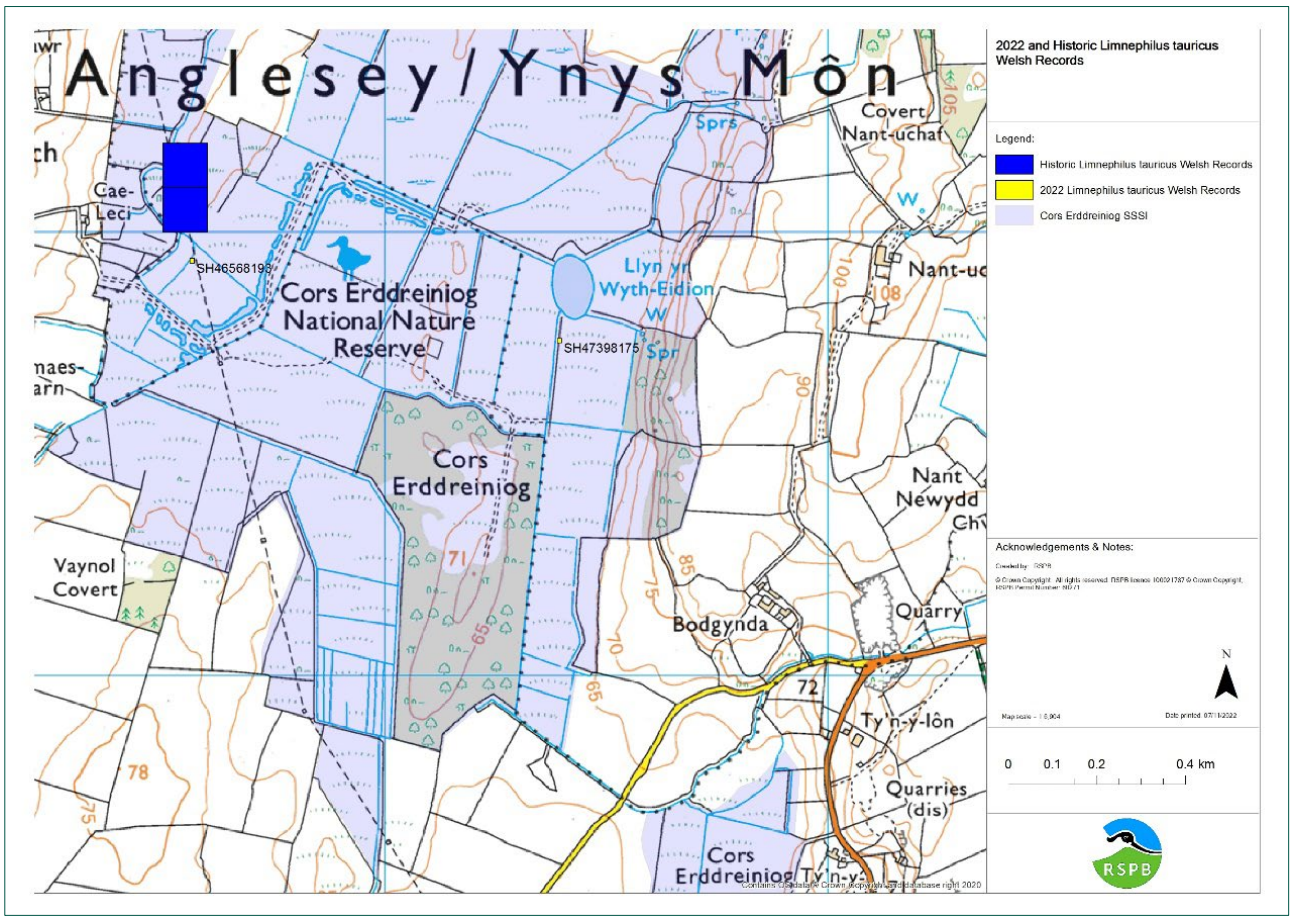


Figure 1. The location of *L. tauricus* records at Cors Erddreiniog NNR in 2022; historic records (2006-2008) are also shown.



Figure 2. *Limnephilus tauricus*.

The first location where *L. tauricus* was trapped on 28/07/2022 (Figure 3) is on rather boggy, open ground with *Juncus*, *Mentha*, *Succisa* and *Myrica gale*.



Figure 3. View of the first location where *L. tauricus* was trapped on 28/07/2022.

The second location where *L. tauricus* was trapped on 04/08/2022 was on the boardwalk leading to Llyn yr Wyth-Eidion; there is an extensive stand of *Phragmites* to the west of the boardwalk, while to the east the marshland includes *Iris*, *Valeriana* and *Filipendula*.



Figure 4. View of the second location where *L. tauricus* was trapped on 04/08/2022.

5.2. Other caddisfly species

A total of 26 caddisfly species were recorded during the survey (Appendix 3). Apart from *Limnephilus tauricus*, these were also common and widespread species. Nevertheless they included the rather spectacular *Phryganea grandis*, the largest caddisfly species in Britain, recorded on the first trapping session on 16th June. *Agrypnia varia* (Speckled Peter) was one of the more attractive and distinctive species and occurred on three of the trapping sessions. July saw an increase in the long-antennaed caddisflies, especially *Oecetis ochracea* and *Leptocerus tineiformis*. The latter species, increasing its range in Britain, was very abundant on 28th July. Other *Limnephilus* species were abundant and diverse with some, such as *L. lunatus* and *L. marmoratus,* quite distinctively marked and identifiable in the field.

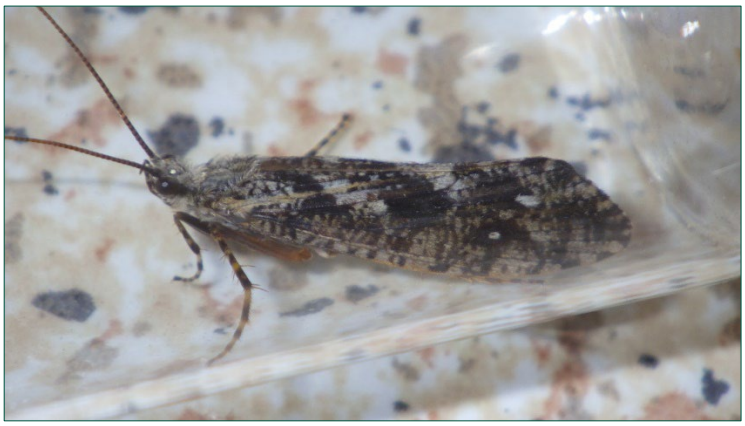


Figure 5. *Agrypnia varia* (Speckled Peter).

5.3. Moths

Cors Erddreiniog NNR provides excellent habitat for fenland, aquatic, woodland and heathland moths. A total of 290 species were recorded over the trapping period. Conditions were generally favourable for moth trapping and warmer, calmer nights were chosen where possible.

5.4. Notable moth species

There were two new Anglesey records: *Calamotropha paludella* (Bulrush Veneer) on 4th August (at SH47408179) and *Epinotia trigonella* on 22nd August (at SH47168145). The former species, a pyralid moth feeding on *Typha,* is increasing its range northwestwards and was first recorded in North Wales, from Marford, in 2016. The attractively-marked tortricoid *E. trigonella*, a birch feeder, is reported to be 'common' in Sterling and Parsons (2012), however, it appears to be uncommon in north-west Wales, with few recent records.

A total of 39 specimens were taken to Andrew Gaham for identification, mainly by genitalia dissection. This resulted in two additional new Anglesey records: *Exoteleia dodecella* and *Epinotia tetraquetrana*. The latter was thought to be *Zeiraphera isertana* and this underlies the difficulties in identifying micros through appearance

alone. There were a number of species additional to the survey lists, including five species of *Coleophora* (Case-bearers) slender micros whose larvae live in a portable case constructed from the foodplant. Large Ear *Amphipoea lucens* was confirmed by dissection; it has been recorded at Cors Erddreiniog – the only known Anglesey site – several times previously but not since 1990.

On 16th June a number of interesting micro-moth species were recorded: the tortricoid moth *Apotomis turbidana*, a birch feeder, has previously only been recorded on Anglesey from Newborough. Another smaller tortricoid, *Cochylis nana*, has previously only been recorded twice on Anglesey, from Cors Erddreiniog NNR and Brynsiencyn. The minute but pretty *Ectoedemia decentella* – the larvae of which mine sycamore seeds – has previously only been recorded from Pentraeth on Anglesey and there are few North Wales records, although the moth could easily be overlooked. The attractive *Incurvaria praelatella* (Strawberry Bright) appears to be rather uncommon in North Wales with Anglesey records being mostly from Pentraeth and also from Capel Coch and Cors Erddreiniog NNR.

On 29th June a pheromone lure for Lunar Hornet Moth *Sesia apiformis* was placed on the *Salix cinerea* bushes close to the light trap. Within a few minutes a moth appeared. This is the first record from Cors Erddreiniog NNR since 1982 of this rather spectacular species. The introduction of pheromones to attract this moth has given rise to a rash of recent records from Anglesey and elsewhere in North Wales.
The 11th July trapping session yielded several more interesting species with *Caloptilia betulicola* being only the second Anglesey record – the larvae of this species rolls birch leaves into cones. The minute, dappled, *Bucculatrix demaryella*, a birch leaf-miner, was only the second Anglesey record, previously from a leaf mine found at Newborough. The tortricoid *Acleris notana*, another birch feeder, has only been recorded previously from Pentraeth on Anglesey.

The 21st July trapping session attracted a Four-spotted Footman *Lithosia quadra* to the MV light; it has been a particularly good year for this large, striking footman moth. At one time it was a scarce migrant to Anglesey but now is a probable resident.

On 28th July a rather obscurely-coloured noctuid with a reddish flush was provisionally identified as Suspected *Parastichtis suspecta*, a species only recently recorded on Anglesey from Llangoed.

5.5. Other moths recorded during the survey

Over the course of the survey, nine species of Wainscot Moth were recorded; these rather monochromatic noctuid moths feed on monocot plants. Five of these species, Brown-veined *Archanara dissoluta*, Silky *Chilodes maritima*, Southern *Mythimna straminea*, Striped *Mythimna pudorina* and Bulrush *Nonagria typhae* are fenland moths, feeding on *Phragmites* or, in the case of the last-named, *Typha*. Brown-veined Wainscot is a rather scarce moth in North Wales, probably due to a lack of habitat, with Anglesey being its stronghold.

China-mark moths occurred quite frequently over the reserve – these attractive moths have aquatic larvae. Brown *Elophila nymphaeata*, Beautiful *Nymphula*

nitidulata and Small China-mark *Cataclysta lemnata* were recorded with the latter being less common. Another aquatic species was the strange fly-like Water Veneer *Acentria ephemerella* which could be easily overlooked as a Dipteran.

Two somewhat similar wetland species were Crescent *Helotropha leucostigma* and Haworth's Minor *Celaena haworthii*; Crescent feeds mainly on *Iris pseudacorus* and Haworth's Minor on *Eriophorum*. Owing to its dependence on this plant, the latter species is quite local but was abundant at Cors Erddreiniog NNR.

Eudonia pallida became the dominant scopariid species, especially later in the survey. This is a local marshland species whose larvae feed on mosses, in common with others within the group. The common torticoid *Bactra lancealana* (Rush Marble) was frequently encountered both at dusk and by day and was abundant in the traps on 12th August.

Hawk-moths were especially frequent during June and July and presented a spectacular sight when at rest in the trap. At Cors Erddreiniog NNR, Poplar *Laothoe populi* and Eyed Hawk-moth *Smerinthus ocellatus* are dependent on *Salix cinerea*, Elephant Hawk-moth *Deilephila elpenor* on *Epilobium angustifolium* and other *Epilobium* species, and the much less common Small Elephant *Deilephila porcellus* on *Galium* species.

6. Conclusion

This survey has demonstrated that *Limnephilus tauricus* maintains a presence at Cors Erddreiniog NNR and is more widespread than formerly thought. However, just the single specimen recorded from the original locality may indicate a decline in the population there, presumably owing to pollution from iron flocculence.

7. Management recommendations

Ian Wallace states that *Limnephilus tauricus* is dependent on pure, unpolluted water in which to breed, therefore, any sources of pollution, either arising within the reserve or resulting from runoff from adjacent areas, should be minimised.

Continued grazing will ensure an open habitat and restrict the spread of S*alix cinerea* which would reduce the area of fen and marsh.

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9. Appendices

9.1 Appendix 1: Details of trap locations

Session 1: 16th June 2022

Site 1. At the edge of the trackway close to a slight depression with abundant *Phragmites* with trees and shrubs including *Salix cinerea* and *Betula*.

Trap 1: SH47308157, 125W Skinner MV trap.
Vegetation: *Phragmites, Salix cinerea, Ulex europaeus, Filipendula ulmaria, Myrica gale*, *Mentha aquatica, Lythrum salicaria.*

Trap 2: SH47358157, 125W Robinson MV trap.
Vegetation: *Phragmites, Salix cinerea, Cyperaceae, Juncus, Filipendula ulmaria, Myrica gale, Cyperaceae, Rubus fruticosus*.

Site 2. On boggy ground close to *Rubus fruticosus* and *Salix cinerea*.

Trap 3: SH47548177, 8W Heath actinic trap.
On rather boggy ground close to a large *Rubus fruticosus* thicket.
Vegetation: Vegetation: *Myrica gale, Filipendula ulmaria, Phragmites, Salix cinerea, Cyperaceae*.

Trap 4: SH47548171, 20W black light trap.
On boggy ground close to *Salix cinerea*.
Vegetation: Vegetation: *Myrica gale, Filipendula ulmaria, Phragmites, Salix cinerea, Cyperaceae*.

Session 2: 29th June 2022

Traps situated at the western flank of the reserve, north of the entrance from Capel Coch. On boggy ground with some tall vegetation such as *Iris pseudacorus* and bordered by a line of *Salix cinerea*. This is the area where Ian Wallace had previously recorded *Limnephilus tauricus*.
Trap 1: SH46558191, 8W Actinic Heath trap.
Vegetation: *Juncus conglomeratus*, *Ranunculus flammula*, *Mentha aquatcica*.

Trap 2: SH46578196, 125W Robinson MV trap.
Vegetation: *Juncus*, *Salix cinerea*, *Myrica gale*, *Iris pseudacorus*, *Narthecium*.

Trap 3: SH46578197, 20W black light trap.
Vegetation: *Iris*, *Juncus*, *Typha*.

Trap 4: SH46558199, 125W Skinner MV trap.
Vegetation: *Salix cinerea, Juncus, Typha.*

Session 3: 4th July 2022
Site 1. Close to the main ditch running west to east across the reserve with abundant tall vegetation.

Trap 1: SH46878214, 125W Skinner MV trap.
Vegetation: *Juncus, Typha, Salix cinerea, Rubus fruticosus*, *Myrica gale*.

Trap 2: SH46868212, 125W Robinson MV trap.
Vegetation: *Myrica gale*, *Crataegus*, *Juncus*, *Salix cinerea*, *Rubus fruticosus*.

Site 2. Situated at the margin of an area of *Salix cinerea* carr with adjacent heathland towards the western edge of the reserve.

Trap 3: SH46488213, 8W actinic trap.
Vegetation: *Juncus*, *Ulex europaeus, Rubus fruticosus*, *Salix cinerea*.

Trap 4: SH46508214, 20W black light trap.
Vegetation: *Salix cinerea*, *Iris pseudacorus*, *Rosa acicularis*, *Ulex europaeus*.

Session 4: 11th July 2022
Site 1. Same as on 16/6 except that trap 2 was placed in amongst the *Phragmites* rather than on the trackway.

Trap 1: SH47308157, 125W Skinner MV trap.
Vegetation: *Phragmites, Salix cinerea, Ulex europaeus, Filipendula ulmaria, Myrica gale*, *Mentha aquatica, Lythrum salicaria*.

Trap 2: SH47348156, 125W Robinson trap.
Vegetation: *Cyperaceae, Phragmites, Salix cinerea, Juncus, Filipendula ulmaria, Myrica gale, Cyperaceae, Rubus fruticosus.*

Site 2. Close to main track running NE across the reserve.

Trap 3: 46808206, 8W Actinic trap.

Vegetation: *Cyperaceae, Phragmites, Salix cinerea, Myrica gale, Filipendula ulmaria, Juncus.*

Trap 4: SH46708185, 20W black light trap.
Vegetation: *Cyperaceae, Phragmites, Salix cinerea, Myrica gale, Filipendula ulmaria, Mentha aquatica.*

Session 5: 21st July 2022

Site 1. Close to a depression with tall marsh vegetation and at the northern end of the limestone ridge.
Trap 1: SH47168202, 125W Skinner MV trap.
Vegetation: *Typha, Juncus, Lythrum salicaria, Mentha aquatica*, *Cirsium palustre*, *Lotus pedunculatus*.

Trap 2: SH47178199, 125W Robinson MV trap.
Vegetation: *Filipendula ulmaria, Juncus, Lythrum salicaria*, *Phragmites australis, Potentilla erecta.*

Site 2: Boardwalk leading to Llyn yr Wyth-Eidion, surrounded by marsh vegetation and flanked by *Salix cinerea*, *Betula pendula* and Alnus glutinosa.

Trap 3: SH47418180, 20W blck light trap.
Vegetation: *Typha, Filipendula ulmaria, Eupatorium cannabinum*, *Salix cinerea,* Alnus glutinosa, *Phragmites australis*, *Equisetum*.

Trap 4: SH47408176, 8W actinic trap.
Vegetation: *Phragmites australis*, *Salix cinerea,* Alnus glutinosa, *Valeriana dioica*, *Iris pseudacorus*, *Filipendula ulmaria.*

Session 6: 28th July 2022

Traps situated at the western flank of the reserve, north of the entrance from Capel Coch. On boggy ground with some tall vegetation such as *Iris pseudacorus*, and bordered by a line of *Salix cinerea*. This is the area where Ian Wallace had previously recorded *Limnephilus tauricus*.

Trap 1: SH46568193, 8W actinic trap.
Vegetation: *Juncus, Mentha aquatica*, *Succisa pratensis, Myrica gale*.

Trap 2: SH46578196, 125W Robinson MV trap.
Vegetation: *Salix cinerea, Myrica gale*, *Iris pseudacorus*, *Juncus, Angelica palustris* .

Trap 3: SH46558199, 125W Skinner MV trap.
Vegetation: *Salix cinerea, Juncus, Typha*.

Trap 4: SH46588198, 20W black light trap.
Vegetation: *Menyanthes trifoliata*, *Iris pseudacorus*, *Ranunculus flammula*, *Salix cinerea*, *Juncus, Cyperaceae.*

Session 7: 4th August 2022

Site 1: On boggy ground close to *Rubus fruticosus* and *Salix cinerea*.

Trap 1: SH47538177, 20W black light trap.
Vegetation: *Myrica gale, Filipendula ulmaria, Salix cinerea, Cyperaceae.*
Trap 2: SH:47578177, 8W actinic trap.
Vegetation: *Myrica gale, Filipendula ulmaria, Salix cinerea, Cyperaceae.*

Site 2: Boardwalk leading to Llyn yr Wyth-Eidion surrounded by marsh vegetation and flanked by *Salix cinerea, Betula pendula* and Alnus glutinosa.
Trap 3: SH47398175, 125W Skinner MV trap.
Vegetation: *Myrica gale, Filipendula ulmaria, Phragmites, Salix cinerea, Cyperaceae.*

Trap 4: SH47408179, 125W Robinson MV trap.
Vegetation: *Myrica gale, Filipendula ulmaria, Phragmites, Salix cinerea, Cyperaceae.*

Session 8: 12th August 2022
Near Entrance from Capel Coch.

Trap 1: 46588178, 8W actinic trap.
Vegetation: *Juncus, Mentha aquatica, Oenanthe, Potentilla palustris, Lythrum, Equisetum, Typha, Ranunculus flammula.*

Trap 2: SH46598177, 20W black light.
Vegetation: *Juncus, Equisetum, Oenanthe, Mentha aquatica, Typha, Potentilla palustris.*

Trap 3: SH46598175, 125W Robinson MV trap.
Vegetation: *Molinia, Filipendula, Potentilla palustris, Oenanthe, Lysimachia, Salix cinerea, Carex.*

Trap 4: SH46578176, 125W Skinner trap.
Vegetation: *Menyanthes, Potentilla palustris, Juncus, Lysimachia, Ranunculus flammula, Mentha aquatica*.

Session 9: 22nd August 2022
Trap 1: SH47198147, 125W Robinson MV trap.
Vegetation: *Quercus, Calluna vulgaris*, *Salix cinerea, Betula, Erica tetralix*,

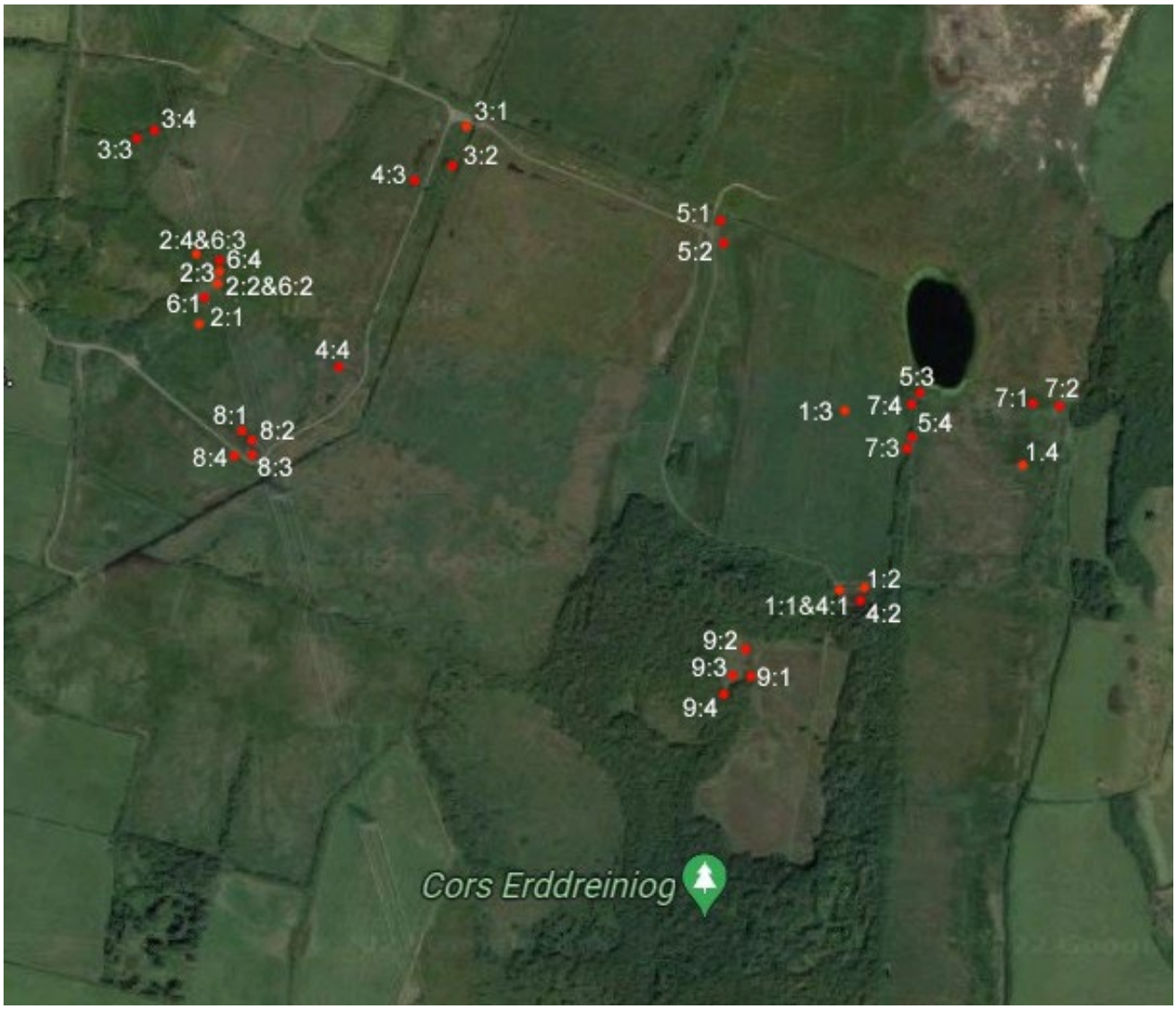
Trap 2: SH47198150, 20W black light.
Vegetation: *Calluna vulgaris*, *Salix cinerea, Betula, Quercus, Erica tetralix*.

Trap 3: SH47178147, 125W Skinner MV trap.
Vegetation: *Calluna vulgaris*, *Salix cinerea, Betula, Rubus fruticosus*, *Ulex europaeus.*

Trap 4: SH47168145, 8W actinic trap.
Vegetation: *Calluna vulgaris*, *Salix cinerea, Betula, Erica tetralix*, *Ulex europaeus.*

9.2 Appendix 2: Satellite image showing all trapping locations

Numbers show Session:Trap Number (e.g. 5:2 = Session 5, Trap 2).



9.3 Appendix 3: List of caddisfly species recorded during the survey

NB – highlighted species with (N) are potentially new for this site.

Scientific name	Notes
Agrypnia varia	3 males & 1 female
Ceralcea fulva	1 female
Glyphotaelius pellucidus	2 females & 1 not sexed
Hydropsyche angustipennis	1 female
Hydropsyche siltalai	4 females
Hydroptila sparsa (N)	2 females
Leptocerus tineiformis	4 males & 12 females
Limnephilus auricula	1 male
Limnephilus extricates (N)	2 females & 2 males
Limnephilus hirsutus	3 males & 3 females
Limnephilus lunatus (N)	2 female & 2 males
Limnephilus luridus	22 females & 16 males
Limnephilus marmoratus	19 females & 13 males
Limnephilus tauricus	2 males
Lype phaeopa	1 male
Mystacides azurea (N)	1 male & 1 not sexed
Mystacides longicornis	4 females & 2 males
Odontocerum albicorne (N)	1 not sexed
Oecetis lacustris	3 females
Oecetis ochracea	8 males & 6 females
Oecetis testacea	1 female
Oxyethira flavicornis	1 female
Phryganea grandis	3 females & 3 males
Plectrocnemia conspersa	2 females & 1 male
Silo pallipes	2 males
Triaenodes bicolor	2 females

9.4 Appendix 4: List of moth species recorded during the survey

Species highlighted in yellow with (N) are potentially new for this site. GD = genitalia dissection.

Scientific name	Common name	Abundance
Abraxas grossulariata	Magpie	17
Abrostola tripartita	Spectacle	1
Abrostola triplasia	Dark Spectacle	6
Acentria ephemerella	Water Veneer	57
Acleris aspersana	Ginger Button	17
Acleris comariana (N)	Strawberry Tortrix	11 (GD)
Acleris laterana	Dark-triangle Button	2

Scientific name	Common name	Abundance
Acleris literana	Lichen Button	1
Acrobasis advenella	Grey Knot-horn	2
Acronicta leporina	Miller	1
Acronicta psi	Grey Dagger	16
Acronicta rumicis	Knot Grass	2
Aethes cnicana	Thistle Conch	3
Agapeta hamana	Common Yellow Conch	2
Agapeta zoegana	Knapweed Conch	4
Agonopterix angelicella	Angelica Flat-body	2
Agonopterix heracliana	Common Flat-body	3 (GD)
Agonopterix nervosa	Dark-fringed Flat-body	1
Agriphila selasella	Pale-streak Grass-veneer	15
Agriphila straminella	Straw Grass-veneer	75
Agriphila Tristella	Common Grass-veneer	18
Agrotis exclamationis	Heart & Dart	103
Agrotis ipsilon	Dark sword-grass	2
Agrotis puta	Shuttle-shaped Dart	1
Agrotis segetum	Turnip Moth	1
Alcis repandata	Mottled Beauty	17
Amphipoea lucens	Large Ear	1 (GD)
Amphipyra pyramidea	Copper Underwing	2
Anania hortulata	Small Magpie	1
Ancylis badiana	Common Roller	2
Apamea crenata	Clouded-bordered Brindle	5
Apamea monoglypha	Dark Arches	243
Apamea remissa	Dusky Brocade	17
Apamea unanimis	Small Clouded Brindle	12
Apeira syringaria	Lilac Beauty	1
Apotomis betuletana (N)	Birch Marble	6
Apotomis semifasciana	Short-barred Marble	6
Apotomis turbidana	White-shouldered Marble	1
Archanara dissoluta	Brown-veined Wainscot	1
Archips podana	Large Fruit-tree Tortrix	3
Arctia caja	Garden Tiger	65
Argyresthia brockeella	Gold-ribbon Argent	1
Argyresthia conjugella	Apple-fruit Moth	1
Autographa gamma	Silver Y	3
Autographa jota	Plain Golden Y	20
Autographa pulchrina	Beautiful Golden Y	3
Axylia putris	Flame	12
Bactra lancealana	Rush Marble	137
Biston betularia	Peppered Moth	24
Blastobasis adustella	Dingy Dowd	3
Borkhausenia fuscescens	Small Dingy Tubic	1
Bryotropha terrella	Cinereous Groundling	1
Bucculatrix demaryella	Birch Bent-wing	2

Scientific name	Common name	Abundance
Cabera exanthemata	Common Wave	18
Cabera pusaria	Common White Wave	20
Calamotropha paludella	Bulrush Veneer	1
Calliteara pudibunda	Pale Tussock	4
Caloptilia betulicola	Red Birch Slender	2 (GD)
Caloptilia stigmatella	White-triangle Slender	3
Campaea margaritaria	Light Emerald	11
Carpatolechia notatella	Sallow-leaf Groundling	1 (GD)
Cataclysta lemnata	Small China-mark	9
Catoptria falsella	Chequered Grass-veneer	1
Catoptria margaritella	Silver-stripe Grass-veneer	2
Celaena haworthii	Haworth's Minor	150
Celypha lacunana	Common Marble	20
Ceramica pisi	Broom Moth	25
Cerapteryx graminis	Antler moth	3
Cerura vinula	Puss Moth	1
Chilodes maritima	Silky Wainscot	3
Chrysoteuchia culmella	Garden Grass-veneer	39
Cilix glaucata	Chinese Character	1
Cirrhia icteritia	Sallow	5
Cleorodes lichenaria	Brussels Lace	3
Clepsis spectrana	Cyclamen Tortrix	42
Cochylis nana	Birch Conch	3
Coenobia rufa	Small Rufous	23
Coleophora albidella	White Sallow Case-bearer	1 (GD)
Coleophora discordella	Lotus Case-bearer	1 (GD)
Coleophora serratella	Common Case-bearer	1(GD)
Coleophora taeniipennella	Small Rush Case-bearer	4 (GD)
Coleophora tamesis	Jointed-rush Case-bearer	1 (GD)
Colocasia coryli	Nut-tree Tussock	1
Colostygia pectinataria	Green Carpet	20
Coptotriche marginea	Bordered Carl	1
Cosmia trapezina	Dun-bar	4
Cosmorhoe ocellata	Purple Bar	1
Crambus pascuella	Inlaid Grass-veneer	7
Crocallis elinguaria	Scalloped Oak	15
Cydia ulicetana	Grey Gorse Piercer	3
Deilephila elpenor	Elephant hawk-moth	92
Deilephila porcellus	Small Elephant Hawk-moth	4
Deltote pygarga	Marbled White Spot	64
Deltote uncula	Silver Hook	3
Denticucullus pygmina	Small Wainscot	57
Diachrysia chrysitis	Burnished Brass	31
Diarsia brunnea	Purple Clay	3
Diarsia florida	Fen Square-spot	1
Diarsia mendica	Ingrailed Clay	60

Scientific name	Common name	Abundance
Diarsia rubi	Small Square-spot	57
Donacaula mucronella	Scarce Water-veneer	21
Drepana falcataria	Pebble Hook-tip	13
Dysstroma truncata	Common Marbled Carpet	2
Ecliptopera silaceata	Small Phoenix	9
Ectoedemia decentella	Sycamore-seed Pigmy	1
Ectropis crepuscularia	Engrailed	8
Eilema griseola	Dingy Footman	41
Eilema lurideola	Common Footman	4
Elachista albidella	Cotton-grass Dwarf	1
Elachista atricomella	Black-headed Dwarf	5
Elachista canapennella	Little Dwarf	4 (GD)
Electrophaes corylata	Broken-barred Carpet	1
Elophila nymphaeata	Brown China-mark	31
Endothenia marginana	Bordered Marble	1 (GD)
Ennomos alniaria	Canary-shouldered Thorn	26
Ennomos quercinaria	August Thorn	2
Epermenia falciformis	Large Lance-wing	1
Epiblema scutulana	Thistle Bell	4
Epinotia cruciana	Willow Tortrix	2
Epinotia immundana (N)	Common Birch Bell	1 (GD)
Epinotia nanana (N)	Small Spruce Bell	1
Epinotia ramella (N)	Small Birch Bell	2
Epinotia tenerana	Nut Bud Moth	1 (GD)
Epinotia tetraquetrana (N)	Square-barred Bell	1 (GD)
Epinotia trigonella	White-blotch Bell	2 (GD)
Epione repandaria	Bordered Beauty	3
Epirrhoe alternata	Common Carpet	8
Eucosma cana	Hoary Bell	5
Eucosma hohenwartiana	Bright Bell	3
Eudonia lacustrata	Little Grey	60
Eudonia mercurella	Small Grey	5
Eudonia pallida	Marsh Grey	104
Eudonia truncicolella	Ground-moss Grey	1
Eulithis testata	Chevron	50
Eupithecia absinthiata	Wormwood Pug	2
Eupithecia nanata	Narrow-Winged Pug	1
Eupithecia satyrata	Satyr Pug	4
Eupithecia subfuscata	Grey Pug	2
Eupithecia tenuiata	Slender Pug	1
Eupithecia valerianata	Valerian Pug	12
Eupithecia virgaureata	Golden-rod Pug	3
Eupithecia vulgata	Common Pug	1
Euplexia lucipara	Small Angle Shades	2
Eupoecilia angustana	Marbled Conch	1
Euproctis similis	Yellow-tail	39

Scientific name	Common name	Abundance
Euthrix potatoria	Drinker	82
Evergestis pallidata	Chequered Pearl	1
Exoteleia dodecella (N)	Pine Groundling	1 (GD)
Furcula furcula	Sallow Kitten	2
Gandaritis pyraliata	Barred Straw	41
Gelechia sororculella	Dark-striped Groundling	3
Geometra papilionaria	Large Emerald	3
Glyphipterix fuscoviridella	Plain Fanner	1
Glyphipterix thrasonella	Speckled Fanner	2
Gymnoscelis rufifasciata	Double-striped Pug	2
Habrosyne pyritoides	Buff Arches	16
Hadena bicruris	Lychnis	6
Hecatera bicolorata	Broad-barred White	1
Hedya nubiferana	Marbled Orchard Tortrix	4
Hedya pruniana	Plum Tortrix	1
Helotropha leucostigma	Crescent	62
Hemithea aestivaria	Common Emerald	7
Hepialus humuli	Ghost Moth	1
Hofmannophila pseudospretella	Brown House-moth	1
Hoplodrina blanda/octogenaria	Rustic / Uncertain	23
Hydraecia micacea	Rosy Rustic	1
Hydrelia flammeolaria	Small Yellow Wave	1
Hydria undulata	Scallop Shell	1
Hydriomena furcata	July Highflyer	55
Hydriomena impluviata	May Highflyer	1
Hypena proboscidalis	Snout	3
Hypenodes humidalis	Marsh Oblique-barred	4
Idaea aversata	Riband wave	25
Idaea biselata	Small Fan-footed Wave	7
Idaea dimidiata	Single-dotted Wave	14
Idaea subsericeata	Satin Wave	2
Incurvaria praelatella	Strawberry Bright	1
Korscheltellus fusconebulosa	Map-winged Swift	24
Lacanobia oleracea	Bright-line Brown-eye	110
Lacanobia thalassina	Pale-shouldered Brocade	2
Lampropteryx suffumata	Water Carpet	1
Laothoe populi	Poplar Hawk-moth	50
Lasiocampa quercus	Oak Eggar	2
Leucania comma	Shoulder-striped Wainscot	3
Lithosia quadra	Four-spotted Footman	2
Lomaspilis marginata	Clouded Border	52
Lomographa temerata	Clouded Silver	1
Lozotaenia forsterana	Large Ivy Twist	1
Luperina testacea	Flounced Rustic	4
Lycophotia porphyrea	True Lover's Knot	174
Lyonetia clerkella	Apple Leaf-miner	1

Scientific name	Common name	Abundance
Malacosoma neustria	Lackey	1
Mesapamea secalis	Common Rustic	84
Mompha ochraceella	Buff Mompha	1
Mythimna ferrago	Clay	6
Mythimna impura	Smoky Wainscot	103
Mythimna pallens	Common Wainscot	13
Mythimna pudorina	Striped wainscot	48
Mythimna straminea	Southern Wainscot	117
Naenia typica	Gothic	3
Neofaculta ericetella	Heather Groundling	1(GD)
Noctua comes	Lesser Yellow Underwing	12
Noctua fimbriata	Broad-bordered Yellow Underwing	2
Noctua janthe	Lesser Broad-bordered Yellow Underwing	37
Noctua pronuba	Large Yellow Underwing	348
Nomophila noctuella	Rush Veneer	1
Nonagria typhae	Bulrush Wainscot	1
Notocelia trimaculana	Triple-blotched Bell	2
Notocelia uddmanniana	Bramble Shoot Moth	1
Notodonta dromedarius	Iron Prominent	5
Notodonta ziczac	Pebble Prominent	43
Nudaria mundana	Muslin Footman	1
Nymphula nitidulata	Beautiful China-mark	35
Ochropacha duplaris	Common Lutestring	6
Ochropleura plecta	Flame Shoulder	124
Oligia fasciuncula	Middle-barred Minor	5
Oligia strigilis agg.	Marbled Minor agg.	6
Opisthograptis luteolata	Brimstone Moth	32
Orthonama vittata	Oblique Carpet	17
Orthotaenia undulana	Woodland Marble	2
Orthotelia sparganella	Reed Smudge	6
Ourapteryx sambucaria	Swallow-tailed Moth	4
Pandemis cerasana	Barred Fruit-tree Tortrix	2
Parastichtis suspecta (N)	Suspected	1 (GD)
Pasiphila rectangulata	Green Pug	1
Peribatodes rhomboidaria	Willow Beauty	3
Perizoma affinitata	Rivulet	1
Perizoma albulata	Grass Rivulet	1
Perizoma alchemillata	Small Rivulet	3
Perizoma flavofasciata	Sandy Carpet	1
Petrophora chlorosata	Brown Silver-Line	1
Phalera bucephala	Buff-tip	27
Pheosia gnoma	Lesser Swallow Prominent	8
Pheosia tremula	Swallow Prominent	5
Phlogophora meticulosa	Angle Shades	2
Photedes minima	Small Dotted Buff	1
Phragmatobia fuliginosa	Ruby Tiger	9

Scientific name	Common name	Abundance
Phyllonorycter hilarella	Sallow Midget	1
Plagodis pulveraria	Barred Umber	1
Platyptilia gonodactyla	Triangle Plume	1
Plusia festucae	Gold Spot	25
Plutella xylostella	Diamond-back Moth	2
Polia nebulosa	Grey Arches	9
Pseudargyrotoza conwagana	Yellow-spot Twist	1
Pseudoips prasinana	Green Silver-lines	2
Pseudoterpna pruinata	Grass Emerald	8
Pterostoma palpina	Pale Prominent	4
Ptilodon capucina	Coxcomb Prominent	16
Pyrausta despicata	Straw-barred Pearl	3
Pyrausta purpuralis	Common Purple & Gold	1
Rivula sericealis	Straw Dot	51
Rusina ferruginea	Brown Rustic	5
Schrankia costaestrigalis	Pinion-streaked Snout	7
Scoliopteryx libatrix	Herald	2
Scoparia ambigualis	Common Grey	23
Scopula immutata	Lesser Cream Wave	4
Scotopteryx luridata	July Belle	9
Scrobipalpa acuminatella	Pointed Groundling	2 (GD)
Scythris grandipennis	Black Owlet	1
Selenia dentaria	Early Thorn	15
Selenia tetralunaria	Purple Thorn	1
Sesia bembeciformis	Lunar Hornet Moth	1
Sideridis rivularis	Campion	1
Smerinthus ocellata	Eyed Hawk-moth	35
Spilosoma lubricipeda	White Ermine	31
Spilosoma lutea	Buff Ermine	43
Stenoptilia bipunctidactyla	Twin-spot Plume	2 (GD)
Subacronicta megacephala	Poplar Grey	1
Thera obeliscata	Grey Pine Carpet	1
Thumatha senex	Round-winged Muslin	44
Thyatira batis	Peach Blossom	6
Trichiura crataegi	Pale Eggar	1
Tyria jacobaeae	Cinnabar	1
Udea ferrugalis	Rusty-dot Pearl	1
Udea olivalis	Olive Pearl	1
Udea Prunalis	Dusky Pearl	6
Xanthorhoe ferrugata	Dark-barred Twin-spot Carpet	11
Xanthorhoe fluctuata	Garden Carpet	3
Xanthorhoe montanata	Silver-ground Carpet	2
Xestia baja	Dotted Clay	60
Xestia c-nigrum	Setaceous Hebrew Character	14
Xestia ditrapezium	Triple-spotted Clay	10
Xestia sexstrigata	Six-striped Rustic	5

Scientific name	Common name	Abundance
Xestia triangulum	Double Square-spot	18
Xestia xanthographa	Square-spot Rustic	1
Yponomeuta evonymella	Bird-cherry Ermine	1
Yponomeuta padella	Orchard Ermine	2
Ypsolopha dentella	Honeysuckle Moth	1
Ypsolopha parenthesella	White-shouldered Smudge	3
-	**TOTAL**	**4680**

Data Archive Appendix

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats.

[B] ~~A full set of maps produced in JPEG format~~.

[C] ~~A series of GIS layers on which the maps in the report are based with a series of word documents detailing the data processing and structure of the GIS layers~~.

[D] ~~A set of raster files in ESRI and ASCII grid formats~~.

[E] ~~*A database named [name] in Microsoft Access 2000 format with metadata described in a Microsoft Word document [name.doc]*~~.

[F] ~~A full set of images produced in [jpg/tiff] format~~.

[G] Species records held in Welsh Invertebrate Database (WID).

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue https://libcat.naturalresources.wales (English Version) and https://catllyfr.cyfoethnaturiol.cymru (Welsh Version) by searching 'Dataset Titles'. The metadata is held as record no **125391**.