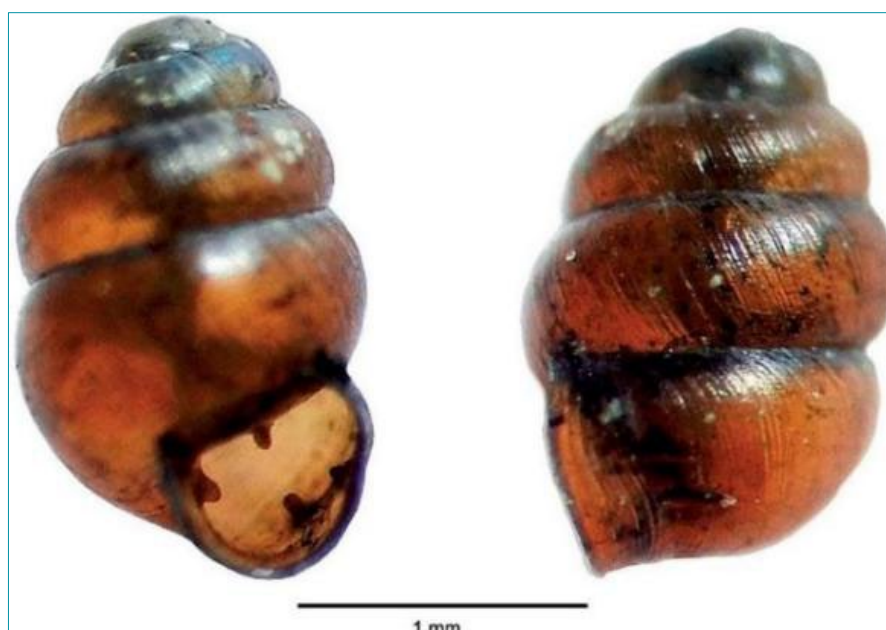


Surveys to determine the status and distribution of Geyer's Whorl Snail *Vertigo geyeri* at Waun Eurad SSSI, Cors Erddreiniog SSSI and Cors Bodeilio SSSI on Anglesey in September 2025

Natur am Byth! Evidence Report No. 017

Author name: M.J. Willing



Geyer's Whorl Snail *Vertigo geyeri*

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Crynodeb gweithredol

Cynhaliwyd arolygon ar gyfer Malwen Droellog Geyer, *Vertigo geyeri*, mewn tri lleoliad ar Ynys Môn ym mis Medi 2025 – SoDdGA Waun Eurad, cae ffynnon Nant Isaf o fewn SoDdGA Cors Erddreiniog, a SoDdGA Cors Bodeilio.

Yn Waun Eurad, safle sy'n cynnal y boblogaeth hysbys olaf o *V. geyeri* yng Nghymru, dewiswyd 29 o leoliadau ar draws rhan ogleddol y safle (y parth a ddefnyddiwyd ym mhob un o'r arolygon blaenorol ac y dangoswyd ei fod yn cynnwys cynefin a allai fod yn addas ar gyfer y falwen) ar hyd cyfres o chwe llinell trawslun o'r dwyrain i'r gorllewin, er mwyn sicrhau y câi'r safle ei gwmpasu'n systematig. Ni chafodd lleiniau'r arolwg eu lleoli ar bwyntiau sefydlog, ond dim ond mewn lleoliadau a oedd o fewn, neu'n agos iawn at, ardaloedd lle'r oedd y Corsfrwyn du *Schoenus nigricans* yn bresennol, ac yr ystyrid eu bod yn **Optimaidd** neu'n **Llai nag optimaidd** ar gyfer y falwen, fel y diffiniwyd mewn arolygon blaenorol. Er gwaethaf ofnau y gallai *V. geyeri* fod wedi diflannu o'r safle yn dilyn cyfres o wanwynau a hafau eithriadol o sych a phoeth, pan sychodd y safle'n llwyr – gan gynnwys yn 2025 – cafwyd hyd i unigolion byw. Drwy'r dull samplu swmp, cofnodwyd 19 o falwod byw o naw o'r 29 lleoliad a arolygwyd, er mai dim ond tair enghraifft o *V. geyeri* o dri safle a gafwyd drwy'r dull samplu drwy wactod (pob un ohonynt hefyd mewn lleoliadau a gofnodwyd drwy'r dull samplu swmp). Fel y gwelwyd yn 2021 (ac mewn arolygon eraill cynharach), roedd y rhan fwyaf o'r malwod i'w cael yng nghanol ac yng ngogledd-orllewin y warchodfa, a oedd yn cyd-fynd yn fras â'r ardal sy'n cynnwys rhwydwaith o ffrydiau gwlyb calchaid wedi'u bwydo gan ffynhonnau. Un o nodau'r arolwg o Waun Eurad oedd asesu a oedd digon o unigolion o *V. geyeri* yn bresennol i ganiatáu trawsleoli 'stoc dros ben' i gynefin llifolchdir wedi'i adfer yn Nant Isaf, a fu unwaith yn 'gadarnle' i'r falwen ar Gors Erddreiniog. Yn anffodus, oherwydd niferoedd bychain y falwen, nid oedd modd i hyn gael ei ystyried yn 2025.

Cofnodwyd 19 rhywogaeth arall i gyd o folysgiaid, gan gynnwys 14 tacson y tir a phump tacson dŵr croyw. Roedd y rhain yn cynnwys dwy o rywogaethau'r tir, sef *Aegopinella nitidula* a *Columella aspera*, a thair rhywogaeth dŵr croyw, sef *Potamopyrgus antipodarum*, *Radix balthica* ac *Euglesa casertana*, na chawsant eu cofnodi yn 2021 (er i *C. aspera* gael ei chofnodi yn 2003 a 2007). Trafodir diflaniad ymddangosiadol, yn 2021 a 2025, grŵp o rywogaethau a gofnodwyd yn Waun Eurad rhwng 2003 a 2007.

Yn Nant Isaf, dewiswyd chwe lleoliad ar draws ardal ddeheuol y safle ble cofnodwyd *V. geyeri* yn eang yn flaenorol yn 2003. Mae'r ardal hon yn parhau i wella ar ôl clirio'r tyfiant trwchus o *S. nigricans* a Brwyn blaendon *Juncus subnodulosus* yn 2017 – planhigion a oedd gynt yn gorchuddio'r safle'n llwyr ar ôl rhoi'r gorau i'w bori. Er bod pori ysgafn gan geffylau, yn dilyn y digwyddiad hwnnw, wedi galluogi adferiad rhannol i gynefin lawnt *Carex* (sy'n ddelfrydol ar gyfer *V. geyeri*), ni chanfuwyd y falwen yn 2025 yn y samplau swmp na'r samplau drwy wactod. Yn ogystal, cofnodwyd saith rhywogaeth o folysgiaid byw a thair rhywogaeth o folysgiaid dŵr croyw; cafwyd hyd i bob un ohonynt hefyd yn y safle yn 2019. Mae'n bosibl bod seithfed safle a samplwyd ar ben uchaf y cae mewn ardal o Nant Isaf nad oedd wedi'i harolygu o'r blaen. Cafwyd hyd i *Vertigo antivertigo* a *Vertigo pygmaea* yn y samplau a gasglwyd, sy'n awgrymu bod gan yr ardal hon – lle'r oedd 'lawnt

Carex dda – amrywiaeth o amodau hydrolegol, o gynefin cymharol sych i gynefin dirlawn, a allai gynnwys rhai ardaloedd sy'n addas ar gyfer *V. geyeri*. O ganlyniad, gallai fod werth arolygu'r ardal hon yn rhan uchaf Nant Isaf ymhellach yn 2026.

Datgelodd yr arolwg yng Nghors Bodeilio ardaloedd helaeth o byllau twffa calchaid sy'n dal i ddyddodi, ond cyfyngedig oedd y cynefin lawnt *Carex* llaith a allai fod yn addas ar gyfer *V. geyeri*; ni chafwyd hyd i'r falwen yn y samplau swmp na'r samplau drwy wactod. Mae presenoldeb *V. antivertigo* mynych yn awgrymu bod yr amodau'n rhy wlyb ar gyfer *V. geyeri*. Yn ogystal, datgelodd samplau o'r safle ffawna molysgiaid cyfyngedig iawn, yn cynnwys chwe rhywogaeth dir a thair rhywogaeth dŵr croyw; mae pob un ohonynt yn gyffredin ac yn eang eu dosbarthiad ar safleoedd gwlyptir eraill yn Ynys Môn.

Mae crynodebau byrion hefyd wedi'u cynnwys o'r holl astudiaethau blaenorol ar *V. geyeri* ar Waun Eurad rhwng 1996 a 2021 ac ar SoDdGA Cors Erddreiniog rhwng 1985 a 2019.

Executive summary

Surveys for Geyer's Whorl Snail *Vertigo geyeri* were undertaken at three locations on Anglesey in September 2025 - Waun Eurad SSSI, Nant Isaf spring field within Cors Erddreiniog SSSI) and Cors Bodeilio SSSI.

At Waun Eurad, a site supporting the last known Welsh *V. geyeri* population, 29 locations were chosen from across the northern area of the site (the zone used in all previous surveys and demonstrated to include habitat potentially suitable for the snail) in a series of six east – west transect lines to get a systematic coverage of the site. The survey plots were not positioned at fixed points, but only at locations which were in, or very close to areas where Black Bog-rush *Schoenus nigricans* was present and were judged to be **Optimal** or **Sub-optimal** for the snail as defined in previous surveys. Despite fears that *V. geyeri* may have been lost from the site following a series of exceptionally dry and hot springs and summers when the site completely dried, including in 2025, live individuals were located. The bulk sampling produced 19 live snails from nine of the 29 survey locations although the vacuum sampling only produced three *V. geyeri* from three sites (all also located at locations recorded by the bulk sampling). As found in 2021 (and other earlier surveys), most of the snails were located, in the centre and north-western reserve approximately corresponding to area covered by a network of spring-fed calcareous flushes. One aim of the Waun Eurad survey was to assess whether sufficient *V. geyeri* was present to allow for the translocation of 'excess stock' to restored flush habitat on Nant Isaf, a former 'stronghold' for the snail on Cors Erddreiniog. Unfortunately, low numbers of the snail did not allow this to be considered in 2025.

A total of 19 other mollusc species were recorded including 14 terrestrial and five freshwater taxa. These included two terrestrial species, *Aegopinella nitidula* and *Columella aspera*, and three freshwater species, *Potamopyrgus antipodarum*, *Radix balthica* and *Euglesa casertana*, not recorded in 2021 (although *C. aspera* was recorded in 2003 and 2007). The apparent disappearance in 2021 and 2025 of a group of species recorded at Waun Eurad between 2003 and 2007 is discussed.

At Nant Isaf, six locations were chosen across the southern area of the site where *V. geyeri* was previously widely recorded in 2003. This area continues to recover following the clearance in 2017 of rank growth of *S. nigricans* and Blunt-flowered Rush *Juncus subnodulosus* that had formerly blanketed the site following a cessation of grazing. Although the light horse grazing that has followed that event has allowed some restoration of *Carex* lawn habitat (ideally suited to *V. geyeri*), the snail was not found in 2025 in either the bulk or vacuum samples. Additionally, a total of seven live and three freshwater mollusc species were recorded, all also found at the site in 2019. A seventh site sampled at the top of the field may be in an area of Nant Isaf not previously surveyed. Samples collected produced both *Vertigo antivertigo* and *Vertigo pygmaea*, suggesting that this area, which had a well-formed 'Carex lawn', has a range of hydrological conditions ranging from moderately dry to saturated habitat that may include some areas suited to *V. geyeri*. Consequently, this upper Nant Isaf area may merit further survey in 2026.

The Cors Bodeilio survey revealed extensive areas of actively depositing calcareous tufa pools but little humid *Carex* lawn habitat, potentially suitable for *V. geyeri*; the snail was not recovered from either the bulk or vacuum samples. The presence of frequent *V. antivertigo* suggests that conditions are too wet for *V. geyeri*. Additionally, samples from the site revealed a very limited mollusc fauna of six terrestrial and three freshwater species, all common and widespread at other wetland sites on Anglesey.

Concise summaries are also included of all previous *V. geyeri* studies on Waun Eurad from 1996 to 2021 and at Cors Erddreiniog SSSI between 1985 to 2019.

1. Introduction

Geyer's Whorl Snail *Vertigo geyeri* Lindholm, 1925 is a rare, boreal species that was widespread in Britain in the pre-wooded Late-glacial and early Post-glacial periods (Kerney, 1999). It is only known from one small site in lowland southern Britain (Holyoak *et al.*, 2006; Willing, 2011) and exhibits a relict distribution pattern elsewhere in upland regions of the British mainland where it is present at nine known centres of distribution (Kerney, 1999, Conchological Society database). The conservation importance of the species has resulted in its inclusion in various schedules and Red Data lists. Categorised as Endangered (category 1) in the GB Invertebrate Red Data Book (Bratton, 1991), it has recently been classed as Near Threatened/Nationally Scarce in the IUCN-based GB Non-Marine Mollusc Status Review (Seddon *et al.*, 2014). The species is listed in Annex IIa of the European Community Habitats and Species Directive (92/43/EEC) and is also a Welsh Section 7 'Species of Principal Importance'. In Britain, *V. geyeri* lives in open, unshaded, permanently wet calcareous flushes and fens. Sites are dominated by small sedges, rushes and mosses. Examples of typical associate plants include Quaking-grass *Briza media*, Long-stalked Yellow Sedge *Carex lepidocarpa*, Marsh Horsetail *Equisetum palustre*, Jointed Rush *Juncus articulatus*, Common Butterwort *Pinguicula vulgaris* and the mosses *Drepanocladus revolvens* and *Campylium stellatum*, with scattered tussocks of Black Bog-rush *Schoenus nigricans*. The snail requires surface water levels to be mostly close to the ground surface for most of the year (Cameron, 2003; Cameron *et al.*, 2003; Kuczyńska & Moorkens, 2010).

V. geyeri is known from just three localities in Wales (Figure 1; Table 1). It was first reported here in 1985 with a find on Cors Erddreiniog NNR on Anglesey when the author of this report recorded a fossil shell of uncertain age in postglacial (possibly recent) tufa, whilst live specimens were found there in 1988 (Boyce *et al.*, 1992; Holmes *et al.*, 1995). *V. geyeri* was later found on a second Anglesey site, Waun Eurad SSSI, by Adrian Fowles in 1996 (record from NRW Welsh Invertebrate Database). A third Welsh population was found on Cors Geirch SSSI (part of Corsydd Llŷn/Lleyn Fens SAC) by Adrian Fowles in 1996 "from tussocks in wet valley fen with *Schoenus* but no tufa" (Adrian Fowles, pers. comm.). *V. geyeri* is a Qualifying feature of Cors Erddreiniog SSSI, Cors Geirch SSSI and Waun Eurad SSSI, and a feature of Corsydd Môn/Anglesey Fens SAC and Corsydd Eifionydd/Eifionydd Fens SAC. In 2019, it was concluded that *V. geyeri* had become extinct on Cors Erddreiniog and Cors Geirch (Willing, 2020).

The current surveys, undertaken in 2025, were commissioned by Natur am Byth! to:

- (1) determine the presence and approximate distribution of the snail at Waun Eurad;
- (2) to re-survey the Nant Isaf area of Cors Erddreiniog to confirm the loss of *V. geyeri* there;
- (3) to undertake a limited survey of Cors Bodeilio NNR. As the latter site has actively depositing calcareous springs it is a potentially suitable *V. geyeri* location but one not previously surveyed for the snail.

The data obtained from Waun Eurad was required to assess whether *V. geyeri* is present in sufficient numbers to allow the translocation of 'excess stock' to restored habitat on Nant Isaf.

Concise summaries of all previous *V. geyeri* work undertaken on Waun Eurad and Cors Erddreiniog are given in Appendices 3a and 3b.

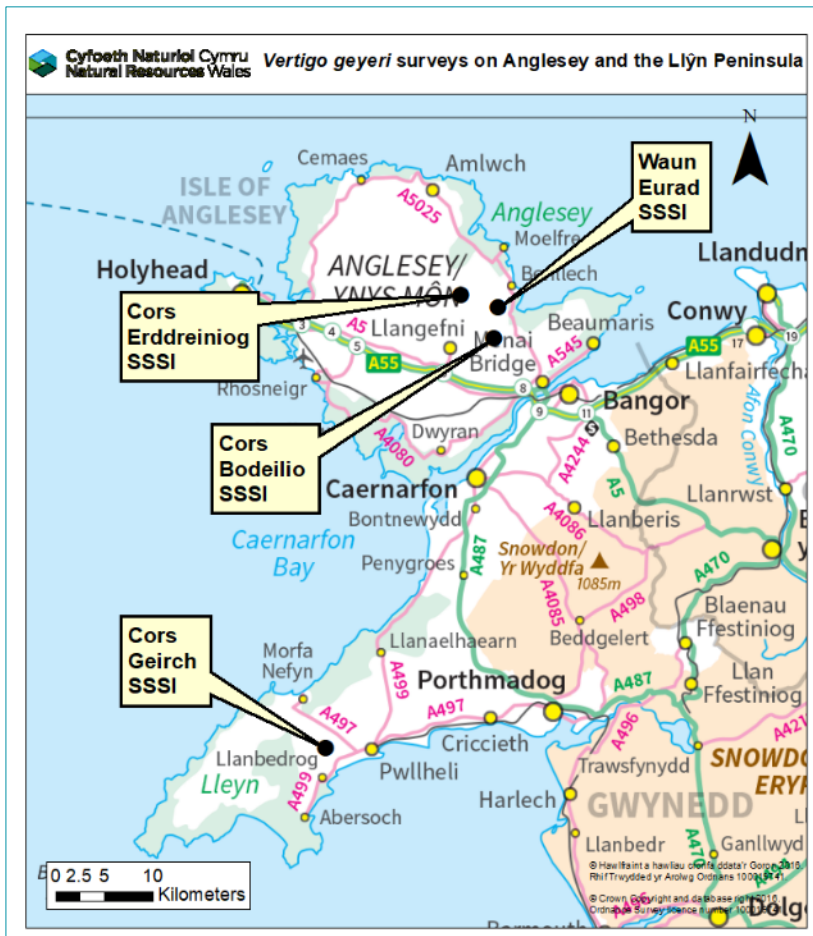


Figure 1. Welsh sites where *Vertigo geyeri* has been recorded and the location of Cors Bodeilio, an additional site surveyed for the snail in 2025.

Table 1. Welsh records of *Vertigo geyeri*.

Site	Grid Reference	Date	Abundance (live specimens)
Cors Erddreiniog	SH475815	July 1985	1
Cors Erddreiniog	SH476818	02/07/1994	1
Cors Erddreiniog	SH47158325	December 1997	-
Cors Erddreiniog	SH471832	15/12/1997	1
Cors Erddreiniog	SH4714383298	23/09/2007	175
Cors Erddreiniog, Cors Nant Isaf	SH4782	29/09/1997	1
Cors Erddreiniog, Cors Nant Isaf	SH47458310	December 1997	-
Cors Erddreiniog, Cors Nant Isaf	SH4740082691	Autumn 2003	1
Cors Erddreiniog, Cors Nant Isaf	SH4742182839	Autumn 2003	1
Cors Erddreiniog, Cors Nant Isaf	SH4742782559	Autumn 2003	1
Cors Erddreiniog, Cors Nant Isaf	SH4745382896	Autumn 2003	1

Site	Grid Reference	Date	Abundance (live specimens)
Cors Erddreiniog, Cors Nant Isaf	SH47478325	Autumn 2003	1
Cors Erddreiniog, Cors Nant Isaf	SH474830	20 - 22/10/2007	6
Cors Erddreiniog, Cors Nant Isaf	SH4757083173	20 - 22/10/2007	1
Cors Erddreiniog, Nant Isaf	SH479823	06/10/1988	1
Cors Erddreiniog, Nant Isaf	SH477823	24/06/1994	11
Cors Erddreiniog, Nant Isaf	SH477823	02/07/1994	3
Cors Erddreiniog, Nant Isaf	SH478823	02/07/1994	1
Cors Erddreiniog, Nant Isaf	SH478823	27/06/1996	2
Cors Erddreiniog, Nant Isaf	SH477823	13 - 14/08/1997	-
Cors Erddreiniog, Nant Isaf	SH478824	Autumn 2003	1
Cors Erddreiniog, Nant Isaf	SH4778982302	20/10/2007	3
Cors Geirch	SH3235	20/09/1996	2
Cors Geirch	SH328353	16/09/1998	3
Cors Geirch	SH329351	16/09/1998	1
Cors Geirch	SH32753518	26/07/2005	2
Cors Geirch	SH3275935181	26/07/2005	-
Cors Geirch	SH33083507	18/09/2008	4
Waun Eurad	SH506804	27/08/1996	32
Waun Eurad	SH506805	27/08/1996	25
Waun Eurad	SH506805	27/08/1996	10
Waun Eurad	SH506804	09/09/1996	several
Waun Eurad	SH506804	23/11/1996	6
Waun Eurad	SH506805	24/04/1997	-
Waun Eurad	SH506805	29/09/1997	3
Waun Eurad	SH506805	07/04/1998 – 11/10/1999	c180 on 02/09/1999
Waun Eurad	SH506805	07/08/1998	1
Waun Eurad	SH506805	Autumn 2003	92
Waun Eurad	SH5061880465	22 - 23/09/2007	12
Waun Eurad	SH506805	09/09/2014	8
Waun Eurad	SH506805	08-09/11/2021	66 @ 8 of 17 sites
Waun Eurad	SH506805	08/09/2025	19 @ 9 of 29 sites

2. Methods

Surveys for *V. geyeri* were undertaken on Waun Eurad on 8th September 2025 and Nant Isaf (Cors Erddreiniog SSSI) and Cors Bodeilio SSSI on the morning and afternoon of 10th September 2025 respectively. Work took place on Waun Eurad and Nant Isaf in mostly dry conditions with occasional light showers whilst that at Cors Bodeilio was accompanied by heavy rain showers. Due to the saturated ground conditions, it was not possible to undertake field searches for this tiny snail by direct observation of ground vegetation or by shaking plucked vegetation over a tray. Survey sampling therefore relied upon two methods: (1) the well-established technique of selecting potentially suitable habitat and then removing sample material for later laboratory processing and (2) the use of an electric vacuum sampler.

At Waun Eurad, a wide selection of sample points was selected to approximately cover areas previously sampled during previous surveys between 2003 and 2021 (Killeen & Moorkens, 2004, 2008; Lloyd, 2014; Willing, 2025). To try to ensure an approximately even and systematic site coverage, sample points were located along a series of transect lines laid out in an approximately north-east > south-west direction and originating along the eastern margins where the edge of the flush seepages abut upon drier habitat unsuitable for *V. geyeri*. The six sample transect lines (TL) were laid out thus:

- TL1: S1 > S4
- TL2: S5 . S8;
- TL3: S9 > S13;
- TL4: S14 > S19;
- TL5: S20 > S24;
- TL6: S25 > S28;
- S29 in isolation (insufficient sub-optimal habitat either side for transect line).

All survey points were positioned in habitat associated with the nearby presence of *S. nigricans* and broadly conforming to habitat definitions of '**Optimal**' and '**Sub-optimal**' habitat as defined by Killeen & Moorkens (2004, 2008; descriptions given in Appendix 3b).

At each survey point both (1) bulk and (2) vacuum samples were taken.

(1) Bulk sampling: To make the surveillance results directly comparable with those earlier surveys, techniques involved the refinement of those methods used previously (e.g. Willing, 2017, 2018, 2020, 2025) and described by Killeen & Moorkens (2004, 2008).

At each sampling point:

1. Vegetation (e.g. mosses, sedges and bryophytes and surface vegetation litter) was cut down to about 10cm (if initially higher) and then cut just below ground level over a series of small areas (approx. 15cm x 15cm max) using a serrated kitchen knife. Collected material was then amalgamated into one bag (typically resulting in about 2 - 3 litres of sample material). To avoid significant damage at any one point and to sample from several points at a sample point, material was collected from a total area measuring 0.5m x 0.5m (0.25m²) and combined from a series of points over about a 2m x 2m;
2. The collected material was retained in polythene bags until returned to the laboratory where samples were placed in fine muslin bags and then air-dried to constant mass. Dried material was then shaken through series of sieves with 5mm, 2mm and 0.5mm meshes (with most *Vertigo* spp. accumulating in the 0.5mm fraction);
3. Counts of adult and juvenile *Vertigo* spp. were made using a x7 to x50 binocular microscope;
4. Other molluscan species were recorded;
5. The following information was also gathered -

- a. The GPS location (at 10 figure level)
- b. A simple site description in terms of major vegetational type
- c. Digital photographs were taken to display key site features.

(2) Vacuum sampling: Additionally at each survey point samples were collected using a Stihl SHA56 leaf blower powered by an AK20 battery. Samples were collected by placing the suction nozzle at a series of points over an approximate radius of 2m around each bulk sample collection point. Unlike the bulk samples, which were dried and processed off-site, the vacuum sampled material was examined immediately after collection on a white lipped tray and examined with hand-held magnifiers. All *Vertigo* spp were recorded and the specimens then retained (in ethanol) for later microscopic verification.



Figure 2. Vacuum sampling in progress on Cors Bodeilio.

Surveys at Cors Bodeilio and Nant Isaf (Cors Erddriniog) were undertaken together with the NRW Invertebrate Ecologist Dr. Mike Howe and David Barwani-Rai (RSPB) who both, together with Dr. Clare Sampson, were also present at Waun Eurad.

3. Results

3.1 Waun Eurad

The presence of *V. geyeri* was reconfirmed at Waun Eurad with bulk sampling producing 19 specimens from nine (out of 29) sites, a 31% presence. By contrast the vacuum sampling resulted in only three live specimens from three sites also recorded at these sites in the bulk samples. Results are provided in Table 2 and Appendix 1a and site locations in Figure 3 and Appendix 4.1. A comparison of bulk and vacuum sampling results for the three *Vertigo* species is given in Appendix 2.

V. geyeri distribution (Figure 3) is broadly similar to that seen in 2021 (Willing, 2025) and previous surveys in 1989 (Sharland, 2000), 2003 and 2007 (Killleen & Moorkens, 2004, 2008) finding most sites present at the north-eastern sector of the site corresponding to an area of calcareous flushes. The single record situated to the southwest of the site is also close to where the snail was recorded in 2021 although not in an obvious area of calcareous flushes at this point.

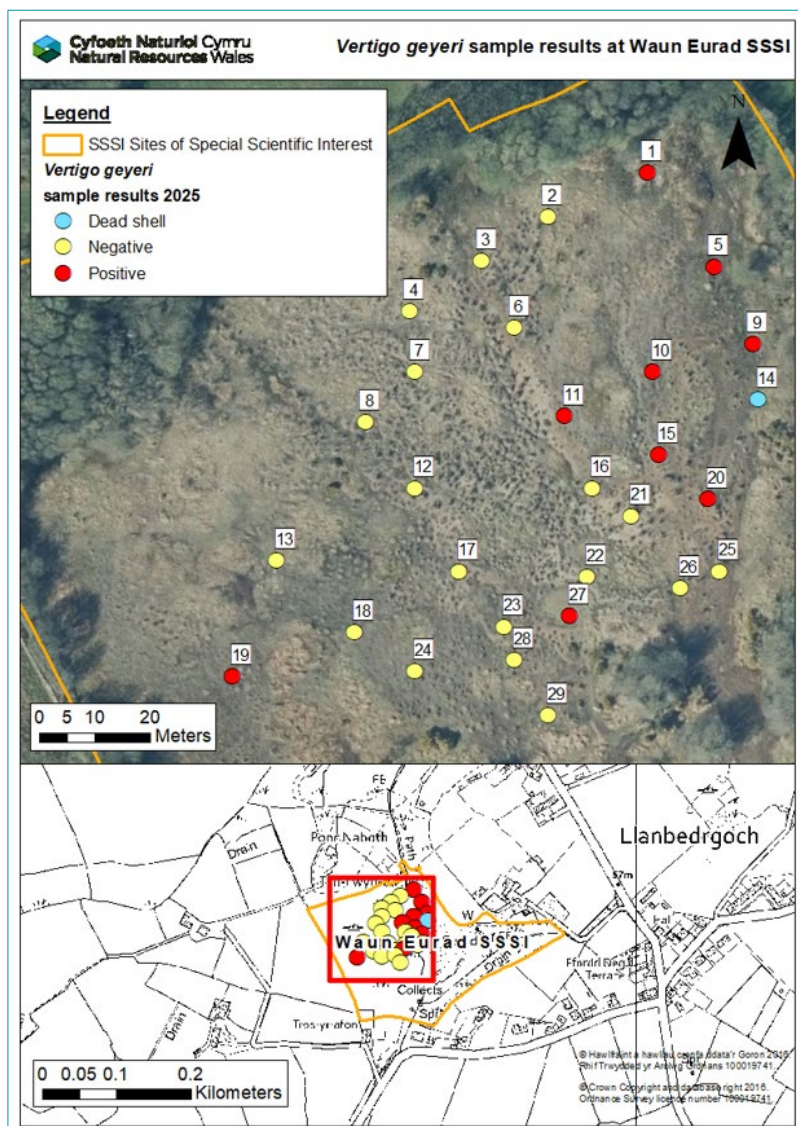


Figure 3. *Vertigo geyeri* survey locations and results on Waun Eurad in September 2025. Locations are numbered 1 to 29. Red points = live presence; Blue points = dead presence; Yellow points = negative.

A total of 19 other mollusc species were recorded, 14 terrestrial and five freshwater in Appendix 1a. These included two terrestrial species, *Aegopinella nitidula* and *Columella aspera*, and three freshwater species, *Potamopyrgus antipodarum*, *Radix balthica* and *Euglesa casertana*, not recorded in 2021 (although *C. aspera* was recorded in 2003 and 2007). The apparent disappearance in 2021 and 2025 of a group of species recorded at Waun Eurad between 2003 and 2007 is discussed in Section 4.1.

Table 2. Number of *Vertigo geyeri* recorded on Waun Eurad in September 2025.

Location no.	Grid Reference	No. live snails
1	SH 50698 80578	1
2	SH 50680 80570	-
3	SH 50668 80562	-

Location no.	Grid Reference	No. live snails
4	SH 50655 80553	-
5	SH 50710 80561	1
6	SH 50674 80550	-
7	SH 50656 80542	-
8	SH 50647 80533	-
9	SH 50717 80547	1
10	SH 50699 80542	5
11	SH 50683 80534	1
12	SH 50656 80521	-
13	SH 50631 80508	-
14	SH 50718 80537	2 (dead)
15	SH 50700 80527	2
16	SH 50688 80521	-
17	SH 50664 80506	-
18	SH 50645 80495	-
19	SH 50623 80487	1
20	SH 50709 80519	3
21	SH 50695 80516	-
22	SH 50687 80505	-
23	SH 50672 80496	-
24	SH 50656 80488	-
25	SH 50711 80506	-
26	SH 50704 80503	-
27	SH 50684 80498	4
28	SH 50674 80490	-
29	SH 50680 80480	-
Total from all sites:	-	19

3.2 Nant Isaf (Cors Erddreiniog)

No *Vertigo geyeri* were recorded from the seven survey sites although ten live mollusc species (seven terrestrial and three freshwater) were, all species previously recorded at the Nant Isaf site on the most recent 2019 (Willing, 2020) and previous surveys. Results given in Appendix 1b and site locations are shown in Figure 4 and Appendix 4.2. A comparison of bulk and vacuum sampling results for the two *Vertigo* species is given in Appendix 2. Sites 1 – 6 were all located in the lower spring area of Nant Isaf where all previous surveys have been undertaken (e.g. Killeen & Moorkens 2004, 2008; Willing 2017, 2020). Site 7 is in an area located at the head of this sloping site in a small network of flushes widely separated well from the other sites at the top of the site and not believed to have been surveyed previously. A comparison of bulk and vacuum sampling results for the two *Vertigo* species is given in Appendix 2.

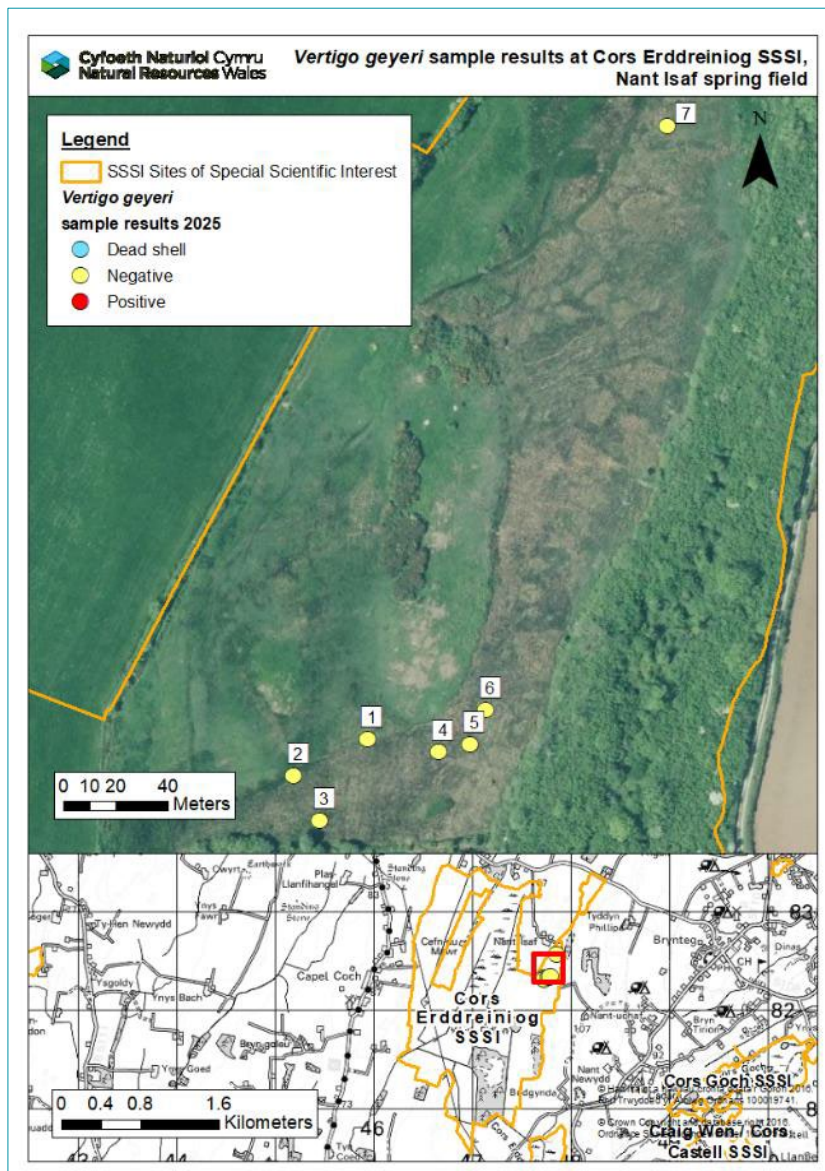


Figure 4. Survey locations on Nant Isaf (Cors Erddreiniog) in September 2025.

3.3 Cors Bodeilio

No previous molluscan surveys of Cors Bodeilio are known to have been undertaken, Results are provided in Appendix 1c and site locations in Figure 5 and Appendix 4.3. A comparison of bulk and vacuum sampling results for the two *Vertigo* species is given in Appendix 2. No *V. geyeri* were found, but a limited fauna of six terrestrial and three freshwater species were found, all common and widespread at other wetland sites on Anglesey (including study locations Waun Eurad and Cors Erddreiniog).

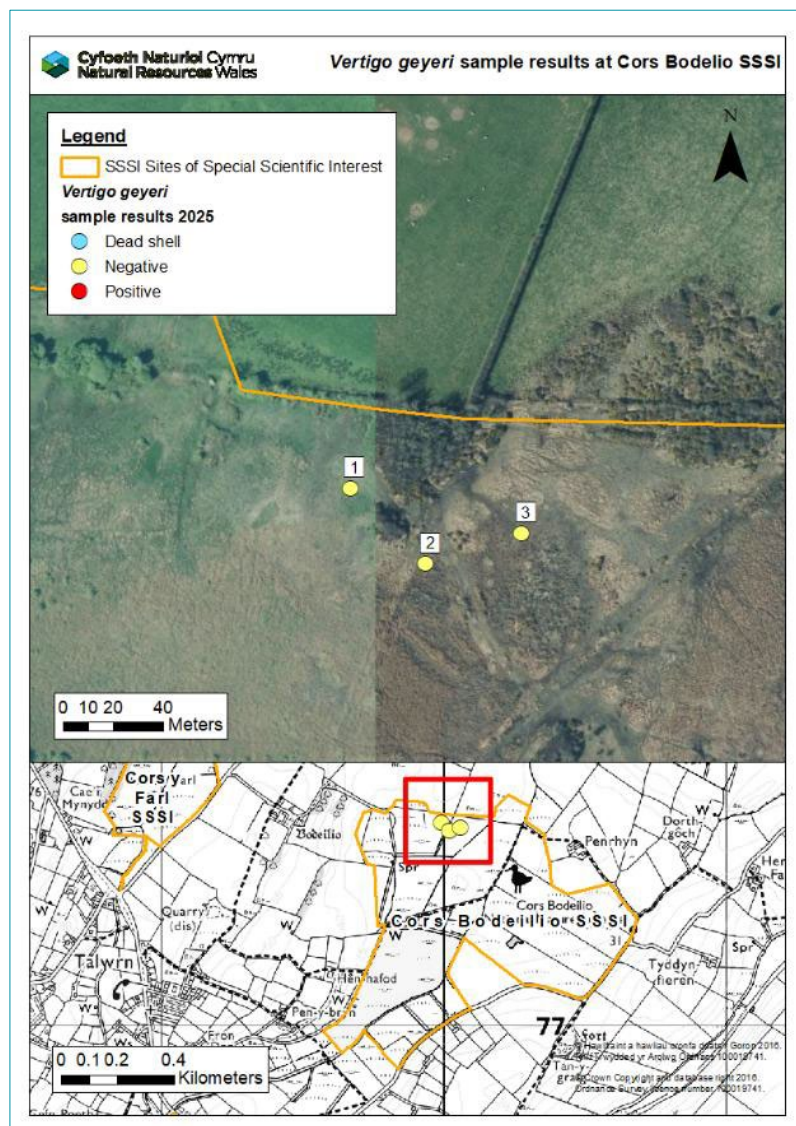


Figure 5. Survey locations on Cors Bodeilio in September 2025.

4. Discussion & recommendations

4.1 Waun Eurad

The survey of Waun Eurad in September 2025 demonstrates the continued presence of *V. geyeri* within the SSSI. The distribution confirms that the snail is present, albeit in low numbers, in the north-east sector of the site (Figure 3), a situation first shown in the 2003 survey and then again in 2007, 2014 and 2021 (Killeen & Moorkens, 2004, 2008; Lloyd, 2014; Willing, 2025). This area has the predominance of calcareous springs and flushes with short *Carex* spp. and moss-dominated lawns lying between a network of shallow

channels. Habitat in this area is mostly '**Optimal**' or '**Sub-optimal**' for *V. geyeri* (see Appendix 3a for an explanation of these habitat descriptors as described by Killeen & Moorkens [2004, 2008]). Also, as shown in previous surveys in 2007 and 2021 the south-west corner of the site is largely devoid of the snail although a small population was detected in 2025 at Site 19, close to where it was previously recorded in 2007 and 2021 (Killeen & Moorkens, 2008; Willing, 2025). This south-west area is generally drier and does not display the network of shallow drainage channels present in the north-east. Although all the survey locations* in this area support *S. nigricans* and can be judged at least **Sub-optimal** for *V. geyeri*, the snail has been largely unrecorded here since at least 2007.

The 2025 work was undertaken in September, a time recommended as optimal for *V. geyeri* survey by Eva Sharland (2000) who demonstrated that (during her two-year survey period) numbers of the snail were then at their highest. The 2025 survey however recorded relatively low numbers of the snail with only 19 specimens from 9 (out of 29) sites, a 31% presence. This is a marked decrease from the last survey undertaken at a theoretically less suitable time in November 2021 (when 66 specimens were recovered from 8 out of 17 survey locations - a 47% presence). There were fears, following the long period of dry weather and record high summer temperatures experienced earlier in 2025 and dry summers in 2022 and 2023, that *V. geyeri* may have been lost from the site. At the end of these long hot spells, the former Waun Eurad wet flushes were reported to have totally dried (M. Howe, pers. comm.) suggesting that the water table was well below ground level. It is therefore reassuring that *V. geyeri* remains at the site still occupying much of the eastern margins flushed area although in low numbers.

Each of the survey sites was sampled by both bulk and vacuum sampling. In a previous study where both techniques were used simultaneously during surveys for Narrow-mouthed Whorl Snail *Vertigo angustior* on the Gower Peninsula in 2023 (Willing, 2024), bulk methods proved very much more effective than vacuum sampling in recovering the snail at more sites and in higher numbers. A similar disparity was recorded during these surveys, with the bulk sampling recovering 19 live *V. geyeri* from 11 sites and the vacuum method collecting 3 snails from just 3 sites (Appendix 2). The bulk sampling was also better in removing more *V. antivertigo* and *Vertigo pygmaea* and from a greater number of sites than obtained by suction. The lesser success of the vacuum sampling in collecting all three *Vertigo* species may be due to their being located close to, or at ground level. In contrast to the other two *Vertigo* species, *V. pygmaea* does climb vegetation and so is often, unlike the other two, collected in tray beat samples and so one might have expected this species to be better represented in the vacuum cohort.

One of the key aims of the 2025 survey was to assess whether the Waun Eurad *V. geyeri* population was sufficiently large to allow the translocation of 'excess stock' to restored habitat on Nant Isaf. It was also hoped that the vacuum sampling technique might allow for the immediate identification and collection of *V. geyeri*, something not possible using the bulk sample technique (where extraction of the snails follows many weeks after collection). Disappointingly, as discussed above, the vacuum sampling produced only a few specimens from just three sites. It is therefore concluded that in 2025 there were insufficient numbers of *V. geyeri* living at Waun Eurad that could be easily collected by suction techniques for any translocation programme to Nant Isaf to be considered.

Although, despite the drought and high temperatures experienced in 2025 *V. geyeri* has survived at Waun Eurad, surveys undertaken between 2003 and 2025 suggest that several other molluscs including *Vertigo substriata*, *Leiostryla anglica* and *Ashfordia granulata* have been lost from the site. Thus *V. substriata* was present in 59% of the sites surveyed in 2003, but absent from samples collected in 2007, 2021 and in 2025. (Killeen & Moorkens, 2004, 2008; Willing, 2025); *L. anglica* was present in 55% of 2003 samples falling to 30% in 2007 and with no records in 2021 and 2025; *A. granulata* was present in 9% and 8% of sites in 2003 and 2007 but absent from the numerous samples collected in 2021 and 2025. The reason/s for the loss of these species is/are unknown.

4.2 Nant Isaf (Cors Erddreiniog)

As in 2019, no *V. geyeri* were located from samples taken from the restored habitat where the snail had previously been living, the last confirmed record there being in 2007 (Killeen & Moorkens, 2008). These results appear to confirm the conclusion, based on the 2019 surveys (Willing, 2020) that *V. geyeri* has been lost from at least this area of Nant Isaf. The 2025 surveys included an area at the extreme northern end of the site (Site 7 close to the upper entrance gate; Figure 4) which may not have been surveyed previously. The presence there of both *V. antiveritigo* and *V. pygmaea* suggests a range of hydrological conditions that might include an 'intermediate' ground saturation suited to *V. geyeri*. A more extensive future sampling of this area is suggested.

4.3 Cors Bodeilio

All samples were all removed from areas of active tufa deposition, but there were few *Carex* lawn habitats favoured by *V. geyeri* compared to the extensive areas on Waun Eurad. So it was not surprising that *V. geyeri* was not found in either the bulk or vacuum samples. The predominance of *Vertigo antiveritigo* might suggest that the site is generally too wet to provide the optimal humid but not saturated *V. geyeri* habitat. The bulk sampling was again more successful at recovering *V. antiveritigo* but the vacuum sampling collected more *V. pygmaea* than found in the bulk samples, probably due to this species habit of climbing vegetation making it a frequent component of vegetation tray-beat samples.

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Appendix 1a. Molluscs recorded on Waun Eurad by location in September 2025

Species	1	2	3	4	5	6	7	8
Terrestrial	-	-	-	-	-	-	-	-
<i>Vertigo geyeri</i> (live / fresh dead)	1	-	-	-	1	-	-	-
<i>V. geyeri</i> (juvenile live)	-	-	-	-	-	-	-	-
<i>V. geyeri</i> (dead shell)	-	-	-	-	-	-	-	-
<i>V. geyeri</i>	1	-	-	-	-	-	-	-
Total: live / fresh dead								
<i>Aegopinella nitidula</i>	-	-	-	-	-	1	-	-
<i>Carychium minimum</i>	1	-	-	-	-	-	-	-
<i>Cepaea nemoralis</i>	2	-	-	-	-	1	1	-
<i>Cochlicopa lubrica</i>	2	-	1	-	5	-	-	-
<i>Columella aspera</i>	-	-	-	-	-	-	-	1
<i>Euconulus alderi</i>	3	-	1	2	-	1	-	3
<i>Nesovitrea hammonis</i>	-	1	1	-	-	-	1	-
<i>Oxyloma elegans</i> / Succinidae	20	6	8	2	15	11	4	10
<i>Punctum pygmaeum</i>	-	-	-	-	-	-	-	-
<i>Vallonia pulchella</i>	-	-	-	-	-	-	-	-
<i>Vertigo antivertigo</i>	8		1	-	4	2	-	-
<i>Vertigo pygmaea</i>	3	-	-	-	-	-	-	-
<i>Vitrea crystallina</i>	-	-	-	-	-	-	-	-
<i>Zonitoides nitidus</i>	-	-	-	-	1	-	-	-
Aquatic	-	-	-	-	-	-	-	-
<i>Galba truncatula</i>	14	2	-	2	15	2	1	9
<i>Potamopyrgus antipodarum</i>	-	-	-	-	6	-	-	-
<i>Radix balthica</i>	-	-	-	-	1	-	-	-
<i>Euglesa personata</i>	2 - 3	-	-	-	13	-	-	5
<i>Euglesa casertana</i>	4	-	3	-	11	-	-	1
<i>Euglesa</i> spp	2	-	-	1	10	-	-	-

Species	9	10	11	12	13	14	15	16
Terrestrial	-	-	-	-	-	-	-	-
<i>Vertigo geyeri</i> (live / fresh dead)	1	3	1	-	-	-	1	-
<i>V. geyeri</i> (juvenile live)	-	2	-	-	-	-	1	-
<i>V. geyeri</i> (dead shell)	1	1	-	-	-	2	-	-
<i>V. geyeri</i>	1	5	1	-	-	-	2	-
Total: live / fresh dead								
<i>Aegopinella nitidula</i>	-	-	-	1	-	-	-	-
<i>Carychium minimum</i>	-	-	-	2	-	11	-	-

Species	9	10	11	12	13	14	15	16
<i>Cepaea nemoralis</i>	-	1	-	2	-	-	-	-
<i>Cochlicopa lubrica</i>	13	-	5	4	-	25	2	-
<i>Columella aspera</i>	-	-	-	-	-	-	1	-
<i>Euconulus alderi</i>	-	-	-	-	5	-	3	-
<i>Nesovitrea hammonis</i>	-	-	4	9		1	1	4
<i>Oxyloma elegans</i> / Succinidae	17	27	21	16	10	23	6	4
<i>Punctum pygmaeum</i>	-	-	-	-	-	-	-	-
<i>Vallonia pulchella</i>	-	11	10	1	-	2	-	-
<i>Vertigo antivertigo</i>	7	6	1	-	-	23	2	-
<i>Vertigo pygmaea</i>	-	-	11	4	7	2	3	2
<i>Vitrea crystallina</i>	-	-	-	-	-	-	-	-
<i>Zonitoides nitidus</i>	4	3	-	-	-	5	1	-
Aquatic	-	-	-	-	-	-	-	-
<i>Galba truncatula</i>	24	6	9	4	2	22	7	6
<i>Potamopyrgus antipodarum</i>	6	1	-	-	-	-	-	-
<i>Radix balthica</i>	-	-	-	-	-	-	-	-
<i>Euglesa personata</i>	12	1	5	1	6	10	-	1
<i>Euglesa casertana</i>	3	4	5	-	-	9	6	-
<i>Euglesa</i> spp	9	1	9	-	1	5	3	-

Species	17	18	19	20	21	22	23	24
Terrestrial	-	-	-	-	-	-	-	-
<i>Vertigo geyeri</i> (live / fresh dead)	1?	-	1	1	-	-	-	-
<i>V. geyeri</i> (juvenile live)	-	-	-	2	-	-	-	-
<i>V. geyeri</i> (dead shell)	-	-	3	-	-	-	-	-
<i>V. geyeri</i>	1?	-	1	3	-	-	-	-
Total: live / fresh dead								
<i>Aegopinella nitidula</i>	-	-	-	-	-	-	-	-
<i>Carychium minimum</i>	-	-	-	-	3	-	2	-
<i>Cepaea nemoralis</i>	-	-	-	-	1	-	-	-
<i>Cochlicopa lubrica</i>	16	-	-	36	4	-	-	-
<i>Columella aspera</i>	-	-	-	-	1	-	-	-
<i>Euconulus alderi</i>	3	-	-	5	5	-	-	-
<i>Nesovitrea hammonis</i>	5	1	1	4	5	1	1	-
<i>Oxyloma elegans</i> / Succinidae	8	1	4	9	6	4	7	3
<i>Punctum pygmaeum</i>	-	-	-	-	1	-	-	-
<i>Vallonia pulchella</i>	-	-	-	-	-	-	-	-
<i>Vertigo antivertigo</i>	-	-	-	9	16	-	-	-
<i>Vertigo pygmaea</i>	2	2	2	1	8	12	-	6
<i>Vitrea crystallina</i>	-	-	-	-	1	-	-	-
<i>Zonitoides nitidus</i>	-	-	-	2	1	-	-	-
Aquatic	-	-	-	-	-	-	-	-

Species	17	18	19	20	21	22	23	24
<i>Galba truncatula</i>	1	1	2	3	11	5	3	-
<i>Potamopyrgus antipodarum</i>	-	-	-	-	-	-	-	-
<i>Radix balthica</i>	-	-	-	-	-	-	-	-
<i>Euglesa personata</i>	-	1	1	2?	2	7	5	-
<i>Euglesa casertana</i>	-	-	-	8	-	-	-	-
<i>Euglesa</i> spp	-	-	-	-	-	-	-	-

Species	25	26	27	28	29
Terrestrial	-	-	-	-	-
<i>Vertigo geyeri</i> (live / fresh dead)	-	-	2	-	-
<i>V. geyeri</i> (juvenile live)	-	-	2	1?	-
<i>V. geyeri</i> (dead shell)	-	-	1	-	-
<i>V. geyeri</i>	-	-	4	1?	-
Total: live / fresh dead					
<i>Aegopinella nitidula</i>	-	-	-	-	-
<i>Carychium minimum</i>	41	5	-	-	-
<i>Cepaea nemoralis</i>	-	-	-	-	-
<i>Cochlicopa lubrica</i>	22	10	-	-	1
<i>Columella aspera</i>	-	-	-	-	-
<i>Euconulus alderi</i>	8	2	2	3	2
<i>Nesovitrea hammonis</i>	3	1	-	1	-
<i>Oxyloma elegans</i> / Succinidae	6	8	10	2	5
<i>Punctum pygmaeum</i>	-	-	-	-	-
<i>Vallonia pulchella</i>	-	11	2	-	-
<i>Vertigo antivertigo</i>	13	19	14	-	5
<i>Vertigo pygmaea</i>	3	7	11	6	1
<i>Vertigo</i> spp	8	-	-	-	-
<i>Vitrea crystallina</i>	-	-	-	-	-
<i>Zonitoides nitidus</i>	-	-	-	-	-
Aquatic	-	-	-	-	-
<i>Galba truncatula</i>	6	21	11	4	3
<i>Potamopyrgus antipodarum</i>	-	1	-	-	-
<i>Radix balthica</i>	-	-	-	-	-
<i>Euglesa personata</i>	1 - 2	-	1 - 2	-	1
<i>Euglesa casertana</i>	12	1	6	-	-
<i>Euglesa</i> spp	3	-	8	-	-

Appendix 1b. Molluscs recorded on Nant Isaf (Cors Erddreiniog) by location in September 2025

Species	1	2	3	4	5	6	7
Terrestrial (*dead shell)	-	-	-	-	-	-	-
<i>Carychium minimum</i>	-	2	-	-	-	-	13
<i>Cepaea</i> sp.	-	1*	-	-	-	-	-
<i>Cochlicopa lubrica</i>	1*	-	1*	-	-	-	-
<i>Euconulus alderi</i>	2	3	4	-	1	-	4
<i>Nesovitrea hammonis</i>	4	1	4	-	-	-	3
<i>Oxyloma elegans</i> / Succinidae	5	2	7	7	3	1	3
<i>Trochulus hispidus</i>	1*	-	-	-	-	-	-
<i>Vertigo antivertigo</i>	4	-	3	3	-	-	2
<i>Vertigo pygmaea</i>	2	-	-	-	-	-	6
<i>Zonitoides nitidus</i>	-	2	2	-	-	-	-
Aquatic	-	-	-	-	-	-	-
<i>Galba truncatula</i>	1	3	-	1	1	-	2
<i>Euglesa personata</i>	-	-	-	-	-	-	1
<i>Euglesa casertana</i>	8	-	1*	-	-	-	-

Appendix 1c. Molluscs Recorded on Cors Bodeilio by Location in September 2025.

Species	1	2	3	4	5
Terrestrial	-	-	-	-	-
<i>Carychium minimum</i>	-	-	1	-	1
<i>Cochlicopa lubrica</i>	2	-	-	2	-
<i>Nesovitrea hammonis</i>	-	-	1	2	1
<i>Oxyloma elegans</i> / Succinidae	20	10	7	3	5
<i>Vertigo antivertigo</i>	9	1	3	2	12
<i>Vertigo pygmaea</i>	-	-	-	-	1
Aquatic	-	-	-	-	-
<i>Galba truncatula</i>	2	2	-	12	11
<i>Euglesa personata</i>	-	-	-	1	-
<i>Stagnicola</i> sp	2	-	2	1	-

Appendix 2. A comparison of bulk and vacuum sample results for *Vertigo* spp found in samples from Waun Eurad, Nant Isaf (Cors Erddreiniog) and Cors Bodeilio

Waun Eurad

Sample Sample no.	Transect Transect	<i>Vertigo geyeri</i> Bulk sample (* = dead)	<i>Vertigo geyeri</i> Vacuum sample	<i>Vertigo antivertigo</i> Bulk sample	<i>Vertigo antivertigo</i> Vacuum sample	<i>Vertigo pygmaea</i> Bulk sample	<i>Vertigo pygmaea</i> Vacuum sample
1	1	1	-	8	-	3	-
2	1	-	-	-	-	-	-
3	1	-	-	-	-	-	2
4	1	-	-	-	-	-	1
5	2	1	-	4	1	-	-
6	2	-	-	2	-	-	-
7	2	-	-	-	-	-	-
8	2	-	-	-	-	-	-
9	3	1 (+1*)	-	7	-	-	-
10	3	5 (+1*)	-	6	2	-	2
11	3	1	-	1	-	11	-
12	3	-	-	-	-	14	1
13	3	-	-	-	9	7	-
14	4	(+2*)	-	23	10	2	2
15	4	2	1	2	-	3	-
16	4	-	-	-	-	2	-
17	4	1?	-	-	-	2	-

Sample	Transect	<i>Vertigo geyeri</i>	<i>Vertigo geyeri</i>	<i>Vertigo antivertigo</i>	<i>Vertigo antivertigo</i>	<i>Vertigo pygmaea</i>	<i>Vertigo pygmaea</i>
18	4	-	-	-	-	2	-
19	4	1 (+3*)	1	-	-	2	2
20	5	3	1	9	3	1	-
21	5	-	-	16	5	8	-
22	5	-	-	-	-	12	-
23	5	-	-	-	-	-	-
24	5	-	-	-	-	6	-
25	6	-	-	13	20	3	9
26	6	-	-	19	3	7	3
27	6	4 (+1*)	-	14	8	11	1
28	6	1? (juv)	-	-	1	6	-
29	7	-	-	5	-	1	-
TOTAL		19 (live confirmed)	3	129	62	103	23

Nant Isaf (Cors Erddreiniog)

Sample	<i>Vertigo antivertigo</i>	<i>Vertigo antivertigo</i>	<i>Vertigo pygmaea</i>	<i>Vertigo pygmaea</i>
Sample no.	Bulk sample	Vacuum sample	Bulk sample	Vacuum sample
1	4	-	2	-
2	-	-	-	-
3	3	-	-	-
4	3	-	-	-
5	-	-	-	-
6	-	-	-	-
7	2	1	6	-
TOTAL	12	1	8	0

Cors Bodeilio

Sample	<i>Vertigo antivertigo</i>	<i>Vertigo antivertigo</i>	<i>Vertigo pygmaea</i>	<i>Vertigo pygmaea</i>
Sample no.	Bulk sample	Vacuum sample	Bulk sample	Vacuum sample
1 (Site1)	9	From sites 1 or 2	-	From sites 1 + 2
2 (Site 1)	1	From sites 1 or 2	-	From sites 1 + 2
3 (Site 2)	3	From sites 1 or 2	-	From sites 1 + 2
4 (Site 3)	2	From sites 1 or 2	-	From sites 1 + 2
5 (Site 3)	12	From sites 1 or 2	1	From sites 1 + 2
TOTAL	27	1	1	6

Appendix 3a. Previous surveys of *Vertigo geyeri* on Waun Eurad

This is a brief chronology of the main *Vertigo geyeri* survey events that have taken place on Waun Eurad between 1996 > 2021. A further detailed account and associated discussion of these events is provided in Appendix 2 in Willing 2025.

1996: *Vertigo geyeri* was discovered at Waun Eurad by Adrian Fowles (Countryside Council for Wales) in calcareous flush areas associated with Black Bog Rush *Schoenus nigricans*.

1998-1999: The first detailed *V. geyeri* studies on Waun Eurad were undertaken by Eva Sharland between April 1998 and October 1999 as part of PhD studies at Sheffield University (Sharland, 2000). Her work formed the foundations for all subsequent studies by establishing a baseline of *V. geyeri* distribution, habitat preferences and lifecycle details.

2003: I. Killeen and E. Moorkens undertook a resurvey of the 1998 / 1999 Sharland 'monitoring plot, a general *V. geyeri* site survey and established two monitoring transects (Killeen & Moorkens, 2004). To easily describe *V. geyeri* habitat suitability they devised three broad vegetation / habitat 'classes' to assist with site survey and monitoring. These three 'classes' were described thus:

- **Optimal Habitat:** Flushed fen grassland with sedge/moss lawns 5-15cm tall, containing species such as *Carex viridula* subsp. *brachyrrhyncha*, *Pinguicula vulgaris*, *Briza media*, *Equisetum palustre*, *Juncus articulatus* and the mosses *Drepanocladus revolvens* and *Campyllum stellatum*, with scattered tussocks of *Schoenus nigricans* no greater than 80cm tall. Water table between 0- 5cm of the soil surface, but not above ground level.
- **Sub-optimal Habitat:** Vegetation composition as above but either vegetation height is less than 5cm or greater than 15cm, or the water table is below 5cm or ground is flooded at the time of sampling.
- **Unsuitable Habitat:** Any other habitat.

Using the two transects they recorded a total of 92 *V. geyeri* from 30 transect survey locations.

2007: Killeen and Moorkens resurveyed the two 2003 monitoring transects (Killeen & Moorkens, 2008). They discovered a reduction in *V. geyeri* numbers recording 9 *V. geyeri* from 13 of the transect plots.

2014: Dylan Lloyd resurveyed the two 2003 monitoring transects (Lloyd, 2014). A further *V. geyeri* decline was logged with only 7 live snails recorded from 12 transect survey plots.

2021: A wide-ranging survey with essentially randomly placed survey plots although all placed in habitat assessed as either Optimal or Sub-optimal for the snail (Willing 2025). *V. geyeri* was located at 8 of the 17 survey locations with a total of 66 snails recorded. The site was assessed as in favourable condition for the snail.

Appendix 3b. Previous surveys of *Vertigo geyeri* on Cors Erddreiniog.

1. **1985:** *V. geyeri* found as a dead shell of uncertain age (Willing, unpublished).
2. **1988:** The first live specimen found in pitfall trap but initially incorrectly identified as *Vertigo lilljeborgi* ((Boyce *et al.*, 1992; Holmes *et al.*, 1995).
3. **1994:** Barry Colville (Colville, 1994) is first to identify *V. geyeri* on Cors Erddreiniog at a site on the eastern side of the reserve; sloping ground with calcareous springs known as Nant Isaf.
4. **1994 – 1997:** Further finds of the snail by R. Marriott, A.P. Fowles, E.A. Howe and M. Sutton.
5. **2003:** The first detailed survey of the site was undertaken in summer 2003 (Killeen & Moorkens, 2004) when 9 reserve compartments situated on the northern and eastern margins of the site were surveyed and *V. geyeri* was confirmed in 4 of these. The key 'hotspot site was Nant Isaf, a series of spring-fed calcareous flushes on the centre-east of the site. The project formulated a 'Conservation Objective' for future monitoring of the site for assessment of the snail; this proposed prescribed levels of snail presence together with certain habitat attributed including vegetation type and water table levels.
6. **2007:** Following a 4-year hiatus, the area was resurveyed in September 2007 (Killeen & Moorkens, 2008). At the key Nant Isaf site only three *V. geyeri* were located at just one sample point marking a huge decline in presence of the snail there this being attributed to a lack of grazing causing the growth of rank shading vegetation first noted in 2003. Elsewhere, *V. geyeri* was detected at a few locations although at one location in the extreme north-west corner of the site the snail was found in large numbers (175) in a small area of a survey compartment where the snail was not detected in 2003 (or later surveys in 2019).
7. **2016:** Following a 9-year survey hiatus, most sites previously supporting the snail were resurveyed in 2016 (Willing, 2017) but *V. geyeri* was not located from any samples. The former key Nant Isaf site was found to be very heavily overgrown by rank, shading *Schoenus nigricans* tussocks following a lack of grazing over many years possibly also a reason for the snail's absence at other locations.
8. **2019:** After a further three-year break, selected sites were resurveyed (Willing, 2020). The Nant Isaf spring field site had been grazed in the period since the previous 2016 survey removing much of the rank shading tussock growth and there were early signs

of a restoration of short 'Carex-lawn' habitat favoured by *V. geyeri*. As the snail was not detected in any of the samples taken, it was concluded that the years of shading growth had probably eliminated any remaining *V. geyeri* population pockets. The snail was also not recovered elsewhere on Cors Erddrieniog.

Appendix 4

Appendix 4.1. Site locations and summary habitat descriptions on Waun Eurad in 2025

Note: All sites were selected to lie within or close to *Schoenus nigricans* and so were judged to be potentially '**Optimal**' or '**Sub-optimal**' for *Vertigo geyeri*.



Location WE1. SH 50698 80578. Short *Carex* lawn; *Schoenus* not close to site.
Vertigo geyeri present.



Location WE2. SH 50680 80570. Much as L1 but *Schoenus* tussocks close by, horse poached tufa on surface.



Location WE3. SH 50668 80562. Much as L2; site probably fully dries in summer.



Location WE4. SH 50655 80553. *Schoenus* tussocks close; surface dry but no tuffaceous crust evident.



Location WE5. SH 50710 80561. Damp calcareous flush; no *Schoenus* tussocks within 2m. *Vertigo geyeri* present.



Location WE6. SH 50674 80550. *Schoenus* tussocks; damp tufaceous patches.



Location WE7. SH 50656 80542. Tall *Schoenus* tussocks with tufaceous patches and short *Carex* lawn between.



Location WE8. SH 50647 80533. Much as L7. Ground surface dry.



Location WE9. SH 50717 80547. Wet flush with occasional *Mentha aquatica*, with *Schoenus* tussocks within 2 – 3m. *Vertigo geyeri* present.



Location WE10. SH 50699 80542. Short *Carex* lawn with tufaceous patches between, close-cropped *Schoenus* tussocks. *Vertigo geyeri* present.



Location WE11. SH 50683 80534. Short *Carex* lawn with tufaceous patches between, tall *Schoenus* tussocks. *Vertigo geyeri* present.



Location WE12. SH 50656 80521. Much as L11.



Location WE13. SH 50631 80508. Much as L12 but dry ground surface.



Location WE14. SH 50718 80537. *Schoenus* tussocks set in quite wet ground with occasional *Mentha aquatica* and patches of *Carex* lawn. *Dead Vertigo geyeri* shells present.



Location WE15. SH 50700 80527. *Schoenus* tussocks set between short-grazes *Carex* lawn and tufaceous channels. *Vertigo geyeri* present.



Location WE16. SH 50688 80521. 0.5m high *Schoenus* tussocks set between short-grazes *Carex* lawn and tufaceous channels.



Location WE17. SH 50664 80506. Much as L16.



Location WE18. SH 50645 80495. Rather dry *Carex* lawn set between rather acidic tussocks topped with occasional *Erica* sp.



Location WE19. SH 50623 80487. Occasional *Schoenus* tussocks, quite damp tufaceous patches. *Vertigo geyeri* present.



Location WE20. SH 50709 80519. *Schoenus* tussocks set between short-grazed *Carex* lawn and very wet tufaceous channels. *Vertigo geyeri* present.



Location WE21. SH 50695 80516. Similar to L20 but drier.



Location WE22. SH 50687 80505. Similar to L21.



Location WE23. SH 50672 80496. Similar to L22 but slightly drier.



Location WE24. SH 50656 80488. Similar to L23 but rather less grazed and drier.



Location WE25. SH 50711 80506. Very wet flush with *Mentha aquatica*.



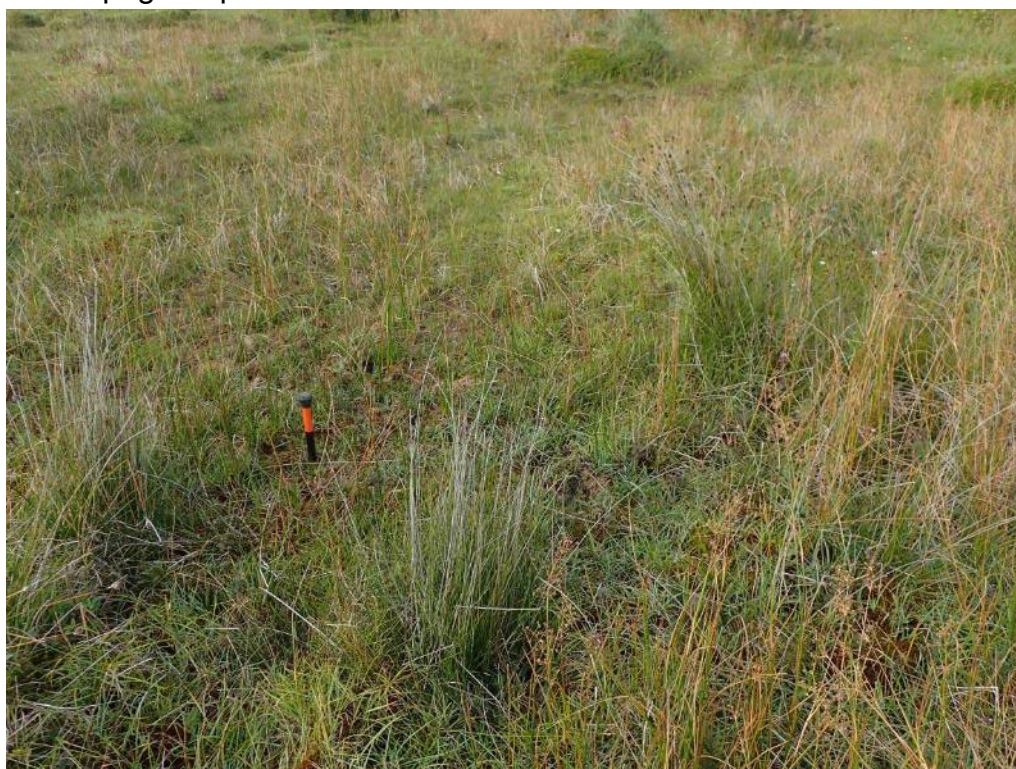
Location WE26. SH 50704 80503. Occasional *Schoenus* tussocks amongst dry tuffaceous ground.



Location WE27. SH 50684 80498. Slightly raised ground with *Carex* lawn and tuffaceous flushes. *Vertigo geyeri* present.



Location WE28. SH 50674 80490. Dry, occasional *Schoenus* tussocks, no tufa suggests no seepage or previous water flow over surface.



Location WE29. SH 50680 80480. Occasional *Schoenus* tussocks, quite damp tufaceous patches.

Appendix 4.2. Site locations and summary habitat descriptions on Nant Isaf (Cors Erddreiniog) in 2025



Location CE1. SH 47744 82334. Short grazed lightly horse-poached *Schoenus nigricans* tussocks and *Carex* sp. 'lawn' with some tufa deposition evident.



Location CE2. SH 47716 82320. Site like L1.



Location CE3. SH 47726 82303. Similar to L1 & L2 but much wetter with noticeable surface water flow.



Location CE4. SH 47771 82329. More heavily grazed than L1 – L3. *Carex* scarce, tufaceous deposits in pools between *Schoenus* tussocks.



Location CE5. SH 47783 82332. Very similar to L4.



Location CE6. SH 47789 82345. Very similar to L4 but more *Juncus* spp.



Location CE7. SH 47858 82567. Site situated at very top of spring field well removed from sites L1 > L6. Closely grazed and lightly poached series of flushes with *Schoenus* tussocks lying in well-structured *Carex* lawn and some signs of tufaceous deposits on surface.

Appendix 4.3. Site locations and summary habitat descriptions on Cors Bodeilio in 2025



Location CB1. SH 49990 77718. *Schoenus* tussocks with tufaceous mud between occasional *Carex*.



Location CB2. SH 50020 77688. Prominent *Schoenus* tussocks with tufaceous shallow muddy pools; *Carex* not evident.



Location CB3. SH 50058 77700. Much as L2.

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 are held in the 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. **NRW_DS161561**.

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