Improvement Programme for England's Natura 2000 Sites (IPENS) – Planning for the Future IPENS061c

SAC Status reporting on *Vertigo moulinsiana* in England: Monitoring at selected sites on the Hampshire / Wiltshire River Avon and tributary rivers Wylye and Bourne

River Avon Special Area of Conservation (SAC)

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Foreword

The **Improvement Programme for England's Natura 2000 sites (IPENS)**, supported by European Union LIFE+ funding, is a new strategic approach to managing England's Natura 2000 sites. It is enabling Natural England, the Environment Agency, and other key partners to plan what, how, where and when they will target their efforts on Natura 2000 sites and areas surrounding them.

As part of the IPENS programme, we are identifying gaps in our knowledge, and where possible, we are addressing these through a range of evidence projects. Results from these projects will feed into Theme Plans and Site Improvement Plans. This project forms one of these studies.

A survey of Desmoulin's whorled snail *Vertigo moulinsiana* was commissioned at nine sites on the River Avon, the River Wylye and the River Bourne, all of which fall within the River Avon Special Area of Conservation (SAC). Desmoulin's whorled snail is a notified feature of the SAC. The study aimed to inform our understanding not only of the current distribution, but also the overall threats to the population on a site by site basis, leading to an overall catchment assessment, of which this report forms the current basis.

The 2014 survey confirmed the presence of the snail at five sites. Two of these sites were judged to have favourable conservation status for the snail, but population declines were recorded at three other sites. The survey revealed the loss of the snail from three sites since they were last surveyed in 2010.

The report suggests the reasons for recent and confirmed population losses within the site as being due to (1) drier ground conditions and (2) the scouring of river-side fen by prolonged river flooding. Additionally habitat clearance during 2009 is possibly associated with habitat loss and deterioration at one site. Population declines were suggested to also be due to excessive grazing, poaching or the mechanical cutting of fen vegetation. It is estimated that there has been an approximately 86% decline in populations of the snail in the River Avon catchment over an approximately 14 year period.

Management options for the sites where population losses or declines were detected are discussed. These include reducing scrub from the site and maintaining an open fen habitat; monitoring and managing the intensity of grazing to ensure the site is not excessively grazed or poached; managing water levels to ensure they are maintained at an appropriate level; and in one area, obstructing drainage to the river from marginal swamp areas to create wetter ground conditions.

The key audience for this work is the staff within Natural England. The collation of all survey information in one place has greatly improved our understanding of the current population losses, and what remedies might be undertaken to resolve the issues around decline.

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Fig. 1: *Vertigo moulinsiana* habitat in river-marginal fen at Porton Meadows (River Bourne)

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CONTENTS:

1. SUMMARY

- This project is part of: *The Improvement Programme for England's Natura 2000 Sites (IPENS), supported by EU LIFE+, is a new strategic approach to managing England's Natura 2000 sites. It will enable Natural England, the Environment Agency, and other key partners to plan what, how, where and when they will target their efforts on Natura 2000 sites and areas surrounding them*.

- Nine former *V. moulinsiana* sites were surveyed, six on the River Avon, one on the River Wylye and two on the River Bourne. All sites lie adjacent to the River Avon System SSSI or additionally form separate SSSI units alongside it.

- The 2014 surveys confirmed the presence of the snail at five sites. Two of these (Porton Meadows & Jones's Mill) were judged to have Favourable Conservation Status for the snail, but population declines were recorded at three others (Sopley Island, Hurdcott and West Amesbury/Normanton) which were judged to have Unfavourable Conservation Status.

- The surveys revealed the loss of *V. moulinsiana* populations from three sites since last surveyed in 2010 (Bisterne, Breamore & North Woodford) and further confirmed the loss of the snail at Wishford Swamp.

- Reasons for recent and confirmed *V. moulinsiana* site losses are suggested as being due to (1) drier ground conditions (possibly also partially linked to some indirect shading) at Breamore, North Woodford and Wishford Swamp and (2) the scouring of river-side fen by prolonged river flooding at Bisterne. Additionally habitat clearance during a 2009 STREAM initiative is possibly associated with habitat loss and deterioration at Upper Woodford.

- *V. moulinsiana* declines were suggested as being due to drier ground conditions (Hurcott and Sopley Island) as well as excessive grazing, poaching or the mechanical cutting of fen vegetation (at West Amesbury / Normanton and Hurdcott).

- Options for site improvement are discussed at sites where *V. moulinsiana* losses or declines were detected.

- When the latest *V. moulinsiana* site losses are included, it is now estimated that there has been an approximately 86% decline in populations of the snail in the River Avon catchment over an approximately 14 year period.

- A log of *V. moulinsiana* site histories is given showing full details from the first year of the snail's discovery at each of the nine survey locations.

2. BACKGROUND

The Improvement Programme for England's Natura 2000 Sites (IPENS), supported by EU LIFE+, is a new strategic approach to managing England's Natura 2000 sites. It will enable Natural England, the Environment Agency, and other key partners to plan what, how, where and when they will target their efforts on Natura 2000 sites and areas surrounding them. See: www.naturalengland.org.uk/ipens2000.

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 and north Cornwall.

The conservation importance of the species has meant its inclusion in various schedules and red data lists. Thus it is categorised as Rare (category 3) in the UK Red Data Books (Bratton 1991). Whilst more recently the snail has been and classed as vulnerable on the recent IUCN based UK red list 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 an English Section 41 'Species of Principle Importance' (replacing the UK BAP priority species in 2006). Following the inclusion of *V. moulinsiana* as a Priority Species in 1995, many surveys have been undertaken (summary details of some of these appear in Drake, 1999).

V. moulinsiana is a qualifying feature (S1016) of the River Avon SAC[1]. Populations of the snail have been recorded from close to the head of the river near Pewsey, in Wiltshire downstream to Sopley, just north of Christchurch in Hampshire (Killeen 2007; Killeen & Willing 2002). Additionally the snail has also been recorded on most of the tributary rivers including the Bourne, Nadder, Wylye, Nine Mile River and Nutbush Stream (Killeen 1997a, 1997b, Willing 2000, Killeen & Willing 2002).

In 2010 a series of surveys were undertaken to revisit most previously recorded *V. moulinsiana* sites on the rivers Avon, Bourne, Wylye, Nadder, Till and Nutbush Stream (Willing 2011), whilst in 2011 a selection of sites mostly those where losses had been recorded in 2010 were revisited (Willing 2012).

This project revisits 9 former *V. moulinsiana* sites in the Hampshire and Wiltshire sectors of the Avon catchment, all of which were also surveyed in either 2010 and/or 2011. These surveys are intended to determine if earlier recorded losses are continuing at formerly occupied sites.

In the 2010 surveys a total 98 sites were revisited, but the snail was only recorded at 17, marking an 83% decline in site occupancy in about 10 years. The latest (2014) losses at a further three sites now suggests an approximately 86% decline of snail populations in the

[1] EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora 'Citation for Special Area of Conservation (SAC)' states for the River Avon on 1.4.2005, "There is an extensive population of Desmoulin's whorl snail *Vertigo moulinsiana* along the margins and associated wetlands of the Rivers Avon, Bourne and Wylye".

Avon catchment (assuming that no recovery or recolonization of former losses has occurred) over the last 14 years. This latest estimated loss may be an under-estimate as it assumes that *V. moulinsiana* remains at the other 14 previously recorded sites; in the light of these latest surveys, this seems unlikely.

3. METHODS

Surveys were completed over 5 days on 15th, 18th, 20th, 24th November and 11th December 2014. Survey days were selected to ensure the dry conditions needed to undertake sampling. Survey locations in the Avon catchment basis are displayed on Fig. 2 with individual sites given in Appendix 9.2

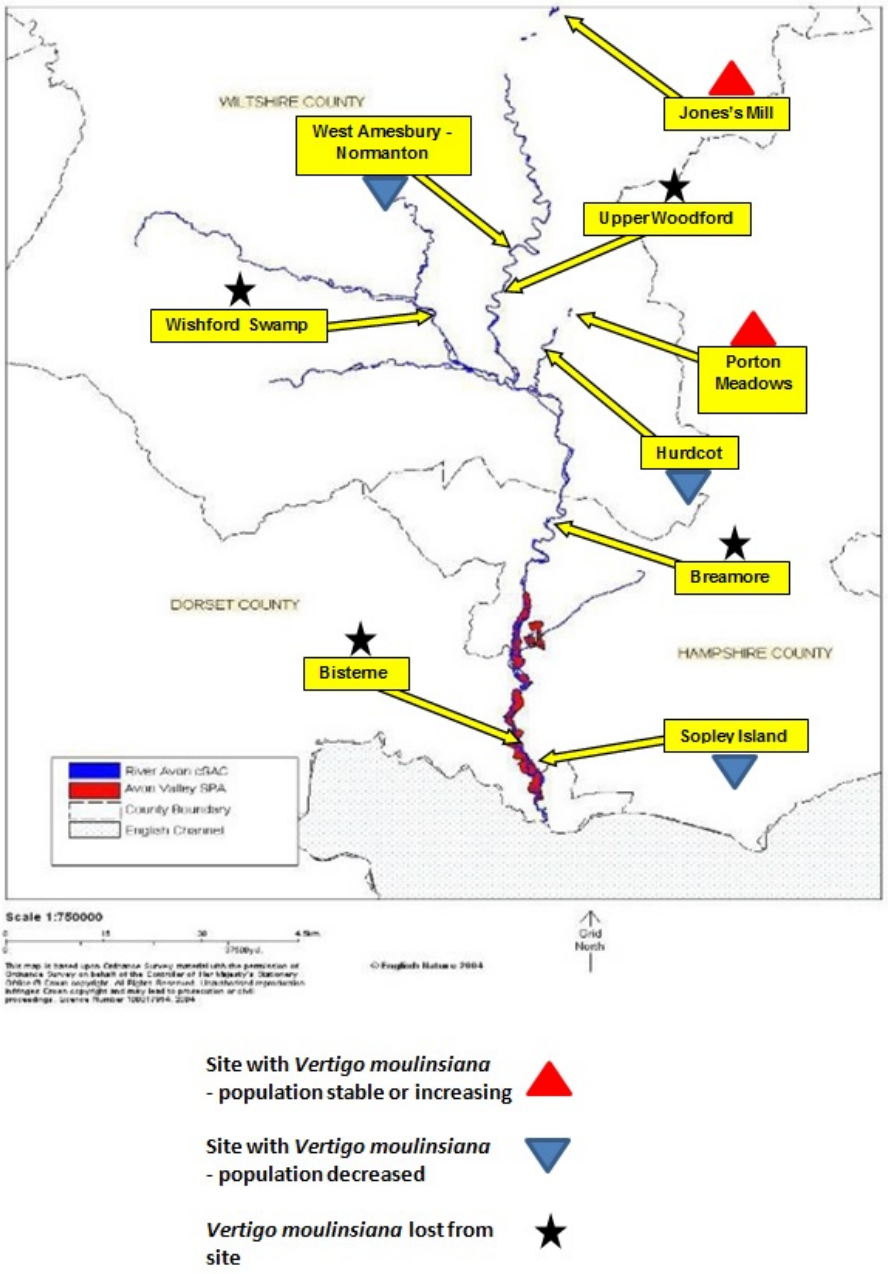

Fig. 2: Approximate survey locations displayed on River Avon catchment

Surveys focussed on locating and assessing populations of *Vertigo moulinsiana*. Survey methodology broadly followed 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.

1. Tray beating was undertaken in dry weather conditions. The use of a gridded white beating tray measuring approximately 25cm X 33cm was used to assess approximate *V. moulinsiana* numbers per unit area. (6 trays being approximately equivalent to 0.5 m^2). Several 6 sampling locations were taken at each main site (number and time spent surveying being assessed in the field). At most of these sampling locations, a total of six trays samples were taken (for each, beating beneath 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 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 be initially confirmed, sampling continued (at as many points on the site as reasonably practical) for at least an hour 1 hour (in most cases far more time was spent at a site). Survey stations were randomly located in fens, although preferentially sampling habitat that is judged to be most likely to produce *V. moulinsiana*. At sites where *V. moulinsiana* was not located by beating, small vegetation litter samples will also be sieved (using a 2mm and 0.5mm sieve nest) to try to locate non-climbing individuals that are sometimes present nearer to ground level.

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

3. 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.

4. Dominanat 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 '-').

5. 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)*.

6. Other potentially important site environmental and management details were recorded e.g. (i) grazing and/or ground poaching, (ii) recent cutting, (iii) human trampling, (iv)

pheasant release pens. Other mollusc species present were not be recorded (unless noteworthy rarities or other species of interest were discovered) as this usually provides little useful additional information.

7. 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.

8. GPS 12 fig references and digital images were recorded for each site and sub-site (and of any site features of importance to help relocate sub-sites for future monitoring).

4. RESULTS

Vertigo moulinsiana was not located at three former Avon sites where it was the present in 2010 (Bisterne, Breamore and Upper Woodford) and a previously reported absence was further confirmed at Wishford Swamp on the Wylye. The snail was reconfirmed living, but in reduced numbers, at Sopley Island (Avon) and Hurdcott (Bourne), but in seemingly 'good' numbers at Jones's Mill (Avon) and Porton Meadows (Bourne).

Vertigo moulinsiana survey results are displayed in Appendix 9.1 Tables 3 – 7 and site descriptions are given in Appendix 9.2.

5. DISCUSSION

Table 1 compares results of the 2010, 2011 and 2014 surveys and gives a summary of the conservation statuses of the surveyed sites.

Table 1: Summary comparison of Avon, Bourne & Wylye site results with 2010 and or 2011 survey data

Site:	Monitoring summary:	'Conservation Status' summary:
River Avon: Sopley Island **(Avon Valley SSSI unit 137)**	Detailed surveys of small area of fen where *V. moulinsiana* previously recorded in 2010 located only a single live adult. The fen vegetation had become rank and un-grazed/uncut with tall *Carex riparia* and an increased spread of *Phramites australis*. Ground moist conditions were relatively dry and so unfavourable water levels may be responsible for decline of the snail in the fen.	**Unfavourable** (*Vertigo moulinsiana* probably close to loss from site).
River Avon: Bisterne **(Avon Valley SSSI unit 139)**	The site was seemingly unchanged from when last surveyed in 2010. No *V. moulinsiana* recorded in marginal *Carex / Glyceria / Typha* fen where the snail was abundant in February 2010.	**Unfavourable** (*Vertigo moulinsiana* probably lost from site)
River Avon: Breamore	The site is only slightly changed from when last surveyed in 2010; vegetation tray-beating and visual searching for about 1.5 hours produced no living or dead *V. moulinsiana*.	**Unfavourable** (*Vertigo moulinsiana* lost from site)
River Avon: Upper Woodford **(River Avon System SSSI)**	The site is only slightly changed from when last surveyed in 2010. Prolonged field survey for about 2 hours along the length of the marginal fen hours produced no living or dead *V. moulinsiana*. See further discussion in Appendix 9.4.	**Unfavourable** *Vertigo moulinsiana* probably lost from the site.
River Avon: West Amesbury to north of Normanton **(River Avon System SSSI: Units 23 & 24 28)**	Unit 24: Very low numbers of *V. moulinsiana* recorded at one location only in a *Carex* filled field drain (the snail not recorded in this compartment in 2010); Unit 23: *V. moulinsiana* absent from one length of ditch (survey site 5.2, Fig. 14) where present in 'good numbers' in 2010; at two other locations *V. moulinsiana* still present where previously recorded, but in much lower numbers.	**Unfavourable** *Vertigo moulinsiana* not recorded from parts of site where present in 2010; lower numbers recorded elsewhere

River Avon: WWT Jones's Mill Reserve **(Jones's Mill SSSI)**	*V. moulinsiana* present in large numbers in three reserve compartments (E, F1, F2) at the eastern end of site. Central reserve sections had fen in recently cleared carr, but the snail was not recorded. Despite large blocks of seemingly ideal habitat at western end of reserve (compartments A1, A2, A3), *V. moulinsiana* was only recorded in low numbers close to where similarly low numbers were recorded in 2010.	**Favourable**
River Wylye: Wishford Swamp **(River Avon System SSSI: Unit 28)**	Extensive surveys throughout the fen and on river margins failed, as in 2010 and 2011, to find *V. moulinsiana.*	**Unfavourable** *Vertigo moulinsiana* confirmed lost from site.
River Bourne: Hurdcott **(River Avon System SSSI: Unit 36)**	To the west of the River Bourne *V. moulinsiana* was recorded absent from one ditch (site 8.1) and in very low numbers in marginal river fen on that side of the river (site 8.2) . To east of river much reduced numbers in the wider river-marginal fen border (sites 8.3, 8.4, 8.6 & 8.7).	**Unfavourable** *Vertigo moulinsiana* lost from one site and present in very low numbers in a narrow band of river-margin fen
River Bourne: **(River Avon System SSSI: Unit 2)**	*V. moulinsiana* was present in low numbers (at least comparable to 2010 survey) along narrow fen margin to river; larger numbers present in *Carex*-filled field drain.	**Favourable** *Vertigo moulinsiana* present in 'good numbers' in fen on immediate river margins and in fen-filled drainage ditch

It is difficult to identify the causes of *V. moulinsiana* declines or losses with certainty. This is because in most cases relatively long periods of time have elapsed between site-monitoring visits. In the case of most sites revisited on this project this is about 4.5 years. During this period the sites have experienced a series of potentially relevant natural events including extended flooding, long periods of drought, high summer and low winter temperatures. Additionally site management actions are unknown. Any single or combination of these factors might have had a negative effect on populations of the snail.

The chief causes of *V. moulinsiana* loss include:

- Low ground moisture levels often resulting from a lowered ground water levels sometimes accentuated by water uptake (and transitional loss) by *Phragmites* or the spread of woody species (e.g. *Salix* spp).

- Site shading due to a spread of woody species and / or tall reed growth.
- Site damage due to a variety of factors such as fen cutting, cattle poaching (as around cattle feed stations), excessive grazing and fen damage from vehicle tracks.
- Site flooding of river-marginal fens due to elevated river levels. This may both wash snails from fen vegetation of drown those remaining submerged for prolonged periods.

Table 2 summarises the possible reasons for *V. moulinsiana* declines or losses at the 2014 survey sites. It also makes suggestions as to how management actions might assist in the maintenance, recovery or enhancement of populations of the snail.

Table 2: Possible reasons for *Vertigo moulinsiana* loss or decline and suggested management options

Site	If *Vertigo moulinsiana* loss or decline detected possible reasons for:	Possible management actions:
Sopley Island (R. Avon)	Decline is possibly due to: • lack of site management causing an increase of *Phragmites* (Fig 3) leading to increased ground drying. Several other adjacent areas of *Carex / Glyceria maxima* river-marginal fen lying about 30 – 50 m downstream (Fig 4) appeared ideal for the snail, but surveys were negative; • prolonged river flooding between December 2013 –February 2014 (an alternative or additional cause of decline) that may have 'scoured' river side fen sweeping away climbing *V. moulinsiana.*	Initiate some cutting of *Phragmites* to reduce site shading and drying.
Bisterne (R. Avon)	Site not noticeably different from when surveyed in 2010. The prolonged river flooding, which would have inundated this area, between December 2013 – February 2014 would have 'scoured' this river side fen, washing away climbing *V. moulinsiana* and possibly drowning those that remained.	Maintain site as open fen and monitor periodically for natural recolonization.
Breamore (north) (R. Avon)	Likely causes of loss are a combination of: • increased site shading due to the spread of marginal *Salix* scrub (the area of open fen has decreased since 2010); • drier ground conditions (although ground conditions were wet when surveyed the frequency of nettles in the open fen suggests drier ground conditions throughout the year).	This small site might be open by some *Salix* clearance, but if the snail has been lost then recolonization seems unlikely as there do not appear to be corridors to other *V. moulinsiana* habitat and the site is also set too far back from the river Avon for recolonization via that route. Efforts to improve other sites might be a better use of resources if funding is restricted.

Upper Woodford (R. Avon)	Very low numbers of *V. moulinsiana* were recorded in the 2006 and only one small cluster in 2010 surveys suggesting long term site deterioration. The loss of *V. moulinsiana* from this site appears to be due to a combination of: • damage or removal of bank-side fen vegetation (resulting from extensive STREAM initiative work in 2009 – discussed in Appendix 9.4) and • site drying (Relatively dry ground conditions were observed when the site was surveyed. The increased presence of nettles in many locations suggests drier ground conditions throughout the year). The recently re-engineered banks may have also contributed to drier ground moisture levels by raising bank levels and so reducing the occasional over-flow of water from the river into marginal fen areas.	Site conditions might be improved by: • some cut back of marginal *Salix* (which both shaded the ground and dries it) and; • obstructing drainage to the river from marginal swamp areas to create wetter ground conditions (so improving the area for possible *V. moulinsiana* re-colonisation).
West Amesbury – Normanton (R. Avon)	Local population declines and losses of *V. moulinsiana* may be due to: • heavy grazing pressure leading to with ditch-edge poaching damaging marginal fen. • Drier ground conditions in parts of SSSI unit 23 may also have lowered water levels on the site.	Limited temporary electro-fencing of ditch margin fen and wet fen-hollows during periods of heavy stock usage, might help retain better *Carex / Glyceria* conditions for the snail.
Jones's Mill (R. Avon)	Comparison with past survey data does not suggest any *V. moulinsiana* decline on this reserve. This appears to be the first systematic 'whole area' survey for the snail. The open fen in the eastern compartments of the site (E, F1, F2) supports 'good' numbers of *V. moulinsiana.* The central compartment areas (B1, B2, B3) include shaded wet woodland, but also open areas of fen, some of which have developed where tree cover has been removed or thinned. *V. moulinsiana* was not found in these areas although they may be potentially suitable for colonisation by the snail.	(1) The intensity of grazing in the eastern compartments needs careful monitoring to ensure that the site is not excessively grazed / poached. (2) Habitat conditions in the western compartments seem to be ideal for *V. moulinsiana* despite very low numbers of the snail.

	Very low numbers of *V. moulinsiana* recorded in the fen of the western compartments (A1, A2, A3) do not seem to be due to habitat conditions. Is the water feeding this area of low calcium ion content?	
Wishford Swamp (R. Wylye)	Dry ground conditions were observed over much of fen, the frequent presence of nettles suggesting low water levels. The previous two surveys (2010, 2011) also noted unfavourable ground moisture levels which are probably the cause of *V. moulinsiana* loss from the site.	The possible damming of the side ditch draining into the Wylye at the upstream end of the site, might locally raise ground water levels sufficiently to make the site more suitable to snail recolonization.
Hurdcott (R. Bourne)	Population declines and losses of *V. moulinsiana* may be due to: • Drier ground conditions in parts of the site and • A reduction of tall fen vegetation due to recent close-cutting across the site extending close to the river margins. The loss from the western ditch (site 8.1) appears to be due to site drying as shown by presence of nettles. Declines on the river margins (most marked on western margins) may be due to fall in the river levels or a general fall in the water table. Most of the fen (SSSI on eastern side) had recently been close-cut up to the river margins and this habitat reduction may also have contributed to lowered snail numbers.	Possibly maintaining higher water levels in this stretch of the R. Bourne (there is a sluice gate in river immediately down-stream of the site which might allow level management) raise ground water levels in river-side fen. Future mechanical cutting of the site should leave a wider margin of un-cut fen on the river margins.
Porton Meadows (R. Bourne)	The site seems to have had 'good' populations of *V. moulinsiana* since at least 1996 and so conditions seem broadly favourable for continued presence of the snail.	The river side fen and that in the central field drain were locally rather heavily grazed; perhaps some limited, temporary electro-fencing during periods of heavy stock usage might help retain better *Carex / Glyceria* conditions.

6. FURTHER WORK

Determination of the precise cause of *Vertigo moulinsiana* site losses and declines has not been possible to determine with certainty because of the infrequency and irregularity of site monitoring of Avon catchment SAC and SSSI sites. It is suggested that a selection of still extant sites be monitored on a more regular basis to try to determine the causes of losses or population changes with greater precision.

With so many *V. moulinsiana* losses recorded in the SAC, it may also be worth surveying those Avon catchment sites that were supporting populations of the snail in 2010, but have not been assessed since. This may locate remaining populations of the snail allowing conservation measures to be considered. There are some Avon catchment sites that have not been re-surveyed since surveys in 1996 or 2001

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9. APPENDICES

9.1 Appendix 1: Survey results (only sites with *V. moulinsiana* present are shown)

Table 3: River Avon: Sopley Island
(site counts are aggregates of *V. moulinsiana* from 6 standard trays)

Sampling location:	**1**
Juvenile	0
Adult	1
Total *V. moulinsiana*	1
Approx. *V. moulinsiana* m^{-2}	n/a as single individual resulted from about 40 minutes tray beating over many **m^{-2}** throughout this fen

Table 4: River Avon: West Amesbury to north of Normanton
(site counts are aggregates of *V. moulinsiana* from 6 standard trays

Sampling location:	**5.1**	**5.3**	**5.4**
Juvenile	3	7	16
Adult	5	8	5
Total *V. moulinsiana*	8	15	21
Approx. *V. moulinsiana* m^{-2}	16	30	42

Table 5: River Avon: Jones's Mill
(site counts are aggregates of *V. moulinsiana* from 6 standard trays)

Sampling location (WWT site compartments):	**1 (Unit F1)**	**2 (Unit F2)**	**3 (Unit E)**	**4 (Unit A1)**
***Juvenile**	18	60	60	1
***Adult**	96	318	54	5
Total *V. moulinsiana	114	378	114	6
Approx. *V. moulinsiana* m^{-2}	228	756	228	12

Table 6: River Bourne: Hurdcott
(site counts are aggregates of *V. moulinsiana* from 6 standard trays)

Sampling location:	**1**	**2**	**3**	**4**	**6**	**7**
Juvenile	0	0	6	26	0	1
Adult	0	1	1	7	1	2
Total *V. moulinsiana*	0	1	7	33	1	3
Approx. *V. moulinsiana* m^{-2}	0	2	14	66	2	6

Table 7: River Bourne: Porton Meadows

(site counts are aggregates of *V. moulinsiana* from 6 standard trays)

Sampling location (WWT site compartments):	**1 (river margin fen) downstream**	**2 (field ditch: lower section)**	**3 (field ditch: middle section)**	**4 (river margin fen) downstream**
Juvenile	1	3	74	23
Adult	10	18	29	3
Total *V. moulinsiana*	11	21	103	26
Approx. *V. moulinsiana* m^{-2}	22	42	206	52

9.2 Appendix 2: Site locations and brief descriptions

9.2.1 RIVER AVON SITE COMPLEX 1: SOPLEY ISLAND (SURVEY 20.11.2014)

Fig. 3: Site location of Sopley Island

General site description: A small area of now uncut /ungrazed *Carex riparia* and *Phragmites australis* dominated fen lying immediately adjacent to river margins. Ground moisture levels appeared drier than when the site was surveyed in 2010. Site vegetation is now un-managed (in 2010 appeared cut and/or grazed) with an increase in *Phragmites australis* and occasional nettles the ground conditions seem drier.

Two additional river marginal fens lying about 40 – 50 m downstream of the monitoring site and appearing ideal for *V. moulinsiana* (Fig 4) were surveyed but the species was not recorded.

Extent of habitat: Previously *V. moulinsiana* occupied fen was surveyed over approximately 10 m x 35 m.

Management: The site is now ungrazed / unmown.

Table 3: Avon Site 1: Site details – Sopley

Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
1.1 Open fen	SZ 15090 96840 (centre fen) SZ 15116 96840 (fen margins)	3 (in *Carex*); 2 (in *Phragmites*)	Nil (except due to increased growth of *Phragmites*)	Fen dominated by *Phragmites australis* with occasional areas of *Carex* spp (*C. riparia, C. paniculata*) and also *Urtica dioica*	< 1

1.2 Fen downstream of monitoring site	Surveyed at two locations SZ 15009 96521 & SZ 15025 96450	3 (grading into 4 at river margins)	nil	Fen lying on margins of a river channel dominated by *Glyceria maxima* with *Carex riparia*	0

Fig. 4: Sopley – central area of fen

Fig. 5: Sopley – river-side fen downstream of survey site (apparently ideal for *V. moulinsiana* but not supporting the snail)

9.2.2 RIVER AVON SITE 2: BISTERNE (SURVEY 20.11.2014)

Fig. 6: Bisterne - site location

General site description: A small area of fen lying on outer margins of *Salix caprea* border Ground moisture levels similar to than when site was surveyed in 2010.

Extent of habitat: Previously *V. moulinsiana* occupied fen was surveyed over approximately 25 m X 10 m.

Management: The fen is un-managed (as largely inaccessible lying on outer edge of *Salix* swamp.

Table 4: Avon Site 2: Site details – Bisterne (Survey 20.11.2014)

Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
2.1	SU 13828 00487	4 - 5	Nil (in all sampled areas except some lateral shading by *Salix* at extreme margins of site)	*Typha latifolia, Glyceria maxima, Carex* spp, *Phragmites australis*	0

Fig. 7: Site at Bisterne

9.2.3 RIVER AVON SITE 3: BREAMORE (SURVEY 18.11.2014)

Fig. 8: Site location of Breamore

General site description: A small areas of fen bordered by *Salix caprea* with some invasion of alder and sallow. Ground moisture levels appeared drier than when site was surveyed in 2009.

Extent of habitat: Fen lying in small patches between *Salix* scrub and woodland and field fence. Two moderately open areas 15 m X 10m and 20 m X 25 m

Management: Not managed.

Table 5: Avon Site 3: Site details – Breamore

Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
Sampling undertaken across area	Surveyed between **SU 16390 18512** to approx. **SU 16358 18474**	3 (4 in a few hollows) on river margins; elsewhere in fen mostly 2	Nil in a few spots, but much of fen subject to lateral shading from willows and ash	*Carex riparia, Epilobium* sp, *Urtica dioica*, *Phalaris arundinacea*	0

Fig. 9: Breamore: note encroachment of marginal shading *Salix*

Fig. 10: Breamore: nettles in fen demonstrating increasingly dry ground conditions

9.2.4 RIVER AVON SITE 4: UPPER WOODFORD (SURVEY 15.11.2014)

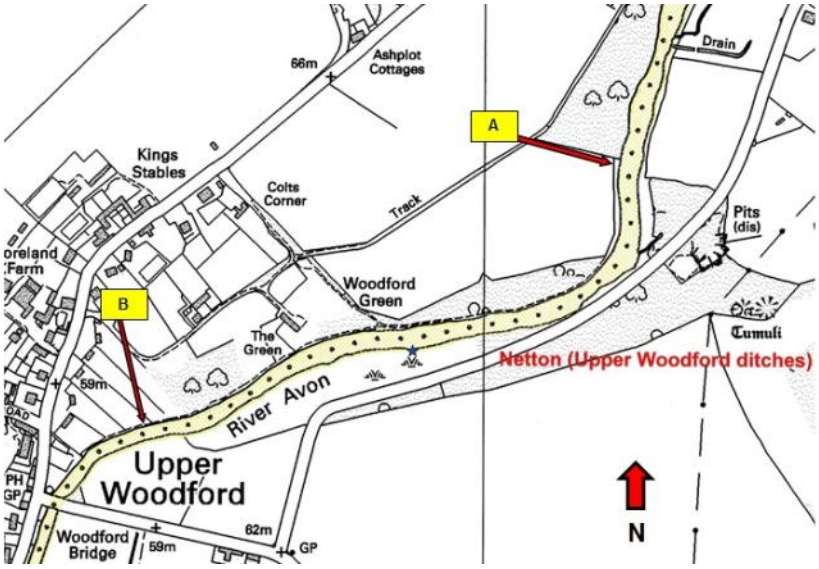


Fig. 11: Site location – Upper Woodford

General site description: Narrow margins of fen lying on river margins on west (right) bank of river.

Extent of habitat: Narrow margins (10 – 15 m) of fen bordering both banks of river running in a broken sequence downstream surveyed over approximately 350 m (between points A and B on Fig. 11).

Management: Not grazed, but path track cleared; some recent work on river bank reinforcement.

Table 6: Avon Site 4: Site details – Upper Woodford

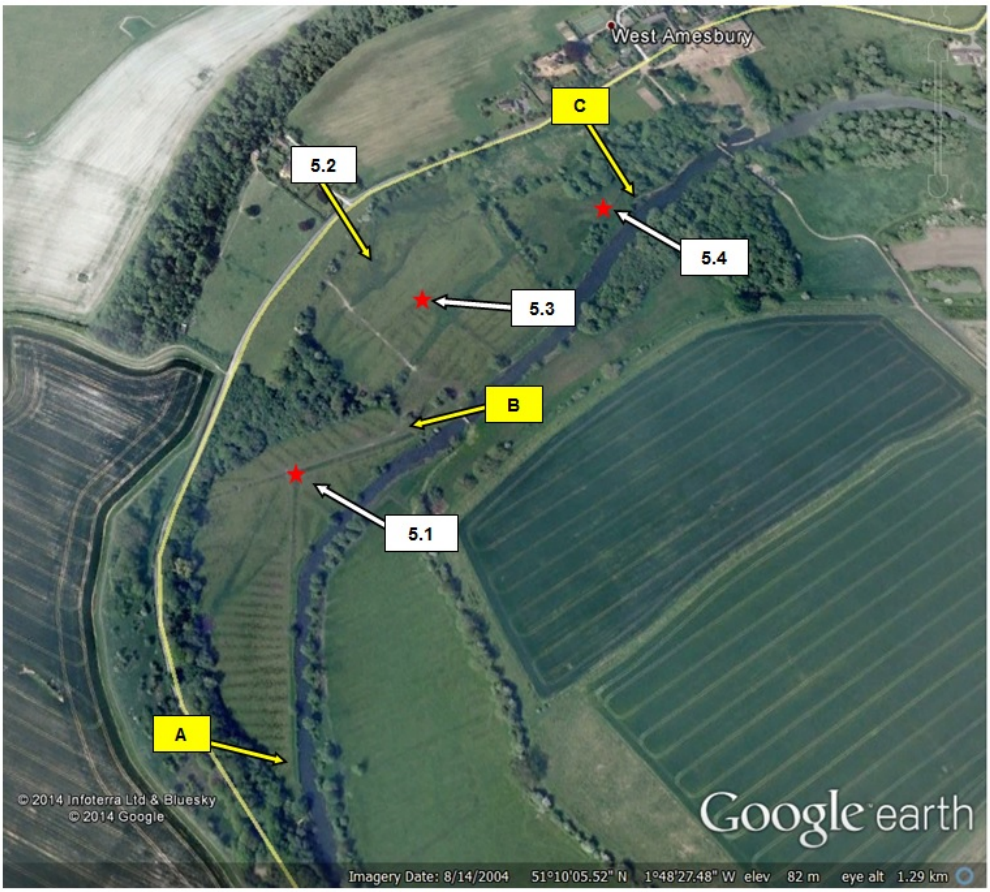
Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
4.1	Upstream at SU 13172 37576 – downstream to about 40 m below SU 12874 375 63	Mostly 2 in surveyed fen (wetter on immediate river margin)	Nil except for some slight indirect *Salix* shading (morning & evening shadow) at extreme western fen margins	Chiefly in surveyed areas fen lying between *Salix* scrub and river comprising *Carex riparia with* some *Phalaris arundinacea, Iris pseudacorus, Eupatorium cannabinum, Solanum dulcamara,* and increasing presence of *Urtica dioica* (since previous survey)	0

Fig. 12: Habitat on banks of Avon at Upper Woodford near 'point A' on Fig. 11

Fig. 13: Reinforced river banks at Upper Woodford (work undertaken in 2009)

Fig. 14: Invasive nettles in dry fen at Upper Woodford

9.2.5 RIVER AVON SITE 5: WEST AMESBURY TO NORTH OF NORMANTON (SURVEY 15.11.2014)



★ = *Vertigo moulinsiana* locations

Fig. 15: West Amesbury to north of Normanton survey locations

General site description: Two SSSI survey blocks were surveyed; the southern SSSI unit 24 (SU 13714 40634 – SU 13851 40992) and northern Unit 23 stretching for about 1 km and lying west of the River Avon. Unit 24 consists of cattle grazed formed water meadows. One central *Carex*-fillled ditch runs in the middle of unit

Extent of habitat: *Vertigo moulinsiana* habitat at:

a. location 5.1 (in SSSI Unit 24) about 6 m X 3 m;
b. location 5.3 (SSSI Unit 23) hollow approximately 16 m X 16 m;
c. location 5.4 (SSSI Unit 23) approximately 30 m X 10 m.

Management:

Table 7: Avon Site 5: Site details – West Amesbury to north of Normanton

Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
5.1	SU 13709 40907	4 – 5	nil	Lightly grazed *Carex* spp filled drainage channel.	16 (snails only found in at one location in long, seemingly suitable ditch
5.2	Ditches running between SU 13780 41160 (west to SU 13763 41085 (south) & SU 13835 41177 (north)	3 – 4	nil	*Juncus* and *Carex* ditch margins with some *Glyceria* maxima on ditch edges: much poached and grazed down	0 (frequent in this ditch system in 2010)
5.3	SU 13847 94410	3 – 4	nil	*Carex* spp with some *Juncus* on margins	30
5.4	SU 14004 41211	3 – 4	nil	Poached and grazed *Carex* merging into *Glyceria maxima*	42

Fig. 16: West Amesbury / Normanton: survey location 5.1

Fig. 17: West Amesbury / Normanton: survey location 5.2

Fig. 18: West Amesbury / Normanton: survey location 5.3

Fig. 19: West Amesbury / Normanton: survey location 5.4

9.2.6 RIVER AVON SITE 6: JONES'S MILL (SURVEY 24.11.2014)

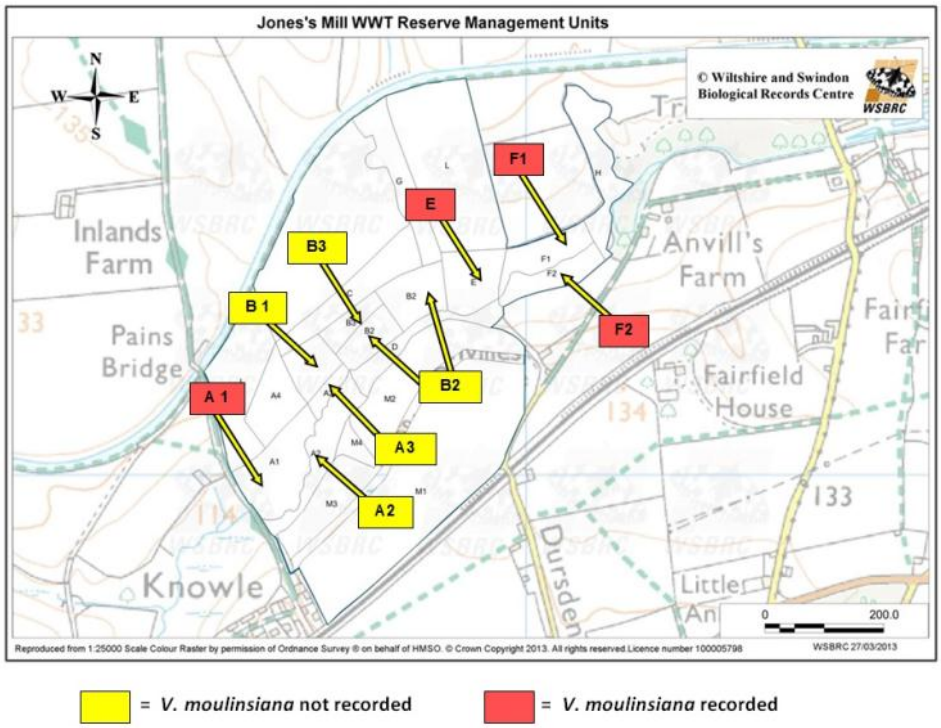


Fig. 20: Jones's Mill (Wiltshire Wildlife Trust Reserve): reserve compartments surveyed

General site description: Jones's Mill Reserve lies in a band either side of the upper River Avon, upstream of Pewsey. In this survey only those reserve habitat compartments described as 'fen, marsh and swamp' were visited. At the eastern end of the reserve lie areas of open grazed fen (compartments E, F1, F2). In the centre are areas (B2, B3) of alder and willow carr which in places have been opened to allow unshaded fen to develop. The western sectors (A1, A2 & A3) consist of un-grazed or low grazed fen, with numerous drainage channels leading down to the River Avon and filled with fen vegetation (e.g. *Carex* spp, *Glyceria maxima*). Ground moisture conditions (typically 3 / 4 when surveyed) and open monocotyledonous fen fed with presumed calcareous waters would seem to provide ideal conditions for *Vertigo moulinsiana*.

Extent of habitat: *Vertigo moulinsiana* habitat at:

a. location 1 (in F1) : Random beating over compartment F1 showed *V. moulinsiana* present over much of the area, but mainly restricted to the wetter fen in a series of parallel drainage channels draining into the Avon.
b. location 2 (in F2) : Much as 6.1: Random beating over compartment F2 showed *V. moulinsiana* present over much of the area but mainly restricted to the wetter fen in a series of parallel drainage channels draining into the Avon.
c. location 3 (in E): Random beating of the southern sector (south of planketed walk-way) of compartment E showed *V. moulinsiana* to be present in hollows and channels where wetter fen present
d. Location 4 (in A1): Beating down through compartment A1 only located *V. moulinsiana* in low numbers in one small area extending over several m^2.

Management: Compartments F1 and F2: moderately heavily cattle-grazed; E: lightly cattle-grazed; A1: un-grazed rank fen at time of survey.

Table 8: Avon Site 6: *Vertigo moulinsiana* site details – Jones's Mill

Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
1 (Comp. F1)	SU 17070 61426 (@ sample point)	3 - 4	nil	*Carex* cf *acutiformis*	228
2 (Comp. F2)	SU 17037 61346 (@ sample point)	3 - 4	nil	*Carex* cf *acutiformis*	756
3 (areas of open fen in compartments B1, B2, B3)	n/a	Variable but where sampled ranging between 2 - 4	nil where surveyed	Variable	0
4 (Comp. E)	SU 16933 61327 (@ sample point)	3 - 4	nil	*Carex* spp & *Juncus* fen	228
5 (Comp. A1)	SU 16589 60970 (@ sample point)	3 - 4	nil	Rank *Carex* spp fen with some invasive young *Alnus glutinosa*	12
6 (compartment A2)	Beat surveys between SU 16685 61134 (east) to SU 16649 61016 (west)	3 – 4 where surveyed	nil	Rank *Carex* spp; seemingly suitable habitat present in series of parallel drainage channel running down to River Avon	0

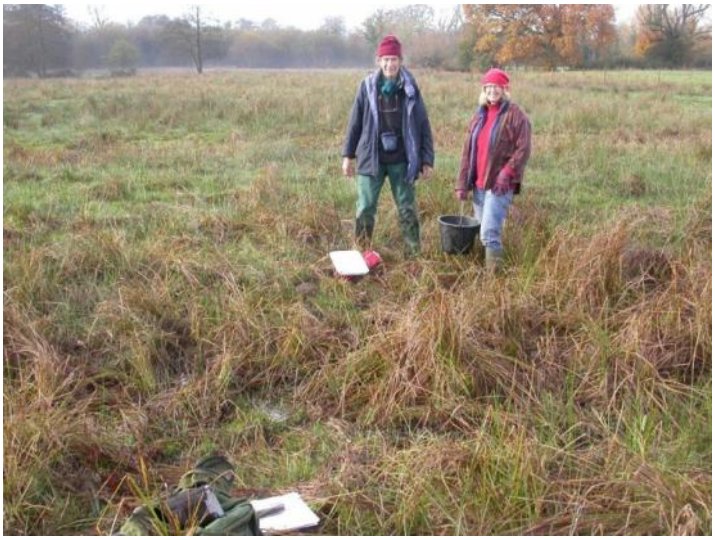


Fig. 21: – Jones's Mill location 1 (compartment F1)

Fig. 22: – Jones's Mill location 2 (compartment F2)

Fig. 23: – Jones's Mill location 4 (compartment E)

Fig. 24: – Jones's Mill location 5 (compartment A1)

9.2.7 RIVER WYLYE SITE: WISHFORD SWAMP (SURVEY 15.11.2014 & 11.12.2014)

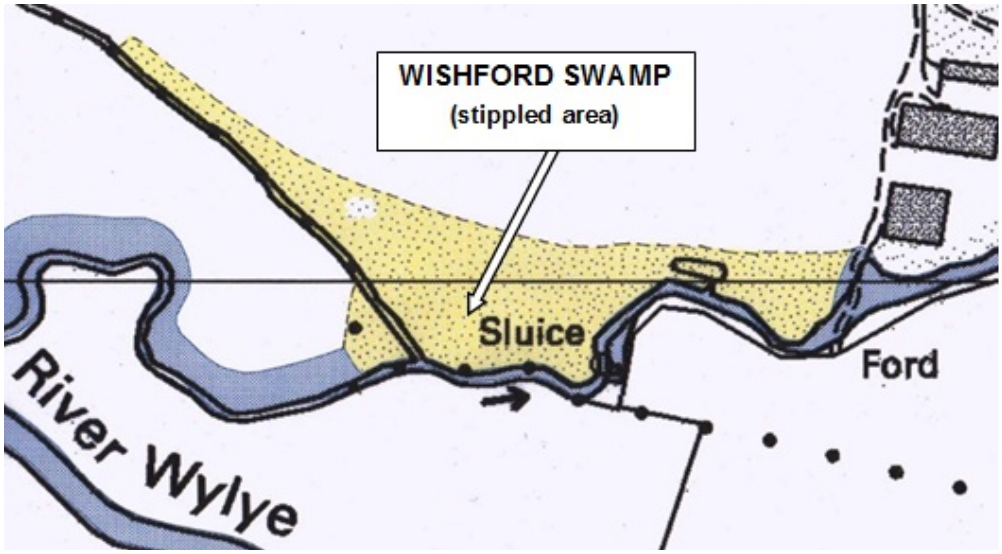


Fig. 25 : Wishford Swamp – location of survey area

General site description: A large area of mostly open fen on a broad river flood-plain and fen immediately on the river margins plus a tongue of fen lying either side of a channel leading into a branch of the River Wylye.

Extent of habitat: Extent of habitat about 150m+ with a width of up to 40m

Management: The area is ungrazed and mostly unmanaged, except for a small area set back from the river where pheasant / partridge feeders were situated.

Table 9: Wylye Site: Site details – Wishford Swamp

Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
Whole fen	Fen sampled intermittently between SU 07255 36093 (upstream point) & SU 07601 36029 (downstream / southern)	1 – 2 in most of survey area, even up to river margins except at extreme southern end of site where *Glyceria maxima* borders the river with ground moisture of 3	Nil over most of site	Overall a mosaic of open fen. Nearer to the river and infilling the inflow channel is a predominance of *Phragmites australis.* The river margins have *Carex riparia* whilst at the downstream end of the site a bed of *Carex riparia* / *Glyceria maxima* lines the river margins. In from the river margins the *Phragmites australis* thins to be replaced with a mix of *Urtica dioica, Symphytum officinale, Cirsium* spp. Nettles *Urtica dioica* have increased over much of the swamp since the surveys of 2010 & 2011 indicating drier ground conditions.	0

Fig. 26: Wishford Swamp – fen on river margins – note increased presence of nettles

Fig. 27: Wishford Swamp – central fen

Fig. 28: Wishford Swamp – *Carex riparia* / *Glyceria maxima* fen at lower end of site potentially suitable for *V. moulinsiana*

9.2.8 RIVER BOURNE SITE COMPLEX: HURDCOTT (SURVEY 18.11.2014)

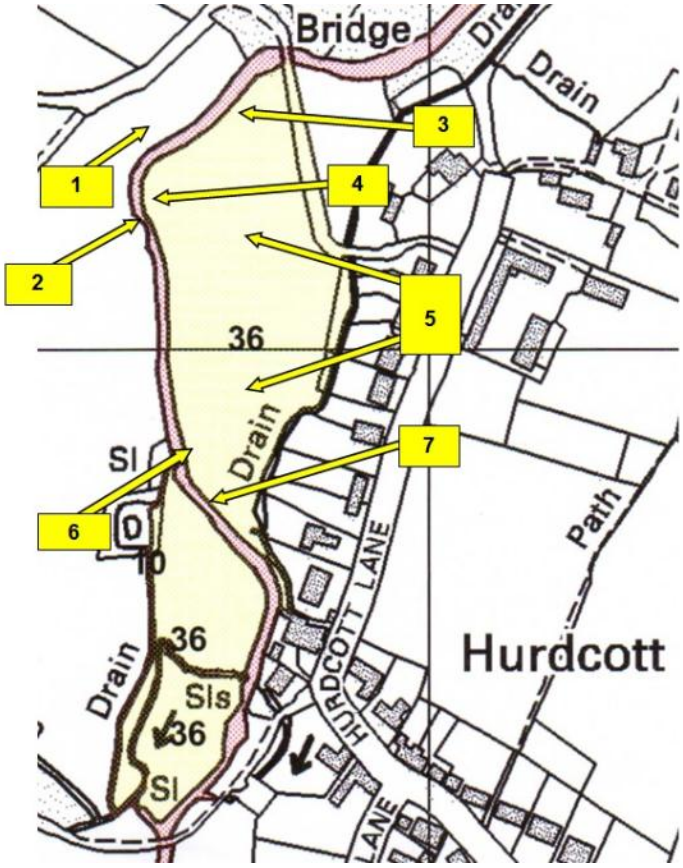


Fig. 29: Hurdcott – sampling locations

General site description: A large area of fen meadow mostly lying to the east of the River Bourne and fen lying on river margins. At the north-west of site (on western side of river and just outside SSSI boundary) a fen-filled ditch runs parallel to river.

Extent of habitat: The main study area lies to the east of the river extending to a boundary marked by houses on the western fringes of Hurdcott. This block of land (to the east of the Bourne) is approximately 250m X 125m (N-S; E-W respectively). The *Vertigo moulisiana* habitat now lies entirely in a narrow 2 – 3 m strip lying immediately on the river margins on the east side of the river.

Management: The large fen-meadow is moderately heavily cattle grazed; when surveyed in November 2014 all except the very edge of the river margins had been mown . The river margins to the east of the Bourne are unfenced, but are fenced and un-grazed to west of river.

Table 10: Bourne Site: Site details – Hurdcott

Sampling location	Grid. Ref	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
1	SU 16866 34130	3	nil	*Carex* spp, *Iris pseudacorus*, *Oeanthe crocota, Uritica dioica*	0
2	SU 16855 34036 (Sampled between: SU 16904 34159 – SU 16862 33951)	2 (3 on extreme river margins)	nil	Variable proportions *Carex* spp and *Phalaris*	< 2
3	SU 16883 34116	3 (in narrow 2 m width near river)	nil	*Phalaris aruninacea, Carex* spp, *Glyceria maxima*, *Epilobium* sp (only narrow uncut strip remaining)	14
4	SU 16861 34079	3	nil	*Carex* spp, *Glyceria maxima* (a wider uncut strip)	66
5	SU 16935 34018	2 – 3 (in few hollows)	nil	*Carex* spp & *Juncus* spp but mostly mown	0
6	SU 16869 34002	2 – 4 (a steep gradient toward river)	nil	*Carex* spp , *Phalaris aruninacea,*	2
7	SU 16882 33955	2 - 3	nil	*Carex* spp , *Phalaris aruninacea,*	6

Fig. 30: Hurdcott – sampling location 1

Fig. 31: Hurdcott – sampling location 2

Fig. 32: Hurdcott – sampling location 3

Fig. 33: Hurdcott – sampling location 4

Fig. 34: Hurdcott – mechanical fen cutting at Hurdcott extending across the eastern SSSI area and reducing the amount of river-side fen, leading to a reduction of *V. moulinsiana* marginal fen habitat at the site

Fig. 35: Hurdcott – showing uncut flood meadow with rank fen vegetation extending to the river margins in 2011 – *note differences with 2014 management in Fig. 34)*

Fig. 36: Hurdcott – sampling location 6

Fig. 37: Hurdcott – sampling location 7

9.2.9 RIVER BOURNE SITE: PORTON MEADOWS (SURVEY 18.11.2014)

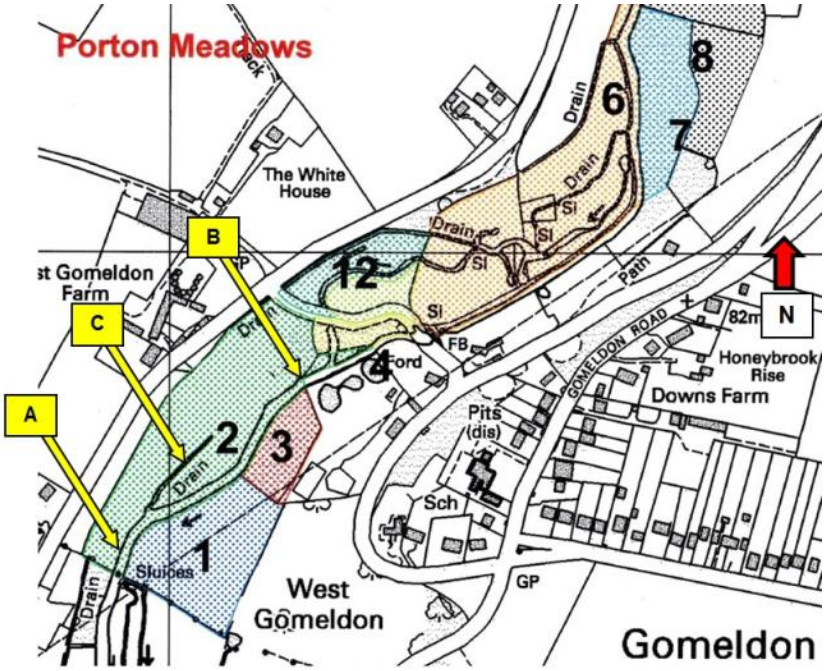


Fig. 38: Porton Meadows – displaying markers used to explain extent of *V. moulinsiana* habitat sampling (within SSSI Unit 2)

General site description: An area of unimproved cattle-grazed meadow, lying to the west of the River Bourne. Patches of *Carex*-dominated fen lie on the river margins as well as in a ditch running parallel to the river and draining into it towards the south of the site.

Extent of habitat: *Vertigo moulinsiana* habitat exists in two areas:

- in a narrow, broken band of *Carex* fen running along the river margins between points A and B on Fig. 38 (approx. SU 17982 35755 downstream and SU 18095 35855 upstream) and
- in a *Carex*-filled field-drain marked point C on Fig. 38 (central location SU 18017 35797).

Management: The fen-meadow is moderately heavily cattle grazed but there were possible signs of excessive grazing pressure toward the upper end of ditch C (more distant areas of ditch C visible in Fig. 39).

Table 11: Bourne Site: Site details – Bourne Meadows

Sampling location	Grid. Ref (and location notes for sampling points)	Wetness (Scale 1- 5)	Degree of site shading	Principle plant species present	Approximate *V. moulinsiana* m^{-2}
1	SU 17982 37555 (a river margins site **near point A** Fig 38)	4 - 5	nil	*Carex* spp,	22
2	At river end of field ditch (**at lower end of ditch C** Fig 38)	3 - 5	nil	Variable proportions of *Carex* spp, some *Iris pseudacorus*	42
3	SU 18017 35797 (**central location in ditch C** Fig. 38).	3 - 4	nil	Variable proportions of *Carex* spp with some *Glyceria maxima*	206
4	SU 18075 35805 (a river margins site **near to point B** Fig 38)	3 - 5	nil	*Carex* spp, *Glyceria maxima* (a wider uncut strip)	52

Fig. 39: Porton Meadows – sampling location 3 (ditch C)

9.3 Appendix 3: *Vertigo moulinsiana* (*Vm*) site histories (including first known discovery dates):

1. **Sopley Island** (Avon): (**Significant decline of *Vm* at site – probable imminent loss**)
    - 22.12.1997: report stated '10 – 15 snails found in 5 minute search' (Willing 1998);
    - 19.2.2010: 108 m^{-2} & 168 m^{-2} recorded at two spots (Willing 2011)
    - 20.11.2014: single snail after 40 minutes search (this report)

2. **Bisterne** (Avon): (***Vm* lost from site since 2010**)
    - 22.12.1997: report stated abundant in fen; "30 individuals found on one 15 cm length of *Carex* leaf" (Willing 1998);
    - 19.2.2010: report up to 10 Vm on a single *Carex* leaf & 152 m^{-2} (Willing 2011)
    - 20.11.2014: Vm not recorded at site (this report)

3. **Breamore** (north) (Avon): (***Vm* lost from site since 2010**)
    - 16.2.1998: first recorded at site; no specific numbers (Willing 1998)
    - 8.3.2010: only 3 live recorded (Willing 2011)
    - 18.11.2014: Vm not recorded at site (this report)

4. **Upper Woodford** (Avon): (***Vm* lost from site since 2010**)
    - March – May 1996 "*Vertigo moulinsiana* frequent" (grid ref given lies close to point of largest numbers in 2005 & 2010) (Killeen 1997a)
    - 1.07.2006 low Vm numbers on west bank, approx. 20 m^{-2} recorded close to Killeen site of 1996 (Willing 2006)
    - 7.03.2010 approx. 12 m^{-2} recorded close to Killeen site of 1996 with odd individuals for about 150 m to south (Willing 2011)
    - 15.11.2014 Vm not recorded at site (this report)

5. **West Amesbury – Normanton** (Avon): (***Vm* decline since 2010**)
    - March – May 1996 "*Vertigo moulinsiana* locally common, particularly in the ungrazed areas" (Killeen 1997a).. the report does not give more specific site details or indicate which SSSI units the snail is present in
    - 6.03.2010 present in 'good numbers' at three sites in SSSI unit **23** (Willing 2011)
    - 15.11.2014 Vm recorded in lower numbers at 2 of the 3 sites where it was present in 2010 and absent from a third site.

6. **Jones's Mill (Avon):** (***Vm* probably stable at site**)
    - First reported find by June Chatfield 25.07.1992 at location in compartment B2 / E (still present in compartment E in 2014)
    - I. Killen (Killeen 1997a & WWT centre notes) reports from surveys March – May 1996, "common & widely dispersed in open areas" i.e. 10 – 15 each time vegetation beaten over a sheet". No specific site compartment details given.
    - 26.10.2000 Killeen reports (WWT notes) "Overall the site was found to support a moderately-sized population with a mean of 31.7 individuals per sample". Specific compartment details not given.

- 9.11.2004 P. Mobsby reports (WWT records) “small numbers found in (A2) by beating and searching by hand; vegetation grazed to medium height. None found in B2”. This is in broad agreement with later surveys.
- 5.03.2010 M. Willing (2011) surveyed western compartments A1 & A2 finding low numbers (18 m^{-2}) at one spot in A2.
- 24.11 2014 (this report) the first systematic survey of the reserve: Vm found in high numbers in compartments E, F1, F2 and low numbers in A1.

7. **Wishford Swamp** (Wylye): (***Vm* lost from site since 2000**)
    - March – May 1996 Killeen (1997a) reports, ‘”*Vertigo moulinsiana* common on the sedge along the river banks and in depressions”.
    - 28.10.2000 Killeen (2002) Reported 14.9 Vm per sample (presumed 0.5 m^2) and states, “Distribution patchy and discontinuous. Found along the denser *Carex* fringe of the river but the core of the population lies in the marginal swampy areas dominated by *Glyceria* just to the south and south-west of the farm”.
    - 13.03.2010 (Willing 2011) Vm not located despite extensive searches.
    - 16.11.2011 & (Willing 2012) Vm not located despite extensive searches of site
    - 15.11.2014 & 11.12.14 (this report) Vm not located despite two extensive searches of site.

8. **Hurdcott (**Bourne): (***Vm* decline since 2011**)
    - March – May 1996 Killeen (1997b), “Mixed fen, depressions with sedge and *Glyceria*, raised areas of *Filipendula*, nettles and tall herbs. *Vertigo moulinsiana* distributed throughout in the wetter depressions, commonest in the fringe of sedge along the river margins towards the southern end” (no specific grid references given; the report mentions maps but these are not included in the report)
    - 6.3.2010 Vm only recorded (approx. 38 m^{-2}) in field drain and immediately adjacently on western river margins outside SSSI; not recorded on eastern river bank (Willing 2011)
    - 23.10.2011 (Willing 2012) Vm found widely on site in large numbers especially along eastern margins of the river; lower number in north-western ditch site
    - 18.11.2014 (this report) loss from western ditch site and lower numbers at all other sites.

9. **Porton Meadows** (Bourne): (***Vm* probably stable at site**)
    - March – May 1996 Killeen (1997a) reports, “Low-lying meadows with swampy vegetation (mainly *Carex*) in depressions and along river margins. *Vertigo moulinsiana* common”.
    - 7.03.2010 Willing (2011) reports in low numbers in marginal river-side *Carex*
    - 18.11.2014 (this report) ‘good numbers of Vm both along river margins and in *Carex*-filled field drain.

9.4 Appendix 4: Information relating to STREAM management works at Upper Woodford (2009)

In 2006 MJW was commissioned to undertake a molluscan survey for *Vertigo moulinsiana* and *Pisidium tenulineatum* (Willing 2006) ahead of planned STREAM works at Upper Woodford (R. Avon) and Dinton (R. Nadder). This reported on the presence of low numbers of *V. moulinsiana* at two locations on the right (north) bank at Upper Woodford of the river and made recommendations thus (Willing 2006: p. 9) to, "…..*preventing the encroachment of woody species such* Salix *and managing hydrological conditions to maintain water levels at, or close to, the ground surface throughout the year (especially the 'challenging' summer months*)". It would appear (see Figs 40 & 41) that work in 2009 may have (1) removed much of the suitable or potentially suitable marginal fen habitat and (2) possibly led to drier ground conditions. Certainly the newly created chalk walk-way has removed the gentle marginal gradient at the river edge, which is often the location of fen that supports *V. moulinsiana* (as at Porton Meadows and Hurdcott – see Figs. 1, 32 & 33 above). Very low numbers of *V. moulinsiana* were recorded at one spot in 2010 so that works did not completely remove all of the species from this length of bankside habitat or prevent a possible re-colonisation by the snail following winter flooding in 2009 / 2010.

The report on the plans and actions at Upper Woodford (and at other Avon catchment sites) (Hamersley & Wheeldon, 2009) makes no direct mention of impact assessment work on *V. moulinsiana* in 2006 or the need to maintain and enhance the marginal fen habitat on the right bank of the river for the snail during management work.

There are very few references to *V. moulinsiana* conservation in the report. In "Action C1.1 River restoration at Woodford" (p. 86) it is reported that (in section 'The works included a range of techniques'); the third bullet point relating to these states:

• Construction of a 60m length of causeway in order to narrow the channel. Construction to be from a mixed matrix of chalk excavated from an existing pit at the site, and faggot bundles derived from coppicing of riparian trees. An isolated area of emergent stillwater fringed with emergent vegetation will be retained behind the causeway. This will ephemerally be subject to ingress of river water at higher discharges and will provide valuable habitat for a range of species including *Vertigo moulinsiana* and *Arvicola terrestris.*

Specific details seem lacking in this statement and it is presumably assumed that *V. moulinsiana* will colonise the site in an unspecified way.

Further in the report in 'expect results' (p. 88) the sixth bullet point states ….

• The creation of an isolated still-water area, valuable for a range of target species including *Vertigo moulinsiana.*

Worryingly this seems to imply that *V. moulinsiana* is an aquatic species.

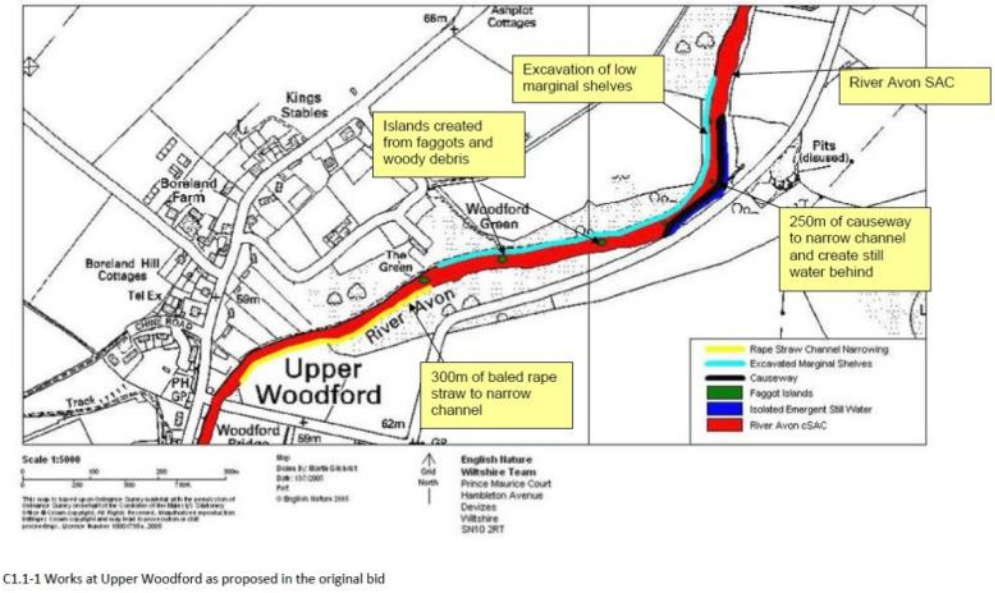
MJW has not yet been able to inspect and consider the UKRRC assessment audit of restoration site report for Upper Woodford (as mentioned on p. 135) or other monitoring studies undertaken post-restoration at the site. More work needs to be undertaken to

understand and monitor the benefits of the extensive works at Upper Woodford for *V. moulinsiana* and other River Avon SAC 'Qualifying Species'.

Reinstated access Feb 2009 and (right) in July 2009

The work was implemented in February-April 2009. The design and implementation was by the angling club, with NE and the EA leading on obtaining permission for the works. The access has been successfully reinstated, and the site is again now suitable as a demonstration site.

Fig. 40: Extract from STREAM report (Hamersley & Wheeldon 2009; p 16) including details of restoration works at Upper Woodford in 2009 and showing removal of *Vertigo moulinsiana* habitat there.



C1.1-1 Works at Upper Woodford as proposed in the original bid

Fig. 41: Extract from STREAM report (Hamersley & Wheeldon 2009 ; p 91) showing plans to 'excavate marginal shelves' (turquoise coloured band on map) and which was undertaken in 2009. These actions seem to have removed at least some *Vertigo moulinsiana* habitat and may also have led to detrimental drying of the fen areas in the path areas next to the river.