

# Whorl snails (*Vertigo* spp.) surveillance in Scotland: a condition assessment of the narrow-mouthed whorl snail *Vertigo angustior* in Aberdeenshire





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# COMMISSIONED REPORT

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Commissioned Report No. 615

**Whorl snails (*Vertigo* spp.) surveillance in  
Scotland: a condition assessment of the  
narrow-mouthed whorl snail *Vertigo*  
*angustior* in Aberdeenshire**

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## COMMISSIONED REPORT

# Summary

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### Whorl snails (*Vertigo* spp.) surveillance in Scotland: a condition assessment of the narrow-mouthed whorl snail *Vertigo angustior* in Aberdeenshire

**Commissioned Report No.: 615**  
**Contractor: Malacological Services**  
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#### Background

The narrow-mouthed whorl snail *Vertigo angustior* is listed on Annex II of the EC Habitats Directive. In Scotland the species is known only from two coastal locations at White Port on the Solway and in two places at Perthumnie Bay in Aberdeenshire. To provide information for the next round of Article 17 reporting, a condition assessment of *V. angustior* has been carried out by using methods designed to allow assessments of population, habitat and prospects.

The attributes used to assess condition were:

- Area of occupancy of *Vertigo angustior* habitat in the two sites at Red Man Bay and at Garron Point and at selected transects or plot areas.
- Number of overall positive recordings per number of field samples.
- Hydrological field assessment.

#### Main findings

- Although small in area, the habitat at both Garron Point and Red Man Bay is in good condition for *Vertigo angustior*, and the snail is present at several places within each site and in moderately high abundance.
- The assessments for population, habitat and future prospects are all 'favourable - maintained', and therefore, the overall assessment is 'favourable - maintained'.

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All aerial photographs used in this report are licensed to Scottish Natural Heritage under the PGA, through Next Perspectives, 2012. I am grateful to Gabor Barton (SNH) of provision of these aerial tiles.

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## 1 BACKGROUND AND OBJECTIVES

The narrow-mouthed whorl snail *Vertigo angustior* is listed on Annex II of the EC Habitats Directive. In Scotland the species is known only from two coastal locations at White Port on the Solway and at Perthumnie Bay in Aberdeenshire.

In the second report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006, the overall national assessment for *Vertigo angustior* was 'unfavourable - no change'. Although range, population and habitat were 'favourable - maintained', future prospects were 'unfavourable - no change'. Hence, in accordance with Annex C, the overall assessment was "unfavourable - no change". Paradoxically, this arose from the discovery of extensive new populations of this species on sea embankments of East Anglian estuaries which changed perceptions of future prospects from favourable to unfavourable. This is because the bulk of the UK population is now known to occur in this habitat and there are uncertainties over the impact of predicted sea-level rise and the effectiveness of managed coastal retreat.

To provide information for the next round of Article 17 reporting, due in 2013, a condition assessment of *Vertigo angustior* has been carried out at the Aberdeenshire sites using methods designed to allow assessments of population, habitat and future prospects; a condition assessment of the Solway White Port was carried out in 2010 by Marriot & Colville (2011).

The fieldwork for this project was carried out on 19 June 2012.

## 2 KNOWN DISTRIBUTION IN PERTHUMNIE BAY

Garron Point SAC/SCI/cSAC comprises 15.6 ha of coastal area with the following habitats (source JNCC):

Coastal sand dunes, sand beaches, machair (4.5%).  
Shingle, sea cliffs, islets (11%).  
Bogs, marshes, water-fringed vegetation, fens (5.8%).  
Heath, scrub, maquis and garrigue, *Phygrana* (18.7%).  
Humid grassland, mesophile grassland (60%).

The narrow-mouthed whorl snail *Vertigo angustior* is the sole reason for designation.

All of the distributional and ecological information on *Vertigo angustior* at Perthumnie Bay is based on work carried out by Richard Marriot (Phillips, 2002; Marriot, 2004), who found two sites for the species: at Garron Point in *Festuca rubra* grassland on top of a rocky peninsula, and at Red Man Bay in a narrow strip of mossy grassland immediately above the high water mark. It was estimated that the areas of suitable habitat at both sites was less than 200 m<sup>2</sup>. The locations of the two sites are shown in Figure 1.

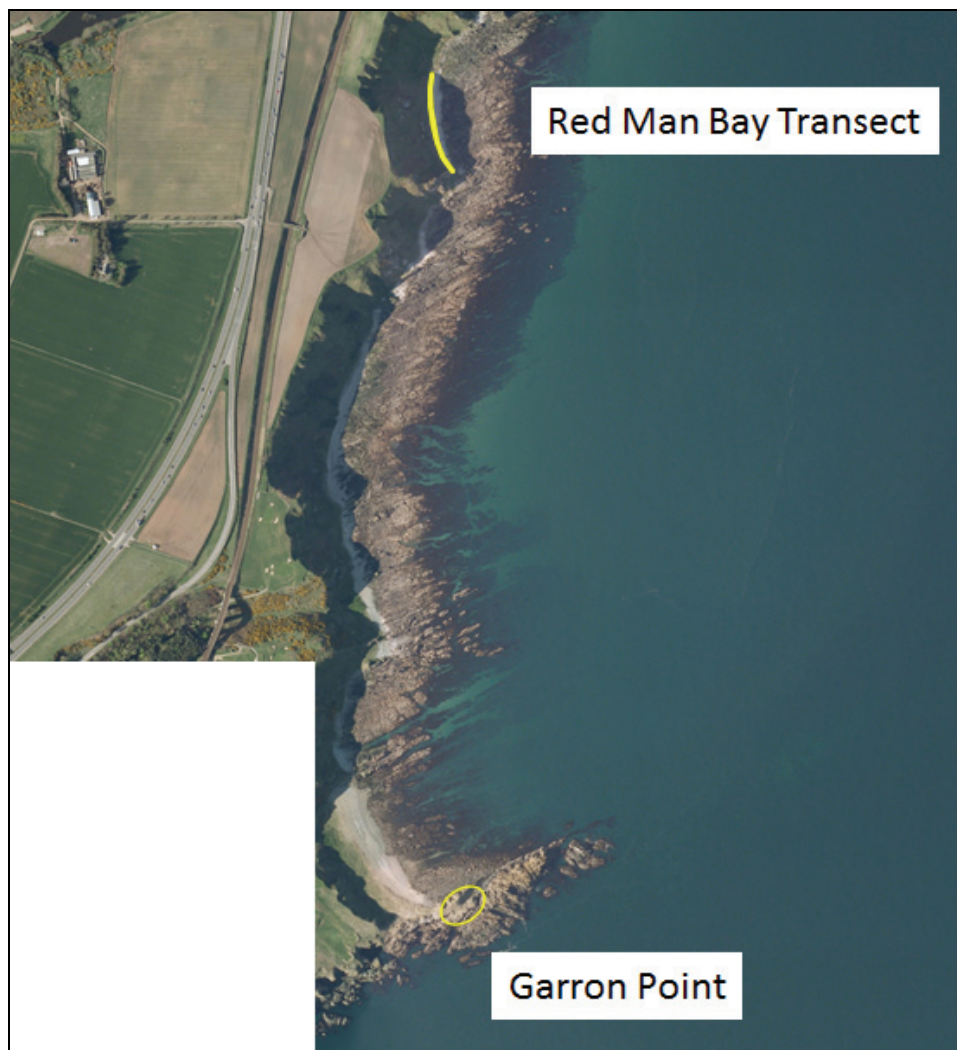


Figure 1: Perthumnie Bay showing locations of *Vertigo angustior* sites. Aerial imagery licensed to: Scottish Natural Heritage under the PGA, through Next Perspectives, 2012

### 3 METHODOLOGY

The principal requirements of Article 17 reporting are assessments of range, population, habitat, future prospects and overall. To fulfil these criteria, a programme of work using a methodology specifically designed for *Vertigo* species condition assessments was carried out.

The methodology used for *Vertigo angustior* condition assessment has evolved over the last 10 years. The methods were originally designed for use at *Vertigo geyeri* sites on Anglesey by Killeen & Moorkens (2004, 2008).

The attributes used to assess Condition were:

- Area of occupancy of *Vertigo angustior* habitat in individual sites.
- Area of occupancy of *Vertigo angustior* in selected transects or plot areas.
- Number of overall positive recordings per number of field samples.
- Hydrological field assessment.

#### 3.1 Area of habitat by site

Within each of the sites, areas of habitat were delineated for the purposes of monitoring *Vertigo angustior*. Specific habitat suitable for the snail was identified, using best expert knowledge. Areas that could not possibly support the species were excluded from the study areas. The area of potential *Vertigo* habitat was delineated with a GPS, and the resulting polygons containing all potentially suitable habitat can be marked on aerial photographs to enable their transfer to a GIS system. It was not considered practicable to set up transects at Garron Point due to the small and well-defined area of the habitat.

#### 3.2 Assessment using linear transects

Transects are useful for assessing the condition of the site, and to provide means of future monitoring. At Red Man Bay, a series of short transects running from the high water mark inland at 10 m intervals along the length of the bay, were laid out using 30 m tape measures. Start points were also located with a GPS.

The habitat (at the plant community and structure level) along the tape was described and the linear distance of that habitat type measured using the tapes. This was repeated every time the habitat changed, thereby delineating uniform plant community zones along the transects. Whilst there was not always a clear boundary, best expert judgement was used to delineate e.g. *Festuca* grassland, from more *Arrhenatherum* dominated grassland and so on. The habitat in each zone was then categorized into three classes according to its suitability for *Vertigo angustior*, an example of each zone is shown below.

Optimal habitat is where *Vertigo angustior* could survive in its majority area (>50%). At Perthumnie Bay this comprises grassland dominated by *Festuca rubra* with low-growing herbs (e.g. *Plantago lanceolata*) and mosses, particularly *Rhytidiadelphus squarrosus*. This habitat is characterized by a deep layer of thatch which feels warm to the hand. At Garron Point this habitat is found on the tops of rocky cliffs whereas at Red Man Bay, the habitat occurs as a strip in a transition zone between the shoreline and the lower slopes of the cliffs.

Sub-optimal habitat is where there are patches of vegetation and conditions that support *Vertigo angustior*, but the majority of the habitat cannot. An example would be in terrain that is generally too dry, or has a patchy distribution of sward habitat with only a thin thatch layer. At Red Man Bay sub-optimal is also defined as having some taller, transition vegetation.

Unsuitable habitat is an area of the site where the combination of vegetation and hydrological influence is outside the snail's range of tolerance. This includes both dry sparse sward with very little thatch, or tall, rank vegetation with bracken and *Arrhenatherum elatum* dominated grassland. This habitat class may be naturally unsuitable, or alternatively the snail may be restricted by excessive grazing or fertilization of flat areas of grassland, or by patches of weeds arising due to enrichment in the past. Tables 1 and 2 give the locations of sample sites at Garron Point and Red Man Bay respectively.

Table 1: Garron Point sample sites

Site	Grid Reference	Description
1	NO89227 87607	<i>Festuca rubra</i> grassland with deep thatch layer
2	NO89215 87598	<i>Festuca rubra</i> grassland, <i>Plantago lanceolata</i>
3	NO89206 87602	<i>Festuca rubra</i> grassland near shore with <i>Potentilla anserina</i> , <i>Plantago lanceolata</i>
4	NO89221 87602	Field observation
5	NO89230 87610	Field observation
6	NO89211 87598	Field observation

Table 2: Red Man Bay sample sites

Site	Reference	Description
1	Transect 30 m at 2 m	Good <i>Festuca rubra</i> thatch with <i>Rhytidiadelphus squarrosus</i>
2	Transect 60 m at 4 m	Good <i>Festuca rubra</i> thatch with <i>Rhytidiadelphus squarrosus</i>
3	Transect 80 m at 4 m	Good <i>Festuca rubra</i> thatch with <i>Rhytidiadelphus squarrosus</i>
4	Transect 110 m at 4 m	Good <i>Festuca rubra</i> thatch with <i>Rhytidiadelphus squarrosus</i>
5	23 m	Field observation: under log
6	42 m	Field observation: under flotsam
7	55 m	Field observation: under flotsam
8	Transect 90 m at 8 m	Field observation: under flotsam
9	Transect 120 m at 3 m	Field observation: in <i>Festuca</i> thatch

### 3.3 Snail sampling

In selected delineated habitat zones on transects, and in individual habitat areas, a bag of moss/grasses and litter (c. 2 L volume) was also taken. This is approximately equivalent to an area measuring 0.25 x 0.25 m. These samples were collected by plucking handfuls of moss, grass and thatch (but not underlying soil).

The vegetative material was teased apart and spread on sheets of newspaper to dry. This was then shaken over a 5 mm sieve to remove the bulk of the plant material but to allow all molluscs to pass through. The residue was passed over a graded stack of sieves and examined microscopically. All mollusc species were picked out and counted.

### 3.4 Condition assessment

Having obtained baseline data on the attributes required to assess condition, the baseline surveys are used establish thresholds to reflect the extent of optimal habitat and distribution for population assessment and habitat for the species assessment. Future prospects are assessed by examining how the impacts are affecting the other attributes (i.e. population and habitat for the species) and their impact if they continue unchecked. Future prospects should balance positives and negatives to determine whether the species will survive at a

particular site for the foreseeable future. The overall assessment at a particular site is then determined by how well the site meets these key targets for the attributes associated with this species.

## 4 RESULTS

### 4.1 Garron Point

The area of suitable habitat is similar to that recorded by Marriot (2004) and is restricted to a gentle sloping hollow of grassland on a rocky peninsula (Annex 1, photographs 1 and 2). The habitat comprises *Festuca rubra* dominated grassland with a deep, springy thatch layer, and with *Armeria maritima*, *Plantago lanceolata*, *Lotus corniculatus*, *Trifolium repens*, and occasional *Plantago maritima*, *Potentilla anserina* and *Anthyllis vulneraria*. The habitat is heavily grazed by rabbits.

It is estimated that the area enclosing all the *Vertigo angustior* habitat considered to be optimal is 275 m<sup>2</sup> (Figure 2). Allowing for rocks and more marginal habitat (approx. 25%), it is estimated that at least 200 m<sup>2</sup> are optimal. Further potential (sub-optimal at best) habitat occurs on the northern slopes but *V. angustior* was not seen in the field on this or previous occasions. However, this does not amount to more than another 100 m<sup>2</sup>.

*Vertigo angustior* was found in all three of the samples collected and at a further three locations (Table 3). Numbers of individuals in the samples ranged from 5-91 (mean 36) giving an approximate density of 576/m<sup>2</sup>. This is in a similar order of magnitude of c. 400/m<sup>2</sup> recorded by Marriot (2004).

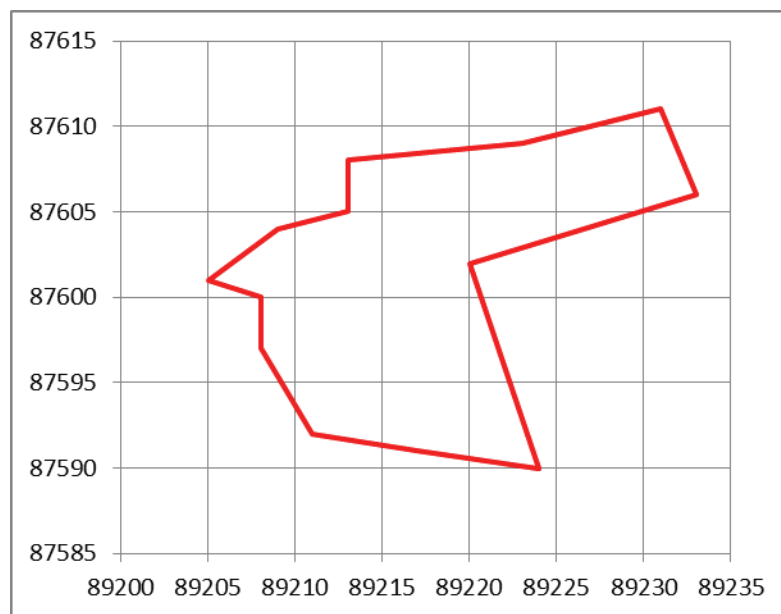


Figure 2: Garron Point polygon showing limit of suitable habitat

Table 3: Results of molluscan analysis (P = present)

Sample	Garron Point						Red Man Bay								
	1	2	3	4	5	6	1	2	3	4	5	6	7	8	9
<i>Vertigo angustior</i>	12	91	5	P	P	P	45	19	7	3	P	P	P	P	P
<i>Carychium tridentatum</i>							24	2		6					
<i>Cepaea nemoralis</i>									1	1					
<i>Clausilia bidentata</i>	2	14	4						2	1					
<i>Cochlicopa lubrica</i>			9							2					
<i>Cochlicopa lubricella</i>	3						3	1							
<i>Discus rotundatus</i>			2						2	1					
<i>Lauria cylindracea</i>	7	15	3												
<i>Nesovitrea hammonis</i>			2				3		4	3					
<i>Oxychilus alliarius</i>			3				2	1	3	1					
<i>Pupilla muscorum</i>		4					8	2	5						
<i>Punctum pygmaeum</i>							3	2	5	5					
<i>Vallonia excentrica</i>	1		1				2	1							
<i>Vertigo substriata</i>			16				9		4	3					
<i>Vitrea contracta</i>								2	2						
Total No. of species	5	4	9				9	8	10	10					
Total No. of snails	25	124	45				99	38	35	36					

## 4.2 Red Man Bay

The *Vertigo angustior* habitat comprises a narrow strip of transition grassland between the high water mark and the slopes at the base of the cliffs (Annex 2, photographs 9 and 10). The habitat is mostly *Festuca rubra* sward with the moss *Rhytidiadelphus squarrosus* lying approximately 1-5 m from the HWM. The zone nearest the HWM tends to be rather dry and fragmented with sparse vegetation over gravel and limpet shells, whereas on the lower cliff slopes the vegetation is dominated more by taller grasses such as *Arrhenatherum elatum* and bracken *Pteridium aquilinum*. The suitable habitat extends for approximately 150 m from south to north but is rarely more than 6 m in width from the HWM (Figure 3). If one takes an average of 4 m wide over the whole transect length, then the total area of habitat classed as optimal or sub-optimal is 600 m<sup>2</sup> (500-700).

*Vertigo angustior* was found to be widespread in good habitat, being found in all four transect samples plus in the field at a further five locations, especially under flotsam (Table 3). The snail was found along 120 m of the transect. Numbers of individuals in the samples ranged from 3-45 (mean 18.5) giving an approximate density of 296/m<sup>2</sup>. This is an order of magnitude higher than the 32/m<sup>2</sup> recorded by Marriot (2004). Marriot's density was based on an area of suitable habitat of 52 m<sup>2</sup>.

Figure 3: Red Man Bay Transects

All Transects start from the coastal edge

Key

	Optimal habitat
	Sub-optimal habitat
	Unsuitable

0 m transect at large lichen covered rock at NO89203 88739

0 m	1.3	2.5	3.6 →
Sparse <i>Festuca rubra</i> (FR) over rocks, limpets and gravel	Good FR thatch with <i>Rhytidiadelphus squarrosus</i>	Lots of FR & <i>Rhytidiadelphus</i>	FR, <i>Angelica sylvestris</i> , <i>Pteridium aquilinum</i> , <i>Iris pseudacorus</i>

10 m transect at NO89193 88750

0 m	1.3	2.5	3.6 →
Sparse <i>Festuca rubra</i> (FR) over rocks, limpets and gravel	Good FR thatch with <i>Rhytidiadelphus squarrosus</i>	Lots of FR & <i>Rhytid</i>	FR, <i>Angelica</i> , <i>Pteridium</i> , <i>Iris</i>

20 m transect at large lichen covered rock at NO89189 88761

0 m	1.0	2.7	4.3	6.0 →
Sparse FR over limpets & gravel	Good FR thatch with <i>Rhytidiadelphus</i>	Open, <i>Arrhenatherum</i> and <i>Rhytid</i> , <i>Urtica dioica</i>	More <i>Urtica</i> than previous zone	<i>Urtica</i> and <i>Pteridium</i> going into <i>Iris</i>

30 m transect at NO89188 88770

0 m	1.0	2.7	4.1	6.0 →
FR, <i>Armeria maritime</i> , <i>Trifolium repens</i> over limpets & gravel	Dense FR thatch with clover and some <i>Rhytidiadelphus</i>	More <i>Arrhenath</i> and <i>Rhytid</i> , <i>Primula vulgaris</i> , <i>Pteridium</i>	Ranker than previous zone	<i>Urtica</i> and <i>Pteridium</i>

40 m transect at NO89185 88783

0 m	1.2	2.1	4.2 →
FR over limpets & gravel	Mostly FR with <i>Primula Rhytid Arrhenath</i>	Taller, ranker with <i>Arrhenath</i> and <i>Rhytid</i> , <i>Primula</i> , <i>Pteridium</i> , occasional <i>Urtica</i> & <i>Angelica</i>	Taller <i>Arrhenatherum</i> and <i>Pteridium</i>

50 m transect at NO89183 88793

0 m	1.4	2.6	3.6 →
Virtually bare, with occasional grasses, <i>Senecio vulgaris</i> & hawkweeds	FR thatch with <i>Rhytid</i> and low <i>Arrhenatherum</i>	Taller FR <i>Arrhenatherum</i> and <i>Rhytid</i> , with flotsam	Ranker than previous zone becoming dominated by <i>Pteridium</i>

60 m transect at NO89179 88802, pile of flotsam and *Halmione* below start point

0 m	1.4	4.0	6.3 →
Sparse FR over limpets & gravel	Dense <i>Rhytidiadelphus</i> with FR, sparse <i>Arrhenatherum</i> and flotsam	Similar to previous zone with <i>Urtica</i> , <i>Geranium robertianum</i> , but still open habitat	<i>Filipendula ulmaria</i> and <i>Pteridium</i>

70 m transect at NO89184 88810

0 m	0.9	1.6 →
Very sparse FR	FR with <i>Rhytid</i> and <i>Stellaria</i> sp.	Tall <i>Arrhenatherum</i> and <i>Urtica</i> going in to <i>Pteridium</i>

At 76.5 m (NO89181 88815) the habitat opens out and the potential habitat zone becomes wider

80 m transect at NO89180 88818

0 m	1.3	2.9	4.8	8.2 →
Sparse FR	Relatively sparse FR with some <i>Rhytidiadelphus</i>	<i>Rhytidiadelphus</i> dominated with FR	<i>Rhytidiadelphus</i> dominated with FR but also with <i>Arrhenatherum</i> , <i>Urtica</i> , <i>Angelica</i> , <i>Silene dioica</i>	<i>Pteridium</i> but still lots of moss

90 m transect at NO89178 88828

0 m	2.4	5.4	10.8 →
Sparse FR lots of flotsam	<i>Rhytidiadelphus</i> dominated with FR and flotsam	Taller sward, still with <i>Rhytidiadelphus</i> and FR, but also <i>Holcus</i> , sparse <i>Digitalis vulgaris</i> & <i>Pteridium</i>	Slope with rocks & <i>Pteridium</i>

100 m transect at NO89177 88839

0 m	2.9	6.9	11.6 →
Sparse FR stony	<i>Rhytidiadelphus</i> dominated by FR and flotsam	Taller sward, still with <i>Rhytidiadelphus</i> and FR, but also <i>Holcus lanatus</i> , sparse <i>Digitalis</i> & <i>Pteridium</i>	Slope with <i>Arrhenath</i> , <i>Pteridium</i> , <i>Digitalis</i>

110 m transect at NO89178 88852

0 m	2.2	5.4	8.0	10.9 →
Sparse FR stony with limpets and <i>Tripleurospermum maritimum</i>	Good <i>Festuca rubra</i> sward with <i>Rhytidiadelphus</i>	Similar with <i>Stellaria</i> sp. and umbellifers	More <i>Arrhenatherum</i> coming in	Slope with <i>Filipendula Pteridium</i>

120 m transect at NO89175 88860

0 m	1.9	4.5	8.0	10.1 →
Sparse FR stony with limpets and <i>Tripleurospermum maritimum</i>	Good <i>Festuca rubra</i> sward with <i>Rhytidiadelphus</i>	Taller sward with more <i>Stellaria</i> sp. and <i>Arrhenatherum</i>	Even taller with more <i>Arrhenatherum</i>	Slope with <i>Filipendula Pteridium</i>

130 m transect at NO89175 88873

0 m	1.2	2.3	4.1 →
Sparse FR	Better <i>Festuca rubra</i> sward moss rare	Taller sward with umbellifers and <i>Arrhenatherum</i>	Slope with <i>Filipendula Urtica</i>

140 m transect at NO89177 88881

0 m	3.2	4.6 →
Moderately good FR sward, patchy habitat though	Still FR sward but taller with <i>Arrhenatherum</i> , umbellifers and <i>Stellaria</i>	Tall, dense <i>Arrhenatherum</i>

148 m transect at NO89176 88888

0 m	4.2	5.2	6.7	8.4 →
Shingle, <i>Phragmites</i> and <i>Tripleurospermum</i>	Shingle & denser <i>Tripleurospermum</i>	Sparse FR sward	Denser FR sward with sparse <i>Phragmites australis</i>	Taller <i>Phragmites Arrhenatherum</i> becoming very tall & rank beyond

The *Festuca rubra* zone extends to 152 m (NO89178 88892) where it becomes a dense *Phragmites australis* bed.

## 5 CONDITION ASSESSMENT

Having obtained some baseline data in 2004 on the attributes required to assess condition, the present baseline survey established thresholds to reflect the extent of optimal habitat and distribution of the snail.

### 5.1 Population assessment

It is known that *V. angustior* populations can fluctuate considerably from year to year (e.g. Sharland, 2000; Moorkens & Gaynor, 2003; Killeen, 2010), and for this reason abundance of *V. angustior* has not been considered as one of the targets for condition assessment at Perthumnie Bay.

Table 4: Targets for population assessment

Indicator	Target	Result	Pass/Fail
Presence/absence	<ul style="list-style-type: none"> <li>Adult or sub-adult snails are present in at least 3 sites of suitable habitat with a geographical spread at Garron Point OR 75% of suitable sites surveyed (minimum 4 samples)</li> </ul>	Present in 6 sites	Pass
Presence/absence	<ul style="list-style-type: none"> <li>Adult or sub-adult snails are present in at least 5 sites of suitable habitat with a geographical spread on the transect at Red Man Bay or 80% of suitable sites surveyed (minimum 6 samples)</li> </ul>	Present in 9 sites	Pass

Two passes 'favourable - maintained' (green); one pass 'favourable - declining' (amber); zero passes 'unfavourable - declining' (red)

### 5.2 Habitat for the species assessment

Table 5: Targets for habitat assessment

Indicator	Target	Result	Pass/Fail
Habitat extent:	<ul style="list-style-type: none"> <li>Habitat at Garron Point should occur within an area of at least 275 m<sup>2</sup>, of which at least 200 m<sup>2</sup> is classed as optimal</li> </ul>	200 m <sup>2</sup> classed as optimal	Pass
Habitat extent:	<ul style="list-style-type: none"> <li>At least 500 m<sup>2</sup> of habitat at Red Man Bay should be classed as suitable (optimal or Sub-optimal habitat)</li> </ul>	600 m <sup>2</sup> classed as optimal	Pass

Two passes 'favourable - maintained' (green); one pass 'favourable - declining' (amber); zero passes 'unfavourable - declining' (red)

### 5.3 Future prospects assessment

Future prospects for *Vertigo angustior* are assessed by listing the activities that are influencing or are likely to influence the site that could result in changing the status of the species. The location of the pressure (from inside or outside the site), its influence (positive, negative or neutral), and the intensity of the pressure (low, medium or high) are noted. The

combination of the influences is balanced to assess the site's future prospects as green, amber or red.

*Table 6: Future prospects assessment*

Activity	Location	Influence	Intensity
non intensive mixed animal grazing	Inside	Neutral	Low
other human intrusions and disturbances	Inside	Neutral	Low
oil spills in the sea	Inside	Neutral	Low
rise of temperature & extremes	Inside	Neutral	Low
droughts and less precipitations	Inside	Neutral	Low
flooding and rising precipitations	Inside	Neutral	Low

Future prospects have been assessed by examining how impacts are affecting the other attributes (i.e. population and habitat for the species) and their impact if they continue unchecked. Several impacts are having a minor effect at Perthumnie Bay: neither deer and rabbit grazing are having a negative impact on the quality of the habitat; barbeques and fires with driftwood were evident at Red Man Bay, and these practices, combined with trampling, could possibly affect adversely the transition margin habitat. A major offshore oil spill could have a serious impact on the narrow transition zone at Red Man Bay. The greatest unknown is the future impact of climate change, Red Man Bay in particular has very low resilience to climate change and relatively small rises in sea level would inundate the habitat.

Future prospects should balance positives and negatives to determine whether the species will survive at this site for the foreseeable future. On the basis of the status quo being maintained, future prospects have been assessed as 'favourable - maintained' (green). If greater weighting were placed upon climate change, then as with the 2007 national assessment, the prospects would be initially 'favourable - declining', and possibly thereafter 'unfavourable - declining'.

#### **5.4 Overall assessment**

The baseline condition assessment at Perthumnie Bay can be determined by how well the site meets the key targets for the attributes associated with this species. Although small in area, the habitat at both Garron Point and Red Man Bay is in good condition and the snail is present at several places within each site. The overall assessment is 'favourable - maintained' (green).

Attribute	Assessment
Population	favourable - maintained
Habitat for the species	favourable - maintained
Future prospects	favourable - maintained
Overall	favourable - maintained

## 6 RECOMMENDATIONS

### 6.1 Monitoring

Given the small area of occupancy and habitat of *Vertigo angustior*, it is recommended that monitoring is carried out at 3-yearly intervals. This should be re-assessed in light of any deterioration of condition or any changes to site management:

Frequency	Methods
Next monitoring due 2015	<p>Assessment of the Red Man Bay transect and the Garron Point site with snail sampling, plus assessment of condition of polygons and transects. Prescription as follows:</p> <ul style="list-style-type: none"><li>• Describe habitat and take at least four samples from the most suitable habitat in the Garron Point site and analyse for molluscan composition.</li><li>• At Red Man Bay repeat at least six of the short transects on the main transect up to 120 m and take at least six samples from the most suitable habitat and analyse for molluscan content.</li><li>• Redraw boundary of the habitat polygons at Garron Point and Red Man Bay and assign habitat to either optimal, optimal &amp; sub-optimal, sub-optimal, sub-optimal and unsuitable, or unsuitable.</li><li>• Assess the impacts upon the habitat for <i>V. angustior</i>.</li><li>• Use results to determine overall condition assessment.</li></ul>

### 6.2 Management

The habitat at both sites is maintained by rabbit grazing and deer browsing, and by the natural hydrological regime. No other management is recommended.




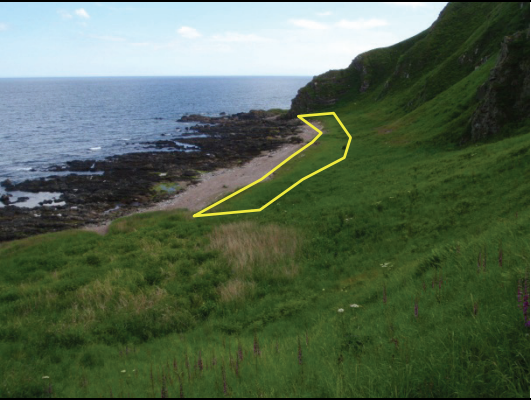




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**ANNEX 1: PHOTOGRAPHS - GARRON POINT**

 A photograph showing a rocky, grassy slope leading down to a rocky shore. A yellow arrow points to a specific area on the slope.	 A photograph of a grassy slope with a yellow line outlining a specific area of habitat.
<p>1.View into the Garron Point site</p>	<p>2.Extent of <i>V. angustior</i> habitat</p>
 A photograph showing a wide view of a grassy slope overlooking the sea, with some pink flowers in the foreground.	 A close-up photograph of a grassy slope with several pink flowers.
<p>3.View of habitat looking SE</p>	<p>4.Garron Point sample site 1</p>
 A close-up photograph of a grassy slope with a large rock and pink flowers.	 A close-up photograph of a grassy slope with a large rock.
<p>5.Garron Point sample site 2</p>	<p>6.Garron Point sample site 3</p>

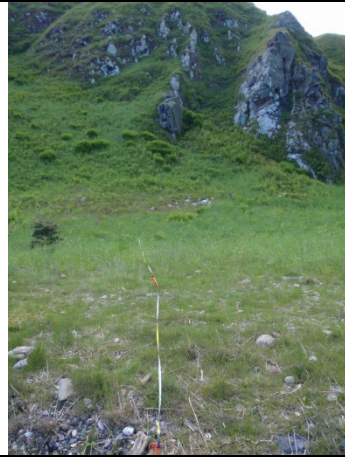
**ANNEX 2: PHOTOGRAPHS - RED MAN BAY**

	
<p>7. View looking N to Red Man Bay</p>	<p>8. Red Man Bay</p>
	
<p>9. <i>V. angustior</i> habitat looking N</p>	<p>10. <i>V. angustior</i> habitat looking S with boundary</p>
	
<p>11. <i>V. angustior</i> under log</p>	<p>12. Transect: boulder at start point 0 m</p>
	
<p>13. 10 m transect → inland</p>	<p>14. 10 m transect → north to 20 m transect</p>

	
<p>15. 20 m transect → inland</p>	<p>16. 30 m transect habitat at 2 m</p>
	
<p>17. 50 m transect → north across transect</p>	<p>18. 60 m transect → inland</p>
	
<p>19. 70 m transect → inland</p>	<p>20. 76.5 m (where habitat zone widens) looking north</p>
	
<p>21. 80 m transect → coast (note pillow lavas)</p>	<p>22. 80 m transect – habitat at 4m sample</p>



23. 90 m transect → inland



24. 100 m transect → inland



25. From 100 m transect → south



26. 100 m transect → north



27. 110 m transect → north across transect



28. 120 m transect → inland



29. From 130 m transect → north



30. View back to start from 130 m



31. 140 m transect → coast



32. To end of habitat from 148 m transect

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