

Survey for Desmoulin's Whorl Snail *Vertigo moulinsiana* on the Afon Penrhos floodplain in 2025

Natur am Byth! Evidence Report No. 018

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Crynodeb gweithredol

Yn 2016, canfuwyd bod ardal o orlifdir gorllewin afon Penrhos yn cynnal poblogaethau mawr o *Vertigo moulinsiana*, ac ar 9 Medi 2025 ymwelodd Martin Willing, Mike Howe a Clare Sampson â'r ardal honno eto i gynnal arolwg arall o'r falwen. Daeth hyn ar ôl ymgais aflwyddiannus i gofnodi'r falwen yn ystod ymweliad gan y ddau arolygwr olaf ar 29 Gorffennaf. Roedd yr arolwg o'r falwen yn cwmpasu'n bennaf y dechneg a ddefnyddiwyd o'r blaen, sef hambyrddau curo, ond defnyddiwyd hefyd declynnau samplu drwy wactod (sugno). Ni chofnodwyd unrhyw *V. moulinsiana* byw o'r rhwydwaith o gaeau wedi'u torri'n fyr â pheiriant, na'r ffosydd rhyngddynt wedi'u llenwi â brwyn, ble cofnodwyd y falwen yn 2016.

Canfuwyd poblogaeth recriwtio fechan o'r falwen mewn bloc ynysig o ffen trwchus heb ei bori a oedd wedi'i leoli yng ngogledd-orllewin y safle (rhwng ffos ddraenio ddofn a'r A499) ac na ymwelwyd ag e yn 2016.

Yn y caeau a fu'n cynnal y falwen o'r blaen, roedd wyneb y ddaear yn sych, yn wahanol i'r sefyllfa yn 2016 pan roedd yn ddirlawn, sy'n awgrymu bod y lefel trwythiad bryd hynny'n agos at yr wyneb ac yn cynnal twf planhigion byr ond toreithiog (na welwyd yn 2025). Gwelwyd bod sawl ffos wedi'u clirio'n fecanyddol yn ddiweddar a'u dyfnhau, gan ostwng lefel y dŵr. Roedd hynny o bosibl wedi cyfrannu at ostyngiad yn lefelau'r dŵr daear ar draws y safle.

Trafodir y rhesymau posibl dros y gostyngiad yn niferoedd *V. moulinsiana*, er enghraifft cysgod ar y safle, llifogydd, amodau tywydd eithafol a lefelau dŵr daear. Deuir i'r casgliad mai'r achos mwyaf tebygol yw'r gostyngiad yn lefelau'r dŵr, o bosibl oherwydd y gwaith rheoli ffosydd diweddar, ac mae'n debygol bod hynny wedi'i ddwysáu gan gyfnod o dywydd eithriadol o boeth a sych yn haf 2025.

Yn dilyn cydnabod pwysigrwydd cenedlaethol safle afon Penrhos ar gyfer *V. moulinsiana* yn 2016, argymhellodd dau adroddiad o arolygon Cyfoeth Naturiol Cymru (Adroddiadau Tystiolaeth CNC 210 a 258) y dylid hysbysu'r safle fel SoDdGA ond, hyd yn hyn nid yw hynny wedi digwydd ac felly nid oes gan Afon Penrhos unrhyw warchodaeth swyddogol ar hyn o bryd. Awgrymir efallai na fyddai caniatâd wedi cael ei roi ar gyfer y gwaith clirio ffosydd, a berodd ddifrod o bosibl, pe bai'r safle wedi bod dan warchodaeth.

Argymhellir y dylid gwneud gwaith pellach ar afon Penrhos ar gyfer 2026, i gynnwys: (1) arolygon o'r ardaloedd hynny sydd ar ochr ddwyreiniol y safle y canfuwyd eu bod yn cynnal y falwen yn 2016/17 ond na ymwelwyd â hwy yn 2025, (2) astudiaethau o hydroleg y tir yn lleol, gan gynnwys data ar dynnu dŵr a llifogydd lleol a (3) yn dilyn astudiaeth o ddata arolwg 2026, ystyriaeth bellach ar gyfer cais i ddynodi ardal gorllewin Afon Penrhos yn SoDdGA.

Executive summary

An area of the western Afon Penrhos flood plain found to support large populations of *Vertigo moulinsiana* in 2016 was revisited and surveyed for the snail on 9th September 2025 by Martin Willing, Mike Howe and Clare Sampson. This followed a failed attempt to record the snail during a visit by the latter two surveyors on 29th July. Survey for the snail primarily involved the previously used technique of vegetation tray beating but additionally also employed the use of vacuum (suction) samplers. No live *V. moulinsiana* were recorded from the network of close-cropped and mechanically mown fields and intervening rush-filled ditches where the snail was recorded in 2016.

A low frequency, recruiting population of the snail was found in an isolated block of ungrazed rank fen located at the north-west of the site (sandwiched between a deep drainage ditch and the A499) and not visited in 2016.

In the fields previously supporting the snail the ground surface was dry, in contrast to the situation in 2016 when it was saturated, suggesting that the water table was then close to the surface and supporting short but luxuriant plant growth (not seen in 2025). Several ditches were seen to have recently been mechanically cleared and deepened lowering their water levels and so possibly contributing to a fall in ground water levels across the site.

Possible reasons for *V. moulinsiana* losses such as site shading, flooding, extreme weather conditions and ground water table levels are discussed. It is concluded that the most likely cause is linked to a fall in water levels possibly linked to the recent ditch management work and probably intensified by a period of exceptionally hot and dry weather in summer 2025.

Following the recognition in 2016 of the national importance of the Afon Penrhos site for *V. moulinsiana*, two Natural Resources Wales survey reports (NRW Evidence Reports 210 & 258) recommended that the site be notified as a SSSI but, to date that has not occurred and so Afon Penrhos currently has no official protection. It is suggested that, if that had been in place then the possibly damaging ditch clearance work may not have been allowed to take place.

Further Afon Penrhos work is suggested for 2026 to include: (1) surveys of those areas lying on the eastern side of the site found to have supported the snail in 2016/17 but which were not visited in 2025, (2) studies of local ground hydrology including water abstraction and local flood data and (3) following a study of the 2026 survey data further consideration for an SSSI designation application for the western Afon Penrhos area.

1. Introduction

Desmoulin's Whorl Snail *Vertigo moulinsiana* (Dupuy, 1849) is a small snail found mostly in old or semi-natural open, calcareous fen and wetlands, usually adjacent or close to rivers, streams, lakes and ponds. In the UK, it is chiefly distributed in a broad band of country from central-southern England to East Anglia (Kerney, 1999). Outlying populations also exist in north and mid-Wales, the north-west English Midlands and north Cornwall. It was categorised as Rare (category 3) in the UK Red Data Books (Bratton, 1991), and more recently as Vulnerable on the IUCN-based UK red list status review (Seddon *et al.*, 2014). The snail is listed on Annex IIa of the European Community Habitats and Species Directive (92/43/EEC) and is also a Welsh Section 7 'Species of Principal Importance'.

V. moulinsiana is known from just three localities in Wales (Figure 1) - Cors Geirch NNR/SSSI and the Afon Penrhos floodplain near Pwllheli on the Llŷn peninsula, and Rhos Goch National Nature Reserve near Hay-on-Wye in Radnorshire, where a survey in 2015 highlighted a strong population (Willing, 2016). It is a feature of Corsydd Llŷn – Lleyn Fens SAC of which Cors Geirch is a part, but there is currently no statutory protection for the site on the Afon Penrhos floodplain. All the Welsh *V. moulinsiana* sites are isolated and do not closely resemble the lake and riverside, base-rich fens which the snail is typically associated with at most of its English sites. The nearest English *V. moulinsiana* sites to Afon Penrhos and Cors Geirch lie in the north-west Midlands (meres in Shropshire & Cheshire) (Cousins, 2015; Kerney, 1999). Although they support very different habitats, the Afon Penrhos and Cors Geirch sites only lie about 2.5 km apart.

V. moulinsiana was first found on the Afon Penrhos floodplain by Dylan Lloyd (then working for the Countryside Council for Wales) for in October 2002, who recorded it again in June 2003 when it was associated with emergent Meadowsweet *Filipendula ulmaria* and Yellow Flag *Iris pseudacorus* along a ditch-line. It was recorded in abundance at the same location in an area of open fen in 2008 (Figure 2), although a wider search failed to find additional populations and the population boundaries were not delineated (Willing, 2008).

It was recorded again in 2010 by John Bratton. A brief visit in October 2015 by Dylan Lloyd and Mike Howe of NRW failed to find the snail but highlighted major land management changes to the previously occupied area, including drainage, ditch clearance, scrub removal, and sheep grazing. In October 2016, a large area at the western end of the Afon Penrhos floodplain was surveyed (including all areas previously found supporting the snail) and *V. moulinsiana* was found in large numbers in short, mechanically-cut and lightly horse-grazed 'fen-meadow' (Figure 3; Table 1); tall uncut fen supported significantly lower numbers (Willing, 2017b). Elsewhere in the UK, the snail is typically associated with tall fen. *V. moulinsiana* was recorded on about 19 acres (8 hectares) of the site, but population boundaries were not established on the eastern and south-east borders of the surveyed area.

Following this survey, it was estimated that a further 75 acres (30 hectares) of potentially-suitable habitat existed to the east of the 2016 survey area, and this was surveyed in 2017 (Willing, 2018). Virtually all potentially suitable habitat was surveyed. Although most new

survey areas proved negative, an additional 0.5ha of *V. moulinsiana* habitat was identified, this being contiguous with the occupied habitat block lying to the immediate west surveyed in 2016. Areas of habitat not supporting the snail were judged to be too dry and/or too acidic to support the snail. It was then calculated that the minimum total area of the Afon Penrhos floodplain occupied by *V. moulinsiana* is 11.07ha, with a possible maximum of 13.2ha if several adjoining but potentially suitable un-surveyed areas also support the snail. The 2016/17 surveys showed that the Afon Penrhos *V. moulinsiana* population was not only the most extensive in Wales, but also probably one of the largest in mainland Britain.



Figure 1. Welsh *Vertigo moulinsiana* sites.



Figure 2. Fen at Afon Penrhos supporting (west of central footpath) *Vertigo moulinsiana* in 2008.



Figure 3. A horse-grazed field supporting abundant *V. moulinsiana* on the western Afon Penrhos flood plain in 2016. Note the pool of water lying on the surface and short, lush vegetation showing high ground water levels.

The significance of the population here was further enhanced by recent considerable population losses at several SACs in southern England (Willing 2015, 2017a) and on the nearby Corsydd Llŷn SAC (Cors Geirch NNR/SSSI). Once the significance of Afon Penrhos population was known both the 2016 and 2017 survey reports (Willing 2017b, 2018) recommended that the site should be notified as a SSSI to reduce any risk of loss or damage due to changes in site management.

Afon Penrhos was visited by Mike Howe and Bethan Beech (NRW) and Clare Sampson (Natur am Byth!) on 29th July 2025 but attempts to reconfirm presence of the snail in areas previously supporting large populations were unsuccessful. Apart from this brief visit, the 2025 surveys follow a 9-year hiatus since the previous 2016 / 2017 surveys and were planned to re-examine the ‘health’ of the Afon Penrhos *V. moulinsiana* populations.

Failure to find any live specimens raised concerns that the population may have declined and provided a further reason to undertake a detailed site assessment in September 2025.

Table 1. *Vertigo moulinsiana* records from Afon Penrhos 2016 and 2017.

Grid Reference	Date	<i>V. moulinsiana</i> abundance
SH3430133659	5.10.2016	Several snails
SH3432733631	5.10.2016	Several snails
SH34349 33742	5.10.2016	Several snails
SH3436133620	5.10.2016	Several snails
SH34383 33655	5.10.2016	Frequent 100m ⁻²
SH34413 33565	5.10.2016	Several snails
SH34415 33706	5.10.2016	Several snails
SH34451 33653	5.10.2016	Very low numbers
SH34464 33590	5.10.2016	Several snails
SH34474 33634	5.10.2016	Very low numbers
SH34505 33590	5.10.2016	Several snails
SH34537 33649	5.10.2016	Several snails
SH34549 33781	5.10.2016	4 > 5m ⁻²
SH345591 33793> SH34645 33849	5.10.2016	Several snails
SH34645 33849 > SH34730 33912	5.10.2016	Several snails
SH34771 33925 > SH34822 33834	16.10.2017	Present throughout sector ranging 10 > 20m ⁻²

2. Methods

Surveys on the Afon Penrhos floodplain were undertaken on 9th September 2025. Except for a midday shower, the weather was dry with a gentle breeze. The Afon Penrhos survey area lies to the west of the public footpath running from approximately SH 34348 33808 to SH 34329 33758 and displayed in Figure 8, with survey blocks shown in Figure 5.

Survey for *V. moulinsiana* presence employed three techniques:

(1) The visual search of emergent vegetation for the presence of climbing snails;

(2) Searches for climbing snails upon wetland vegetation were carried out by the well-established technique of beating herbaceous fen vegetation onto a gridded white plastic tray measuring approximately 25cm x 33cm. If present in sufficient numbers, approximate *V. moulinsiana* per unit area can be estimated (6 trays being approximately equivalent to 0.5 m²). Material on the trays was inspected in the field. Most survey points were located in areas where the snail was recorded in surveys in 2008 and 2016. Tray beating was difficult in cut fen areas at Afon Penrhos because of the low vegetation height but was successful in locating the snail in the survey areas in 2016 and 2017;

(3) Vacuum sampling was also undertaken in 2025 at numerous sampling points over the survey area using a Stihl SHA56 leaf blower powered by an AK20 battery (Figure 4). Samples were collected by placing the suction nozzle close to the ground and moving over a small area for a two-minute period, with each field (see Figure 5) being sampled this way on two or three occasions. Vacuum sampled material was examined immediately after collection on a white lipped tray and examined with hand-held magnifiers. Any *Vertigo* spp. were recorded and the specimens retained (in ethanol) for later microscopic verification.

Tray beating and the visual inspection of vegetation was undertaken by Martin Willing whilst the vacuum sampling was carried out by Mike Howe and Clare Sampson.



Figure 4. Vacuum sampling in progress at Afon Penrhos in September 2025.

3. Results

Extensive and systematic field tray-beating and vacuum sampling of the short-cut, grazed fields and intervening ditches failed to locate any *V. moulinsiana* in the areas where it was recorded, often in large numbers, in 2016 (Willing, 2017b) and almost no other species of mollusc were recorded in this area either. The field surfaces and most of the chiefly *Juncus* in-filled ditches were dry.

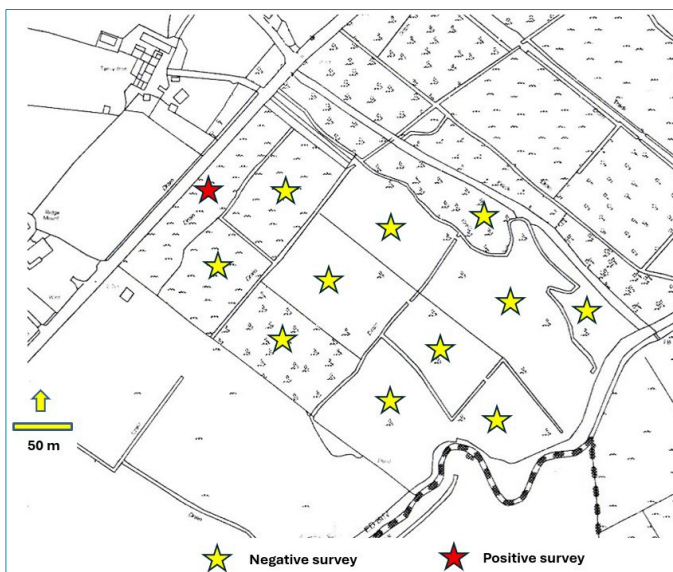


Figure. 5. Survey blocks lying at the western end of Afon Penrhos. Yellow stars indicate field blocks occupied by *Vertigo moulinsiana* in 2016 but not recording the snail in 2025. The red star shows the location of a block of ungrazed fen (not surveyed in 2016) supporting low numbers of the snail in 2025.

Low numbers of the snail were found by both tray beating and vacuum sampling in a rectangular area of unmown and ungrazed fen (Figure 5 - the block marked by a red star; Figure 9) sandwiched between the A499 and a deep, recently cleared ditch (Figure 10). About 60 minutes of simultaneous tray and vacuum sampling produced a total of 11 *V. moulinsiana* and 4 *V. antivertigo* (Table 2). The presence of juvenile *V. moulinsiana* indicates a recruiting population. Only the vacuum sampling produced *V. antivertigo* indicating that it was removing at least some material from close to the ground surface where this snail would have been living; it does not climb up into the taller fen vegetation as *V. moulinsiana* does.

Table 2. *Vertigo* species recovered from ungrazed rank fen lying at SH 34281 33716 ('red star' shown in Figure 5).

Species	Tray beating	Vacuum sampling
<i>Vertigo moulinsiana</i>	7 (3 adult; 4 juvenile)	4 (2 adult; 2 juvenile)
<i>Vertigo antivertigo</i>	-	4

4. Discussion

The 2025 surveys found that *V. moulinsiana* had disappeared from all the block of fields and foot path margin lying to the west of the central footpath (Figure 5 & 8) that were last surveyed in 2016 (Willing, 2017b). These fields have low vegetation maintained by a combination of mechanical cutting and low-intensity horse grazing. It is believed that the management had not changed noticeably since 2016. A low-density *V. moulinsiana* population was discovered in a rectangular block of un-grazed and uncut fen at the northeastern end of the area (Figure 5 - site with red star) that was not surveyed for the snail in 2016 but probably supported it at that time. This area appears to closely resemble (Figure 2) the uncut rank fen that lay either side of the footpath when the area was visited in 2008 (Willing, 2008) that has now largely gone due to grazing and cutting and probably low water levels. In 2025, the ground surface in all the cut fields was noticeably dry; water did not rise to the surface if the ground was pressed and no pools of standing water were seen (even though a brief period of heavy rain occurred during the middle of the survey period).

It is difficult to determine the cause and date of the snail's disappearance due to the 9-year hiatus since the last survey in 2016. Has there been a slow decline or has some sudden event or events caused the loss to have occurred more rapidly? To consider all options it is necessary to understand details of the snail's ecology. Factors that might individually or in combination affect *V. moulinsiana* populations include:

- (1) low water table / drought;
- (2) site flooding;
- (3) shading;
- (4) land management change and
- (5) climatic events.

One of the most important factors affecting the suitability of habitats for the snail are high ground water levels throughout the year. "*The close relationship between the snail's abundance and water levels suggests that site hydrology is a major factor determining the local distribution of the snail*" (Killeen, 2003). Thus, following their hydrological studies of three *V. moulinsiana* Special Areas of Conservation in southern and eastern England, Tattersfield and McInnes (2003) concluded that "*V. moulinsiana requires water levels to be at or slightly above the local ground surface for at least part of the year*". Additionally, they found that maximum snail densities occurred at locations where water levels were continuously above the ground surface throughout the year. At the three study sites they found that minimum ground water levels ranged from -11.8 cm to -0.38cm.

In the condition assessment determinants for monitoring the status of *V. moulinsiana* sites, Killeen and Moorkens (2003) suggested the use of five simple levels of ground moisture these being:

1. DRY: No visible moisture on ground surface

2. **DAMP:** Ground visibly damp (damp to touch) but water does not rise under pressure,
3. **WET:** Water rises under light pressure,
4. **VERY WET:** Pools of standing water, generally less than 5cm deep,
5. **SITE UNDER WATER:** Entire sampling site in standing or flowing water over 5cm deep.

They stated that suitable ground moisture for the snail occur at levels 2 – 4 (level 3 being optimal).

When Afon Penrhos was surveyed in 2016, ground moisture levels in the fields lying west of the footpath and supporting large numbers of the snail were at levels 2 to 4. At all sites, the ground surface was at least damp and mostly saturated, so that water rose when the ground was lightly pressed. Ground water levels were such that in many fields, small pools were evident, and the surface vegetation was luxuriant (Figures 3, 11 & 12). By contrast, in 2025 ground moisture levels at all field surface locations were dry (ground moisture 'Level 1') and the field vegetation was short (Figure 13) and not displaying the vigorous growth seen in the same areas in 2016 / 2017.

It seems certain that ground water levels have fallen. The reasons for this are not clear but recent observations at the site may provide an answer. It is evident that several ditches have recently been cleared of weed and sediment. Thus, the ditch running south-west to north-east (ditch 'D1' in Figure 6) has flattened spoil heaps on the southern bank and signs of cut clay-like sediments in the cut sides of the ditch (Figure 10). If this ditch (pre-clearance of weeds and sediments) had water levels only slightly below the current ground surface, then ditch water levels may have fallen between 0.3 and 0.5 m. Unfortunately, no pre-clearance ditch data is available making this an approximate estimate.

Evidence of a fall in previously higher ground water levels was seen at the eastern end of 'Ditch 1'. This point marks the end of the ditch clearance operations before open fen gives way abruptly to an area of wet *Salix* spp. and *Alnus glutinosa* scrubby woodland (Figures 14 & 15). The continuation of the ditch in the woodland has water levels close to the ground surface; where the woodland section of the ditch meets the open (cleared) section of the ditch there is a 30 to 40 cm drop (cut into the ditch sediment by the mechanical digger) over which water was flowing into the newly excavated section (water flowing in a south-westerly direction). Water levels in the wet woodland may closely represent a level closer to (or lower if the overall water table had fallen) the former water table level. Other ditches in the area also revealed evidence of recent clearance such as 'Ditch 2' lying immediately south of Ditch 1 (at SH34396 33747; Figure 16). 'Ditch 3' lying further to the east of the 2025 survey block (at SH 34664 33739; Fig 17) also showed recent clearance. The combined effects of these extensive ditch management operations are likely to have caused a fall in the local water table. Unfortunately, no historical hydrological data of the area is available such as was obtained by Tattersfield and McInnes (2003) when they used dip wells to study key *V. moulinsiana* sites in England.

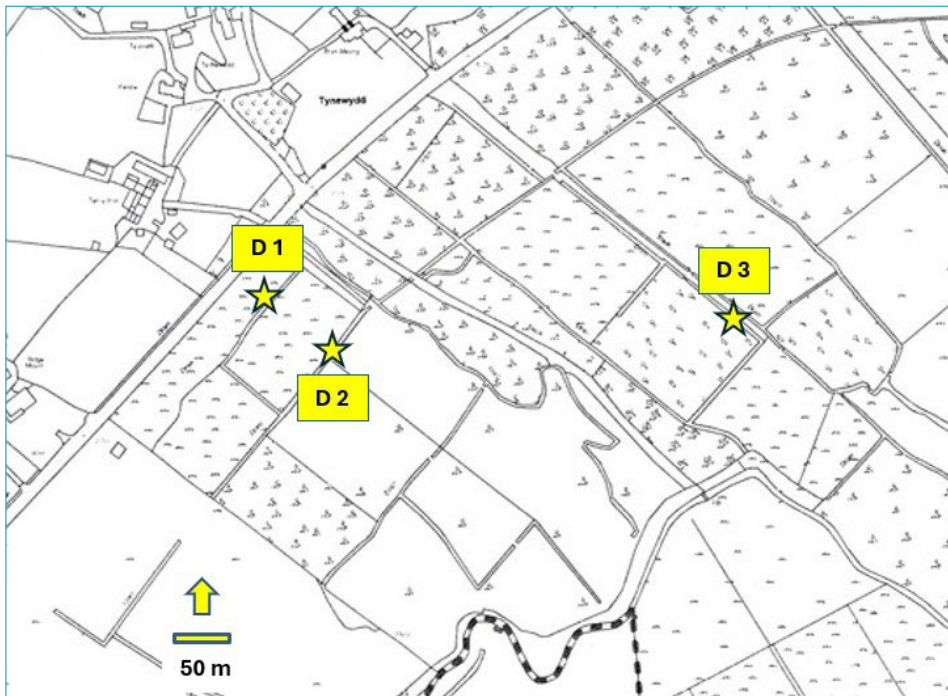


Figure 6. Locations of ditches 'D1', 'D2' & 'D3' - all showing evidence of recent clearance.

The prolonged period of drought (low rainfall) and record high temperatures experienced in the summer of 2025 will probably have compounded the fall in ground water levels leading to the loss of any remaining *V. moulinsiana* 'pockets' at the site.

Low numbers of *V. moulinsiana* have remained in the block of unmanaged fen (red star on Figure 5). If a lowered water table also affected this area, the tall fen vegetation would have ameliorated the situation by providing a humid and part shaded micro-habitat. Killeen (2003) stated that "*it would seem likely that the influence of groundwater levels on the snail may be mediated via air humidity, since the snail spends much of the year climbing in the canopy of the vegetation well above the ground*". This block of fen lies immediately east of the A499 road, under which ground water may flow from the sloping ground lying to the west.

On 17th February 2026, Clare Sampson and Mike Howe viewed Afon Penrhos from the A499 at a time when the site was partially flooded (Figure 7).



Figure 7. Flooding observed in the western area of Afon Penrhos, 7th February 2026.

It was wondered if a similar earlier flooding episode or episodes (the A499 frequently floods close to this location) might have been a factor in *V. moulinsiana* decline and /or loss. Most threats and recorded losses of snail populations (such as the more than 85% decline in river margin habitats on the Wiltshire / Hampshire Avon; personal currently unpublished data) focus upon low ground water levels and drought. Little is written about the converse threat of too much water! The Killeen and Moorkens 5 levels of ground moisture indicate that sites at 'level 5' where water levels exceed 5cm depth are sub-optimal for the snail. Additionally, Killeen (2003) noted that "*Permanent flooding of reedbeds may also be detrimental as there will be no litter layer in which the animals can over-winter, and no sites for laying eggs*".

Only a few studies document flooding leading to the loss of a *V. moulinsiana* population. One such is at Chingford Pond (near Petworth in West Sussex) where an artificial ornamental 18th century pond had the water levels lowered by several metres in the early 1980s. This allowed a wide band of fen to develop around the pond that was found to support *V. moulinsiana* in the early 1990s which by 2010 was found to be living all around the pond in very high numbers (recording some of the highest densities for the snail in the UK; Willing, 2011, 2012, 2015a&b). Following structural improvements to the pond embankment, plans were made to slowly increase water levels to historic limits over a 10-year period and so allow marginal fen to keep pace with the increase (to maintain populations of the snail). Unfortunately, due to an outflow obstruction, water levels rose faster than planned so that when the pond was surveyed in late 2014 *V. moulinsiana* was only present in the now flooded fen, clustered at the very tops of emergent *Carex*, *Typha* and *Sparganium* (the snail is an air-breathing species and cannot survive submergence).

Following this visit water levels rose still higher so for a 2-week period in early 2015 all fen was completely submerged by > 1m of water. When water levels fell again several fen surveys in following months failed to find any live *V. moulinsiana*. Flood debris found around the pond contained numerous freshly dead snails.

The flooding observed at Afon Penrhos (from study of images and personal accounts), unlike that described at Chingford Pond, did not show that the fields were completely submerged. There were frequent patches and 'tufts' of emergent stems up which *V. moulinsiana* could climb until water levels subsided. So, flooding at Afon Penrhos unless fully submerging the site for an extended period is unlikely to have led to a significant fall in the population. In 'low-level' flooding, snails can seek temporary refuge in floating plant debris. Low-level, occasional flooding may in fact have contributed to the former widespread presence of the snail in the fields at the western end of Afon Penrhos. In describing *V. moulinsiana* ecology, Killeen (2003) stated, "*Waterborne transportation is believed to be the principal dispersal mechanism of Desmoulin's Whorl Snail. By the nature of its wetland habitat, the snails are likely to be able to float on the water surface or attached to floating vegetation and could therefore disperse during periods of flooding*".

In addition to flooding, *V. moulinsiana* is intolerant of shading (particularly in wetlands by alder and willow scrub) and even slight lateral shading can depress snail numbers (Drake, 1999; Killeen, 2003; Killeen & Moorkens, 2003, Willing, 2011, 2016). As all parts of the fields previously supporting an abundance of the snail are largely free of woody, shading growth this negative habitat issue is not a factor operating at Afon Penrhos.

Unfortunately, the ditch works that may have indirectly contributed to the loss of *V. moulinsiana* over a large area of Afon Penrhos were not able to be prevented, despite the national importance of the site. The site is currently unprotected despite two Natural Resources Wales survey reports (NRW Evidence Report Nos. 210 & 258) recommending that the area be notified as an SSSI. It is suggested that, if such protection had been in place, then the possibly damaging ditch clearance work may not have been permitted.

5. Further work

Due to a shortage of time not all the 2016/2017 Afon Penrhos sites supporting *V. moulinsiana* were surveyed in 2025. The key area lying west of the central footpath was visited but sites lying east of this path were not (Figure 8) and these need to be surveyed in 2026.

Investigations should be made to obtain local ground hydrology and water abstraction data from NRW (and other governmental bodies) to try to understand and so possibly manage water levels at the site.

Further attempts should be considered to have the site designated as an SSSI once results of the additional 2026 surveys are available.

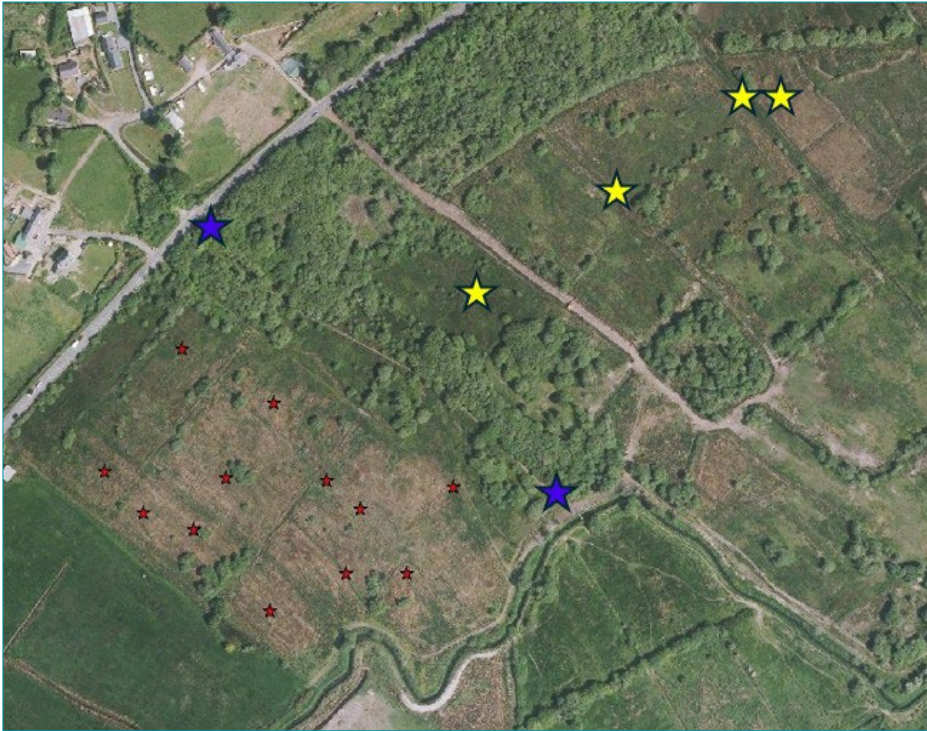


Figure. 8. A public footpath runs between the two blue stars; the red stars show the locations of *V. moulinsiana* presence at Afon Penrhos (western block) in 2016 and resurveyed in 2025; the yellow stars show approximate *V. moulinsiana* 2016/2017 presence east of the footpath, an area requiring survey in 2026.

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Appendix 1. Site images



Figure 9. Fen (north-west Afon Penrhos) supporting low numbers of *Vertigo moulinsiana*. Dominant plants included *Mentha aquatica*, *Filipendula ulmaria*, *Potentilla palustris*, *Phalaris arundinacea*, *Phragmites australis*, *Iris pseudacorus*, *Carex* spp., *Juncus* spp. September 2025.



Figure 10. 'Ditch 1' showing evidence of recent clearance (note flattened ditch sediments to left of ditch and *V. moulinsiana* supporting fen to right). September 2025.



Figure 11. A *Vertigo moulinsiana* supporting field lying at the western end of Afon Penrhos. Note lush vegetation, with saturated ground surface. October 2016.



Figure 12. A *Vertigo moulinsiana* supporting field lying at the western end of Afon Penrhos. Note lush vegetation, with saturated ground surface. October 2016.



Figure 13. Close-cropped dry field at western lying at the western end of Afon Penrhos – a site supporting *Vertigo moulinsiana* in 2016 (contrast with fields shown in Figures 11 & 12). September 2025.



Figure 14. North-eastern end of 'Ditch 1' – the limit of recent ditch clearance – water flow down into ditch from a higher uncleared ditch in adjacent wet woodland. September 2025.



Figure 15. 'Ditch 1' – uncleared shallow ditch in wet woodland shown adjacent to cleared section of ditch into which water flowed. September 2025.



Figure 16. 'Ditch 2' showing evidence of recent clearance. September 2025.



Figure 17. 'Ditch 3' showing evidence of recent clearance. Note ditch sediments spread to left of ditch. September 2025.

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_DS161640**.

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