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The status of the Snowdon Beetle *Chrysolina cerealis* on Yr Wyddfa in 2016

National Museums Liverpool

NRW Evidence Report No. 193



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1. Crynodeb Gweithredol

Mae chwilen amryliw'r Wyddfa *Chrysolina cerealis* wedi ei chyfyngu'n unig i'r Wyddfa yn y DU, er cyn 1980 fe'i canfuwyd hefyd yng Nghwm Idwal. Gan na fu rhyw lawer o gofnodion o'r chwilen yn ddiweddar, cynhaliwyd arolwg yn 2015 i geisio nodi ei gyflwr a'i ddosbarthiad. Canfuwyd cyfanswm o bum chwilen (pedwar larfa ac un oedolyn) yn dilyn 63.5 awr o chwilio gyda dwylo o amgylch ac ar blanhigion teim (unig blanhigyn bwyd y chwilen yn y DU) a chodi cerrig ger clytau o deim o fis Fehefin i fis Medi 2015, gyda phob sbesimen yn cael eu canfod ger Clogwyn Coch, ym mis Medi. Ni welwyd unrhyw chwilod yng Nghwm Du'r Ardd, ei lecyn traddodiadol, er gwaethaf chwiliadau trylwyr.

Yn dilyn parhad o'r arolwg o fis Mai i fis Hydref, fe ddarganfuwyd deg oedolyn ac un larfa yn dilyn 69 awr o chwilio, gyda'r oedolion yn cael eu cofnodi yng Nghlogwyn Coch a'r larfae dan garreg yng Nghwm Glas Bach. Mae arolwg 2016 yn atgyfnerthu'r awgrym fod y chwilen efallai yn encilio i diroedd uwch, efallai oherwydd newid yn yr hinsawdd neu ffactorau eraill. Yn ystod y ddwy flynedd, fe ddarganfuwyd 16 chwilen (11 oedolyn a 5 larfa) ar ôl chwilota am fwy na 130 awr. Fel yn 2015, ni welwyd unrhyw chwilod yng nghwm Idwal.

2. Executive Summary

The Snowdon Beetle *Chrysolina cerealis* is restricted in the UK to Snowdon (Yr Wyddfa), although it was also found in Cwm Idwal until 1980. As recent records of the beetle have been few, a survey was undertaken in 2015 in an attempt to determine its status and distribution. A total of five beetles (four larvae and one adult) was found following 63.5 hours of hand searching on and around thyme plants (the only recorded foodplant of the beetle in the UK) and stone-turning near patches of thyme from June to September 2015, with all specimens found in Clogwyn Coch in September. No beetles were found in Cwm du'r Arddu, its traditional hotspot, despite exhaustive searches.

A continuation of the survey from May to October 2016 located ten adults and one larva following 69 hours of search, with all adults recorded in Clogwyn Coch and the larva found under a stone in Cwm Glas Bach. The 2016 survey reinforces the suggestion that the beetle may be retreating to higher altitudes, perhaps as a consequence of climate change or other factors. Over the two year period, 16 beetles (11 adults and 5 larvae) have been found after more than 130 hours of search. As in 2015, no beetles were found in Cwm Idwal.

3. Introduction

3.1 Background information

Whilst the Snowdon Beetle *Chrysolina cerealis* is widespread in Europe, from Norway to northern Italy (Buse, 1993), it has been recorded in the UK only from the Snowdon massif (Yr Wyddfa) and Cwm Idwal, although subfossil deposits have been found in kettle holes to the west of Criccieth (Coope & Brophy, 1972). Described as a glacial relict, it is most often associated with montane habitats, although there are anomalous records of it feeding on lavender at sea level in southern France, and it was reported from France in abundance on wheat in the 1870s (Anon., 1875). At its Welsh localities, it is restricted to base-rich montane grassland where both larvae and adults feed exclusively on the flowers and leaves of wild thyme *Thymus polytrichus*. European populations are reported to utilise members of various plant families including Asteraceae, Fabaceae, and Labiatae.

It has not been recorded in Cwm Idwal since 1980, despite repeated searches (Shackshaft, 2007a&b; Strong & Moscrop, 1991). It is regarded as Endangered in the UK (Hubble, 2014) although it is more likely to be Critically Endangered given its apparent absence from Cwm Idwal. The beetle is also protected under Schedule 5 of the Wildlife & Countryside Act. Adults have been recorded from April to October, with most found between June and September, and larvae have been found in August and September. It is thought to be flightless (Buse, 1993, Shackshaft, 2007b), presumably to save energy and avoid being blown away from its habitat (Lopatin, 1996).

Buse (1993) highlights the fluctuating population numbers and often contradictory nature of records since recording on Snowdon was first reported in mid-1800s. It “appeared to be plentiful in Wales” in 1856 (Anon., 1856) and it was not uncommon on a slope at 853m in 1874 (Champion, 1875). Only two adults were found after “a long and careful search” in August 1885 (Wilding, 1885), who noted that thyme “was almost as scarce as the beetle”. Ellis (1934) found it difficult to find in 1886 although he recorded 17 adults in a small area after four hours of searching on 30th June 1886 (Ellis, 1887), and was pleased to see the beetle “occurring in sudden abundance” (Birch, 1902). Wood (1901) failed to find a single specimen in 1901 but Tomlin & Sopp (1901) found 12 specimens in the same year and Kidson-Taylor (1906) found it very sparingly at the roots of thyme in September 1905. Thirteen specimens in the National Museum of Wales, Cardiff collected by J. Chappell are labelled ‘Snowdon July 1902’, and Donisthorpe (1906) collected 24 specimens on 30th June 1906. Parry (1988) found 13 adults under stones after 90 minutes of searching in July 1978 and Shackshaft (2007a) found the remains of beetles at thirteen localities in July 2007, but no live specimens. Table 1 highlights counts in excess of 10 individuals. Remaining counts are of low numbers of adults or larvae, even during intensive searches (Buse, 1993; Evans, 1990; Shackshaft, 2007a&b; Turner, 1991; Adrian Fowles, pers.obs.).

Detailed studies of the Snowdon population, including autecological observations of captive specimens, have been undertaken by Buse (1993), Parry (1988) and Sopp (1902). Buse (1993) reported that females laid between seven and 18 eggs, mainly singly but with clutch sizes varying between one and six eggs, at the tips of grass

blades, with eggs hatching after 14 days. Larvae took 38 days to develop to 4th instar at which stage they became inactive in hollows in soil or between stones. Captive females have also been observed laying eggs on thyme leaves (Geoff Gartside, personal communication to Richard Gallon [Cofnod]). Parry (1988) observed that larvae and adults most typically hide amongst root debris and matted fibres beneath vegetation, rather than under stones, making them more difficult to find. Observations by Evans (1990) and Adrian Fowles & Dr. Mike Howe (Fowles, 1995) suggest that adults beetles are nocturnal but that observations are difficult at such times. Whilst population estimates are difficult to make, Buse (1993) suggested 1000 adults in June and July, whilst Parry (1988) and M.L. Cox (in a letter to Peter Hope Jones of the Nature Conservancy Council, dated 11th January 1989) postulated a population of 10,000 adults.

Table 1: Counts in excess of 10 specimens of *Chrysolina cerealis*.

Site	GR	Date	Abundance	Recorder	Source
Yr Wyddfa	SH6254	30 June 1886	17 adults	J.W.Ellis	Ellis (1887)
Yr Wyddfa	SH65	18-20 August 1901	12 adults	B.Tomlin & E.J.B.Sopp	Tomlin & Sopp (1901)
Yr Wyddfa	SH65	July 1902	13 adults	J.Chappell	National Museum of Wales
Yr Wyddfa	SH65	30 June 1906	24 adults	H.Donisthorpe	Donisthorpe (1906)
Clogwyn d'ur Arddu	SH6254	July 1978	13 adults	J.Parry	Parry (1988)
Clogwyn du'r Arddu	SH6055	July 2007	remains of 13 adults	M.Shackshaft	Shackshaft (2007a)

C. cerealis has been recorded from a wide area of Yr Wyddfa but there are clusters of records around four main locations – Cwm du'r Arddu; Llechog ridge in Cwm Clogwyn; the Pyg & Miners Tracks and Clogwyn y Garnedd in Cwm Glaslyn; and Cwm Glas (see Figures 1 to 4). Figure 4 illustrate the distribution of sightings in relation to areas of thyme-rich grassland mapped in 1996-98 and 2006. The most recent records are from high altitude (Table 2).

Table 2: Records of *Chrysolina cerealis* from 2010 to 2014.

Site	GR	Altitude	Date	Abundance	Recorder
Clogwyn y Garnedd	SH61265441	765 m	23 September 2011	1 adult	Alastair Hotchkiss
Cwm Clogwyn	SH598539	610 m	16 June 2010	2 adults	Andrew Graham
Cwm Clogwyn	SH600537	675 m	26 June 2011	1 adult	Andrew Graham

In 2015, NRW commissioned World Museum Liverpool to undertake searches for *C. cerealis* on Yr Wyddfa and in Cwm Idwal. A total of five beetles (four larvae and one adult) was found following 63.5 hours of hand searching on and around thyme plants (the only recorded foodplant of the beetle in the UK) and stone-turning near patches of thyme from June to September 2015, with all specimens found on Clogwyn Coch, Yr Wyddfa in September (World Museum Liverpool, 2016). No beetles were found in Cwm du'r Arddu, its traditional hotspot, despite exhaustive searches. It was tentatively suggested that Snowdon Beetle may be retreating to higher altitudes, perhaps as a consequence of climate change or other factors. No beetles were found

in Cwm Idwal following a five hour search in September 2015 despite the presence of the foodplant.

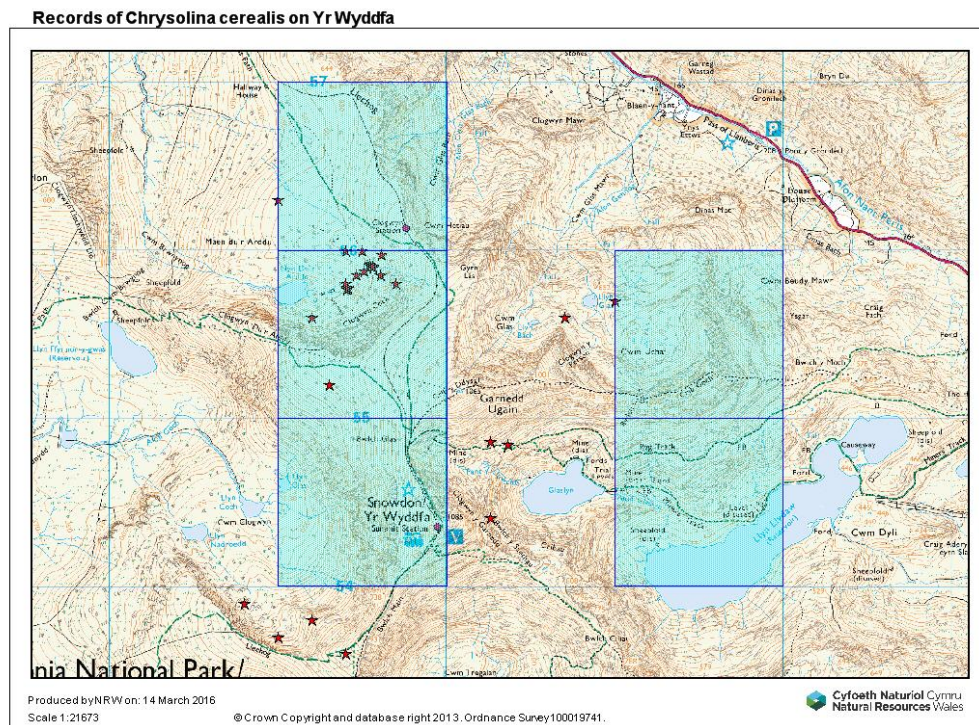


Figure 1: Records of *Chrysolina cerealis* from Yr Wyddfa. Red star = records with at least a 6-figure grid reference; blue square = records with a 4-figure grid reference.

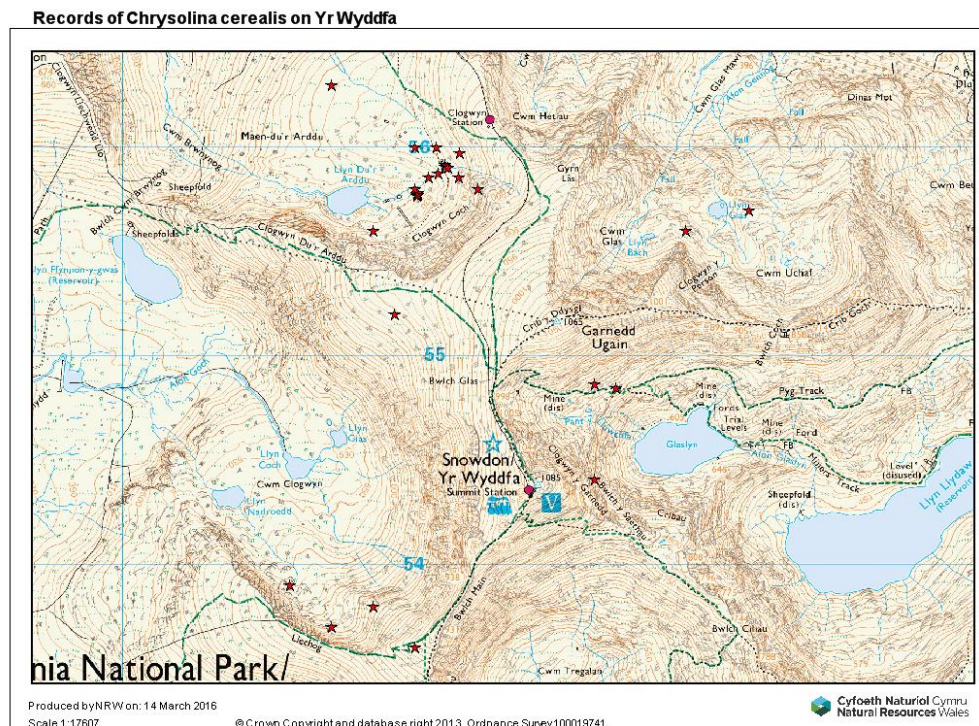


Figure 2: Records of *Chrysolina cerealis* from Yr Wyddfa. Red star = records with at least a 6-figure grid reference.

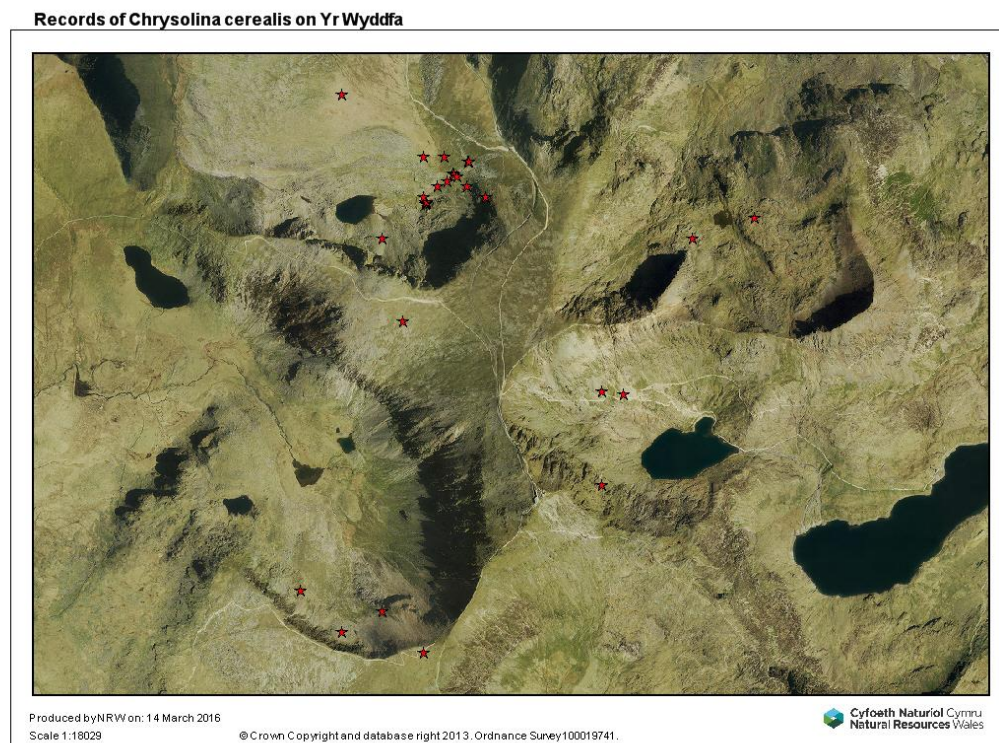


Figure 3: Records of *Chrysolina cerealis* from Yr Wyddfa. Red star = records with at least a 6-figure grid reference.

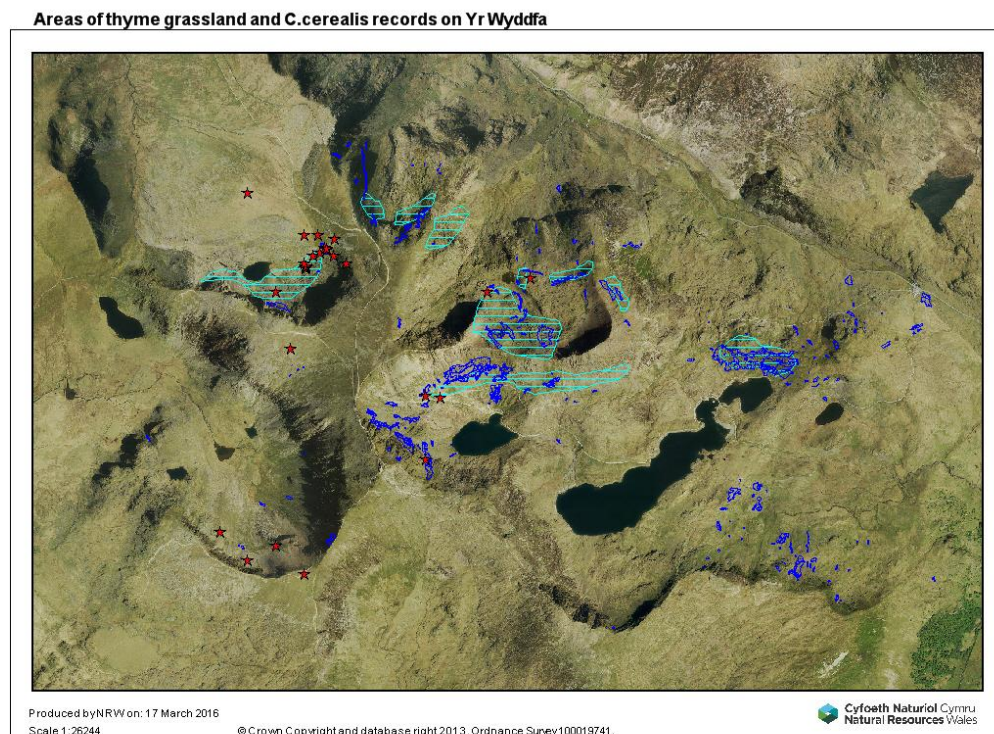


Figure 4: Records of *Chrysolina cerealis* from Yr Wyddfa. Red star = records with at least a 6-figure grid reference. Dark blue = thyme grassland mapped in 1996-98 by Alex Turner. Light blue = areas of thyme mapped in 2006.

3.2. Objectives

The objective of this survey was to build upon the results of the 2015 work, with a primary focus on locating the beetle on Yr Wyddfa.

4. Methods

As in 2015, search effort focussed on areas of thyme-rich grassland, and particularly those areas with recent records of Snowdon Beetle. Adults and larvae were looked for by visual searches of the foodplant and by turning over stones within the vicinity of thyme during daylight hours. Fieldwork was undertaken by the following people - CF Chris Felton (NML associate), RG Richard Gallon (Cofnod LRC), MH Mike Howe (NRW), TH Tony Hunter (NML), SJ Steve Judd (NML), DP Dafydd Parry (NRW) and HR Hywel Roberts (NRW). Yr Wyddfa was visited on seven occasions and resulted in a total of 52 hours of search. Seventeen hours of search were also expended in Cwm Idwal.

- 12.05.2016 (RG, MH, TH, SJ) = 16 person hours (fine, dry) – Yr Wyddfa.
- 13.05.2016 (TH, SJ) = 8 person hours (fine, dry) – Yr Wyddfa.
- 29.05.2016 (TH) 1 person hour (dry but overcast) – Cwm Idwal.
- 28.07.2016 (CF, TH, SJ, DP, HR) = 13 person hours (wet and windy) – Yr Wyddfa.
- 29.07.2016 (CF, TH, SJ) = 13 person hours (wet and windy) – Cwm Idwal + Yr Wyddfa.
- 26.08.2016 (TH) = 1 person hour (overcast and windy) – Yr Wyddfa.
- 25.09.2016 (TH) = 4 person hours (fine and dry) = Cwm Idwal & Yr Wyddfa.
- 29.09.2016 (TH, SJ, DP) = 5 person hours (dry and very windy) – Cwm Idwal.
- 30.09.2016 (TH, SJ) = 8 person hours (windy conditions) – Yr Wyddfa.

The opportunity was taken to record other invertebrates encountered during the survey. Araneae, Chilopoda, Coleoptera, Hemiptera and parasitic Hymenoptera were identified by TH, aculeate Hymenoptera by Carl Clee (NML associate) and Lepidoptera by Lorna Blackmore (NML placement).

5. Results

A total of eleven beetles were recorded during the 2016 survey (Table 3; Appendix A). Ten adults were near patches of thyme in Clogwyn Coch, including two mating in full sunshine (Table 3; Figure 5). Several areas in the adjacent Cwm Clogwyn support good habitat for the beetle (Figure 8) but none was found, perhaps because of poor weather conditions during visits. A single larva was found under a stone near the foodplant in Cwm Glas Bach (Table 3; Figures 6, 7 + 11), and this appears to be a new locality for the beetle. As in 2015, Snowdon Beetle was not found in Cwm Idwal.

An additional 23 species of invertebrates was recorded (Appendix A), including the Nationally Scarce centipede *Lithobius curtipes* and a larva of Ashworth's Rustic moth *Xestia ashworthii* (Figure 10).

Table 3: Records of *Chrysolina cerealis* from the 2015 and 2016 surveys.

Date collected	Abundance	Grid Reference	Altitude
4 September 2015	2 larvae	SH6085255820	795 m
4 September 2015	1 larva	SH6077155705	827 m
17 September 2015	1 adult + 1 larva	SH6068655758	729 m
12 May 2016	7 adults	SH6068655758	729 m
12 May 2016	3 adults (2 in cop)	SH6085255820	795 m
26 August 2016	1 larva	SH6073056639	555 m



Figure 5: Snowdon Beetle in cop. May 2016 © Tony Hunter



Figure 6: Snowdon Beetle larva under stone, Cwm Glas Bach © Tony Hunter



Figure 7: Stone with Snowdon Beetle larva beneath © Tony Hunter



Figure 8: Snowdon Beetle May 2016 © Richard Gallon



Figure 9: Potential habitat in Cwm Clogwyn © Tony Hunter



Figure 10: Larva of Ashworth's Rustic, Cwm Idwal May 2016 © Tony Hunter

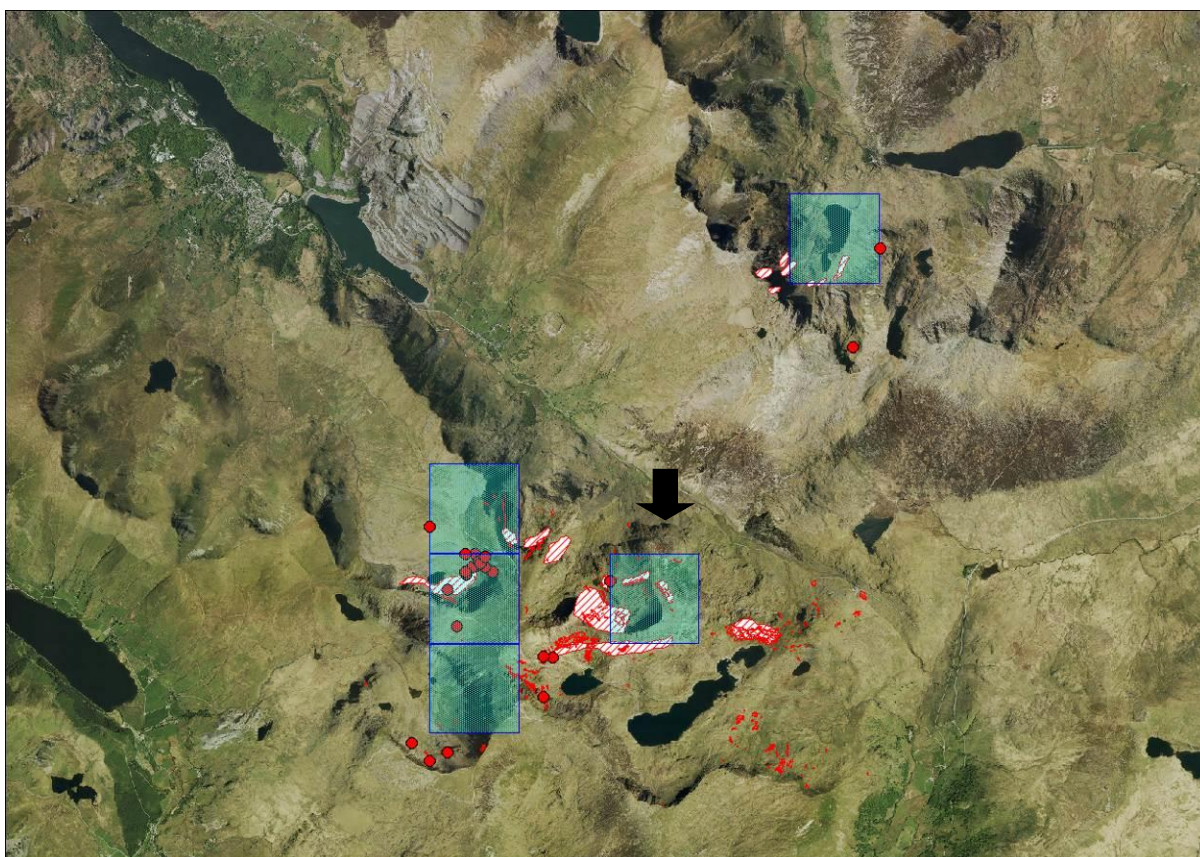


Figure 11: The location of Cwm Glas Bach (black arrow), a new location for Snowdon Beetle in 2016.

6. Discussion

Over the two-year survey period, just sixteen beetles (11 adults and 5 larvae) were recorded in over 130 hours of search, suggesting that the beetle is either exceedingly difficult to locate or is present at very low densities. Several areas supporting apparently suitable habitat such as Cwm Clogwyn appear to be unoccupied. Whilst *C. cerealis* has always proved difficult to find throughout the history of recording the beetle on Yr Wyddfa, much larger numbers were recorded in the early 1900s and even as recently as the early 1990s (Buse, 1993) suggesting an apparent population decline. The reasons for this decline were explored fully in the 2016 report (World Museum Liverpool, 2016) and included the impact of climate change which has been suggested as a possible driver for this species (Hubble, 2014), and particularly for montane specialists with restricted ranges and small populations (Parmesan, 2006). The mean air temperature in Wales is estimated to have increased by 0.7° Celsius between 1914 and 2006 and it is predicted to continue rising exponentially for the foreseeable future (Anon., 2009).

Long-term monitoring on Yr Wyddfa as part of the Environmental Change Network has shown an increase in temperature and rainfall, and a decline in vegetation species-richness over the 1992 to 2007 period (Lloyd *et al.*, 2011). Key findings from the monitoring include:

- Spring air temperatures have risen and winters have become less severe. Soil and grass minimum temperature have also both risen since the earlier period. These changes are accompanied by a rise in annual precipitation totals since 1995. Such observed shifts are influenced by the period of observation and the variability in climate, with more recent severe winters reducing the extent of the overall temperature rise since ECN recording started in 1995.
- Levels of acidification and pollutant concentrations have decreased in response to emission controls. The recovery of Snowdon's ecosystems is taking longer and on-going pollution levels (such as nitrogen and ozone) are still likely to be having a negative impact on semi-natural habitats.
- Snowdon has undergone a significant reduction in grazing intensity over the recording period with sheep numbers on the site having fallen by around 50% from the levels recorded in 1997. This fall in sheep numbers is accompanied by the reintroduction of cattle grazing on the site and an increase in goat numbers.
- Vegetation community composition has shifted to one more indicative of acidic habitats and species richness has decreased, with grasses becoming more dominant over herbs. This may result from acidification of soils over a 40-year period. Although acidification has reduced more recently, following emission controls, recovery of vegetation appears to be lagging behind changes to inputs probably as the buffering potential of soils takes time to recover. This in turn has meant that there has been a lag in seeing changes to the plant communities on the site.

- Warmer winter and early spring weather in recent years have ensured the survival of larger numbers of new-born kid goats and there has been a population increase. As they often graze areas avoided by sheep such as cliff ledges and rocky outcrops, an increase in goat numbers may have an impact upon ledge floristics.

Increasing temperatures and rainfall and less severe winters may be having an impact upon *C. cerealis*. Conditions which favour wetter, more acidic vegetation may have a deleterious effect on thyme which prefers free-draining, base-rich substrates (Preston *et al.*, 2002). With beetles seemingly restricted to less accessible crags and ledges, an increasing goat population (and any increase in sheep numbers) may result in the loss of these retreats through trampling, grazing out stands of thyme or accidentally ingesting eggs oviposited on grass tips (Buse, 1993). It is appreciated however that some light grazing will help to prevent the foodplants being shaded out by more vigorous species (Martin *et al.*, 2013).

The finding of ten adults, including a mating pair, on 12 May 2016 suggests that these had recently emerged from hibernation and/or pupation and were searching for mating partners during a period of warm and sunny conditions. Historically, peak adult numbers have been recorded in June and July but this may be an artefact of recording effort as montane spring weather can be highly unpredictable and entomologists would have visited in more settled conditions. The discovery of a larva in Cwm Glas Bach is thought to have extended the range of the beetle on Yr Wyddfa. Over the two-year survey, beetles have been found at altitudes ranging from 555m to 827m with a mean altitude of 738m, which does add credence to the suggestion in World Museum Liverpool (2016) that the population may be retreating to higher altitudes.

Despite searches in 2015 and 2016, Snowdon Beetle has not been recorded in Cwm Idwal since 1980 despite the availability of suitable habitat, suggesting that *C. cerealis* may now be confined to very small areas of thyme grassland on Yr Wyddfa.

7. Conclusions & Recommendations

The results of the 2015 and 2016 surveys have demonstrated that Snowdon Beetle is still present on Yr Wyddfa, with breeding populations in Clogwyn Coch and Cwm Glas Bach. It occurs at very low population densities and is apparently absent from areas of suitable habitat. A perceived reduction in numbers could indicate some degradation of the beetle's habitat or reproductive fitness. A longer period of study, with searches adopting a variety of techniques, is required to fully understand the current status and distribution of *C. cerealis* and to identify any management issues.

There is a suggestion that the population is retreating to higher altitudes perhaps as a consequence of climate change, although grazing may also be a significant factor. Small enclosures could be erected to monitor the response of thyme to an absence of grazing.

A genetic comparison between Welsh and continental beetles may identify any genetic bottleneck within the Snowdon population.

It is recommended that surveys continue in the hope of identifying additional locations on Yr Wyddfa, with a particular emphasis on surveys in good conditions in early May when adults may be most active after coming out of hibernation. Further searches in Cwm Idwal are required before considering it extinct here.

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10. Appendices

10.1. Appendix A: Records of invertebrates recorded during the 2016 survey.

Date collected.	Stage/Sex.	Locality.	Grid Ref.	Recorder.
Araneae: Amaurobiidae: <i>Coelotes atropos</i> (Walckenaer, 1830)				
25.09.2016	Female	Cwm Idwal: Nr. Lyn Bochwylyd	SH 6597 5872	Tony Hunter
Araneae: Gnaphosidae: <i>Zelotes apricorum</i> (L. Koch, 1876)				
29.07.2016	Female	Clogwyn D'ur Arrdu	SH 6014 5481	Tony Hunter
Araneae: Linyphiidae: <i>Centromerita concinna</i> (Thorell, 1875)				
25.09.2016	Female	Cwm Idwal: Lyn Bochwylyd	SH 6540 5918	Tony Hunter
30.09.2016	Female	Cwm Clogwyn	SH 6023 5426	Tony Hunter
Araneae: Linyphiidae: <i>Diplocephalus permixtus</i> (O.P.-Cambridge, 1871)				
25.09.2016	Female	Cwm Idwal: Lyn Bochwylyd	SH 6540 5918	Tony Hunter
Araneae: Linyphiidae: <i>Poecilonea variegata</i> (Blackwall, 1841)				
25.09.2016	Female	Cwm Idwal: Nr. Lyn Bochwylyd	SH 6597 5872	Tony Hunter
Araneae: Linyphiidae: <i>Saariotia abnormis</i> (Blackwall, 1841)				
29.09.2016	Female	Cwm Idwal: Nameless Cwm	SH 6475 5883	Tony Hunter
Araneae: Linyphiidae: <i>Tenuiphantes tenuis</i> (Blackwall, 1852)				
25.09.2016	Male	Cwm Idwal: Nr. Lyn Bochwylyd	SH 6597 5872	Tony Hunter
Araneae: Linyphiidae: <i>Tenuiphantes zimmermanni</i> (Bertkau, 1890)				
29.09.2016	Female	Cwm Idwal: Nameless Cwm	SH 6475 5883	Tony Hunter
Araneae: Lycosidae: <i>Pardosa pullata</i> (Clerck, 1757)				
25.09.2016	Female	Cwm Idwal: Y-Garn	SH 6402 6000	Tony Hunter
Araneae: Theridiidae: <i>Robertus arundineti</i> (O.P.-Cambridge, 1871)				
25.09.2016	Female	Cwm Idwal: Lyn Bochwylyd	SH 6540 5918	Tony Hunter
Araneae: Theridiidae: <i>Robertus lividus</i> (Blackwall, 1836)				
25.09.2016	Male	Cwm Idwal: Nr. Lyn Bochwylyd	SH 6597 5872	Tony Hunter
29.09.2016	Female	Cwm Idwal: Nameless Cwm	SH 6475 5883	Tony Hunter
Chilopoda: Lithobiidae: <i>Lithobius curtipes</i> C.L. Koch, 1847				
25.09.2016	Female	Cwm Idwal: Nr. Lyn Bochwylyd	SH 6597 5872	Tony Hunter
Coleoptera: Carabidae: <i>Carabus arvensis</i> Herbst, 1784				
13.05.2016	Unsexed	Snowdon: Nr. summit	SH 6087 5424	Tony Hunter
Coleoptera: Carabidae: <i>Notiophilus palustris</i> (Duftschmid, 1812)				
30.09.2016	Unsexed	Snowdon: Pyg Track	SH 614 548	Steve Judd
Coleoptera: Chrysomelidae: <i>Chrysolina cerealis</i> (Linnaeus, 1767)				
12.05.2016	7 adults	Clogwyn Coch	SH 60686 55758	
12.05.2016	3 adults	Clogwyn Coch	SH 60852 55820	Tony Hunter
26.08.2016	1 larva	Cwm Glas Bach	SH 60730 56639	Tony Hunter
Coleoptera: Elateridae: <i>Athous haemorrhoidalis</i> (Fabricius, 1801)				
12.05.2016	Unsexed	Clogwyn Coch	SH 607 557	Tony Hunter
Coleoptera: Elateridae: <i>Ctenicera cuprea</i> (Fabricius, 1775)				
13.05.2016	Unsexed	Snowdon: Miners track	SH 639 547	Tony Hunter
Coleoptera: Elateridae: <i>Hypnoidus riparius</i> (Fabricius, 1792)				
13.05.2016	Unsexed	Clogwyn Coch	SH 607 557	Tony Hunter
Hemiptera: Cicadellidae: <i>Eupteryx notata</i> Curtis, 1837				
28.07.2016	Unsexed	Cwm Glas Mawr	SH 616 559	Tony Hunter
Hymenoptera: Formicidae: <i>Myrmica sulcinodis</i> Nylander, 1846				
25.09.2016	Female	Cwm Idwal: Nr. Lyn Bochwylyd	SH 6597 5872	Tony Hunter
Hymenoptera: Ichneumonidae: <i>Ichneumon oblongus</i> Schrank, 1802				
13.05.2016	Female	Snowdon: Miners track	SH 627 544	Tony Hunter

Lepidoptera: Noctuidae: *Xestia ashworthii* (Doubleday, 1855)

29.05.2016 1 larva Cwm Idwal: Y-Garn. SH 638 599 Tony Hunter

Lepidoptera: Nymphalidae: *Coenonympha pamphilus* (Linnaeus, 1758)

29.07.2016 Unsexed Clogwyn D'ur Arrdu SH 59834 54042 Tony Hunter

10.2. Data Archive Appendix

The data archive contains:

- [A] The final report in Microsoft Word and Adobe PDF formats.
- [B] Species records, which are held on the NRW Recorder 6 database.

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue <http://libcat.naturalresources.wales> or <http://catllyfr.cyfoethnaturiol.cymru> by searching 'Dataset Titles'. The metadata is held as record no. 117097.

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