

Improvement Programme for England's Natura 2000 Sites  
(IPENS) – Planning for the Future IPENS061b

# SAC status reporting on *Vertigo moulinsiana* in Norfolk and Suffolk 2014

The Broads Special Area of Conservation (SAC)  
Waveney and Little Ouse Valley Fens Special Area of  
Conservation (SAC)

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*This project is part of the IPENS programme (LIFE11NAT/UK/000384IPENS) which is financially supported by LIFE, a financial instrument of the European Community’.*

## 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, addressing these through a range of evidence projects. The project findings are being used to help develop our Theme Plans and Site Improvement Plans. This report is one of the evidence project studies we commissioned.

A survey of Desmoulin’s whorled snail *Vertigo moulinsiana* was commissioned for a number of Sites of Special Scientific Interest (SSSIs) that make up components of The Broads and the Waveney and Little Ouse Valley Fens Special Areas of Conservation (SACs). The study looked at the extent of the species current and former occupation; the factors operating to threaten the population; and the remedies necessary to offset them.

In 2010 a series of surveys were undertaken of ten sample sites where Desmoulin’s whorled snail had previously been recorded. The 2014 study resurveyed seven of these sample sites, two in Norfolk and five in Suffolk. The results of these surveys have confirmed the presence of the snail at each of the seven sites. The snail was in reduced numbers at four of the sites, but in ‘good’ numbers at two sites.

The study reports that two of the sites were recorded as being in a good condition with a large area of continuous habitat within suitable moisture ranges. There were no apparent influences that were affecting these populations. Changes in the hydrological regime through water abstraction were noted at another site. The population at this site has shown a decline in the last three years. The remaining four sites were considered in an inadequate or bad condition, with issues including habitat fragmentation, and habitat subjected to high variations in water levels.

Management options for the sites where population declines were detected are discussed. These include hydrological monitoring of the site to ensure there is limited variation in water table height during the summer in particular; continuing to reduce scrub from the site and maintaining an open fen habitat; monitoring the intensity of grazing across the site to ensure no excessive grazing or poaching occurs; and maintaining the wet nature of the site.

The key audience for this work is the staff within Natural England. The survey will form the most recent part of a wider historical assessment of the component sites to understand the extent and nature of the losses, and what might be attempted to reverse them.

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# SAC status reporting on *Vertigo moulinsiana* in Norfolk and Suffolk 2014

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Survey carried out in November and December  
2014 by Abrehart Ecology  
for Natural England



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# Executive summary

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- 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.
- *V. moulinsiana* is a qualifying feature (S1016) of the Broads SAC and the Waveney and Little Ouse Valley Fens SAC.
- In 2010 a series of surveys were undertaken to re-visit a series of *Vertigo moulinsiana* sites, this resurvey is of sites where this species was recorded during that survey. Two in Norfolk and five in Suffolk.
- In 2010, ten sites were surveyed but the snail was only recorded in seven of these, marking a 30% decline in site occupancy in four years. Although there were no losses there were continued declines in four sites.
- Each site was surveyed in accordance to standard monitoring which included an assessment of area occupied, the quality of the habitat within the site, and an assessment of other rare species found on the site.
- The results of these surveys have shown that *V. moulinsiana* was still found at each of the seven sites. These sites were surveyed from 28th November to 3rd December 2014.
- Crostwick Marsh SSSI and Market Weston Fen SSSI were the sites that were in Favourable condition and passed on each assessment. These sites were in good condition with a large area of continuous habitat within suitable moisture ranges. There were no apparent influences that were affecting these populations.
- Burgh Common and Muckfleet Marshes were in a favourable condition, though failed on the future prospects of the site. This was due to the changes in the hydrological regime through water abstraction within the system. The population has shown a decline in the last three years which is of concern.
- Fakenham Magna and Blundeston were both an Unfavourable inadequate condition, though still holding small areas of population. The habitat is fragmented and subjected to high variations in water levels at Fakenham Magna and increased saline incursion at Blundeston.
- Fritton and Euston Estate were both considered in an Unfavourable bad condition. There was a low level of connectivity of habitat through each site, the hydrology of each site was unstable.

# 1. Introduction and background

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## 1.1 Purpose of the report

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.

This project is part of the IPENS programme (LIFE11NAT/UK/000384IPENS) which is financially supported by LIFE, a financial instrument of the European Community.

*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 the midland meres, 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 review (Seddon *et al* 2014). The species is listed in Annex IIa of the European Community Habitats and Species Directive (92/43/EEC) 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 Broads SAC and the Waveney and Little Ouse Valley Fens SAC.

In 2010 a series of surveys were undertaken to re-visit a series of *V. moulinsiana* sites, this resurvey is of sites where this species was recorded during that survey. Two in Norfolk and five in Suffolk.

## 2. Methods

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This section outlines the methods used to assess changes in the distribution and abundance of *Vertigo moulinsiana* at a selection of seven sites in Norfolk and Suffolk.

### 2.1 Desktop study

Historical records for these sites, excluding data already collected by Abrehart Ecology of the past ten years, was not located. It was these Abrehart Ecology data sets (Abrehart 2008 & 2010) that were used for the comparisons across all the sites. Additional sources of records included those held of pro bono species specific surveying carried out by Abrehart Ecology in 2014.

### 2.2 Field survey method

To make this survey as comparable to previous surveys as possible, samples were re-surveyed as near as possible the exact locations of the previous surveys at each site.

#### **Terrestrial mollusc sampling methods**

The sampling strategy and recording procedure is designed to provide information on the population and distribution of *V. moulinsiana*, including its finer scale distribution.

- terrestrial mollusc community—For the present survey Natural England requested that a plastic tray method be used. This requires that at each sample site, the vegetation is beaten into the tray at six places within an area of approximately 0.5m<sup>2</sup>. These six samples were combined and the numbers of *V. moulinsiana* (adult and juvenile) were counted.
- the vegetation from a 30cmx30cm quadrat was vigorously shaken over a large white tray to beat the molluscs out of the vegetation and frass. This was then inspected in the field for *V. moulinsiana* and other molluscs. Incidental rare molluscs (*Vertigo angustior* and *Mercuria similis*) were also collected by this sampling method. The number of individuals of each species were counted.
- The number of *V. moulinsiana* occupying the given space of 1m<sup>2</sup> was calculated by multiplying the number of snails in a sample by a factor that is dependent on the number of sub-samples taken per sample. 6 trays (6 sub-samples) equates to 1/2m<sup>2</sup>, therefore if 1, 2, 3, 4, 5 or 6 trays were analysed, the number of snails present are multiplied by a factor of 12, 6, 4, 3, 2.4 and 2, respectively.
- moisture level of the soil (scale of 1-5, where 1 = dry and 5 = very wet (table 1 for definition of integers).
- vegetation composition (via recording the abundance of plant species on a DACFOR scale) and vegetation class (table 1).

#### **Botanical methods**

Quadrats were used to provide information on vegetation composition throughout a (desirably

uniform) stand of vegetation around the mollusc sample sites. Depending on the records made (here species present were specified), they can take less time than more detailed records typically made in permanent plots. Here, frequency determinations were made on a compartment basis.

In this “sample site specific survey”, the emphasis was on covering the area immediately around the mollusc sample sites and detecting as many of the species as possible. At each site chosen by the surveyor, for detailed work, a minimum of five minutes was spent to record all molluscs and vegetation within an area of one metre from the centre point. This designated time was to ensure all observations are recorded, especially at intervals of the whole ecosystem cross-section, and to ensure all valuable observations are recorded in the limited time available.

Each area had estimates of vegetation cover:

D – Dominant (over 70% cover)

A – Abundant (70-50% cover)

C – Common (50–30 % cover)

F – Frequent (10-30% cover)

O – Occasional (3-10% cover)

R – Rare (less than 3% cover)

Vegetation Classes (For condition assessment the plant species are classified into 4 groups): Class 1 the most favoured to class 4 which are unsuitable.	Class I Tall Carex species, Cladium mariscus Glyceria maxima	Class II Equisetum fluviatile Phragmites australis	Class III Juncus subnodulosus Mentha aquatica Angelica sylvestris	Class IV Urtica dioica Eupatorium cannabinum and all other species
Soil moisture classes (Ground moisture levels recorded on a scale of 1-5 at each replicate sampling point): classes 3-5 are usually most favoured	1 - Dry. No visible moisture on ground surface	2 - Damp. Ground visibly damp, but water does not rise under pressure	3 - Wet. Water rises under light pressure 4 - Very wet. Pools of standing water, generally less than 5cm deep	5 - Site under water. Entire sampling site in standing or flowing water over 5cm deep.

Table 1: Specific habitat definitions for the Norfolk and Suffolk sites.

The exact mid-point to a survey area was determined by GPS co-ordinates by ten figure grid references.

## 2.3 Limitations of the study

The sampling was carried out quite late in the season and followed a period when there had been considerable flooding across a number of the sites in the proceeding weeks.

## 3. Results

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*Vertigo moulinsiana* was located at all the former sites in Norfolk and Suffolk where it was the present in 2010 (Crostick Marsh SSSI, Burgh Common and Muckfleet Marshes SSSI, Fakenham Magna, Euston Estate, Market Weston Fen SSSI, Blundeston and Fritton). The snail was in reduced numbers, at Burgh Common and Muckfleet Marshes SSSI, Fakenham Magna and Blundeston and Fritton, but in seemingly 'good' numbers at Crostick and Market Weston Fen SSSI.

*Vertigo moulinsiana* 2014 survey results are presented in appendices A and B, tables A1-7 and B1-7. Site descriptions, summary of results from 2014 and 2010, and population maps are displayed in appendix B. A history of recordings of *V. moulinsiana* at each site are displayed in appendix C.



## 4. Discussion

Table 2 compares results of the 2010 and 2014 surveys and gives a summary of the conservation statuses of the surveyed sites.

Site:	Monitoring summary	Conservation status' summary
Croswick Marsh SSSI Unit 1	<p><i>V. moulinsiana</i> numbers have improved from 2010. Consistently higher numbers of <i>V. moulinsiana</i> was evident across the site. There has been continued removal of alder and willow from the marshes, enabling larger areas of continuous habitat to persist without shading. The only trees on the site were the carr at the western end, and the occasional plant along the edges of the beck and ditches. It was apparent that there was a slight change in habitat and the grazing regime, being grazed more in 2014, and the site appeared to be less wet. As long as the site does not dry any further then this site in in a good condition.</p>	<p><b>Favourable</b> (Vertigo moulinsiana increasing at this site).</p>
Burgh Common and Muckfleet Marshes SSSI (Units 2 and 9)	<p>This survey has shown that the site is in a suitable condition to support <i>V. moulinsiana</i>, with suitable habitat in a number of sections around the unit. A comparison with the 2010 survey has shown the population has reduced by 36% over the three years between surveys. This is a significant drop and of concern for the site. The area of suitable habitat at Burgh Common has remained similar to 2010 with much of the site in good condition, there was limited grazing and some works to remove the willow swamp at several areas across the site. Both these factors will help create a dense sward of suitable plant species for this mollusc. Low level grazing is not appearing to have an adverse effect on the population of <i>V. moulinsiana</i>. Though the fluctuations in the water level across the site may be having a longer lasting effect on the population within this system of water bodies.</p>	<p><b>Favourable</b> (Vertigo moulinsiana decreasing at this site).</p>
Fakenham Magna	<p>A small section of the Blackbourn River is susceptible to regular flooding events after heavy rains. This had occurred within the previous two weeks before the survey was carried out. The water level was still high in the river at the time of the survey, with the most suitable vegetation along the hover margin sedge swamp in over two feet of water. Access to the remaining vegetation was only possible with thigh waders though chest waders would have been advisable. Here only the remaining foot of sedge was above the water level and hence possible to sample, within this though, there were still good numbers of <i>V. moulinsiana</i>. The previous survey was carried out after a prolonged dry period and the recent wetter year may have aided a slight recovery in this section of the valley. This site is in an unfavourable inadequate condition.</p>	<p><b>Unfavourable</b> (Vertigo moulinsiana decreasing at this site. Only found in one sample in any numbers along the river margin).</p>
Euston Estate	<p>This survey has shown that the site holds some suitable habitat for <i>V. moulinsiana</i> this is a very narrow strip of vegetation along the river margin. There was only one sample which held good numbers of <i>V. moulinsiana</i> There was a small population within an area of tall herb fen on the south of the river this was subject to periodic drying out and held only very small areas of possibly suitable habitat. There was no grazing along the margin of the river and the flood meadow too was ungrazed. A comparison with the 2010 survey has shown the population has increased by 35% over the three years between surveys, the main gain though is from one sample which held a high number of animals all the other samples had a low density across them. This site is still of concern for its viability within the system.</p>	<p><b>Unfavourable</b> (Vertigo moulinsiana decreasing at this site. Only found in one sample in any numbers in one very small area of sedge fen).</p>

Table 2. Comparisons between survey results from 2010 and 2014 of all areas surveyed in this report.



Site:	Monitoring summary	Conservation status' summary
Market Weston Fen SSSI Units 7 and 8	This survey has shown that the site holds a considerable area of habitat for <i>V. moulinsiana</i> . The site was within good moisture ranges and the vegetation was suitable across a large area of the survey area. The water levels in the pingos was high and the flood meadow fens were lightly grazed allowing for a good range of vegetation, suitable for <i>V. moulinsiana</i> to inhabit.	<b>Favourable</b> (Vertigo moulinsiana increasing at this site).
Blundeston Marshes	This survey has shown that the site holds a limited area of suitable habitat for <i>V. moulinsiana</i> . This is a very narrow strip of vegetation along the river and dyke margins. No sample site held any more than 12 animals. It was difficult to find enough vegetation to sample across the site.	<b>Unfavourable</b> (Vertigo moulinsiana decreasing at this site. Found across the site in the river ronds).
Fritton	This survey has shown that the site holds a limited area of suitable habitat for <i>V. moulinsiana</i> . This is a very narrow strip of vegetation along the river and dyke margins. No sample site held any more than 12 animals. It was difficult to find enough vegetation to sample across the site.	<b>Unfavourable</b> (Vertigo moulinsiana decreasing at this site. Only found in very low numbers).

Table 2 continued. Comparisons between survey results from 2010 and 2014 of all areas surveyed in this report.

Table 3: Possible reasons for *Vertigo moulinsiana* loss or decline and suggested management options

Site:	If <i>Vertigo moulinsiana</i> loss or decline detected possible reasons for:	Possible management actions:
Crostick Marsh SSSI	<ul style="list-style-type: none"> <li>• Low level grazing is not having an adverse effect on the population of <i>V. moulinsiana</i> at this site.</li> </ul>	The intensity of the grazing across the site will need to be carefully monitored. Ensure no excessive grazing and poaching occurs.
Unit 1	<ul style="list-style-type: none"> <li>• The site was drier in 2014 than previously, as long as this drying does not continue than the site should stay within a good hydrological state for the species</li> </ul>	Monitoring the hydrological regime. It was observed that there was a dip well on site, so it can be assumed that this is occurring.
Burgh Common and Muckfleet Marshes SSSI	<ul style="list-style-type: none"> <li>• Low level grazing is not appearing to have an adverse effect on the population of <i>V. moulinsiana</i>.</li> <li>• Though the fluctuations in the water level across the site may be having a longer lasting effect on the population within this system of water bodies.</li> </ul>	Monitoring the hydrology of the site to ensure there is limited variation in water table height during the summer in particular.
(Units 2 and 9)		Continuing to reduce scrub from the site and maintaining an open fen habitat.
Fakenham Magna	<ul style="list-style-type: none"> <li>• This site is under pressure from drying out.</li> <li>• <i>Urtica dioica</i> was frequent in the northern samples where previously it was not found.</li> <li>• The floating <i>C. riparia</i> hover margin is the only section on the site where there is suitable habitat for the population.</li> <li>• Much of the river margin was under water at the time of the survey following recent heavy rains.</li> <li>• If the water levels could be maintained higher in the small area of fen to the south then this habitat could support a large population.</li> <li>• Prolonged flooding in the winter of 2013 may have washed away animals on the stems.</li> </ul>	To try and wet the fen on the southern side of the river.  Creating a wetter habitat should create more suitable habitat over a larger area.
Euston Estate	<ul style="list-style-type: none"> <li>• Low level grazing appears to have an adverse effect on the site by reducing sward height across the marshes, though the consequential poaching may help hold more water.</li> <li>• Keeping this site wetter is of great importance on this site for this <i>V. moulinsiana</i>.</li> <li>• Changes in water level across the valley may be having a long lasting effect on the population within this system.</li> </ul>	Fitting a simple sluice at the end of the main dyke leading to the river could lead to higher water levels across the marshes. Making it more suitable/wetter for recolonization.  There may be larger issues locally with water abstraction for use on the farms nearby.

Table 3. Suggested reasons for *V. moulinsiana* population decline and management actions for each site surveyed.

Site:	If <i>Vertigo moulinsiana</i> loss or decline detected possible reasons for:	Possible management actions:
Market Weston Fen SSSI	<ul style="list-style-type: none"> <li>• Low level grazing is not appearing to have an adverse effect on the population of <i>V. moulinsiana</i>.</li> </ul>	The intensity of the grazing across the site will need to be carefully monitored to ensure no excessive grazing and poaching occurs.
Units 7 and 8	<ul style="list-style-type: none"> <li>• Low level grazing had pushed out the population of <i>V. angustior</i> on this section of the site. This species was re-found at a higher level along the vegetation within a pingo at the edge of the marsh.</li> </ul>	Conditions across the survey area appear to be ideal at the moment, therefore maintaining its current condition is of great importance for this species here.
Blundeston Marshes	<ul style="list-style-type: none"> <li>• This habitat is being affected by changes in river flow and salinity.</li> <li>• There are more higher tides through the rivers due to coastal squeeze, which in turn is creating a more saline environment across these ronds.</li> <li>• There is also the chance of increased flooding, and therefore may have introduced pollutants in to the system.</li> <li>• The increase in salinity within the system may start to affect the species composition across the site.</li> <li>• <i>Vertigo angustior</i> and <i>Mercuria similis</i> were not found during these samples. Possibly as a result of the tidal events in December 2013 or increased higher tidal events in general.</li> <li>• Prolonged flooding in the winter of 2013 may have washed away animals from the stems.</li> </ul>	<p>There is nothing that can done about coastal squeeze at this site. This is the most likely cause of the reductions here.</p> <p>The only possibility is to attempt to translocate some <i>V. moulinsiana</i> into the dykes edges of the marshes behind the river wall, in an attempt to start new populations in these sites and a nearby fen at Wicker Well.</p>
Fritton	<ul style="list-style-type: none"> <li>• Continued habitat restoration on the site should improve the fate for this species.</li> <li>• A wider ranging survey should be carried out along the length of the channel leading from the lake and along the lake margins too.</li> <li>• Monitoring water levels to assess if there are considerable changes in hydrology.</li> </ul>	<p>The sedge margins to the river and dykes are becoming better vegetated, though are still not particularly dense.</p> <p>Clearance of some of the marginal scrub will reduce shading and aid the recovery of the sedge beds around the site.</p>

Table 3 continued. Suggested reasons for *V. moulinsiana* population decline and management actions for each site surveyed.

## 5. Further Work

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The changes in the populations at these sites is very difficult to determine. The sites are searched only briefly and infrequently to catch any real changes at any of the sites. It is suggested that these sites be monitored on a more regular basis to try to determine the causes of change within the populations with greater precision.

## 6. References

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Report to cited as:

Abrehart T.R. 2014. Annex A: SAC status reporting on *Vertigo moulinsiana* in Norfolk and Suffolk 2014. An ecological survey including vegetation and invertebrates observations undertaken for Natural England by Abrehart Ecology.

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Abrehart Ecology (2010). Article 17 Reporting cycle on *Vertigo moulinsiana* in Norfolk and Suffolk, November 2010. Lot 4 An ecological survey including floral and faunal observations undertaken for Natural England by Abrehart Ecology

Abrehart T.R.(2008). Desmoulin's whorl snail *Vertigo moulinsiana* in Suffolk. Survey Data for 2007. An assessment of the current distribution of *Vertigo moulinsiana* within Suffolk.

Bratton J.H. 1991. British Red Data Books: 3 Invertebrates other than insects. JNCC Peterborough.

Kerney M.P. 1999. Atlas of land and freshwater molluscs of Britain and Ireland. Harley Books

Rodwell J.S. 2000. British Plant Communities parts 1-5. Cambridge University Press.

Seddon, M.B. 2014. The IUCN Red List of Threatened Species. Version 2014.3. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 13 January 2015.

## 7. Acknowledgements

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Many thanks are due to the many landowners who allowed us access to their lands and special thanks to David Heaver of Natural England for commissioning this survey.

# Appendix A

## Summary of *Vertigo* *mouliinsiana* survey results (sample sites where *V. mouliinsiana* was present)

Sample site	1	2	3	4	5	6	7	8	9
Juvenile count	10	278	80	98	58	25	32	85	40
Adult count	3	229	15	46	34	5	14	60	11
Total number of <i>V. moulinsiana</i>	13	507	95	144	92	30	46	145	51
<b>Approximate count of <i>V. moulinsiana</i>/m<sup>2</sup></b>	<b>26</b>	<b>1014</b>	<b>190</b>	<b>864</b>	<b>368</b>	<b>360</b>	<b>184</b>	<b>435</b>	<b>306</b>

Table A1. Crostwick Marsh survey results showing the approximate count of *V. moulinsiana* per meter square.

Sample site	1	2	3	4	5
Juvenile count	40	45	67	14	45
Adult count	27	6	9	2	21
Total number of <i>V. moulinsiana</i>	67	51	76	16	66
<b>Approximate count of <i>V. moulinsiana</i>/m<sup>2</sup></b>	<b>134</b>	<b>102</b>	<b>152</b>	<b>32</b>	<b>132</b>

Table A2. Burgh Common and Muckfleet Marshes SSSI survey results showing the approximate count of *V. moulinsiana* per meter square.

Sample site	1	2	4
Juvenile count	6	179	7
Adult count	13	41	2
Total number of <i>V. moulinsiana</i>	19	220	9
<b>Approximate count of <i>V. moulinsiana</i>/m<sup>2</sup></b>	<b>38</b>	<b>440</b>	<b>18</b>

Table A3. Fakenham Magna survey results showing the approximate count of *V. moulinsiana* per meter square.

Sample site	1	4
Juvenile count	83	6
Adult count	38	6
Total number of <i>V. moulinsiana</i>	121	12
<b>Approximate count of <i>V. moulinsiana</i>/m<sup>2</sup></b>	<b>242</b>	<b>24</b>

Table A4. Euston Estate survey results showing the approximate count of *V. moulinsiana* per meter square.

Sample site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	16	17
Juvenile count	48	302	254	87	145	252	39	208	39	8	13	9	124	142	0	0
Adult count	20	49	45	21	25	27	10	34	2	0	8	4	49	68	18	9
Total number of <i>V. moulinsiana</i>	68	351	299	108	170	279	49	242	41	8	21	13	173	210	18	9
<b>Approximate count of <i>V. moulinsiana</i>/m<sup>2</sup></b>	<b>816</b>	<b>1404</b>	<b>1794</b>	<b>432</b>	<b>680</b>	<b>1674</b>	<b>196</b>	<b>968</b>	<b>164</b>	<b>32</b>	<b>84</b>	<b>52</b>	<b>692</b>	<b>840</b>	<b>108</b>	<b>54</b>

Table A5. Market Weston Fen SSSI survey results showing the approximate count of *V. moulinsiana* per meter square.

Sample site	1	2	3	4	5	6
Juvenile count	8	5	8	16	12	6
Adult count	3	2	3	3	12	6
Total number of <i>V. moulinsiana</i>	11	7	11	19	24	12
<b>Approximate count of <i>V. moulinsiana</i>/m<sup>2</sup></b>	<b>22</b>	<b>14</b>	<b>22</b>	<b>38</b>	<b>48</b>	<b>24</b>

Table A6. Blundeston survey results showing the approximate count of *V. moulinsiana* per meter square.

Sample site	2	4
Juvenile count	4	6
Adult count	3	1
Total number of <i>V. moulinsiana</i>	7	7
<b>Approximate count of <i>V. moulinsiana</i>/m<sup>2</sup></b>	<b>14</b>	<b>14</b>

Table A7. Fritton survey results showing the approximate count of *V. moulinsiana* per meter square.

# Appendix B

Site descriptions and  
photos, summary of  
2010 and 2014  
results, and  
population density  
maps



## Crostown Marsh SSSI

### Site description

Crostown Marsh lies about 3 miles west of Wroxham in the valley of the Spixworth Beck, a tributary of the River Bure, National Grid Reference: TG 263165.

The site forms an excellent example of unimproved valley meadow and supports a series of intergrading plant communities ranging from damp neutral grassland through species-rich fen grassland to tall-herb fen in the valley bottom. A spring line is present on the valley slopes which provide irrigating water to the site, and calcareous flushes have developed locally at seepage points. The site drains to the Spixworth Beck through a series of dykes.

The site was grazed by cattle and the sward was dominated by a diverse tall-herb fen community species. *Carex riparia*, *Glyceria maxima* and *Filipendula ulmaria* are dominant with *Carex paniculata*, *Cirsium palustre* and *Angelica sylvestris*. The calcareous flushes were characterised by areas of short vegetation within the rush grassland.

### 2014

This survey has shown that *Vertigo moulinsiana* was found across Crostown marsh SSSI, it was found in all areas surveyed (figure B1 and B2). The survey area was similar to 2010 though a few new sites were searched in 2014. In total nine point samples were taken across the site. The site had undergone some changes in grazing regime seen from the previous survey. The grazing was heavier this year than before. This meant the sampling sites were not all in the same places, though close-by. *V. moulinsiana* was found in all the samples taken on the site. With up to 507 animals in a sample within an area of *G. maxima*. Across the site it was most abundant in the *Carex acutiformis* swamp across the site, especially where this was either wet or very wet (wetness scores of 4-5). It was also noted across the MG22 *Juncus subnodulosus* – *Cirsium palustre* (Rodwell 2000). In any sub-sample taken in this habitat there were always a small number of *V. moulinsiana* found.

The site was drier than in 2010 and all the site was safe to access, this was not the case in 2010, especially along the edge of the beck.

A summary of the two years results are presented in table B1.

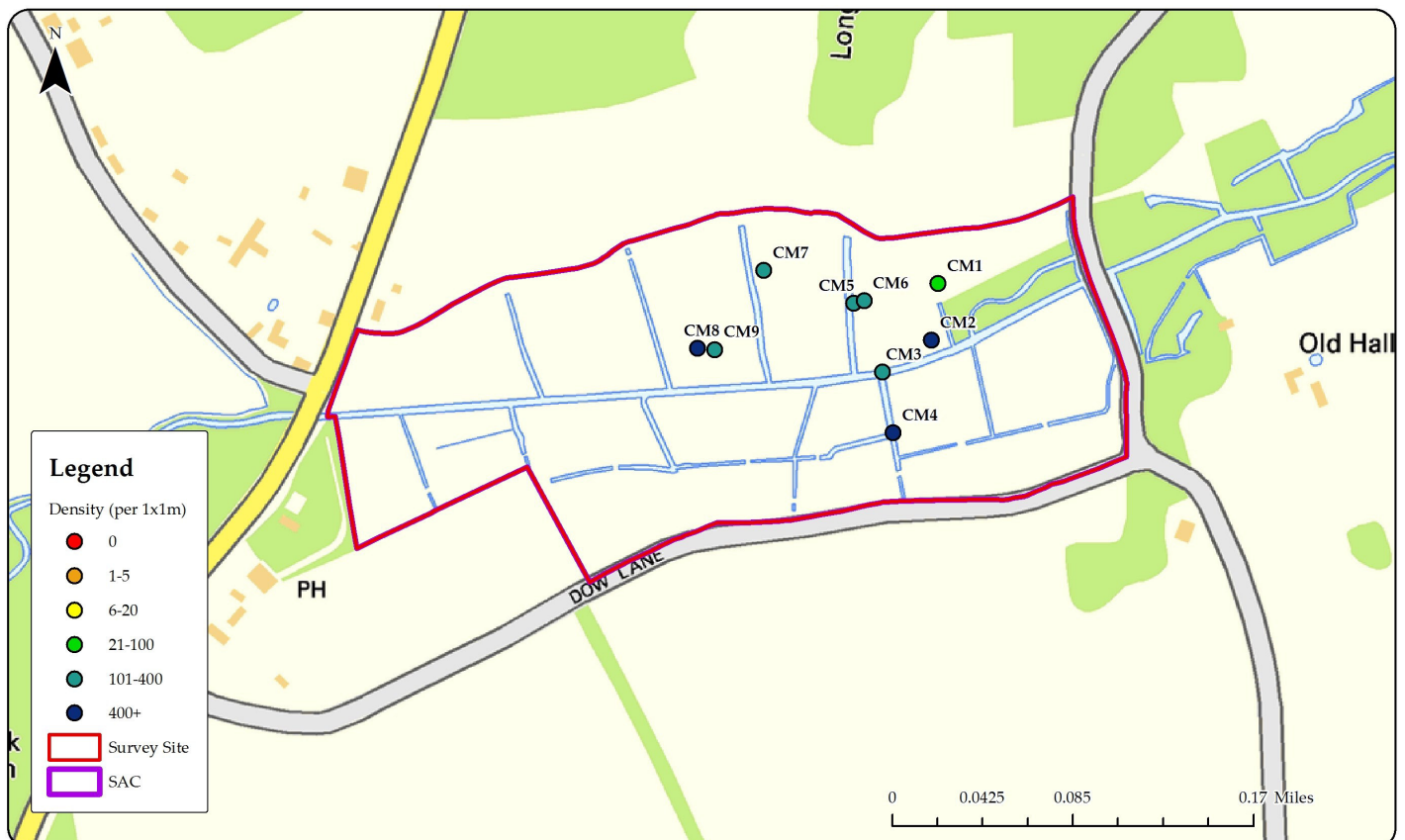
Summary of results	2014	2010
No. of samples with <i>V. moulinsiana</i>	9	7
Total No. of <i>V. moulinsiana</i>	1123	191
Mean no. per sample	125	27
Range	13-507	12-50
<b>Total no. of adults</b>	<b>417</b>	<b>29</b>
Mean no. per sample	46	27
Range	3-229	0-10
<b>Total no. of juveniles</b>	<b>706</b>	<b>162</b>
Mean no. per sample	78	23
Range	10-278	12-45
Percentage of adults	37%	15%

Table B1. Summary of survey results from Crostown marsh SSSI in 2010 and 2014.





Site	Grid reference	Wetness	Degree of shading	Principle plant species present	Approximate <i>V. moulinsiana</i> - m2
1	TG2638416596	3	0		26
2	TG2637916553	4	0		1014
3	TG2634216529	4	0	The site was grazed by cattle and the sward was dominated by a diverse tall-herb fen community species. <i>Carex riparia</i> , <i>Glyceria maxima</i> and <i>Filipendula ulmaria</i> are dominant with <i>Carex paniculata</i> , <i>Cirsium palustre</i> and <i>Angelica sylvestris</i> . The calcareous flushes were characterised by areas of short vegetation within the rush grassland	190
4	TG2635016483	4	0		864
5	TG2632016581	3	0		368
6	TG2632816583	4	0		360
7	TG2625216606	3	0		184
8	TG2620216547	4	0		435
9	TG2621516546	4	0		306

Table B1. 2014 survey results of *V. moulinsiana* at Crostwick marshesFigure B2. Population density of *V. moulinsiana* at each sample site of Crostwick Marsh in 2014.

### 3.1.2 Burgh Common and Muckfleet Marshes SSSI

#### 3.1.2.1 Site description

Filby and Rollesby Broads are part of the Trinity Broads SSSI which comprises of a series of five shallow, inter-connected lakes with fringing reed swamp, wet woodland and fen. These occupied the upper reaches of the Muckfleet, National Grid Reference: TG 440117. Filby and Rollesby Broads were surrounded by extensive areas of fringing reed swamp dominated by *Phragmites australis*, with smaller stands of *Typha latifolia*, *Glyceria maxima*, *Carex riparia* and *Cladium mariscus*.

Burgh Common and Muckfleet Marshes SSSI lie in a shallow valley at the western end of Filby Broad and drain to the River Bure by way of the Muckfleet. The site lies on fen peats and normally retains a high water-table throughout the year. Large areas are still managed by traditional grazing and mowing regimes. A wide range of habitats were present, the most important being the tall-herb fen vegetation. The majority of the surveyed area was grazed by horses and cattle; a diverse flora has been retained by this traditional management. A tall-herb fen community had developed on the wetter, low-lying ground where the land slopes to the Muckfleet and Little Broad. This habitat was dominated by *Phragmites australis*, *Carex paniculata*, *Carex riparia*, *Glyceria maxima* and *Cladium mariscus*.

2014

This survey has shown that *V. moulinsiana* was found across the site, in five of the six samples taken (figures C3 and C4). The main habitat for this species on the site was found to be the *Cladium mariscus*, *C. paniculata*, and *C. acutiformis* swamp around the edge of Little Broad and along the margins of the dykes. There were a number of areas of developing *Cladium mariscus* to the south-west of the broad in the area of open grazing marsh. This was searched for *V. moulinsiana* though none were found. The highest density found across the sample sites was of 67 animals in sample site 1.

A summary of the two years results are presented in Table B2.

Summary of results	2014	2010
<b>No. of samples with <i>V. moulinsiana</i></b>	<b>5</b>	<b>4</b>
Total No. of <i>V. moulinsiana</i>	276	342
Mean no. per sample	55.2	85.5
Range	16-78	78-89
<b>Total no. of adults</b>	<b>65</b>	<b>93</b>
Mean no. per sample	13	18.6
Range	2-27.	15-45
<b>Total no. of juveniles</b>	<b>211</b>	<b>249</b>
Mean no. per sample	42.2	62.2
Range	14-67	44-78
Percentage of adults	24%	27%

Table C2. Summary of survey results from Burgh Common and Muckfleet Marshes SSSI in 2010 and 2014.



Figure B3:  
Burgh Common and Muckfleet  
Marshes SSSI- Sample site 1-6.  
Clockwise from top left corner of  
figure.

Site	Grid reference	Wetness	Degree of shading	Principle plant species present	Approximate <i>V. moulinsiana</i> - m2
1	TG4489513006	5	0	<i>Cladium mariscus</i> , <i>C. paniculata</i> , and <i>C. acutiformis</i> swamp around the edge of Little	134
2	TG4489113000	5	0		102
3	TG4489512991	4	0		152
4	TG4487912966	5	0	This habitat was dominated by <i>Phragmites australis</i> , <i>Carex paniculata</i> , <i>Carex riparia</i> .	32
5	TG4483312919	5	0	<i>C. paniculata</i> , and <i>C. acutiformis</i> swamp	132

Table B2. 2014 survey results of *V. moulinsiana* at Burgh common and Muckfleet Marshes SSSI.

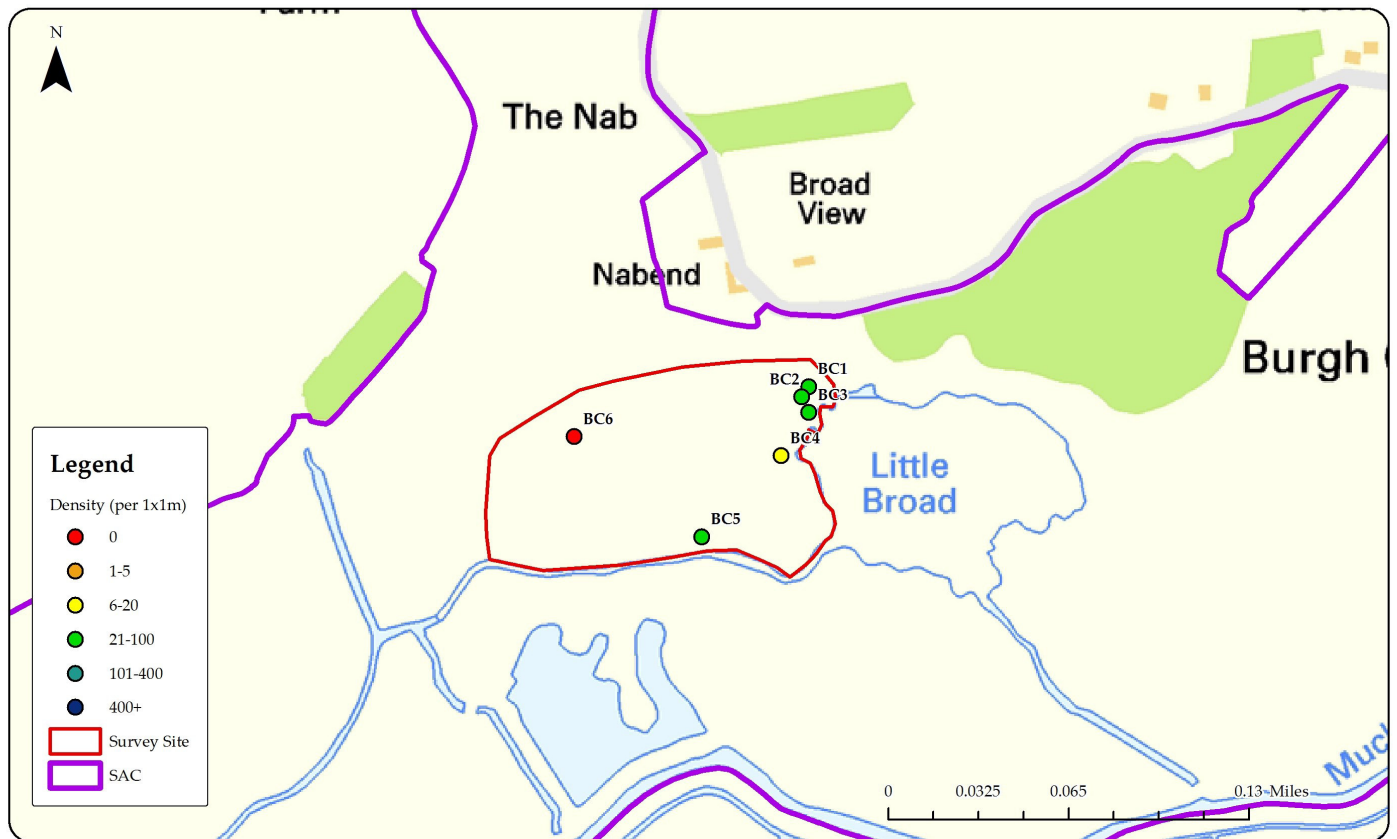


Figure B4. Population density of *V. moulinsiana* at each sample site of Burgh Common and Muckfleet Marshes SSSI in 2014.



### 3.2.1 Fakenham Magna

#### 3.2.1.1 Site description.

The Black Bourne River in Suffolk is a tributary of the Little Ouse River and is part of what was once a corridor of grazing marshes running from Elmswell to Euston. National Grid Reference TL 990630 – TL 948682. It flows north through Suffolk to the Little Ouse on the Norfolk/Suffolk border. The survey area of river and flood plain is privately owned by the Euston Estate. *Vertigo moulinsiana* was newly found in this river system in 2007 (Abrehart Ecology) within the river margins and the adjacent flooded sedge beds. The river has some small sluices across it altering the hydrology in small sections of the river. At Fakenham Magna the river meanders through the grazing marshes, these marshes were mostly heavily grazed and improved. The river margin had vegetation dominated with a wide fringe (three metres) of *Carex riparia* as a hover community. This habitat ranged in moisture from nearly dry to inundated. There was a *C. riparia* dominated meadow to the south of the river, this showed distinct signs of becoming dry.

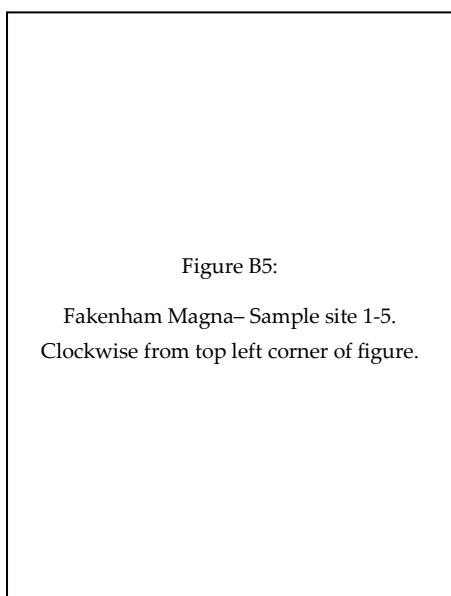
2014

This survey has shown that *V. moulinsiana* was found in two small areas of the site (figures B5 and B6). It was found in all the sub-samples at these sites. This highest numbers were found along the river margin within the *C. riparia*. This was at the time of the survey mostly under water, to a depth of over two feet. Within the vegetation still showing the number of *V. moulinsiana* was still high with a maximum of 220 found at sample site 2. *V. moulinsiana* was not found in the river margin further of the south of this area. The recent flooding may have had an effect on the population along this section of the site. In the tall herb fen on the south of the river there was an area of wet sedge bed, this was searched and held a small number of animals with a total of 9 animals found in sample site 5. This site was wetter and appeared to have been so for a number of years with a large amount of *Filipendula ulmaria* present across the fen, indicating a wetting up of the site.

A summary of the two years results are presented in table B3.

Summary of results	2014	2010
<b>No. of samples with <i>V. moulinsiana</i></b>	<b>3</b>	<b>3</b>
Total No. of <i>V. moulinsiana</i>	248	160
Mean no. per sample	82.6	53.3
Range	9-220	22-90
<b>Total no. of adults</b>	<b>63</b>	<b>84</b>
Mean no. per sample	21	28
Range	2-48	7-23
<b>Total no. of juveniles</b>	<b>149</b>	<b>38</b>
Mean no. per sample	50	12.6
Range	5-138	4-22
Percentage of adults	25%	52%

Table B3. Summary of survey results from Fakenham Magna in 2010 and 2014.





Site	Grid reference	Wetness	Degree of shading	Principle plant species present	Approximate <i>V. moulinsiana</i> - m2
1	TL9119676007	5	0	The river margin had vegetation dominated with a wide fringe (three metres) of <i>Carex riparia</i> as a hover community.	38
2	TL9122575994	5	0	The river margin had vegetation dominated with a wide fringe (three metres) of <i>Carex riparia</i> as a hover community.	440
4	TL9127575977	5	0	Fen with <i>C. riparia</i> swamp, abundant <i>Filipendula ulmaria</i> and occasional <i>Urtica dioica</i> .	18

Table B3. 2014 survey results of *V. moulinsiana* at Fakenham Magna.



Figure B6. Population density of *V. moulinsiana* at each sample site of Fakenham Magna in 2014.

## 3.2.2 Euston Hall Estate Marshes

### 3.2.2.1 Site description

The Black Bourne River in Suffolk is a tributary of the Little Ouse River and is part of what was once a corridor of grazing marshes running from Elmswell to Euston. It flows north through Suffolk to the Little Ouse on the Norfolk/Suffolk border. This area of river and flood plain is privately owned by the Euston Estate. *V. moulinsiana* was newly found in this river system in 2007 (Abrehart Ecology) within the river margins and the adjacent flooded sedge beds. This site has extensive S7 *Carex acutiformis* sedge beds extending to approximately five acres in this section of the valley. The river margin had some areas of S6 *Carex riparia* swamp (Rodwell 2000), these were often extensive and within a suitable moisture level for *V. moulinsiana*.

2014

This survey has shown that his site still holds a population of *V. moulinsiana* in two small areas of the *Carex* swamp (figures B7 and B8). The site has been grazed by cattle through the summer which will help wet the site up with increased poaching. The main population on the site was in an area of wet *C. acutiformis* swamp around the telegraph pole, to the west of the main grazing marsh. Here there were 121 animals found at sample site 1. The only other area were any were found was within the *C. paniculata* and *C. riparia* swamp at the margin of the dyke bisecting the grazing marshes. These where the only two areas that were wet enough to support this mollusc.

A summary of the two years results are presented in table B4.

Summary of results	2014	2010
<b>No. of samples with <i>V. moulinsiana</i></b>	<b>2</b>	<b>1</b>
Total No. of <i>V. moulinsiana</i>	133	1
Mean no. per sample	66.5	1
Range	12-121	12-50
<b>Total no. of adults</b>	<b>44</b>	<b>0</b>
Mean no. per sample	22	0
Range	6-38.	0-1
<b>Total no. of juveniles</b>	<b>89</b>	<b>1</b>
Mean no. per sample	44.5	1
Range	6-83	12-45
Percentage of adults	33%	0%

Table B4. Summary of survey results from Euston Hall Estate Marshes.



Figure B7:  
Euston Estate- Sample site 1-5. Clockwise  
from top left corner of figure.





Site	Grid reference	Wetness	Degree of shading	Principle plant species present	Approximate <i>V. moulinsiana</i> - m <sup>2</sup>
1	TL8992978080	5	0	The main population on the site was in an area of wet <i>C. acutiformis</i> swamp around the telegraph pole,	242
4	TL8994678027	5	0	The only other area were any were found was within the <i>C. paniculata</i> and <i>C. riparia</i> swamp at the margin of the dyke bisecting the grazing marshes.	24

Table B4. 2014 survey results of *V. moulinsiana* at Euston Estate.

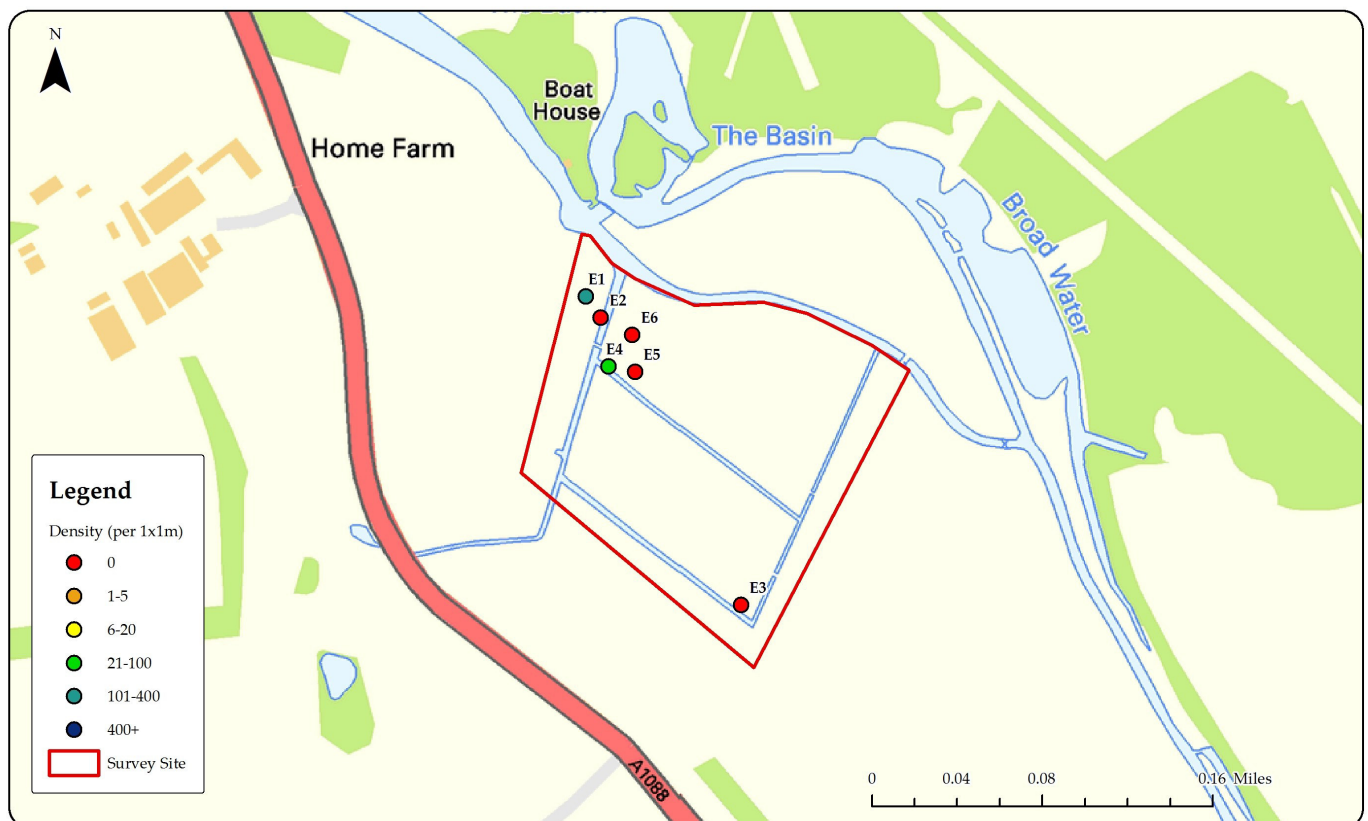


Figure B8. Population density of *V. moulinsiana* at each sample site of Euston Hall Estate Marshes in 2014.

## .2.3 Market Weston Fen SSSI

### 3.2.3.1 Site description

This site is a nature reserve owned by the Suffolk Wildlife Trust, National Grid Reference: TL 981787. This site contains a very valuable example of a species-rich, spring-fed valley fen, with areas of fen grassland and relict heath. The water-table remains high and stable throughout the year and this is reflected in the rich and varied flora of the site. The species-rich fen community which occupies the central area is dominated by *S7 Carex acutiformis* swamp with abundant *Juncus subnodulosus*. There are also several areas of *Cladium mariscus* within the valley floor marshes. The *S3 Carex paniculata* and *S4 Carex riparia* swamps were prominent in several areas and within some of the pingo's (Rodwell 2000). The chalk springs feed into the fen on its western side and as expected, these seepage areas were very wet. The tall-herb fens were dominated by a variety of grasses, rushes and sedges cover the valley bottom in several of the grazing marsh meadows, much of this was lightly grazed and remained tall.

2014

Two main areas were searched during this survey. They focused on two pingo's within the heath and an area of sedge swamp in the valley bottom. The habitat within the two pingo's appeared very similar to three years ago with a mixture of fen species dominated by *C. mariscus* and *C. acutiformis*. It was within these swamps that *V. moulinsiana* was searched for. Several of the sample sites were within small areas of suitable habitat, in these cases only two sub-samples were taken as to not damage the populations present.

*V. moulinsiana* was found in all of the samples taken, showing that the population was present across a wide range of vegetation and moisture levels across this site (figures B9 and B10). The highest density was within the pingo vegetation, here 215 animals were found in a single sub-sample at site 3 within a single tussock of *C. paniculata* in the two sub-samples a total of 299 animals were found.

The valley bottom swamps were very wet at the time of this survey and had been fully flooded at some point in the recent autumn, they also showed a generally taller fen vegetation than in 2010. The population of *V. moulinsiana* here showed that the population was fairing well and found in all but one sub-sample with sample site numbers of up to 420 animals in the pure *C. acutiformis* swamps.

Summary of results	2014	2010
<b>No. of samples with <i>V. moulinsiana</i></b>	<b>16</b>	<b>15</b>
Total No. of <i>V. moulinsiana</i>	2059	948
Mean no. per sample	129	63
Range	9-351	3-154
<b>Total no. of adults</b>	<b>389</b>	<b>205</b>
Mean no. per sample	24.3	13.6
Range	0-68.	0-36.
<b>Total no. of juveniles</b>	<b>1670</b>	<b>743</b>
Mean no. per sample	104.4	49.5
Range	0-254	2-118
Percentage of adults	19%	22%

*Vertigo angustior* was re-found during this survey, though it was not present in the area where it was originally found in 2010. This area was now too wet to support this, it was re-located on the side of a well vegetated pingo to the east of the valley bottom at TL9818978681, though only in small numbers, no more than five animals within a sub-sample.

Table B5. Summary of survey results from Market Weston Fen SSSI in 2010 and 2014.

A summary of the two years results are presented in table B5.



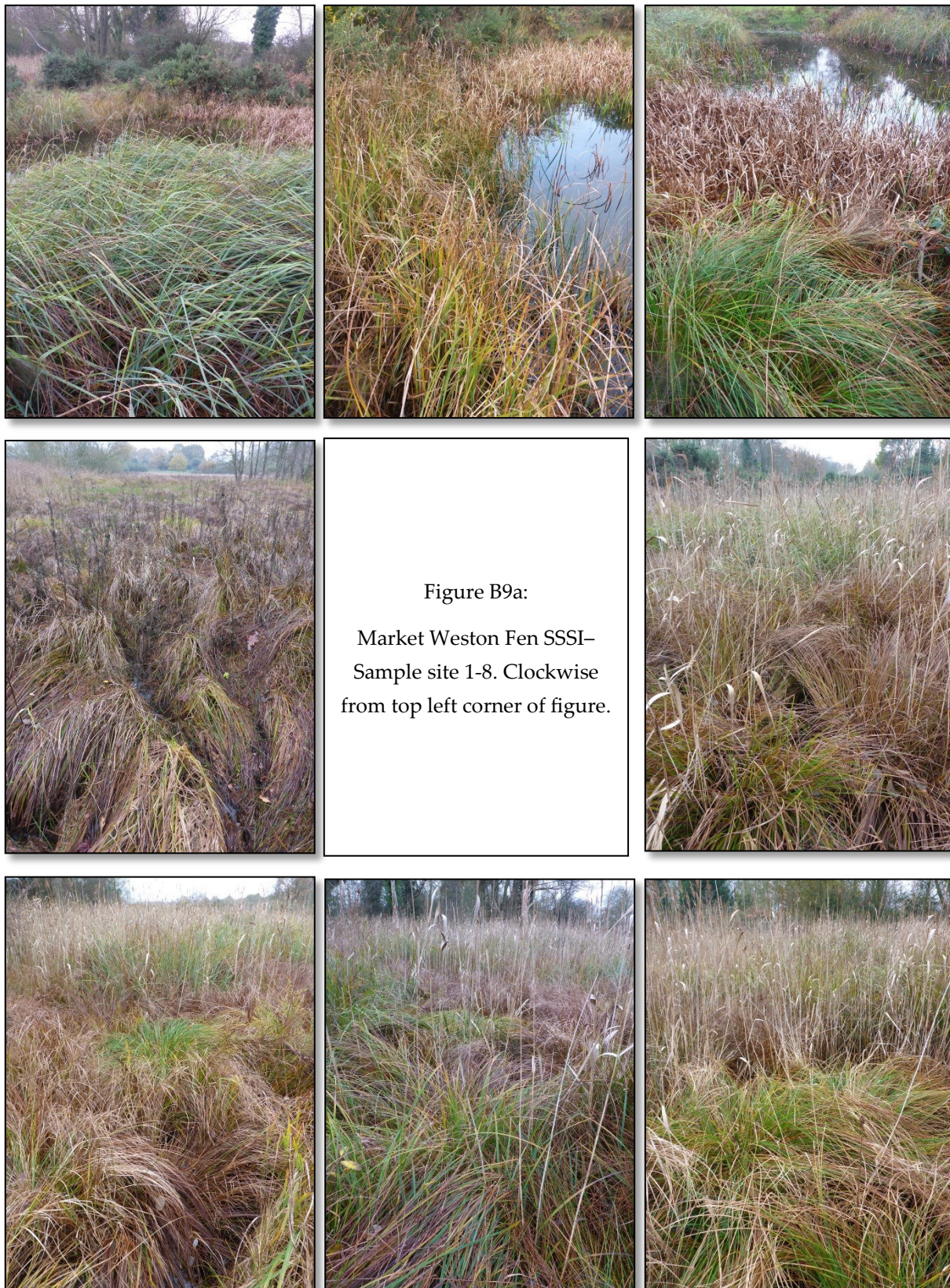






Figure B9b:  
Market Weston Fen SSSI-  
Sample site 9-16. Clockwise  
from top left corner of figure.



Site	Grid reference	Wetness	Degree of shading	Principle plant species present	Approximate <i>V. moulinsiana</i> - m2
1	TL9824278633	4	0		816
2	TL9823378635	4	0		1404
3	TL9823578645	5	0	The habitat within the two pingos appeared very similar to three years ago with a mixture of fen species dominated by <i>C. mariscus</i> and <i>C. acutiformis</i> . It was within these swamps that <i>V. moulinsiana</i> was searched for.	1794
4	TL9822278631	5	0		432
5	TL9822278619	5	0		680
6	TL9820478604	5	0		1674
7	TL9819878611	4	0		196
8	TL9816778637	3	0		968
9	TL9815278652	2	0		164
10	TL9817978708	4	0		32
11	TL9813178706	5	0		84
12	TL9812178739	3	0	The S3 <i>Carex paniculata</i> and S4 <i>Carex riparia</i> swamps were prominent.	52
13	TL9814978689	4	0		692
14	TL9814478717	4	0		840
15	TL9818978681	4	0		108
16	TL9818578680	4	0		54

Table B5. 2014 survey results of *V. moulinsiana* at Market Weston Fen.



Figure B10. Population density of *V. moulinsiana* at each sample site of Market Weston Fen SSSI in 2014.



### 3.2.5 Blundeston Marshes

#### 3.2.5.1 Site description

In north Suffolk this section of the lower Waveney valley at Blundeston is characterised by a wide reed fringe, National Grid Reference: TM 490958. The vegetation within this habitat consisted of S4 *Phragmites australis*, S6 *Carex riparia* and S28 *Phalaris arundinacea* with *Sonchus palustris* (Rodwell 2000). This vegetation matrix is uniform for many miles in each direction here. This section of the river is tidal and at the time of the survey the tide was in giving high moisture readings. This habitat is extensive within this section of the River Waveney extending 18 kilometres upstream towards Barsham and ranging up to 40 metres wide in some sections, though more commonly about five metres wide.

At Blundeston the River Waveney is tidal and through this section of the sampling site it was regularly flooded to a depth of between 10 and 30 centimetres. There is a considerable amount of grazing on the river walls and adjacent rond habitats. The river wall was raised by the Environment Agency for their flood defence schemes in 2010.

#### 3.2.5.2 Result

A summary of the two years results are in Table 8.

2014

Searches were made along the edge of the River Waveney rond. Six samples were taken consisting of 36 sub-samples, the highest density of *V. moulinsiana* along this section of the rond was of 24 animals in site 5, within an area of *P. australis* and *C. riparia* in the middle of the rond (figures B11 and B12). Across the majority of the site there was a low number of animals. This low density of *V. moulinsiana* had been found at other sections of the River Waveney at Barnby to the west in 2014.

A summary of the two years results are presented in table C6.

Summary of results	2014	2010
No. of samples with <i>V. moulinsiana</i>	6	5
Total No. of <i>V. moulinsiana</i>	84	295
Mean no. per sample	14	59
Range	7-24	9-73
Total no. of adults	29	62
Mean no. per sample	5	12.4
Range	2-12.	1-19.
Total no. of juveniles	55	233
Mean no. per sample	9	46.6
Range	5-16	8-54
Percentage of adults	35%	21%

Table C6. Summary of survey results from Blundeston Marshes in 2010 and 2014.



Figure B11:  
Blundeston Marshes—  
Sample site 1-6. Clockwise from  
top left corner of figure.

Site	Grid reference	Wetness	Degree of shading	Principle plant species present	Approximate <i>V. moulinsiana</i> - m2
1	TM4943995856	4	0		22
2	TM4945495841	4	0		14
3	TM4897295837	3	0	The vegetation within this habitat consisted of S4 <i>Phragmites australis</i> , S6 <i>Carex riparia</i> and S28 <i>Phalaris arundinacea</i> with <i>Sonchus palustris</i> . This vegetation matrix is uniform for many miles in each direction here.	22
4	TM4904695891	4	0		38
5	TM4907195885	3	0		48
6	TM4918795933	4	0		24

Table B6. 2014 survey results of *V. moulinsiana* at Blundeston.

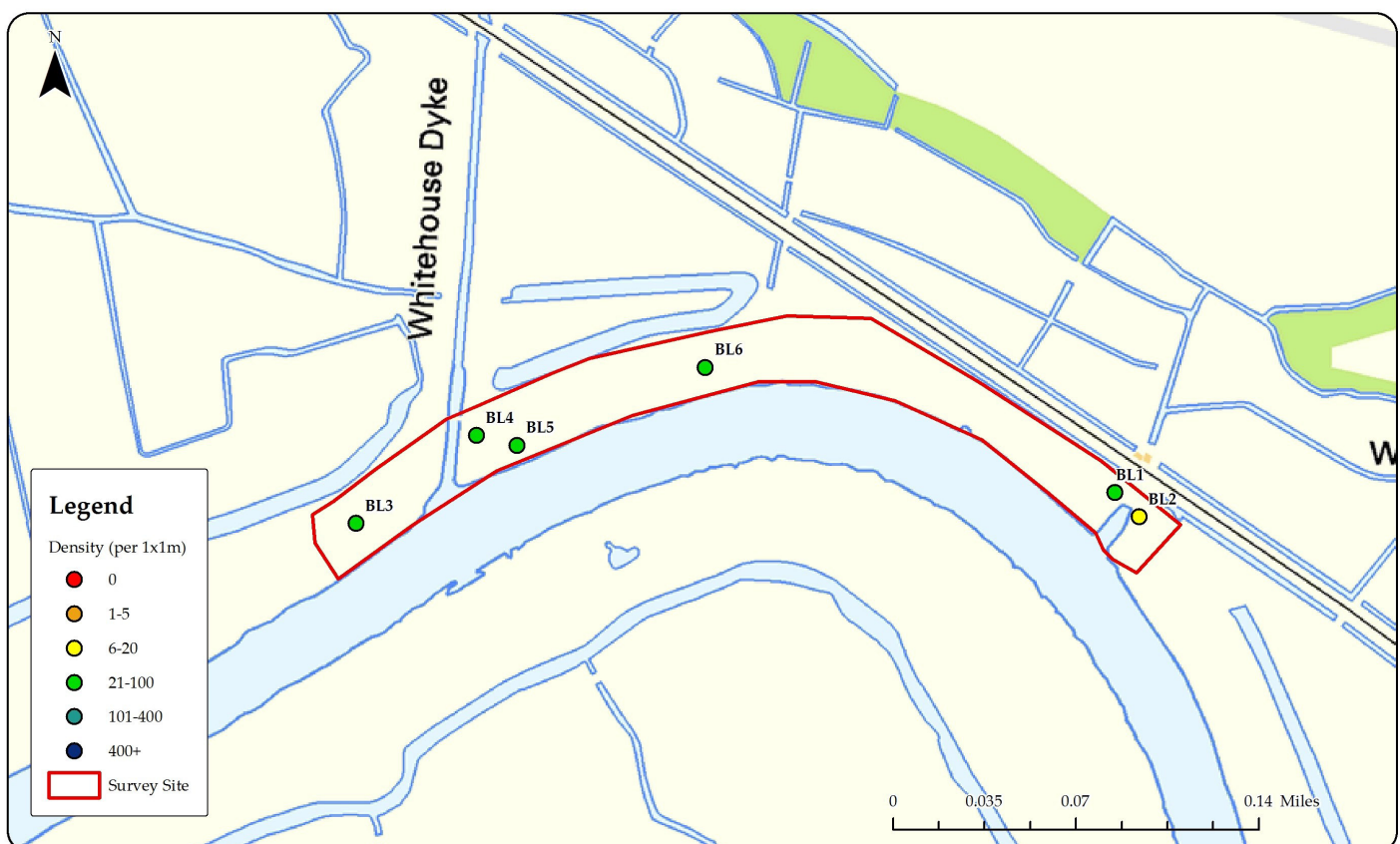


Figure B12. Population density of *V. moulinsiana* at each sample site of Blundeston Marshes in 2014.



### 3.2.4 Fritton

#### 3.2.4.1 Site description

In north Suffolk, Fritton holds a large body of water owned by the Somerleyton Estate, National Grid Reference: TM 467994. The lake is bordered by mature woodland ranging from oak woods to the north with alder carr to the south-west. Around the edges of the lake is a narrow border of *Phragmites australis*. The survey area at Fritton was within the alder carr at the outlet of the lake the habitat was currently under restoration, with much scrub clearance on-going, this was opening up the fen vegetation along the sides of the lake. Mature alder carr woodland is the dominant vegetation at this end of the site, with of *Salix cinerea* and *Viburnum opulus*, within the carr are areas of *Carex paniculata* and *Carex riparia*, though both never form dense stands as there is considerable shade to this site. At the edges of the carr, adjacent to the lake outflow are wide areas of *Carex riparia* swamp, this habitat extends into the bottom of the lake were it forms an extensive habitat.

The survey was carried out off the footpath at the south-western end of the lake. The vegetation was sparse within the alder carr with a dense canopy, the S4 *Carex riparia* and S3 *Carex paniculata* swamps were scattered through this area though never in dense stands. At the edges of the carr there were areas of S4 *Carex riparia* adjacent to the channel these were up to one metre wide with a range of moisture levels, there was still considerable shading along this margin creating a less dense vegetation throughout (Rodwell 2000). This situation has being addressed on the opposite side of the channel with a considerable amount of habitat restoration being carried out in 2010.

2014

This survey has shown that the site still holds a small population of *V. moulinsiana* within the small areas of wet *C. paniculata* and *C. riparia* (figures B13 and B14). No more than 4 animals were found in a sub-sample with no more than 12 in a full sample. Access to all the sites previously surveyed was not possible due to changes in access routes in to the alder carr. Alternative sample sites were found.

A summary of the two years results are presented in table B7.

Summary of results	2014	2010
<b>No. of samples with <i>V. moulinsiana</i></b>	2	5
Total No. of <i>V. moulinsiana</i>	27	12
Mean no. per sample	13	2.5
Range	13	0-4
<b>Total no. of adults</b>	5	1
Mean no. per sample	2.5	0.2
Range	1-4.	0-1
<b>Total no. of juveniles</b>	21	11
Mean no. per sample	10.5	2.2
Range	9-12.	0-4
Percentage of adults	18%	8%

Table B7. Summary of survey results from Fritton in 2010 and 2014.

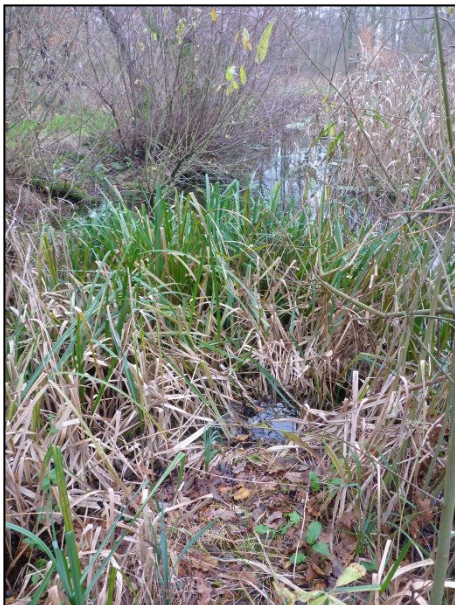
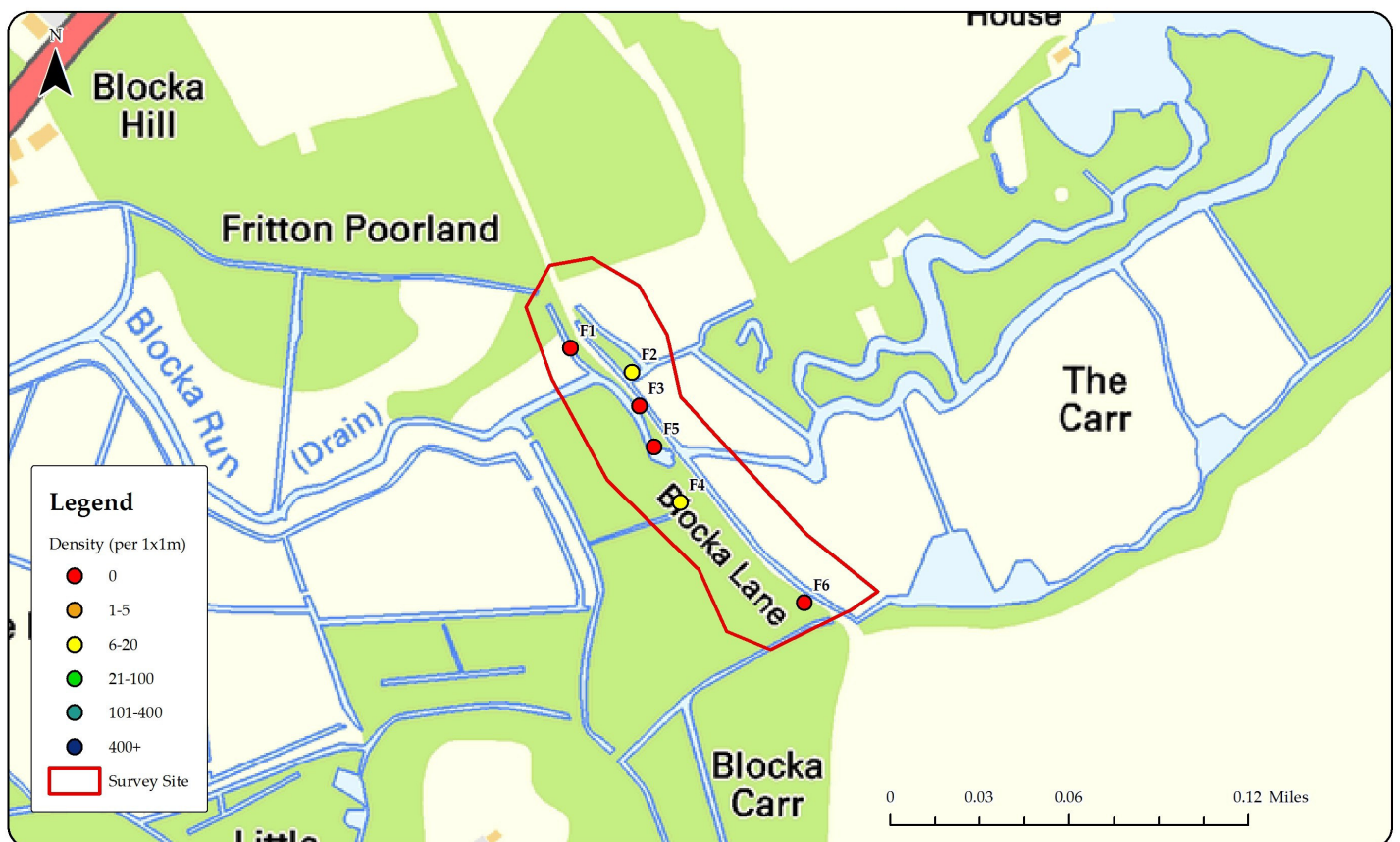


Figure B13:  
Fritton- Sample site 1-5. Clockwise  
from top left corner of figure.





Site	Grid reference	Wetness	Degree of shading	Principle plant species present	Approximate <i>V. moulinsiana</i> - m2
2	TM4669399542	5	0	The vegetation was sparse within the alder carr with a dense canopy, the S4 <i>Carex riparia</i> and S3 <i>Carex paniculata</i> swamps were scattered through this area though never in dense stands	14
4	TM4671999472	4	80		14

Table B7. 2014 survey results of *V. moulinsiana* at Fritton.Figure B14. Population density of *V. moulinsiana* at each sample site of Fritton in 2014.

## Appendix C

*Vertigo moulinsiana* site  
histories (including  
first known discovery  
dates)

Site:	
<b>Croswick Marsh SSSI Unit 1</b>	<ul style="list-style-type: none"> <li>• 2011: report stated a favourable condition, 243m<sup>2</sup> (Abrehart 2011).</li> <li>• 2014: reported as favourable 507 in a sample (this report)</li> </ul>
<b>Burgh Common and Muckfleet Marshes SSSI (Units 2 and 9)</b>	<ul style="list-style-type: none"> <li>• 1941: found <i>V. moulinsiana</i> across the Broads (Ellis EA)</li> <li>• 2000: reported across the Trinity Broads and Muckfleet in preliminary survey. At Burgh Common 16 sample locations were assessed and 44 samples were taken with a maximum of 99 animals were found in one sample, a total of 413 animals were found in these samples. (Killeen 2001a)</li> <li>• 2011: report stated a favourable condition, 720m<sup>2</sup> (Abrehart 2011).</li> </ul>
<b>Fakenham Magna</b>	<ul style="list-style-type: none"> <li>• 2014: Frequent declining, 76 in a sample equating to 152 snails/m<sup>2</sup> (this report)</li> <li>• 2007: First reported. Report stated abundant across the narrow band of <i>C. riparia</i> on the river margin. (Abrehart 2008).</li> <li>• 2010: report stated declining population maximum of 17 per sub-sample at 153m<sup>2</sup> (Abrehart 2011).</li> <li>• 2014: report stated declining, maximum 220 in a sample, though only one sample, equating to 440 snails/m<sup>2</sup>. All others very low (this report).</li> </ul>
<b>Euston Estate</b>	<ul style="list-style-type: none"> <li>• 2007: First reported. Report stated abundant across large continuous habitat of <i>C. riparia</i> and <i>C. acutiformis</i>. (Abrehart 2008).</li> <li>• 2010: Habitat destroyed only one juvenile found after 1 hour search. (Abrehart 2011).</li> <li>• 2014: Habitat still poor though one area improved with 121 in a single sample, equating to 242 snails/m<sup>2</sup>. Only found in one other sample (this report).</li> </ul>
<b>Market Weston Fen SSSI Units 7 and 8</b>	<ul style="list-style-type: none"> <li>• 2007: report stated frequent and significant populations from pingo's to valley marshes.</li> <li>• 2010: reported as frequent across the site 63 animal per sub-sample - 567m<sup>2</sup>. (Abrehart 2011).</li> <li>• 2014: report stated improved population. A maximum of 1794 snails/m<sup>2</sup> (this report)</li> </ul>
<b>Blundeston Marshes</b>	<ul style="list-style-type: none"> <li>• 2007: report stated frequent across the 30m wide rond within <i>C. riparia</i> swamp.</li> <li>• 2010: reported as frequent across the site maximum 270m<sup>2</sup>. (Abrehart 2011).</li> <li>• 2014: reported as declining maximum 24 per sample, equating to 48 snails/m<sup>2</sup>. (this report)</li> </ul>
<b>Fritton</b>	<ul style="list-style-type: none"> <li>• 2007: report stated frequent in suitable habitat, <i>C. riparia</i> and <i>C. paniculata</i>.</li> <li>• 2010: report stated declining conditions -27m<sup>2</sup>. (Abrehart 2011).</li> <li>• 2014: report stated declining, 14 snails/m<sup>2</sup> in a single sample, difficult to find (this report)</li> </ul>

Table C1. History of recordings of *V. moulinsiana* at each site surveyed in this report.





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