



**Cyfoeth
Naturiol
Cymru**
**Natural
Resources
Wales**

The status of Desmoulin's Whorl Snail *Vertigo moulinsiana* at Rhos Goch NNR in 2015

M.J. Willing

NRW Evidence Report No. 157



Figure 1: *Vertigo moulinsiana* habitat at Rhos Goch NNR being examined by the NNR site manager.

About Natural Resources Wales

Natural Resources Wales is the organisation responsible for the work carried out by the three former organisations, the Countryside Council for Wales, Environment Agency Wales and Forestry Commission Wales. It is also responsible for some functions previously undertaken by Welsh Government.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, used and enhanced, now and in the future.

We work for the communities of Wales to protect people and their homes as much as possible from environmental incidents like flooding and pollution. We provide opportunities for people to learn, use and benefit from Wales' natural resources.

We work to support Wales' economy by enabling the sustainable use of natural resources to support jobs and enterprise. We help businesses and developers to understand and consider environmental limits when they make important decisions.

We work to maintain and improve the quality of the environment for everyone and we work towards making the environment and our natural resources more resilient to climate change and other pressures.

Evidence at Natural Resources Wales

Natural Resources Wales is an evidence based organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

This Evidence Report series serves as a record of work carried out or commissioned by Natural Resources Wales. It also helps us to share and promote use of our evidence by others and develop future collaborations. However, the views and recommendations presented in this report are not necessarily those of NRW and should, therefore, not be attributed to NRW.

Report series: NRW Evidence Report
 Report number: 157
 Publication date: March 2016
 Contract number:
 Contractor: Willing MJ
 Contract Managers: Howe MA
 Title: **The status of Desmoulin's Whorl Snail *Vertigo moulinsiana* at Rhos Goch NNR in 2015.**
 Author(s): Willing MJ
 Technical Editors: Howe MA
 Peer Reviewer(s): Howe MA
 Approved By: Duigan C
 Series editor(s): N/A
 Restrictions: None

Distribution List (core)

NRW Library, Bangor	2
National Library of Wales	1
British Library	1
Welsh Government Library	1
Scottish Natural Heritage Library	1
Natural England Library (Electronic Only)	1

Distribution List (others)

Rhys Jenkins (Electronic)	1
---------------------------	---

Recommended citation for this volume:

Willing, M.J. 2016 The status of Desmoulin's Whorl Snail *Vertigo moulinsiana* at Rhos Goch NNR in 2015. NRW Evidence Report No: 157, 20pp. Natural Resources Wales, Bangor.

Contents

1. Crynodeb Gweithredol	1
2. Executive Summary	2
3. Introduction.....	3
3.1. Background	3
3.2 Objectives.....	3
4. Methods.....	4
5. Results.....	5
6. Discussion.....	6
7. Recommendations.....	8
8. Acknowledgements.....	8
9. References.....	9

List of Figures

Figure 1: <i>Vertigo moulinsiana</i> habitat at Rhos Goch NNR being examined by the NNR site manager.....	frontispiece
Figure 2: Tray-beating technique at Rhos Goch	4
Figure 3: Points where detailed survey was undertaken (mostly in habitat deemed potentially suitable for <i>V. moulinsiana</i>)	6

Appendices

10.1. Appendix 1: Survey results.....	10
10.2. Appendix 2: Site locations, brief habitat details, molluscan presence.....	11
10.3. Appendix 3: Selected images of survey locations, including Figures 4 to 13.....	13
10.4. Appendix 4: A summary of the vegetation at Rhos Goch NNR, including Figure 14..	17
10.5. Data Archive Appendix.....	19

1. Crynodeb Gweithredol

Cadarnhaodd gwaith arolygu a gynhaliwyd ar 21^{ain} a 22^{ain} Hydref 2015 fod y falwen droellog Desmoulin *Vertigo moulinsiana* i'w chael o hyd yng Ngwarchodfa Natur Genedlaethol Rhos Goch, yn dilyn ei darganfyddiad yma yn 2007 – un o blith tri o safleoedd yn unig yng Nghymru lle y ceir y falwen. Daethpwyd o hyd iddi yn ei hardal wreiddiol ac mewn chwech o orsafoedd ychwanegol o fewn ymylon canol, gogledd-orllewinol y warchodfa, mewn llecynnau darniog o gors galchog agored, digysgod, tra-fasig dros ardal rhwng 1.5 – 2 hectar o faint. Fe'i gwelwyd yn fwyaf aml ar hesg grafunog mawr *Carex paniculata* neu mewn cymuned o lystyfiant lle ceid brwyn blodeufain *Juncus acutiflorus* yn bennaf (gyda mathau eraill o frwyn a hesg). Cofnodwyd lleiafswm o 245 o falwod, gan gynnwys rhai ifanc a rhai llawndwf.

Yn dilyn gwaith samplu meintiol ar yr holl fathau o lystyfiant gwelwyd bod y falwen yn ffafrio *C. paniculata*, ac efallai fod hyn wedi helpu *V. moulinsiana* i osgoi'r llifogydd dŵr daear rheolaidd ar y safle, sef rhywbeth a fyddai'n effeithio'n negyddol ar boblogaethau'r falwen. Ni ddaethpwyd o hyd i *V. moulinsiana* mewn darn mawr o gors galchog agored, niwtral yn ne-orllewin y warchodfa, efallai oherwydd lefelau is o ionau Ca^{2+} mewn dyfroedd daear yn y fan hon.

Mae ychydig bach o gysgod yn lleihau poblogaethau *V. moulinsiana*, bygythiad penodol yng Ngwarchodfa Natur Genedlaethol Rhos Goch lle y mae helyg a gwern wedi dechrau tyfu'n ddiweddar ar ddarnau bach o gynefin agored sy'n cynnal y falwen. Yn dilyn trafodaethau gyda rheolwr y safle, cafodd llecynnau o helyg a gwern ar gyrion y brif ardal lle y ceir *V. moulinsiana* eu torri ddiwedd mis Hydref 2015 mewn ymdrech i wneud y cynefin yn fwy addas i'r falwen.

Argymhellir y dylid mynd i'r afael â mwy o waith ar y safle, gan gynnwys chwilio ardaloedd nad aethpwyd iddynt yn ystod yr arolwg presennol, disgrifiad mwy cywir o'r llystyfiant mewn ardaloedd lle y ceir *V. moulinsiana*, a phrofi cemeg y dŵr daear er mwyn canfod a oes gan ardaloedd sy'n cynnal y falwen lefelau Ca^{2+} uwch.

2. Executive Summary

Survey work on 21st and 22nd October 2015 confirmed the continued presence of Desmoulin's Whorl Snail *Vertigo moulinsiana* at Rhos Goch NNR following its discovery here in 2007, one of only three known sites in Wales for the snail. It was found both at its original locality and at an additional six stations within the central, north-west margins of the reserve, occurring in fragmented pockets of open, unshaded, base-rich fen occupying an area of between 1.5 to 2 hectares. It was found most frequently on either greater tussock-sedge *Carex paniculata* or in a vegetation community dominated by sharp-flowered rush *Juncus acutiflorus* (together with other rush and sedge species). A minimum of 245 snails, including juveniles and adults, was recorded.

Quantitative sampling of each vegetation type found a significant preference of the snail for *C. paniculata*, which may allow *V. moulinsiana* to avoid the regular ground-water flooding experienced on the site and which would negatively affect snail populations. *V. moulinsiana* was not found in a large area of open, neutral fen lying at the south-west of the reserve, perhaps as a consequence of lower levels of Ca²⁺ ions in ground waters here.

V. moulinsiana populations are reduced by even slight overhead shading, a particular threat on Rhos Goch NNR where there has been recent encroachment of willow and alder onto the small areas of open habitat supporting the snail. Following discussions with the NNR site manager, areas of willow and alder on the margins of the main area for *V. moulinsiana* were cut back in late October 2015 in an attempt to increase the suitability of the habitat for the snail.

Further work is recommended at the site including a search of areas not accessed during the current survey, a more accurate description of the vegetation in areas occupied by *V. moulinsiana* and a testing of ground water chemistry to determine if areas supporting the snail have higher Ca²⁺ levels.

3. Introduction

3.1. Background

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 Wales, the north-west English Midlands, mid-Wales and north Cornwall.

The conservation importance of the species has meant its inclusion in various schedules and Red Data lists. It was categorised as Rare (category 3) in the UK Red Data Books (Bratton 1991), and more recently has been classed as Vulnerable in the recent IUCN-based UK Red List status review (Seddon *et al.*, 2014). The species is listed on Annex IIa of the European Community Habitats and Species Directive (92/43/EEC) and is also a Welsh Section 42 Species of Principal Importance (replacing the UK BAP priority species in 2006).

V. moulinsiana is only known from three localities in Wales; Cors Geirch and Afon Penrhos near Pwllheli on the Llŷn peninsula, and Rhos Goch National Nature Reserve near Hay-on-Wye in Radnorshire. It is a SAC feature of Corsydd Llŷn – Lleyn Fens SAC of which Cors Geirch is a part, but there is currently no statutory protection for site or snail at Afon Penrhos. All of the Welsh *V. moulinsiana* sites are isolated and do not closely resemble the lake and river-side base-rich fens typically associated with the snail at most of its English sites. The nearest English *V. moulinsiana* sites to Rhos Goch lie in the north-west Midlands (e.g. meres in Shropshire) (Cousins, 2015; Kerney, 1999).

It was recorded for the first time at Rhos Goch NNR in 2007 during a survey to assess the condition of the wetland invertebrate assemblage on the site (Boyce, 2008). Eight adults were found by sieving litter and sweeping sedges at SO19484837 on 3rd September 2007. This is an area of transition mire and grey willow scrub in the lagg on the north-western edge of the raised bog. There is considerable lateral water movement through this area, and the diverse vegetation present in the transition mire suggests the water here must be relatively mesotrophic. At the time of sampling in 2007, the water table was very high, with 10–20cm of standing water in the transition mire. *V. moulinsiana* does not appear to have been recorded or looked for since. It was not found in a repeat assessment of the assemblage in 2012, but molluscs were not targeted (Ward, 2012).

3.2. Objectives

This project was established to survey for *V. moulinsiana* in October 2015, focussing initially on the area where the snail was recorded in 2007 and then followed by a wider search of potentially suitable habitat within the NNR and adjoining SSSI to the north west. Suitable sampling techniques would rely primarily on the use of ‘tray beating’ supplemented by visual searches, litter sieving and removal of bulk samples for off-site processing.

4. Methods

Surveys were completed over 2 days on 20th – 21st October 2015. Survey days were selected to ensure the dry conditions needed to undertake sampling. Key survey locations are displayed on Fig. 3 with individual sites given in Appendix 8.1, Table 3. Surveys focussed on locating and assessing populations of *Vertigo moulinsiana*, with methodology broadly following the 'level 1' survey techniques detailed in Killeen & Moorkens (2003). Consequently, searches for *V. moulinsiana* climbing upon wetland vegetation were carried out by the well-established technique of beating herbaceous fen vegetation onto a gridded white plastic tray.

Tray beating was undertaken in dry weather conditions, using a gridded white beating tray measuring approximately 25cm X 33cm (Fig. 2). At selected locations, this allowed approximate *V. moulinsiana* numbers per unit area to be estimated (6 trays being approximately equivalent to 0.5 m²). Each beating tray went at the base of a fresh and undisturbed plot of vegetation, all within approximately 2m of a single sampling point. Material on the trays was combined and either counted in the field (if numbers of snails were low and easily seen amongst other vegetation detritus) or, in most cases, retained for later laboratory examination and snail counting (involving the inspection of samples microscopically using a x7 – x45 binocular microscope to count adult and juvenile *V. moulinsiana*). At sites where the snail's presence could not initially be confirmed, sampling continued for up to 20 minutes. Main survey stations were selected as those deemed most likely to produce *V. moulinsiana*. At sites where *V. moulinsiana* was not located by beating, small vegetation litter samples were also sieved (using 2mm and 0.5mm nested sieves) to try to locate non-climbing individuals that are sometimes present nearer to ground level.



Figure 2: Tray-beating technique at Rhos Goch (photo. Rhys Jenkins).

Approximate area of occupancy was assessed with the use of a tray beating;

Degree of ground moisture (using a version of the '5 Point Wetness scale' of Killeen & Moorkens, 2003) was recorded at all survey sites;

1. Ground dry: Possibly with cracks, and no evidence of surface moisture.
2. Ground damp: Moisture observed on the surface but water does not rise under light pressure.
3. Ground wet: No surface veneer, but water rises under light (foot) pressure.
4. Ground wet: Surface veneer of water less than 1-2cm deep
5. Ground very wet: Water depth greater than 2cm which may cover the sward and tussocks.

Dominant vegetation presence was recorded, noting particularly '+' and '-' *V. moulinsiana* 'suitability indicators' (e.g. *Carex* sp, *Glyceria maxima* as '+' indicators and *Epilobium* sp and *Urtica dioica* as '-');

Degree of site shading by overhead or over-hanging trees and bushes was recorded as a simple % canopy cover where appropriate, as shading can negatively affect the suitability of sites for *V. moulinsiana*;

Other potentially important site environmental and management details were recorded e.g. grazing and/or ground poaching, recent cutting, human trampling, pheasant release pens. Other mollusc species present were noted. At four locations, bulk samples of vegetation were removed (chiefly in the open fen area lying on the western margins of the site;

Where located *V. moulinsiana* numbers were counted per 6-tray samples and then converted into approximate numbers m⁻² with numbers of adult and juvenile snails recorded separately.

GPS 12 fig references and digital images were recorded for each main sample point. In addition to these, tray beating was carried out as the surveyor walked around the site to try and locate *V. moulinsiana* 'pockets' that might otherwise be overlooked.

5. Results

Vertigo moulinsiana was reconfirmed at Rhos Goch, both at the site of original discovery from 2007 and in open 'base-rich fen on *Carex* and *Juncus* in a fragmented distribution over an area of about 2 hectares. *V. moulinsiana* counts from standard quantitative sampling are given in Table 1. Bulk sample results in Table 2 and general habitat information Table 3 (all in Appendix 9). The snail was found living at seven discrete fen 'pockets', although these differed considerably in size (Fig. 3). Thus Site 4 was quite extensive running in a narrow band sandwiched between *Salix* / *Alnus* scrub to the NW and acidic *Calluna* mire to the SE, whereas Sites 14 and 15 were much smaller, including only about 10 X 10 m² each.

A total of 245 live *V. moulinsiana* were counted, but not including the uncounted presence of the snail at Sites 10 and 14 which would increase this total. The counted snails were 60% adult / 40% juvenile, indicating recruiting populations at all sites. Detailed counting produced densities ranging from 4 – 154 m⁻². Unshaded *Carex paniculata* produced the largest *V. moulinsiana* counts.

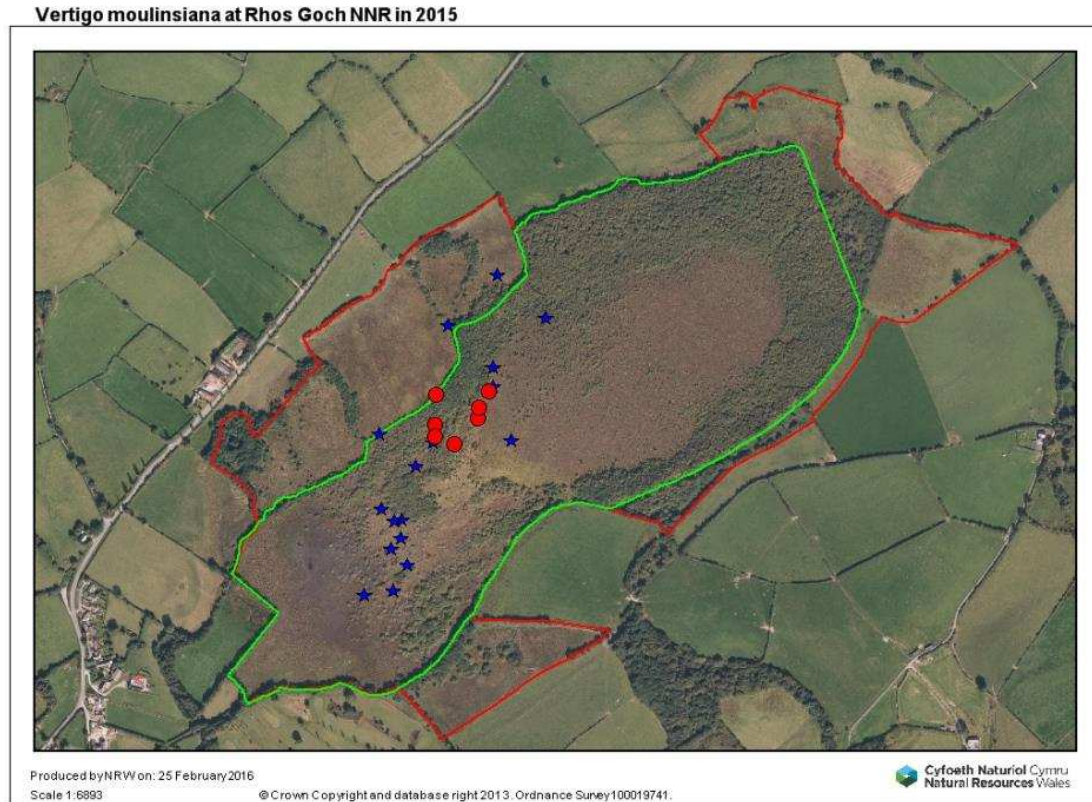


Figure 3: Points where detailed survey was undertaken (mostly in habitat deemed potentially suitable for *V. moulinsiana*). Blue STAR = negative; red CIRCLE positive

In addition to *V. moulinsiana* other species of Mollusca were noted. Boyce (2008, p. 31) recorded the presence of 15 mollusc species from his Rhos Goch surveys and the current survey added a further eight species including *Carychium minimum*, *Columella edentula*, *Arianta arbustorum*, *Lymnaea palustris*, *Potamopyrgus antipodarum*, *Pisidium subtruncatum*, *P. obtusale* and *P. milium*.

6. Discussion

Survey work confirmed the presence of *Vertigo moulinsiana* precisely where David Boyce first recorded the species in 2007 (Fig. 4) at his 'survey station 6' (Boyce 2008). It was found that the snail occurs widely in this area of the reserve, chiefly on either *Carex paniculata* or *Juncus acutiflorus*-dominated fen in open, unshaded 'base-rich' fen. Boyce classified the vegetation here as transition mire (S27 *Carex rostrata*-*Potentilla palustris* tall-herb fen) and carr (W2 *Salix cinerea*-*Betula pubescens*-*Phragmites australis* woodland). Not all areas where these two plants

dominated supported the snail however, so their presence alone cannot be used to confirm the presence of *V. moulinsiana*. On its eastern border (close to where the snail was found in 2007) there is a very sharp transition from base-rich fen to an acidic *Calluna vulgaris* / *Eriophorum vaginatum* habitat (M9 *Carex rostrata*-*Calliargon cuspidatum/giganteum* mire). In places, this change occurs over only 1 – 2 m (Fig. 5) and may correspond to the influence of base-rich waters. The open fen habitat is very fragmented occurring in a scattering of open areas and glades lying between patches of *Salix* / *Betula* / *Alnus*. This mix of small open fen areas and trees extends across to the NNR / SSSI boundary. Because of the patchy occurrence of the open fen and the fact that it does not all appear to support *V. moulinsiana* (although appearing suitable for it) makes it difficult to accurately estimate the area of *V. moulinsiana* occupancy at Rhos Goch.

It is judged that the snail is currently found in about 1.5 – 2 hectares of the reserve, although intermittently in this area. To the north-west of the NNR boundary (but still within the SSSI) lies open, unimproved horse-grazed pasture. This area slopes gently to the south-east and supports a series of drainage channels which in many places are un-shaded and infilled with *Carex paniculata* tussocks. This habitat appeared ideal for *V. moulinsiana* but widespread tray beating failed to locate the snail.

The *Juncus*-dominated open fen at the south-western end of the NNR (before the horse-grazed marshy grassland near the western entrance to the reserve) appeared less base-rich than the *V. moulinsiana* occupied fen. Extensive tray-beat sampling in this area, as well as the removal and processing of bulk samples, failed to produce *V. moulinsiana* but was found instead to support large numbers of *Vertigo antivertigo*. This species typically lives lower in the fen vegetation than *V. moulinsiana* and only climbs emergent stems for a short distance. This snail is more tolerant of a wider range of conditions than *V. moulinsiana*, ranging from base rich to neutral and even slightly acidic fen conditions. This extensive area of fen (survey sites: 1, 2, 20 – 24; Fig. 11) seems less base-rich than the fen supporting *V. moulinsiana*.

During sampling, it was noticed that *V. moulinsiana* appeared to be more plentiful when beating *Carex paniculata* than in mixes dominated by *Juncus acutiflorus*. At survey site 9 (Fig. 7), two standard samples (Table 1) taken exclusively from each of these vegetation types found a significant difference ($p = 0.01$) in the numbers of *V. moulinsiana* m^{-2} favouring *C. paniculata*. It may be that snails occupying this vegetation avoid the flooding which can depress populations. *V. moulinsiana* avoids flooded ground, ideally preferring conditions where water rises under light pressure, but is not permanently flooded (Drake, 1999; Killeen, 2003; Killeen & Moorkens, 2003; Willing 2011). Areas of fen with *J. acutiflorus* had much standing water during the current survey.

Numbers of the snail and presence of numerous juveniles indicate a recruiting population of *V. moulinsiana*. Numbers per m^2 are not especially high as the snail can, in exceptional circumstances, occur in densities of up to 15,000 m^{-2} in some optimal English habitats (Willing, 2011), although it typically occurs in lower numbers.. Thus Baker *et al* (2007) state in relation to *V. moulinsiana*, “although densities of more than 1000 m^{-2} have been noted for the species the norm appears to be densities of between 100 – 200 m^{-2} ”. Indeed during their 4 year monitoring

programme of the 'Trinity Broads Complex' in Norfolk (Ormesby, Rollesby, Filby Broads and Burgh Common) no *V. moulinsiana* density exceeded 100 m².

In addition to flooding, *V. moulinsiana* is intolerant of shading, and even slight lateral shading can depress numbers of the snail (Drake, 1999; Killeen, 2003; Killeen & Moorkens, 2003; Willing, 2011). Thus at site 5, *C. paniculata* shaded by *Salix caprea* (Fig. 6) did not yield *V. moulinsiana*, but instead supported the superficially similar *Columella edentula*. This situation is one that occurs in other fens where shading develops - *C. edentula* is commonly found in shaded areas of fen that in un-shaded sectors support *V. moulinsiana* (Willing, 2011). It is believed that there has been a spread of carr and willow scrub at Rhos Goch since the 2007 survey. This probable spread may have reduced the amount of suitable *V. moulinsiana* habitat on the reserve and may, at least partially, explain its current fragmented distribution. Further encroachment of *Salix* and *Alnus* scrub into the open base-rich fen areas is considered to be a significant threat to the snail's limited distribution on the reserve. In response to discussions with the NNR Site Manager, it was decided to embark upon a short programme of willow and alder removal adjacent to and in *V. moulinsiana* fen at the site (Figs 12 & 13), and work was completed in late October 2015.

7. Recommendations

As there was not sufficient time to assess all areas of the NNR, survey work focussed on areas in and around the point of original discovery and areas judged to be potentially suitable in the view of NRW's Mid-Wales Ecologist (Dave Drewett) and Site Warden (Rhys Jenkins). Habitat towards the south-east and north-east of the site would be worth visiting to seek further pockets of the snail population. A more detailed assessment of vegetation in *V. moulinsiana* populated areas, preferably earlier in the year (when plant identification will be easier with more species in flower) should allow more accurate NVC classification. Finally, chemical testing of water in different fen areas might confirm if there are higher Ca²⁺ levels in *V. moulinsiana*-occupied areas. An assessment of bedrocks in and adjacent to the reserve might also reveal the source of any base-enrichment and assist in locating additional *V. moulinsiana* populations.

8. Acknowledgements

Natural Resources Wales is thanked for funding this project, which was planned and managed by Dr. Mike Howe. Mike is also thanked for his help in providing a 'key-point' survey map of site and for making valued comments that have improved the final report. Additionally I thank Rhys Jenkins, NRW site manager for Rhos Goch who provided site information, assisted on site during the second day of field work and acted immediately to effect management work to improve *V. moulinsiana* habitat. Dave Drewett, mid-Wales Ecologist for NRW, provided vegetation maps and advice on which parts of the site might be best to survey for further *V. moulinsiana* populations. Dave Boyce is thanked for sharing his experience of earlier work at Rhos Goch and for providing map data from his survey of the reserve in 2007. Finally thanks are due to Peter Spode who kindly provided parking facilities in Rhos Goch on the survey days and who shared his local knowledge of the site with me.

9. References

- Baker, R., Clarke, K. & Howlett, D. 2007. Desmoulin's Whorl Snail in the Norfolk Trinity Broads Complex: A review of a four year monitoring programme 2004 – 2007. The Wheatfen Partnership (The Ted Ellis Trust). Report for the Essex and Suffolk Water Company.
- Boyce, D.C. 2008. Monitoring Invertebrate Features on Sites of Special Scientific Interest: The Wetland Invertebrate Assemblage on Rhos Goch National Nature Reserve, Radnorshire. CCW Regional Report No. CCW/SEW/07/2.
- Bratton, J.H. 1991. British Red Data Books: 3. Invertebrates other than insects. Peterborough: JNCC.
- Cousins, M. 2015. Molluscs of the Midland Meres. *Mollusc World* **39**: 15 – 17.
- Drake, M. 1999. A review of the status, distribution and habitat requirements of *Vertigo moulinsiana* in England. *Journal of Conchology* **36**: 63 – 79.
- Kerney, M.P. 1999. Atlas of the Land and Freshwater Molluscs of Britain and Ireland. Colchester: Harley Books.
- Killeen, I.J. 2003. Ecology of Desmoulin's Whorl Snail. Conserving Natura 2000 River Ecology Series No. 6. English Nature, Peterborough.
- Killeen, I.J. & Moorkens, E.A. 2003. Monitoring Desmoulin's Whorl Snail, *Vertigo moulinsiana*. Conserving Natura 2000 Rivers Monitoring Series No. 6. English Nature, Peterborough.
- Seddon, M.B., Killeen, I.J. & Fowles, A.P. 2014. A Review of the Non-Marine Mollusca of Great Britain: Species Status No. 17. NRW Evidence Report No: **14**, 84pp, Natural Resources Wales, Bangor.
- Ward, P.A. 2012. Monitoring wetland invertebrates on Rhos Goch National Nature Reserve, Radnorshire. CCW Regional Report CCW/SEW/12/4. Countryside Council for Wales.
- Willing, 2011. Chingford Pond Restoration Project: A wetland and aquatic molluscan survey of Chingford Pond and upper areas of Burton Mill Pond (October 2010). An unpublished report to West Sussex County Council.

10. Appendices

10.1. Appendix 1: Survey results

Table 1: *Vertigo moulinsiana* counts from detailed sampling points.

Site number & Grid Ref	<i>Vertigo moulinsiana</i> (JUVENILE)	<i>Vertigo moulinsiana</i> (ADULT)	<i>Vertigo moulinsiana</i> (total)	<i>V. moulinsiana</i> /m ²	Other Mollusca in beat sample
Site 4 (SO1948248383) sample A	1	7	8	16	-
sample B	22	9	31	64	-
sample C	2	16	18	36	1 <i>Euconulus fulvus</i>
sample D	2	-	2	4	
Site 5 (SO1950848437)	-	-	-	-	8 <i>Columella edentula</i> In 6 trays (= 16 m ²)
Site 6 (SO1950148428)	2	5	7	14	2 <i>Columella edentula</i>
Site 9 (SO1948548401) sample A (<i>Carex paniculata</i> only)	36	41	77	154	1 <i>Vertigo antivertigo</i>
sample B (<i>Juncus acutiflorus</i> only)	25	4	29	58	-
Site 13 (SO1941048351)	7	56	63	126	3 <i>Succinea putris</i>
Site 15 (SO1941248423)	2	8	10	20	Frequent <i>Succinea putris</i>

Table 2: Results from bulk samples (removed from site and processed in the laboratory).

Terrestrial taxa	Sites				
	9	22	23	24	25
<i>Carychium minimum</i>	9	6	1		
<i>Succinea putris</i>		1			
<i>Vertigo moulinsiana</i>	1				
<i>Vertigo antivertigo</i>	3	16	18	3	
<i>Punctum pygmaeum</i>		9			
<i>Nesovitrea hammonis</i>		4			
<i>Zonitoides nitidus</i>	1	7	7	3	
<i>Euconulus fulvus</i>	1	5	9	12	
Aquatic taxa					
<i>Potamopyrgus antipodarum</i>					1
<i>Galba truncatula</i>	2				
<i>Lymnaea palustris</i> (agg)			1	1	
<i>Pisidium milium</i>	3				
<i>Pisidium subtruncatum</i>					occasional
<i>Pisidium obtusale</i>	6				abundant

10.2. Appendix 2: Site locations, brief habitat details, molluscan presence.

Table 3: Results from Site locations and habitat descriptions

Site	Grid Ref	Site wetness (1 – 5)	Shading	General vegetation/ dominant species	<i>V. moulinsiana</i> m ² or recorded	Other Mollusca	Figs
1	SO1933648161	4 - 5	Nil	<i>Juncus</i> spp; occasional <i>Salix caprea</i>	-	<i>Vertigo antivertigo</i>	-
2	SO1934148210	4	Nil	<i>Juncus</i> spp; occasional <i>Salix caprea</i> , <i>Typha latifolia</i> , <i>Carex paniculata</i> , <i>Menyanthes trifoliata</i>	-	-	-
3	SO1953948345	3	Nil (except in proximity to tree / shrub)	<i>Calluna vulgaris</i> , <i>Sphagnum</i> spp, other mosses, <i>Betula</i> sp	-	-	-
4	SO1948248383	3 - 5	Nil (some local)	'base-rich fen' inc <i>Carex paniculata</i> , <i>Juncus acutiflorus</i> , <u>Note</u> ; very sharp transition from <i>Calluna</i> dominated heath often over 1 – 2 m	4 locations: 16, 62, 36, 4	<i>Succinea putris</i>	Figs. 1, 2, 4, 5
5	SO1950848437	3 - 4	Partial to complete	<i>Carex paniculata</i> & <i>Carex</i> sp partly or fully shaded by <i>Salix</i> & <i>Alnus</i>	-	Numerous <i>Columella edentula</i>	Fig. 6
6	SO1950148428	3 - 4	Marginal in places to un-shaded	Very narrow band of relatively un-shaded habitat here between acidic <i>Calluna</i> / <i>Erica</i> dominated habitat & <i>Salix</i> shaded areas	14	Some <i>Columella edentula</i>	-

7	SO1950948470	3 - 4	Variable some from adjacent <i>Alnus</i> , <i>Betula</i> & from <i>Phragmites</i>	<i>Juncus</i> , spp, <i>Molinia</i> , <i>Phragmites</i> , <i>Alnus</i> , <i>Betula</i>	-	<i>Punctum pygmaeum</i> , <i>Columella edentula</i> , <i>Arianta arbustorum</i> , <i>Nesovitrea hammonis</i> .	-
8	SO1959848553	3 - 4	Partial	<i>Molinia</i> , <i>Betula</i> , <i>Alnus</i> , <i>Phragmites</i>	-	-	-
9	SO1948548401	4 - 5	Nil grading to partial	A narrow band (ca. 28 m) of 'V. moulinsiana habitat' sandwiched between <i>Calluna</i> and <i>Salix</i> / <i>Alnus</i> dominated habitats	154: (<i>Carex paniculata</i>); 58: (<i>Juncus acutiflorus</i>)	Bulk sample 1 - see Table 2	Fig. 7
10	SO1944248339	4 - 5	Nil	'base-rich fen' inc <i>Carex paniculata</i> , <i>Juncus acutiflorus</i> , <u>Note</u> : sharp transition to <i>Salix</i> shading to south	Occasional Vm beating (ca. < 10 m ⁻²)	<i>Succinea putris</i>	-
11	SO1937748303	4 - 5	Nil	As site 10	-	<i>Succinea putris</i>	-
12	SO1940648343	4 - 5	Nil	As site 10	-	<i>Succinea putris</i>	-
13	SO1941048351	3 - 5	Nil – slight lateral	As sites 11 / 12	126	<i>Succinea putris</i>	-
14	SO1941048372	3 - 5	Nil – slight lateral	As sites 11 / 12	Occasional Vm beating (ca. 50 – 60 m ⁻²)	<i>Succinea putris</i>	-
15	SO1941248423	4	Nil – slight lateral	<i>Carex paniculata</i> tussocks on margins of <i>Salix caprea</i> belt (on NNR / SSSI boundary)	20	<i>Succinea putris</i>	Fig. 8
16	SO1943148541	4	Nil – slight lateral	As site 15	-	<i>Succinea putris</i>	Fig. 9
17	SO1951548626	4 - 5	Nil	<i>Carex paniculata</i> tussocks lining following course of ditch draining down hillside (in horse grazed field)	-	<i>Succinea putris</i>	Fig. 10
18	SO1931548357	4 - 5	Nil	Much as site 17	-	<i>Succinea putris</i>	-
19	SO1931848230	4 - 5	Nil	<i>Carex paniculata</i> and surrounding <i>Juncus</i> spp & grading into area with much <i>Menyanthes trifoliata</i>	-	-	-
20	SO1935348211	3 - 4	Nil to slight lateral	<i>Carex paniculata</i> tussocks lying close to <i>Salix caprea</i>	-	-	-
21	SO1928948084	4 - 5	Nil	Open neutral fen dominated by <i>Carex</i> pp & <i>Juncus</i> spp; occasional <i>Carex paniculata</i>	-	-	-
22	SO1935148180	4 - 5	Nil	As site 21	-	Bulk sample 1 - see Table 2	-
23	SO1936348134	4 - 5	Nil	As site 21	-	Bulk sample 1 - see Table 2	Fig. 11
24	SO1933948091	4 - 5	Nil	As site 21	-	Bulk sample 1 - see Table 2	Fig. 11
25	SO1917847997	n/a	n/a	Small recently constructed pond	-	Bulk sample 1 - see Table 2	-

10.3. Appendix 3: Selected images of survey locations.



Figure 4: Typical *Vertigo moulinsiana* habitat at Site 4.



Figure 5: The sharp transition from *Calluna* dominated habitat to base-rich fen supporting *Vertigo moulinsiana* near Site 4.



Figure 6: Site 5 showing shading of *Carex paniculata* by grey willow creating unsuitable conditions for *V. moulinsiana*.



Figure 7: Habitat at Site 9 showing both *Carex paniculata* tussocks and lower lying fen with *Juncus acutiflorus* that may be more prone to surface flooding.



Figure 8: *Vertigo moulinsiana* habitat at Site 15 on the NNR / SSSI boundary



Figure 9: Seemingly suitable *Vertigo moulinsiana* habitat at site 16 but not supporting the snail.



Figure 10: Seemingly suitable *Vertigo moulinsiana* habitat at site 17 but not supporting the snail.



Figure 11: Two views of open neutral fen (Sites 23 & 24) that occupies much of the south-western areas of the Rhos Goch reserve not supporting *V. moulinsiana*.



Figure 12: Area of *Vertigo moulinsiana* habitat (near Site 4) before scrub clearance (photo: Rhys Jenkins).



Figure 13: Area of *Vertigo moulinsiana* habitat (near Site 4) after scrub clearance late October 2015 (photo: Rhys Jenkins).

10.4. Appendix 4: A summary of the vegetation at Rhos Goch NNR

Rhos Goch NNR is a 45ha wetland lying in the valley bottom of the upper Bach Howey at an altitude of approximately 250m and supporting a very diverse vegetation. The western half of the site has an area of lowland raised bog dominated by mixtures of ling *Calluna vulgaris*, hare's-tail cottongrass *Eriophorum vaginatum* and purple moor-grass *Molinia caerulea*. Small bog pools dominated by common cottongrass *Eriophorum angustifolium* and the bog-mosses *Sphagnum cuspidatum*

and *S.recurvum* are scattered across the raised mire, being particularly well-developed in the lagg zone at the western edge of the mire, where it grades into downy birch *Betula pubescens* woodland. East of here, there are extensive stands of transition mire vegetation dominated by mixtures of bottle sedge *Carex rostrata*, water horsetail *Equisetum fluviatile*, marsh cinquefoil *Potentilla palustris* and bogbean *Menyanthes trifoliata*. In the lagg zone around the eastern fringe of the raised mire, the acidic conditions result in a ground layer dominated by carpets of bog-mosses. There are also interesting stands of transition mire vegetation in the lagg zone around the northern and western fringes of the raised bog, with the latter area having some open stands of common reed *Phragmites australis*. However in these areas, the full range of types cannot be seen, as they occur as a narrow strip between the raised bog and stands of wet woodland.

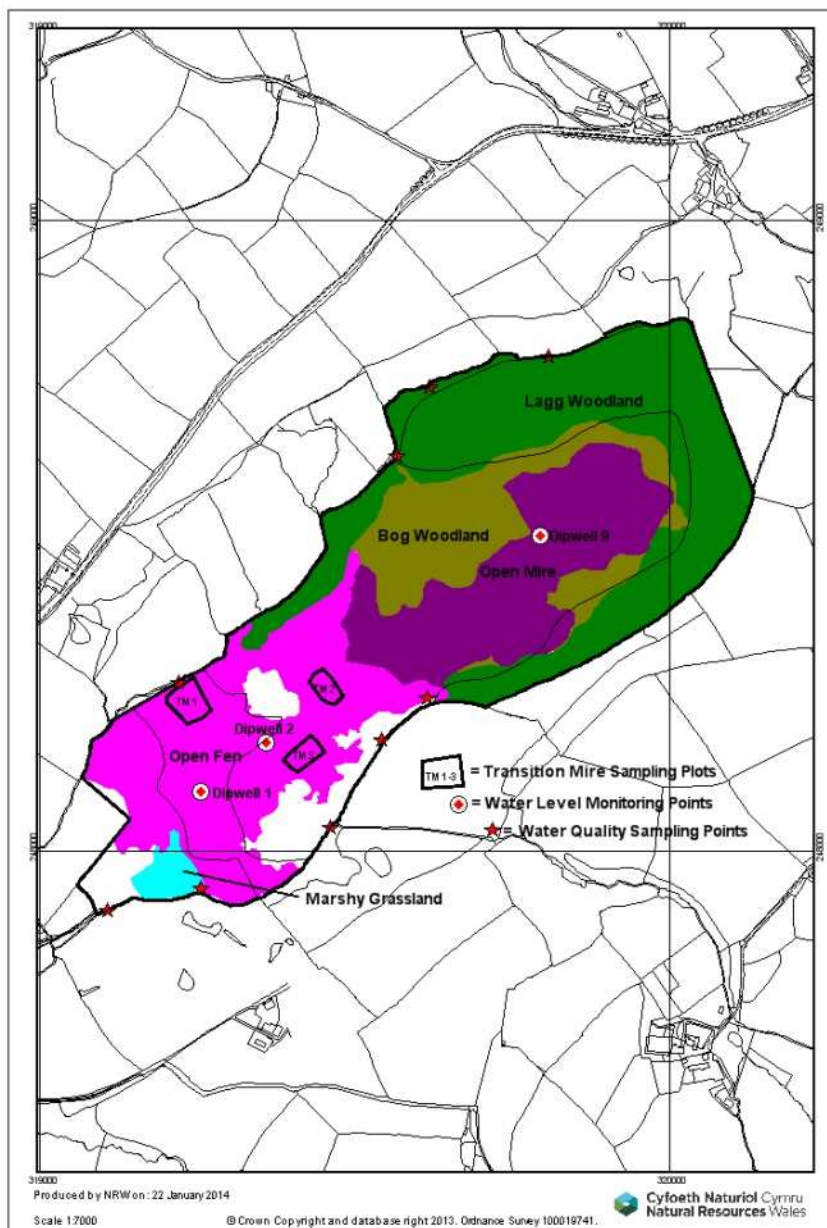


Figure 14: Simplified vegetation zones at Rhos Goch NNR.
(Map provided by Dave Drewitt, mid-Wales Ecologist, NRW)

10.5. 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 116504.



**Cyfoeth
Naturiol**
Cymru
**Natural
Resources**
Wales

Published by:
Natural Resources Wales
Maes-y-ffynnon
Penrhosgarnedd
Bangor
Gwynedd
LL57 2DW

0300 065 3000 (Mon-Fri, 8am - 6pm)

© Natural Resources Wales [2016]

All rights reserved. This document may be reproduced with prior permission of
Natural Resources Wales

Further copies of this report are available from:

Email: library@cyfoethnaturiolcymru.gov.uk