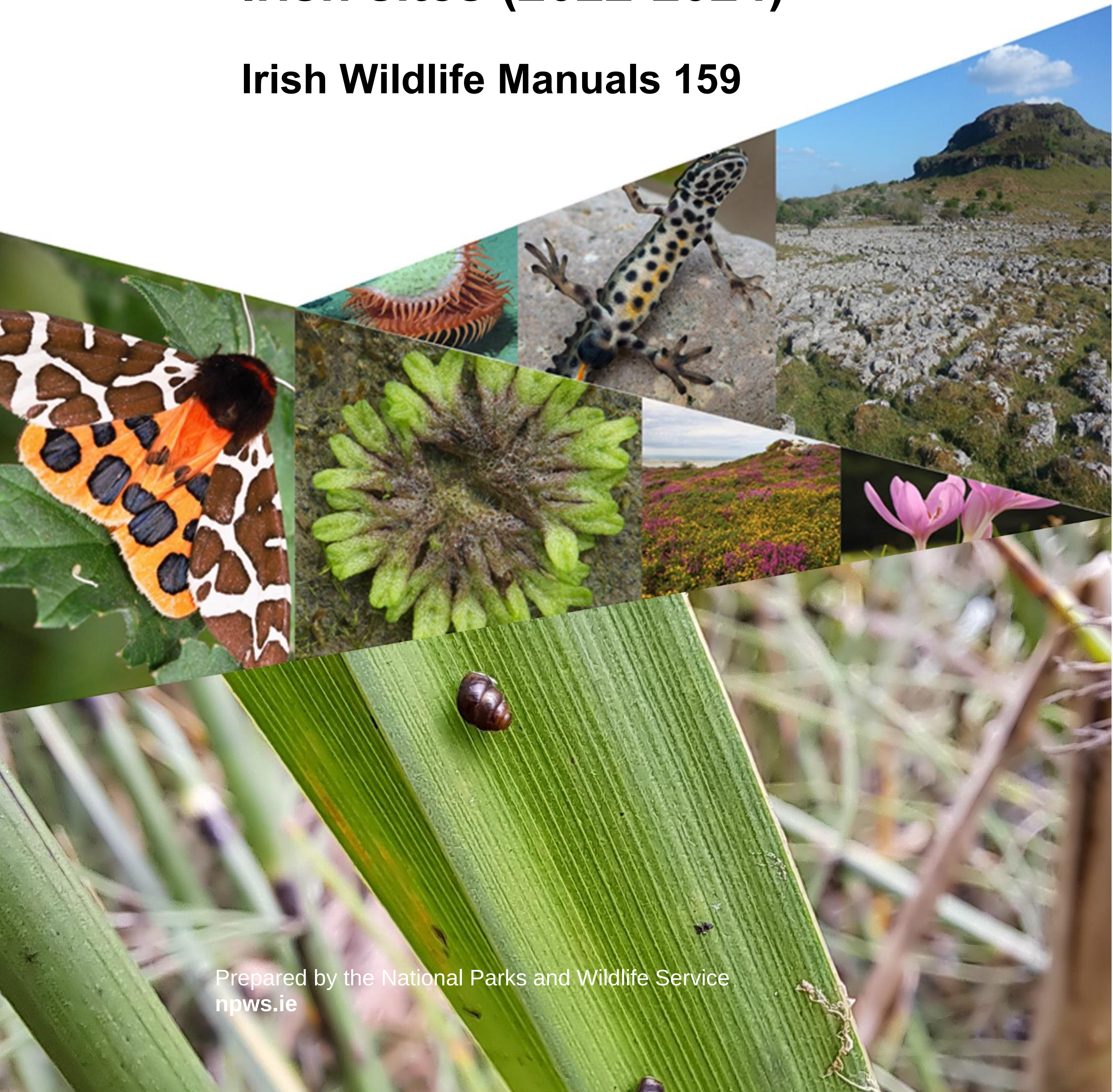
Monitoring of three Annex II species of *Vertigo* snail on Irish sites (2022-2024)

Irish Wildlife Manuals 159



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Front cover, from left to right and top to bottom:

A deep water fly trap anemone *Phelliactis* sp., Yvonne Leahy; **Common Newt** *Lissotriton vulgaris,* Brian Nelson; **Limestone pavement**, Bricklieve Mountains, Co. Sligo, Andy Bleasdale; **Garden Tiger** *Arctia caja,* Brian Nelson; **Violet Crystalwort** *Riccia huebeneriana*, Robert Thompson; **Coastal heath**, Howth Head, Co. Dublin, Maurice Eakin; **Meadow Saffron** *Colchicum autumnale*, Lorcan Scott

Bottom photograph: **Desmoulin's Whorl Snail** *Vertigo moulinsiana*, Charleville Lake, Co. Offaly, John Brophy

Monitoring of three Annex II species of *Vertigo* snail on Irish sites (2022-2024)

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Contents

Executive Summary

All three *Vertigo* species listed in Annex II of the EU Habitats Directive (92/43/EEC) and present in Ireland were surveyed over a three-year period (2022-2024). These surveys were carried out in order to gather the information needed to prepare National Conservation Assessments for the three species for submission to the European Commission, as required every six years. The three species are the Narrow-mouthed Whorl Snail (*Vertigo angustior*), Geyer's Whorl Snail (*Vertigo geyeri*) and Desmoulin's Whorl Snail (*Vertigo moulinsiana*). The 2022-2024 surveys fell within the 2019-2024 Article 17 monitoring period. This is the third round of monitoring that has been carried out for these species, with the previously completed monitoring having been for the periods 2007-2012 and 2013-2018.

During this most recent monitoring period, 60 monitoring sites within the Republic of Ireland were surveyed for the target species. These comprised 20 sites for *V. angustior*, 19 for *V. geyeri* and 21 for *V. moulinsiana*. With the exception of three new *V. moulinsiana* sites, all the survey sites had been surveyed during at least one of the previous monitoring periods.

The survey revealed that the number of sites positive for *V. angustior* has declined by six since the previous round of monitoring, while *V. geyeri* was recorded from seven fewer sites and *V. moulinsiana* was recorded from one additional site (excluding the three new sites).

Of the 20 *V. angustior* sites visited, the overall conservation assessment status has declined at seven since the previous round of monitoring. For *V. geyeri*, a decline was noted for six sites and an improvement noted for one. In the case of *V. moulinsiana*, there was a decline at four sites and an improvement at one.

A range of pressures were recorded at the sites that are considered to be affecting their conservation status. The treatment of threats and pressures in this site-based report is more detailed than that in the Article 17 National Conservation Assessments for the three whorl snail species, which concentrate, by necessity, on the overall national situation for each species and deal with the threats and pressures that are significant at a national level. The main pressures include grazing intensity, hydrological changes resulting in drying out or fluctuating water levels (possibly due to climate change, or to other local factors) and drainage. While grazing can have positive effects depending on the species (*V. geyeri* in particularly benefits from a moderate level of grazing, particularly by sheep), drying out of habitat has negative effects for all three species.

While positive pressures were noted for several sites, these were generally incidental benefits from existing land-uses (*e.g.* agricultural grazing). Occasional conservation measures directed at improving the habitat at *Vertigo* sites were aimed at the general habitat rather than specific measures for the relevant *Vertigo* species. Such measures included the installation of chestnut fencing at sand dune sites, farm plans managing grazing levels, native invasive species control and conservation grazing. A notable example of conservation measures achieving positive effects for a *Vertigo* site is VgCAM08 Sheskinmore, which has seen improvements to the site for *V. geyeri* leading to its overall conservation status becoming Favourable (green) from Unfavourable-Inadequate (amber) after the 2013-2018 round of monitoring. At this site, conservation grazing has been undertaken and the water levels of Sheskinmore Lough controlled using a sluice at the outflow.

The continued decline in overall conservation status of the *Vertigo* species' sites is of considerable concern and active intervention will be required to address the decline and return the species to Favourable Conservation Status. While measures to reverse climate change are beyond the scope of any actions that can be initiated at a site level, the resilience of the sites may still be improved by other measures, such as applying an appropriate level of grazing or blocking drains. While the European Union Nature Restoration Law focuses on habitats, the required management and restoration of habitats including fixed dunes, alkaline fens and reed

and tall herb swamps in Ireland will have to take the needs of the three Annex II *Vertigo* species into account.

Acknowledgements

The authors would like to thank all the people who made the completion of this project possible, including NPWS District Conservation Officers and Conservation Rangers for proving information on the various survey sites and accompanying us on fieldwork; the landowners for providing access to the sites, Maria Long for information on several new *V. moulinsiana* sites; Adam Mantell, Anne Mullen, Chris O’Neill and Lorcán Scott for detailed information on the *V. angustior* site at Derrynane; Paolo Viscardi, Amy Geraghty and Aidan O’Hanlon for the information on DNA sample preservation; and finally, the NPWS project manager, Brian Nelson for support throughout the project.

1 Introduction

Of the four species of *Vertigo* listed in Annex II of the EU Habitats Directive (92/43/EEC), three are found in Ireland. These are the Narrow-mouthed Whorl Snail (*Vertigo angustior* Jeffreys, 1830), Geyer's Whorl Snail (*V. geyeri* Lindholm, 1925) and Desmoulin's Whorl Snail (*V. moulinsiana* (Dupuy, 1849)). Due to their presence in Annex II, Ireland is required to designate Special Areas of Conservation (SACs) for the conservation of these species. To date, 13 SACs have been designated for *V. angustior*, 13 for *V. geyeri* and eight for *V. moulinsiana*, with some SACs supporting two or more of the species. Furthermore, under Article 17 of the Habitats Directive, every six years Ireland is required to report on the implementation of the Directive, including the results of surveillance monitoring carried out for the relevant habitats and species.

Since the Habitats Directive came into force, Ireland has produced three Article 17 reports covering the periods, pre-2007 (NPWS, 2008), 2007-2012 (NPWS, 2013) and 2013-2018 (NPWS, 2019). Across these three reporting periods, the overall conservation status of *V. angustior* has been Unfavourable-Inadequate (with the trend qualifier of 'deteriorating' added for 2013 and 2019) (NPWS, 2008; 2013; 2019). For *V. geyeri*, the overall conservation status has dropped from Unfavourable-Inadequate in 2007 and 2013, to Unfavourable-Bad (deteriorating) in 2019 (NPWS, 2008; 2013; 2019). *Vertigo moulinsiana* saw a change from Unfavourable-Bad in 2007 to Unfavourable-Inadequate (deteriorating) in 2013 with this apparent improvement due to previously unknown populations being recorded, despite the deteriorating trend (NPWS, 2008; 2013). For 2019, the overall conservation status for *V. moulinsiana* remained Unfavourable-Inadequate (deteriorating) (NPWS, 2019).

The current survey was undertaken in order to collect up-to-date information on the populations of the three Annex II *Vertigo* species across Ireland. This information was used in preparing the National Conservation Assessments (NCAs) for the three Annex II *Vertigo* species, as required under Article 17.

2 Methodology

2.1 Site selection

Moorkens & Killeen (2011) surveyed a total of 21 sites for *V. angustior*, 22 for *V. geyeri* and 20 for *V. moulinsiana* in the monitoring period 2007-2012, with some sites supporting more than one of the target species. In the monitoring period 2013-2018, Long & Brophy (2019) carried out repeat surveys for 54 of the 63 sites surveyed by Moorkens & Killeen (2011), with three new sites added for *V. moulinsiana*, two for *V. geyeri* and one for *V. angustior*, which were discovered since the 2007-2012 surveys. Several sites were omitted due to the complete loss of the species and its suitable habitat at those sites, with other sites omitted as they were part of separate monitoring projects.

In the current project, 60 sites (in 52 locations) were selected for survey. The selection of sites was based on the historical list of sites for the target species, adding three new *V. moulinsiana* sites that were discovered since 2017. Again, several sites were omitted due to the complete loss of the species and its suitable habitat at those sites, or because they are part of separate monitoring projects.

The 20 sites surveyed for *V. angustior* in the current monitoring period are presented in Table 1, the 19 *V. geyeri* sites in Table 2, and the 21 *V. moulinsiana* sites in Table 3. All site locations are illustrated in Figure 1.

Table 1 List of *Vertigo angustior* sites surveyed as part of the current monitoring project. * = Sites where two of the species have been previously recorded. ** = Sites where all three species have been previously recorded

Site code	Site name	County
VaCAM01	Beal Point	Kerry
VaCAM02	Derrynane	Kerry
VaCAM03	Dooaghtry	Mayo
VaCAM04	Glencolmcille	Donegal
VaCAM05	Kilshannig	Kerry
VaCAM06	Kinlackagh Bay	Donegal
VaCAM07	Maharees	Kerry
VaCAM08	Dog’s Bay	Galway
VaCAM10	Killanley Glebe	Sligo
VaCAM11	Lahinch	Clare
VaCAM12	Malin Dunes	Donegal
VaCAM13	Pollardstown Fen**	Kildare
VaCAM14	Streedagh Point Dunes	Sligo
VaCAM15	Bartraw	Mayo
VaCAM16	Inishmore Island	Galway
VaCAM17	Curragh Chase*	Limerick
VaCAM19	Louisa Bridge*	Kildare
VaCAM20	Ballysadare Bay	Sligo
VaCAM21	Strandhill Airport	Sligo
VaCAM22	Waterstown Lough**	Westmeath

Table 2 List of *Vertigo geyeri* sites surveyed as part of the current monitoring project. * = Sites where two of the species have been previously recorded. ** = Sites where all three species have been previously recorded

Site code	Site name	County
VgCAM01	Meenaphuil	Leitrim
VgCAM02	Tievebaun	Leitrim
VgCAM03	Brackloon	Mayo
VgCAM04	Clonaslee Eskers	Laois
VgCAM05	Dooaghtry	Mayo
VgCAM06	Drimmon Lough	Roscommon
VgCAM08	Sheskinmore Lough	Donegal
VgCAM09	Annaghmore Lough	Roscommon
VgCAM10	Ballyness Bay	Donegal
VgCAM13	Easkey Valley	Sligo
VgCAM14	Polaguil Bay	Donegal
VgCAM15	Silver River	Laois
VgCAM16	Fermoyle	Mayo
VgCAM18	Fin Lough (Offaly)*	Offaly
VgCAM20	Lisduff Fen*	Offaly
VgCAM21	Ox Mountains	Sligo
VgCAM22	Pollardstown Fen**	Kildare
VgCAM23	Waterstown Lough**	Westmeath
VgCAM24	Duleek Commons	Meath

Table 3 List of *Vertigo moulinsiana* sites surveyed as part of the current monitoring project. Sites not included in any previous monitoring surveys are underlined. * = Sites where two of the species have been previously recorded. ** = Sites where all three species have been previously recorded

Site code	Site name	County
VmCAM01	Borris	Carlow
VmCAM02	Fin Lough (Offaly)*	Offaly
VmCAM03	Lough Owel	Westmeath
VmCAM04	Mountmellick	Laois
VmCAM05	Louisa Bridge*	Kildare
VmCAM06	Ballybeg Lough	Clare
VmCAM08	Cappankelly	Westmeath
VmCAM09	Waterstown Lough**	Westmeath
VmCAM10	Ballynafagh Lake	Kildare
VmCAM11	Charleville Lake	Offaly
VmCAM12	Curragh Chase*	Limerick
VmCAM14	Kildallan Bridge	Westmeath
VmCAM16	Lisduff Fen*	Offaly
VmCAM17	The Murrough	Wicklow
VmCAM18	Pollardstown Fen**	Kildare
VmCAM19	Portumna	Galway
VmCAM21	Royal Canal, Longford Bridge	Longford
VmCAM23	Castletown	Waterford
VmCAM24	Gollierstown	Dublin
VmCAM25	Louisa Bridge (South)	Kildare
VmCAM26	Loughmerans	Kilkenny

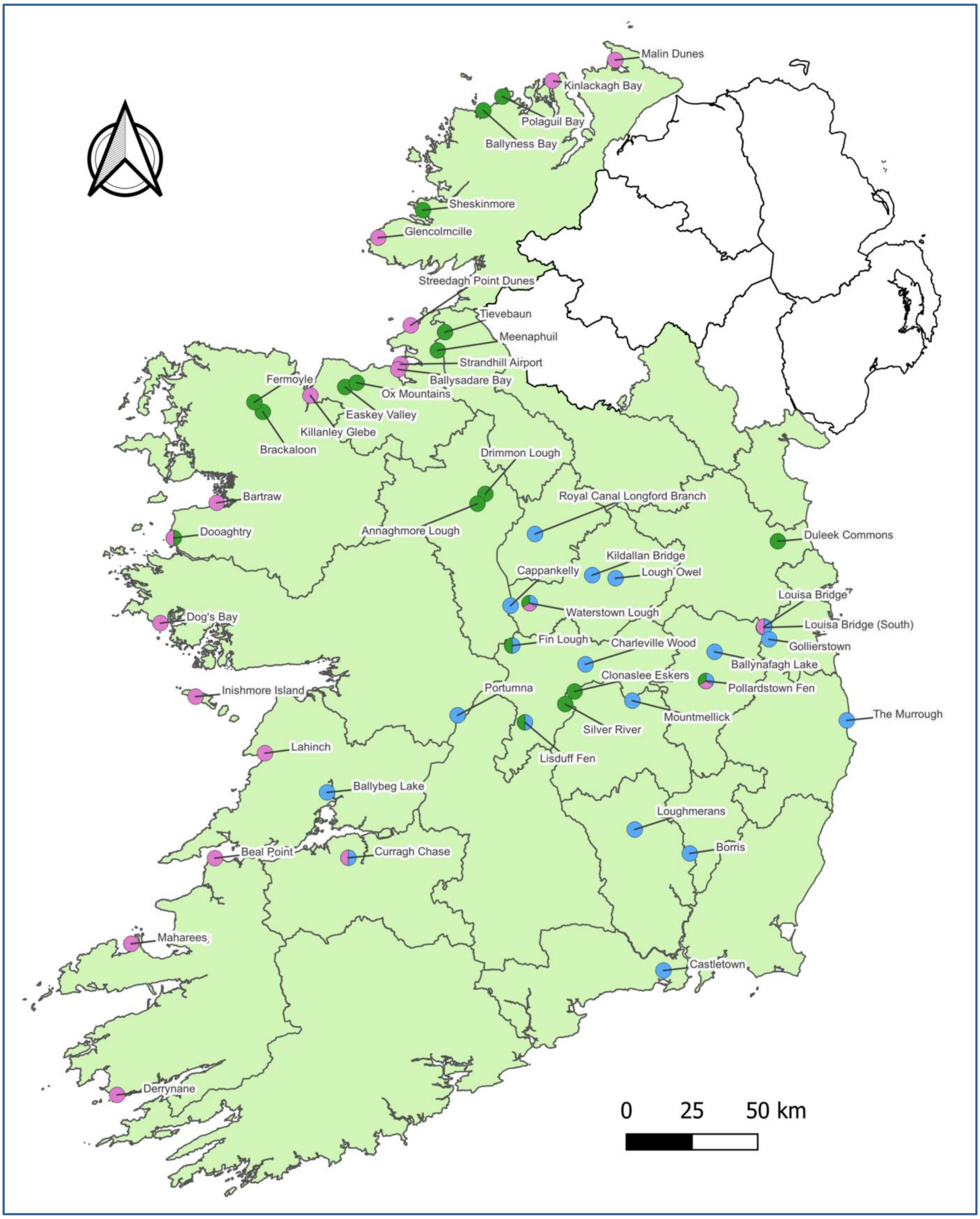

Figure 1 Location of survey sites for the current Annex II *Vertigo* monitoring survey. Pink indicates *Vertigo angustior* sites, green indicates *Vertigo geyeri* sites and blue indicates *Vertigo moulinsiana* sites. Note that some sites support more than one species.

2.2 Survey methodology

The survey methodologies for all three species followed those of Long & Brophy (2019) and, in the interest of brevity, will not be fully detailed here; however, deviations from that methodology will be set out.

1. During the current survey, full vegetation species lists and covers were not recorded from sample locations in Turboveg as it was by Long & Brophy (2019). Instead, a list of plant species present at each sample location was recorded in QGIS.
2. Data were recorded on ruggedized tablet running Android with QField, compared to the Trimble Nomad handheld computer running Windows Mobile with ArcPad used by Long & Brophy (2019).

For *Vertigo moulinsiana,* in order to maintain consistency, the vegetation classes established previously were used for existing sites, while those recommended in Section 4.4.9 of Long & Brophy (2019) were used for sites monitored for the first time during the current survey.

3 Results

3.1 Overview of results

The field surveys for the three *Vertigo* species were carried out over the summer and autumn of 2021-2024. The core field team comprised John Brophy and Orla Daly, with assistance from Jessica Hamilton and Jim Martin. The target species were recorded from 41 of the 60 sites surveyed. By species, this breaks down as 11 of 20 sites for *V. angustior*, 9 of 19 sites for *V. geyeri* and 21 of 21 sites for *V. moulinsiana*. A summary paragraph for each of the sites surveyed is presented in Appendix I.

At some sites, the broadly positive result masks a decline in the population and/or habitat at these sites. To understand the details of any given site, it is necessary to refer to the relevant species section within this report and the site reports presented in Appendices II-IV.

3.2 Vertigo angustior results

3.2.1 *Vertigo angustior* overview

Twenty sites were surveyed for *Vertigo angustior* across the field seasons 2022-2024. All 20 sites were previously surveyed by Long & Brophy (2019), with VaCAM22 Waterstown Lough added after Moorkens & Killeen (2011) discovered the species along with *V. geyeri* during 2007-2012 monitoring of *V. moulinsiana* at the site. *Vertigo angustior* was recorded from 11 of the 20 sites surveyed (Table 4).

Table 4 List of *Vertigo angustior* sites surveyed during the 2019-2024 monitoring period, and whether the site was positive or negative for the species in this round of monitoring and the previous two rounds

Site code	Site name	2007-12	2013-18	2019-24
VaCAM01	Beal Point	Positive	Positive	Positive
VaCAM02	Derrynane	Positive	Positive	Positive
VaCAM03	Dooaghtry	Positive	Positive	Positive
VaCAM04	Glencolmcille	Negative	Negative	Negative
VaCAM05	Kilshannig	Positive	Positive	Positive
VaCAM06	Kinlackagh Bay	Positive	Positive	Negative
VaCAM07	Maharees	Positive	Positive	Positive
VaCAM08	Dog's Bay	Positive	Positive	Positive
VaCAM10	Killanley Glebe	Positive	Positive	Negative
VaCAM11	Lahinch	Positive	Positive	Negative
VaCAM12	Malin Dunes	Positive	Positive	Positive
VaCAM13	Pollardstown Fen	Positive	Positive	Negative
VaCAM14	Streedagh Point Dunes	Positive	Positive	Positive
VaCAM15	Bartraw	Positive	Positive	Positive
VaCAM16	Inishmore Island	Positive	Positive	Negative
VaCAM17	Curragh Chase	Positive	Negative	Negative
VaCAM19	Louisa Bridge	Negative	Negative	Negative
VaCAM20	Ballysadare Bay	Positive	Positive	Positive
VaCAM21	Strandhill Airport	Positive	Positive	Positive
VaCAM22	Waterstown Lough	N/A	Positive	Negative

The number of positive sites has declined by six since the 2013-2018 monitoring survey and these include both coastal and inland sites.

All of the sites fall within SACs, with the exception of VaCAM11 Lahinch, which has only a very small overlap with an SAC, and VaCAM22 Waterstown Lough, which is entirely outside the SAC network.

3.2.2 *Vertigo angustior* population

While the results presented in Section 3.2.1 show a significant (35%) decline in the number of positive sites for *V. angustior* as compared to the 2013-2018 monitoring period, this does not fully describe the situation with regard to the *V. angustior* populations at the survey sites. Even at sites that were positive for the species, many of them have shown a decline in the number or percentage of positive samples as compared to previous monitoring periods. These declines are detailed in the individual site reports (Appendix II).

A broad comparison of the percentage of positive samples at the surveyed *V. angustior* sites across the three monitoring periods is presented in Table 5. This illustrates the general downward trajectory in the percentage of positive samples that has been occurring for *V. angustior* since 2013-18, with 14 sites showing a decrease in the percentage of positive samples, one site showing an increase, and five sites being stable/unchanged (though three of these stable sites had 0% positive samples in 2013-18).

Table 5 A comparison of the percentage (%) of positive samples locations at *V. angustior* sites surveyed across the 2007-12, 2013-18 and 2019-24 monitoring periods

Site ID	Site name	2007-12 (% positive)	2013-18 (% positive)	2019-24 (% positive)
VaCAM01	Beal Point	35	35	35
VaCAM02	Derrynane	46	36	18
VaCAM03	Dooaghtry	100	56	11
VaCAM04	Glencolmcille	0	0	0
VaCAM05	Kilshannig	63	21	7
VaCAM06	Kinlackagh Bay	77	44	0
VaCAM07	Maharees	15	17	6
VaCAM08	Dog's Bay	14	14	14
VaCAM10	Killanley Glebe	43	80	0
VaCAM11	Lahinch	61	7	0
VaCAM12	Malin Dunes	32	75	31
VaCAM13	Pollardstown Fen	67	13	0
VaCAM14	Streedagh Point Dunes	71	93	59
VaCAM15	Bartraw	76	62	92
VaCAM16	Inishmore Island	83	27	0
VaCAM17	Curragh Chase	56	0	0
VaCAM19	Louisa Bridge	0	0	0
VaCAM20	Ballysadare Bridge	100	92	50
VaCAM21	Strandhill Airport	60	21	7
VaCAM22	Waterstown Lough	NA	25	0

The Population status for each site was assessed based mainly on the criteria of Moorkens & Killeen (2011), with occasional additions or amendments by Long & Brophy (2019). Due to the nature of the assessment criteria (detailed in the individual site reports), in some cases the number or percentage of positive samples may remain unchanged, but a criterion may now fail due to the distribution of the positive samples within the site. The reason for any change in Population status at a site level is presented in Table 6.

Table 6 A comparison of the Population status at *V. angustior* sites surveyed across the 2013-18 and 2019-24 monitoring periods, including the reason for any change

Site ID	Site name	2013-18	2019-24	Reason for change
VaCAM01	Beal Point	Amber	Red	Drop in status due to the loss of two positive samples from transect
VaCAM02	Derrynane	Amber	Red	Drop in status due to a drop in number of positive samples across the site
VaCAM03	Dooaghtry	Green	Red	Drop in status due to a drop in number of positive samples along transect and across the site
VaCAM04	Glencolmcille	Red	Red	No change
VaCAM05	Kilshannig	Red	Red	No change
VaCAM06	Kinlackagh Bay	Amber	Red	Drop in status due to the number of positive samples across the site dropping to zero
VaCAM07	Maharees	Red	Red	No change
VaCAM08	Dog's Bay	Green	Red	Drop in status due to no positive samples within the grassy hollow with freshwater upwelling
VaCAM10	Killanley Glebe	Green	Red	Drop in status due to the number of positive samples across the site dropping to zero
VaCAM11	Lahinch	Red	Red	No change
VaCAM12	Malin Dunes	Green	Red	Drop in status due to a drop in number of positive samples along transect and across the site
VaCAM13	Pollardstown Fen	Red	Red	No change
VaCAM14	Streedagh Point Dunes	Green	Amber	Drop in status due to a drop in number of positive samples along transect
VaCAM15	Bartraw	Green	Green	No change
VaCAM16	Inishmore Island	Amber	Red	Drop in status due to the number of positive samples across the site dropping to zero
VaCAM17	Curragh Chase	Red	Red	No change
VaCAM19	Louisa Bridge	Red	Red	No change
VaCAM20	Ballysadare Bridge	Green	Red	Drop in status due to a drop in number of positive samples along transect and across the site
VaCAM21	Strandhill Airport	Red	Red	No change
VaCAM22	Waterstown Lough	Green	Red	Drop in status due to the number of positive samples across the site dropping to zero

3.2.3 *Vertigo angustior* habitat

A total of 992.08 ha of *V. angustior* habitat was included in the current survey of 20 sites, with 851.20 ha having some suitability for supporting the snail (Suboptimal-Unsuitable or better) and 140.89 ha considered Unsuitable (Table 7).

Table 7 A breakdown of *Vertigo angustior* habitat suitability class, in hectares (ha) and percent (%), surveyed during the 2019-2024 monitoring period

Habitat suitability class	Area (ha)	Area (%)
Optimal	78.10	7.9
Optimal-Suboptimal	181.99	18.3
Suboptimal	219.17	22.1
Suboptimal-Unsuitable	371.95	37.5
Unsuitable	140.89	14.2
TOTAL	992.08	

The total area surveyed dropped from 1045.66 ha in 2013-2018 to 992.08 ha in the current survey due to the removal of VaCAM09 Fanore from the survey schedule for the 2019-2024 monitoring period, dropping the total number of sites surveyed from 21 to 20.

The comparison of habitat suitability areas between the current and previous monitoring periods (2013-2018 and 2019-2024) is slightly complicated by the fact that the list of sites surveyed differs between monitoring periods. For this reason, the comparison is based on the figures relating to the surveyed sites that both monitoring periods have in common (Table 8).

Table 8 A comparison *Vertigo angustior* habitat suitability area in hectares (ha) between the 2013-2018 and 2019-2024 monitoring periods. Both ecological and interpreted changes are included. Excludes VaCAM09, which was not surveyed in 2019-2024

Habitat suitability class	2013-2018	2019-2024	Difference (ha)	Difference (%)
Optimal	69.22	78.10	+8.88	+12.8
Optimal-Suboptimal	149.17	181.99	32.82	+22.0
Suboptimal	278.44	219.17	-59.28	-21.3
Suboptimal-Unsuitable	347.40	371.95	+24.55	+7.1
Unsuitable	147.86	140.89	-6.97	-4.7
TOTAL	992.08	992.08		

The total area surveyed at the 20 sites visited during the two monitoring periods remains unchanged. There has been an increase in the area of Optimal (+12.8%), Optimal-Suboptimal (+22.0%) and Suboptimal-Unsuitable (+7.1%) habitat between the monitoring periods, while a decrease in the area of Suboptimal (-21.3%) and Unsuitable (-4.7%) habitat was recorded.

The Habitat status for each site was assessed based mainly on the criteria of Moorkens & Killeen (2011), with occasional additions or amendments by Long & Brophy (2019). Due to the nature of the assessment criteria (detailed in the individual site reports), in some cases the area of suitable habitat may change, but a criterion may still pass or fail as the change in the area of suitable habitat is not sufficient to change the result. The reason for any change in Habitat status at a site level is presented in Table 9.

Table 9 A comparison of the Habitat status at *Vertigo angustior* sites surveyed across the 2013-18 and 2019-24 monitoring periods, including the reason for any change

Site ID	Site name	2013-18	2019-24	Reason for change
VaCAM01	Beal Point	Amber	Amber	No change
VaCAM02	Derrynane	Amber	Red	Drop in status due to a drop in suitable habitat along transect and across the site
VaCAM03	Dooaghtry	Green	Amber	Drop in status due to a drop in suitable wetness and thatch along transect
VaCAM04	Glencolmcille	Amber	Green	Improvement in status to an increase in the suitable habitat along the transect
VaCAM05	Kilshannig	Red	Red	No change
VaCAM06	Kinlackagh Bay	Red	Red	No change
VaCAM07	Maharees	Red	Red	No change
VaCAM08	Dog's Bay	Red	Red	No change
VaCAM10	Killanley Glebe	Green	Green	No change
VaCAM11	Lahinch	Green	Amber	Drop in status due to a drop in the suitable habitat along the transect
VaCAM12	Malin Dunes	Red	Red	No change
VaCAM13	Pollardstown Fen	Red	Red	No change
VaCAM14	Streedagh Point Dunes	Amber	Amber	No change
VaCAM15	Bartraw	Green	Green	No change
VaCAM16	Inishmore Island	Amber	Red	Drop in status due to a drop in the suitable habitat and wetness along the transect
VaCAM17	Curragh Chase	Red	Red	No change
VaCAM19	Louisa Bridge	Red	Red	No change
VaCAM20	Ballysadare Bridge	Green	Red	Drop in status due to a drop in the suitable habitat and wetness along the transect
VaCAM21	Strandhill Airport	Red	Red	No change
VaCAM22	Waterstown Lough	Green	Red	Drop in status due to a drop in the suitable habitat across the site

The reasons for the changes to the habitat suitability class are divided into those that are ecological in nature (*e.g.* drying out, grazing level altering the vegetation structure) and interpretation (*e.g.* view that previous assessment was inaccurate, but no actual ecological change is thought to have occurred). The positive and negative changes that have affected the area covered by the five habitat suitability classes are set out in Table 10 and Table 11, respectively.

Table 10 A breakdown of the positive *Vertigo angustior* habitat suitability changes recorded in 2019-2024 with reason for change. *O = Optimal, O-SO = Optimal-Suboptimal, SO = Suboptimal, SO-U = Suboptimal-Unsuitable, U = Unsuitable. **Eco = Ecological, Int = Interpreted

Site ID	Site name	2013-2018*	2019-2024*	Area (ha)	Change**
VaCAM04	Glencolmcille	U	SO-U	8.43	Eco - Habitat is slight more suitable, particularly in the northwest
VaCAM06	Kinlackagh Bay	S-US	SO	0.83	Eco - Enough suitable habitat present to justify increase
VaCAM06	Kinlackagh Bay	S-US	SO	16.62	Eco - Low level of grazing has allowed more suitable habitat to develop
VaCAM07	Maharees	SO	O-SO	31.39	Eco - Reduction in grazing pressure
VaCAM14	Streedagh Point Dunes	SO	O-SO	9.37	Eco - Sward more open, with less dense, sodden thatch
VaCAM15	Bartraw	O-SO	O	3.58	Int - More suitable habitat present than previously considered

Table 11 A breakdown of the negative *Vertigo angustior* habitat suitability changes recorded in 2019-2024 with reason for change. *O = Optimal, O-SO = Optimal-Suboptimal, SO = Suboptimal, SO-U = Suboptimal-Unsuitable, U = Unsuitable. **Eco = Ecological, Int = Interpreted

Site ID	Site name	2013-2018*	2019-2024*	Area (ha)	Change
VaCAM01	Beal Point	SO	SO-U	6.36	Eco - Heavy overgrazing has resulted in no *Festuca rubra* thatch, with forbs dominating
VaCAM02	Derrynane	SO	SO-U	7.68	Eco - Overgrazed by rabbits and disturbed by burrows
VaCAM16	Inishmore Island	SO	SO-U	16.51	Eco - Sward grazed short and very dry
VaCAM16	Inishmore Island	SO	SO-U	1.3	Eco - Bryophyte layer is replacing *F. rubra* thatch
VaCAM16	Inishmore Island	SO-U	U	1.46	Int - Disturbance from historical sand quarrying and habitat too dry
VaCAM17	Curragh Chase	SO	SO-U	3.19	Eco - Most of the fen is too wet for snail, with rank grasses and rushes causing loss of bryophyte layer
VaCAM22	Waterstown Lough	O-SO	SO	2.64	Eco - Limited bryophyte layer and lack of light *F. rubra* litter, likely due to grazing

3.2.4 *Vertigo angustior* pressures and threats

Pressures are considered to be factors which have acted within a reporting period, while threats are factors expected to be acting in the future. It is possible for the same impact to be both a pressure and a threat if it is having an impact now and this impact is likely to continue. The pressures and threats relevant to the *V. angustior* population at the survey sites were recorded following the pressures list 2019-2024 reporting period for Articles 12 and 17. A total of 17 pressures or threats were recorded across the 20 *V. angustior* sites (Table 12) and all sites had at least one negative pressure recorded.

The most frequently recorded pressure was PM07 *Natural processes without direct or indirect influence from human activities or climate change*. This is a broad category that was recorded from 70% of surveyed sites, with this negative pressure generally referring to marine erosion along the seaward edge of sand dune systems, and occasionally scrub encroachment.

PA07 *Intensive grazing or overgrazing by livestock* was recorded at 65% of the surveyed sites, and related to cattle, sheep and, occasionally, horses. The negative effect of grazing included the removal of a well-developed *Festuca rubra* thatch, and a reduction in the formation of *Ammophila arenaria* tussocks. On two occasions, this pressure was considered to be having a positive effect and one occasion a neutral effect.

PF05 *Sports, tourism and leisure activities* was recorded from 45% of the surveyed sites, with this negative pressure most commonly relating to trampling caused by walkers, but also golf courses and caravan parks.

PI02 Other invasive alien species (other than species of Union concern) was recorded from 40% of sites and related to a range of invasive alien species, the most significant of which was *Hippophae rhamnoides*. Less important examples included *Polygonum wallichii*, *Acer pseudoplatanus*, *Phormium tenax*, *Pinus contorta*, *Petasites pyrenaicus*, and *Montbretia*.

PI03 *Problematic native species* was recorded from 35% of the sites and included rabbits (*Oryctolagus cuniculus*) through burrowing and tight grazing of the sward, reducing or removing the *Festuca rubra* thatch, and sometimes the *Ammophila arenaria* from places.

PJ03 *Changes in precipitation regimes due to climate change* was noted for 30% of sites in the form of drying out of *Festuca rubra* thatch.

The broad category PA25 *Agriculture activities not referred to above* was recorded from 25% of sites and refers to tractor or other vehicle tracks.

PA05 Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming) was record for 10% of sites and was due to vegetation becoming rank and more unsuitable for supporting the snail.

Table 12 List of the pressures and threats recorded at the *Vertigo angustior* sites surveyed during the 2019-2024 monitoring period in decreasing order of frequency of occurrence

Pressure/ threat code	Pressure/threat name	Positive	Negative	Neutral	Total
PM07	Natural processes without direct or indirect influence from human activities or climate change	-	14	-	14
PA07	Intensive grazing or overgrazing by livestock	2	10	1	13
PF05	Sports, tourism and leisure activities	-	9	-	9
PI02	Other invasive alien species (other than species of Union concern)	-	8	-	8
PI03	Problematic native species	1	5	1	7
PJ03	Changes in precipitation regimes due to climate change	-	6	-	6
PA25	Agriculture activities not referred to above	-	5	-	5
PA05	Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming)	-	2	-	2
PA01	Conversion into agricultural land (excluding drainage and burning)	-	1	-	1
PA08	Extensive grazing or undergrazing by livestock	-	1	-	1
PA13	Application of natural or synthetic fertilisers on agricultural land	-	1	-	1
PB01	Conversion to forest from other land uses, or afforestation (excluding drainage)	-	1	-	1
PF01	Conversion from other land uses to built-up areas	-	0	1	1
PF03	Creation or development of sports, tourism and leisure infrastructure	-	0	1	1
PF06	Deposition and treatment of waste/rubbish from built-up areas	-	1	-	1
PH08	Other human intrusions and disturbance not mentioned above	-	1	-	1
PJ07	Cyclones, storms, or tornados due to climate change	-	1	-	1

The remaining nine pressures and threats recorded were only noted for one site (5% of the sites surveyed). Of the agricultural pressures, PA01 *Conversion into agricultural land (excluding drainage and burning)* related to potato cultivation on fixed dunes, PA08 *Extensive grazing or undergrazing by livestock* was noted where rank agricultural grasses had been allowed to develop on fixed dune habitat, and PA13 *Application of natural or synthetic fertilisers on agricultural land* occurred on improved grassland above the *V. angustior* site. PB01 *Conversion to forest from other land uses, or afforestation (excluding drainage)* occurred where *Salix* spp. and *Alnus glutinosa* was planted and continues to grow. PF01 *Conversion from other land uses to built-up areas* refers to one-off housing built above the site, PF03 *Creation or development of sports, tourism and leisure infrastructure* related to a golf course, while PF06 *Deposition and treatment of waste/rubbish from built-up areas* was for the dumping of artificial grass and grass cuttings on a golf course. The pressure PH08 *Other human intrusions and disturbance not mentioned above* was for the dumping of round hay bales on dunes, while PJ07 *Cyclones, storms, or tornados due to climate change* related to the greatly increased erosion of the front the dune system.

3.2.4.1 Negative pressures/threats

In terms of the intensity of the negative effect of the recorded pressures and threats, and the area affected, PJ03 *Changes in precipitation regimes due to climate change* was considered to be having the most widespread effect, with a High intensity recorded over 482.30 ha across five sites (Table 13). This was followed by PA07 *Intensive grazing or overgrazing by livestock* (22.68 ha) and PM07 *Natural processes without direct or indirect influence from human activities or climate change* (19.50 ha). The remaining High intensity negative effects were PI02 *Other invasive alien species (other than species of Union concern)* (13.51 ha), PI03 *Problematic native species* (9.9 ha), PJ07 *Cyclones, storms, or tornados due to climate change* (3.97 ha), PA13 *Application of natural or synthetic fertilisers on agricultural land* (3.19 ha), PA05 *Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming)* (1.40 ha), PB01 *Conversion to forest from other land uses, or afforestation (excluding drainage)* (0.20 ha), PH08 *Other human intrusions and disturbance not mentioned above* (0.13 ha), PF06 *Deposition and treatment of waste/rubbish from built-up areas* (0.11 ha) and PA01 *Conversion into agricultural land (excluding drainage and burning)* (0.08 ha).

Of the Medium intensity negative pressures, PA07 *Intensive grazing or overgrazing by livestock* was the most extensive at 409.22 ha across four sites. This was followed by PF05 *Sports, tourism and leisure activities* (150.24 ha), PJ03 *Changes in precipitation regimes due to climate change* (129.45 ha) and PA05 *Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming)* (52.92 ha) and PM07 *Natural processes without direct or indirect influence from human activities or climate change* (28.95 ha). The remaining Medium intensity negative effects were PA08 *Extensive grazing or undergrazing by livestock* (18.17 ha), PI03 *Problematic native species* (12.28 ha), PA25 *Agriculture activities not referred to above* (1.42 ha) and PI02 *Other invasive alien species (other than species of Union concern)* (0.11 ha).

The remaining negative pressures were of Low intensity, with the most extensive being PI03 *Problematic native species* (79.69 ha), followed by PA07 *Intensive grazing or overgrazing by livestock* (41.91 ha) and PF05 *Sports, tourism and leisure activities* (21.51 ha). The remaining Low intensity negative effects were PM07 *Natural processes without direct or indirect influence from human activities or climate change* (2.34 ha), PI02 *Other invasive alien species (other than species of Union concern)* (0.10 ha) and PA25 *Agriculture activities not referred to above* (0.04 ha).

Table 13 Pressures and threats recorded as having a negative influence at *Vertigo angustior* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PJ03	Changes in precipitation regimes due to climate change	High	482.30	5
PA07	Intensive grazing or overgrazing by livestock	High	22.68	4
PM07	Natural processes without direct or indirect influence from human activities or climate change	High	19.50	8
PI02	Other invasive alien species (other than species of Union concern)	High	13.51	5
PI03	Problematic native species	High	9.90	2
PJ07	Cyclones, storms, or tornados due to climate change	High	3.97	1
PA13	Application of natural or synthetic fertilisers on agricultural land	High	3.19	1
PA05	Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming)	High	1.40	1
PB01	Conversion to forest from other land uses, or afforestation (excluding drainage)	High	0.20	1
PH08	Other human intrusions and disturbance not mentioned above	High	0.13	1
PF06	Deposition and treatment of waste/rubbish from built-up areas	High	0.11	1
PA01	Conversion into agricultural land (excluding drainage and burning)	High	0.08	1
PA07	Intensive grazing or overgrazing by livestock	Medium	409.22	4
PF05	Sports, tourism and leisure activities	Medium	150.24	6
PJ03	Changes in precipitation regimes due to climate change	Medium	129.45	1
PA05	Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming)	Medium	52.92	1
PM07	Natural processes without direct or indirect influence from human activities or climate change	Medium	28.95	3
PA08	Extensive grazing or undergrazing by livestock	Medium	18.17	1
PI03	Problematic native species	Medium	12.28	1
PA25	Agriculture activities not referred to above	Medium	1.42	3
PI02	Other invasive alien species (other than species of Union concern)	Medium	0.11	1
PI03	Problematic native species	Low	79.69	2
PA07	Intensive grazing or overgrazing by livestock	Low	41.91	2
PF05	Sports, tourism and leisure activities	Low	21.51	3
PM07	Natural processes without direct or indirect influence from human activities or climate change	Low	2.34	3
PI02	Other invasive alien species (other than species of Union concern)	Low	0.10	2
PA25	Agriculture activities not referred to above	Low	0.04	2

3.2.4.2 Positive pressures/threats

Two positive pressures were identified during the current survey (Table 14). Neither was identified as a conservation measure, but rather as a pressure that was operating at a level that was having an overall positive effect. PA07 *Intensive grazing or overgrazing by livestock* affected 132.64 ha of *V. angustior* habitat at one site and related to cattle grazing at a level that was maintaining an open *Ammophila arenaria* and *Festuca rubra* dominated sward. PI03 *Problematic native species* refers to a low level of grazing by rabbits, where it helps keep the fixed dune sward open, but has not reached a level that negatively impacts on the *F. rubra* thatch.

Table 14 Pressures and threats recorded as having a positive influence at *Vertigo angustior* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PA07	Intensive grazing or overgrazing by livestock	Low	132.64	2
PI03	Problematic native species	Low	23.72	1

3.2.4.3 Neutral pressures/threats

Four neutral pressures and threats were identified during the current survey (Table 15). The most extensive pressure was PF03 *Creation or development of sports, tourism and leisure infrastructure* (22.17 ha), which referred to a long-established golf course with suitable habitat in the rough. PI03 *Problematic native species* affected 8.9 ha of the *V. angustior* habitat, while PF01 *Conversion from other land uses to built-up areas* (0.79 ha) and PA07 *Intensive grazing or overgrazing by livestock* (0.78 ha).

Table 15 Pressures and threats recorded as having a neutral influence at *Vertigo angustior* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PF03	Creation or development of sports, tourism and leisure infrastructure	Low	22.17	1
PI03	Problematic native species	Low	8.90	1
PF01	Conversion from other land uses to built-up areas	Low	0.79	1
PA07	Intensive grazing or overgrazing by livestock	Low	0.78	1

3.2.5 *Vertigo angustior* site conservation assessments

Individual site conservation assessments were carried out for *Vertigo angustior* sites surveyed during the current monitoring project. The assessment of Population and Habitat for each site was based on criteria set by Moorkens & Killeen (2011) and Long & Brophy (2019), with Future Prospects based on the future trends of Population and Habitat considering the pressures and threats relevant to the site and the effect of any conservation measures that have been implement or will be implemented in the future (DG Environment, 2023). The Overall Conservation Assessment is based on the lowest score achieved across the three elements. Table 16 presents the site conservation assessments for the 20 *V. angustior* sites assessed during the current monitoring period, with the 2007-2012 and 2013-2018 results included for comparison.

There has been a clear decline in the conservation status of the *V. angustior* sites across the three monitoring periods. In 2007-2012, there were 11 Green sites, four Amber and four Red, which dropped to four Green sites (including VaCAM22 Waterstown Lough, which was assessed for the first time), five Amber sites and 11 Red sites in 2013-2018. In the current round of monitoring, there was one Green site, one Amber site and 18 Red sites. Only one site, VaCAM15 Bartraw, has remained consistently Green across the three monitoring periods.

Full details of the criteria used in carrying out the Population and Habitat assessments are presented in the *V. angustior* site reports in Appendix II.

Table 16 Site conservation assessments for *Vertigo angustior* across the last three monitoring periods for the sites surveyed during the current monitoring period. Pop = Population, Hab = Habitat, FP = Future Prospects

Site ID	Site name	2007-2012				2013-2018				2019-2024			
		Pop	Hab	FP	Overall	Pop	Hab	FP	Overall	Pop	Hab	FP	Overall
VaCAM01	Beal Point	Amber	Amber	Amber	Amber	Amber	Amber	Amber	Amber	Red	Amber	Red	Red
VaCAM02	Derrynane	Green	Green	Green	Green	Amber	Amber	Amber	Amber	Red	Red	Amber	Red
VaCAM03	Dooaghtry	Green	Green	Green	Green	Green	Green	Amber	Amber	Red	Amber	Red	Red
VaCAM04	Glencolmcille	Red	Amber	Amber	Red	Red	Amber	Red	Red	Red	Green	Red	Red
VaCAM05	Kilshannig	Green	Green	Green	Green	Red	Red	Amber	Red	Red	Red	Red	Red
VaCAM06	Kinlackagh Bay	Amber	Red	Amber	Red	Amber	Red	Amber	Red	Red	Red	Red	Red
VaCAM07	Maharees	Red	Red	Amber	Red	Red	Red	Amber	Red	Red	Red	Red	Red
VaCAM08	Dog’s Bay	Green	Green	Green	Green	Green	Red	Amber	Red	Red	Red	Amber	Red
VaCAM10	Killanley Glebe	Green	Green	Green	Green	Green	Green	Green	Green	Red	Green	Amber	Red
VaCAM11	Lahinch	Green	Green	Green	Green	Red	Green	Amber	Red	Red	Amber	Red	Red
VaCAM12	Malin Dunes	Green	Green	Green	Green	Green	Red	Green	Red	Red	Red	Red	Red
VaCAM13	Pollardstown Fen	Green	Green	Amber	Amber	Red	Red	Red	Red	Red	Red	Red	Red
VaCAM14	Streedagh Point Dunes	Green	Green	Green	Green	Green	Amber	Green	Amber	Amber	Amber	Amber	Amber
VaCAM15	Bartraw	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
VaCAM16	Inishmore Island	Green	Green	Green	Green	Amber	Amber	Amber	Amber	Red	Red	Red	Red
VaCAM17	Curragh Chase	Green	Amber	Amber	Amber	Red	Red	Red	Red	Red	Red	Red	Red
VaCAM19	Louisa Bridge	Red	Amber	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
VaCAM20	Ballysadare Bay	Green	Green	Green	Green	Green	Green	Green	Green	Red	Red	Red	Red
VaCAM21	Strandhill Airport	Green	Amber	Amber	Amber	Red	Red	Amber	Red	Red	Red	Red	Red
VaCAM22	Waterstown Lough	NA	NA	NA	NA	Green	Green	Green	Green	Red	Red	Red	Red

3.3 *Vertigo geyeri* results

3.3.1 *Vertigo geyeri* overview

Nineteen sites were surveyed for *Vertigo geyeri* across the field seasons 2022-2024. All 19 sites were previously surveyed by Long & Brophy (2019), with VgCAM23 Waterstown Lough added since Moorkens & Killeen (2011) discovered the species along with *V. angustior* during 2007-2012 monitoring of *V. moulinsiana* at the site, and VgCAM24 Duleek Commons also added since 2007-2012. *Vertigo geyeri* was recorded at nine of the 19 sites surveyed (Table 17).

Table 17 List of *Vertigo geyeri* sites surveyed during the 2019-2024 monitoring period, and whether the site was positive or negative for the species in this round of monitoring and the previous two rounds

Site code	Site name	2007-12	2013-18	2019-24
VgCAM01	Meenaphuil	Positive	Positive	Positive
VgCAM02	Tievebaun	Positive	Positive	Positive
VgCAM03	Brackloon	Positive	Positive	Negative
VgCAM04	Clonaslee Eskers	Negative	Negative	Negative
VgCAM05	Dooaghtry	Positive	Positive	Positive
VgCAM06	Drimmon Lough	Positive	Positive	Negative
VgCAM08	Sheskinmore Lough	Positive	Positive	Positive
VgCAM09	Annaghmore Lough	Positive	Negative	Negative
VgCAM10	Ballyness Bay	Positive	Positive	Negative
VgCAM13	Easkey Valley	Positive	Positive	Negative
VgCAM14	Polaguil Bay	Positive	Positive	Positive
VgCAM15	Silver River	Positive	Positive	Negative
VgCAM16	Fermoyle	Positive	Positive	Positive
VgCAM18	Fin Lough (Offaly)	Positive	Positive	Positive
VgCAM20	Lisduff Fen	Positive	Negative	Negative
VgCAM21	Ox Mountains	Positive	Positive	Positive
VgCAM22	Pollardstown Fen	Positive	Positive	Negative
VgCAM23	Waterstown Lough	N/A	Positive	Positive
VgCAM24	Duleek Commons	N/A	Positive	Negative

3.3.2 *Vertigo geyeri* population

While the results presented in Section 3.3.1 show a significant (44%) decline in the number of positive sites for *V. geyeri* as compared to the 2013-2018 monitoring period, this does not fully describe the situation with regard to the *V. geyeri* populations at the survey sites. Even at sites that were positive for the species, many of them have shown a decline in the number or percentage of positive samples as compared to previous monitoring periods. These declines are detailed in the individual site reports (Appendix III).

A broad comparison of the percentage of positive samples at the surveyed *V. geyeri* sites across the three monitoring periods is presented in Table 18. This illustrates the general downward trajectory in the percentage of positive samples that has been occurring for *V. geyeri* since 2013-18, with 13 sites showing a decrease in the percentage of positive samples, six sites remain stable/unchanged (though three of these stable sites had 0% positive samples in 2013-18) and none of the sites are increasing.

Table 18 A comparison of the percentage (%) of positive samples locations at *V. geyeri* sites surveyed across the 2007-12, 2013-18 and 2019-24 monitoring periods

Site ID	Site name	2007-12 (% positive)	2013-18 (% positive)	2019-24 (% positive)
VgCAM01	Meenaphuil	100	100	100
VgCAM02	Tievebaun	91	100	100
VgCAM03	Brackloon	50	50	0
VgCAM04	Clonaslee Eskers	0	0	0
VgCAM05	Dooaghtry	46	57	29
VgCAM06	Drimmon Lough	83	40	0
VgCAM08	Sheskinmore	100	88	75
VgCAM09	Annaghmore Lough	44	0	0
VgCAM10	Ballyness Bay	50	25	0
VgCAM13	Easkey Valley	50	20	0
VgCAM14	Polaguil Bay	64	50	50
VgCAM15	Silver River	75	50	0
VgCAM16	Fermoyle	44	50	33
VgCAM18	Fin Lough (Offaly)	100	50	14
VgCAM20	Lisduff Fen	63	0	0
VgCAM21	Ox Mountains	5	5	3
VgCAM22	Pollardstown Fen	70	10	0
VgCAM23	Waterstown Lough	NA	43	14
VgCAM24	Duleek Commons	NA	25	0

The Population status for each site was assessed based mainly on the criteria of Moorkens & Killeen (2011), with occasional additions or amendments by Long & Brophy (2019). Due to the nature of the assessment criteria (detailed in the individual site reports), in some cases the number or percentage of positive samples may remain unchanged, but a criterion may now fail due to the distribution of the positive samples within the site. The reason for any change in Population status at a site level is presented in Table 19.

Table 19 A comparison of the Population status at *V. geyeri* sites surveyed across the 2013-18 and 2019-24 monitoring periods, including the reason for any change

Site ID	Site name	2013-18	2019-24	Reason for change
VgCAM01	Meenaphuil	Green	Green	No change
VgCAM02	Tievebaun	Green	Green	No change
VgCAM03	Brackloon	Red	Red	No change
VgCAM04	Clonaslee Eskers	Red	Red	No change
VgCAM05	Dooaghtry	Amber	Amber	No change
VgCAM06	Drimmon Lough	Red	Red	No change
VgCAM08	Sheskinmore	Green	Green	No change
VgCAM09	Annaghmore Lough	Red	Red	No change
VgCAM10	Ballyness Bay	Red	Red	No change
VgCAM13	Easkey Valley	Red	Red	No change
VgCAM14	Polaguil Bay	Amber	Amber	No change
VgCAM15	Silver River	Green	Red	Drop in status due to the number of positive samples across the site dropping to zero
VgCAM16	Fermoyle	Green	Amber	Drop in status due to the number of positive samples within Polygon B dropping to zero
VgCAM18	Fin Lough (Offaly)	Green	Red	Drop in status due to a drop in the number of positive samples on transect and across the site
VgCAM20	Lisduff Fen	Red	Red	No change
VgCAM21	Ox Mountains	Amber	Amber	No change
VgCAM22	Pollardstown Fen	Red	Red	No change
VgCAM23	Waterstown Lough	Green	Amber	Drop in status due to a drop in the number of positive samples across the site, away from the transect, to zero
VgCAM24	Duleek Commons	Green	Red	Drop in status due to the number of positive samples across the site dropping to zero

3.3.3 *Vertigo geyeri* habitat

A total of 204.85 ha of *V. geyeri* habitat was included in the current survey of 19 sites, with 168.34 ha having some suitability for supporting the snail (Suboptimal-Unsuitable or better) and 36.51 ha considered Unsuitable (Table 20).

Table 20 A breakdown of *Vertigo geyeri* habitat suitability class, in hectares (ha) and percent (%), surveyed during the 2019-2024 monitoring period.

Habitat suitability class	Area (ha)	Area (%)
Optimal	5.18	2.5
Optimal-Suboptimal	74.33	36.3
Suboptimal	33.26	16.2
Suboptimal-Unsuitable	55.57	27.1
Unsuitable	36.51	17.8
TOTAL	204.85	

The total area surveyed has dropped from 206.63 ha in 2013-2018 to 204.85 ha in the current survey, because Polygon C of VgCAM22 Pollardstown Fen was not accessed during the current survey.

The comparison of habitat suitability areas between the current and previous monitoring periods (2013-2018 and 2019-2024) is slightly complicated by the fact that one polygon at VgCAM22 Pollardstown Fen was surveyed in 2019-2024, but not 2013-2018. For this reason, the comparison is based on the figures relating to the surveyed sites and polygons that both monitoring periods have in common (Table 21).

Table 21 A comparison *Vertigo geyeri* habitat suitability area in hectares (ha) between the 2013-2018 and 2019-2024 monitoring periods. Both ecological and interpreted changes are included.

Habitat suitability class	2013-2018	2019-2024	Difference (ha)	Difference (%)
Optimal	9.24	5.18	-4.06	-43.9
Optimal-Suboptimal	62.68	74.33	+11.65	+18.6
Suboptimal	48.15	33.26	-14.89	-30.9
Suboptimal-Unsuitable	38.02	55.09	+17.07	+44.9
Unsuitable	46.28	36.51	-9.77	-21.1
TOTAL	204.37	204.37		

The total area surveyed at the sites during the two monitoring periods remains unchanged, with the exception of one 0.48 ha polygon at VgCAM22 Pollardstown Fen that was surveyed in 2019-2024, but not accessed in 2013-2018. There has been an increase in the area of Optimal-Suboptimal (+18.6%) and Suboptimal-Unsuitable (+44.9%) habitat between the monitoring periods, while a decrease was recorded in the area of Optimal (-43.9%), Suboptimal (-30.9%) and Unsuitable (-21.1%) habitat.

The Habitat status for each site was assessed based mainly on the criteria of Moorkens & Killeen (2011), with occasional additions or amendments by Long & Brophy (2019). Due to the nature of the assessment criteria (detailed in the individual site reports), in some cases the area of suitable habitat may change, but a criterion may still pass or fail as the change in the area of suitable habitat is not sufficient to change the result. The reason for any change in Habitat status at a site level is presented in Table 22.

Table 22 A comparison of the Habitat status at *V. geyeri* sites surveyed across the 2013-18 and 2019-24 monitoring periods, including the reason for any change.

Site ID	Site name	2013-18	2019-24	Reason for change
VgCAM01	Meenaphuil	Green	Green	No change
VgCAM02	Tievebaun	Green	Amber	Drop in status due to a drop in the suitable habitat along transect
VgCAM03	Brackloon	Amber	Amber	No change
VgCAM04	Clonaslee Eskers	Red	Red	No change
VgCAM05	Dooaghtry	Amber	Green	Increase in status due to improvement in wetness along transect
VgCAM06	Drimmon Lough	Amber	Red	Drop in status due to a drop in the suitable habitat across the site
VgCAM08	Sheskinmore	Red	Green	Increase in status due to improvement in habitat suitability and wetness along transect
VgCAM09	Annaghmore Lough	Amber	Red	Drop in status due to a drop in the wetness along the transect and across the site
VgCAM10	Ballyness Bay	Green	Amber	Drop in status due to a drop in the suitable habitat along the transect
VgCAM13	Easkey Valley	Green	Red	Drop in status due to a drop in the suitable habitat in a number of polygons
VgCAM14	Polaguil Bay	Amber	Amber	No change
VgCAM15	Silver River	Amber	Red	Drop in status due to a drop in the suitable habitat and wetness along transect
VgCAM16	Fermoyle	Amber	Red	Drop in status due to a drop in the suitable habitat across the site
VgCAM18	Fin Lough (Offaly)	Green	Green	No change
VgCAM20	Lisduff Fen	Green	Red	Drop in status due to a drop in the suitable habitat and wetness along transect
VgCAM21	Ox Mountains	Green	Green	No change
VgCAM22	Pollardstown Fen	Amber	Red	Drop in status due to a drop in the suitable habitat along transect
VgCAM23	Waterstown Lough	Green	Green	No change
VgCAM24	Duleek Commons	Red	Red	No change

The reasons for the changes to the habitat suitability class are divided into those that are ecological in nature (*e.g.* drying out, grazing level altering the vegetation structure) and interpretation (*e.g.* view that previous assessment was inaccurate, but no ecological change is thought to have occurred). The positive and negative changes that have affected the area covered by the five habitat suitability classes are set out in Table 23 and Table 24, respectively.

Table 23 A breakdown of the positive *Vertigo geyeri* habitat suitability changes recorded in 2019-2024 with reason for change. *O = Optimal, O-SO = Optimal-Suboptimal, SO = Suboptimal, SO-U = Suboptimal-Unsuitable, U = Unsuitable. **Eco = Ecological, Int = Interpreted.

Site ID	Site name	2013-2018*	2019-2024*	Area (ha)	Change**
VgCAM05	Dooaghtry	U	SO-U	10.15	Int - Small patch of habitat found, but believed to have been present before
VgCAM08	Sheskinmore Lough	SO	O-SO	16.41	Eco - Higher cover of suitable vegetation and less poaching due to appropriate grazing
VgCAM13	Easkey Valley	SO	O-SO	0.34	Int - Sufficient suitable habitat in runnels across grassland
VgCAM13	Easkey Valley	U	SO-U	1.87	Int - Small patch of suitable habitat found along river at end of runnel
VgCAM22	Pollardstown Fen	SO-U	SO	7.79	Int - Slightly more suitable habitat than previously noted, but no indication of ecological change

Table 24 A breakdown of the negative *Vertigo geyeri* habitat suitability changes recorded in 2019-2024 with reason for change. *O = Optimal, O-SO = Optimal-Suboptimal, SO = Suboptimal, SO-U = Suboptimal-Unsuitable, U = Unsuitable. **Eco = Ecological, Int = Interpreted

Site ID	Site name	2013-2018*	2019-2024*	Area (ha)	Change**
VgCAM04	Clonaslee Eskers	SO	SO-U	0.11	Eco - Drier and little suitable habitat. Likely at least partly due to climate change, and also drainage
VgCAM06	Drimmon Lough	O-SO	SO	1.12	Eco - Drier. Likely at least partly due to climate change
VgCAM09	Annaghmore Lough	O-SO	SO	7.20	Eco - Drier. Likely at least partly due to climate change
VgCAM09	Annaghmore Lough	SO	SO-UO	2.91	Eco - Drier. Likely at least partly due to climate change
VgCAM13	Easkey Valley	O-SO	SO-U	0.15	Eco – Road drain cleared, removing most habitat
VgCAM13	Easkey Valley	O-SO	SO-U	0.58	Eco - Track wetter with more bare mud. Southern 25% too dry. Gravel laid?
VgCAM13	Easkey Valley	SO	SO-U	0.10	Eco - Area dominated by *Schoenus nigricans* and *Carex paniculata* tussocks and appears to be drying out
VgCAM13	Easkey Valley	SO-U	U	0.25	Eco - Tightly grazed semi-improved grassland
VgCAM13	Easkey Valley	SO-U	U	0.18	Eco - Flushed marsh has become rank
VgCAM13	Easkey Valley	SO-U	U	0.34	Eco – Loss due to change in vegetation.
VgCAM14	Polaguil Bay	SO	SO-U	0.42	Eco – *S. nigricans* tussocks and *J. subnodulosus* have shaded out most of habitat
VgCAM14	Polaguil Bay	O	O-SO	4.06	Int - Likely due to interpretation, but *S. nigricans* tussocks may be spreading
VgCAM15	Silver River	SO-U	U	1.48	Eco - Satellite images show area has been drained since 2020
VgCAM16	Fermoyle	SO	SO-U	5.70	Eco - Loss of habitat due to rank *S. nigricans* tussocks shading it out
VgCAM18	Fin Lough (Offaly)	O-SO	SO	0.10	Eco - Patchy habitat due to heavy poaching
VgCAM22	Pollardstown Fen	SO	SO-U	0.88	Eco - Ranker due to lack of grazing
VgCAM22	Pollardstown Fen	SO	SO-U	0.22	Eco - Too rank due to lack of grazing
VgCAM22	Pollardstown Fen	S	SO-U	3.82	Eco - Too rank due to lack of grazing
VgCAM23	Waterstown Lough	SO	SO-U	0.20	Eco - Limited suitable habitat and heavily poached

3.3.4 *Vertigo geyeri* pressures and threats

The pressures and threats relevant to the *V. geyeri* population at the survey sites were recorded following the pressures list 2019-2024 reporting period for Articles 12 and 17. A total of 15 pressures or threats were recorded across the 19 *V. geyeri* sites (Table 25) and 16 sites had at least one negative pressure recorded.

The most frequently recorded pressure was PA07 *Intensive grazing or overgrazing by livestock*, which was recorded at 74% of the surveyed sites, and mainly related to cattle and sheep, with horses and donkeys occasionally present. The effect of grazing was considered to be a positive one at 11 of the surveyed sites, as it kept the vegetation low and open. For two sites, cattle grazing was negative due to very tight grazing or poaching. For one site, the grazing was considered to be having an overall neutral effect.

PJ03 *Changes in precipitation regimes due to climate change* was considered to be affecting 47% of sites in the form of drying out, either permanently or sporadically, which has a negative impact on *V. geyeri*.

PA08 *Extensive grazing or undergrazing by livestock* was noted at 32% of the sites. In all cases, this was a negative pressure, allowing the vegetation to become tall and rank. This makes the habitat unsuitable for *V. geyeri*.

Table 25 List of the pressures and threats recorded at the *Vertigo geyeri* sites surveyed during the 2019-2024 monitoring period in decreasing order of frequency of occurrence

Pressure/ threat code	Pressure/threat name	Positive	Negative	Neutral	Total
PA07	Intensive grazing or overgrazing by livestock	11	2	1	14
PJ03	Changes in precipitation regimes due to climate change	0	9	0	9
PA08	Extensive grazing or undergrazing by livestock	0	6	0	6
PA22	Drainage for use as agricultural land	0	4	0	4
PI02	Other invasive alien species (other than species of Union concern)	0	3	0	3
PX03	Unknown pressures or threats	0	2	0	2
PI03	Problematic native species	2	0	0	2
PM07	Natural processes without direct or indirect influence from human activities or climate change	0	1	0	1
PA13	Application of natural or synthetic fertilisers on agricultural land	0	1	0	1
PA25	Agriculture activities not referred to above	0	1	0	1
PD01	Wind, wave and tidal power (including infrastructure)	0	0	1	1
PF13	Drainage, land reclamation and conversion of wetlands, marshes, bogs, *etc.* for built-up areas	0	1	0	1
PF17	Active abstraction of water for built-up areas	0	1	0	1
PL01	Abstraction from groundwater, surface water or mixed water	0	1	0	1
PL05	Modification of hydrological flow	1	0	0	1

PA22 *Drainage for use as agricultural land* was recorded at 21% of sites, resulting in the drying out of habitat.

PI02 *Other invasive alien species (other than species of Union concern)* was recorded at 16% of sites and related to a range of invasive alien species, including *Pinus contortus* seedlings and saplings and *Cotoneaster horizontalis*.

PX03 *Unknown pressures or threats* was noted for 11% of the surveyed sites. This code was assigned as it was clear that something had affected the *V. geyeri* population at these sites, but nothing was discernible on-site.

PI03 *Problematic native species* was also recorded from 11% of the sites and referred to grazing by deer, though it was considered to be having a positive effect for the habitat of *V. geyeri* by providing grazing pressure.

The remaining eight pressures and threats were recorded from only a single site (5% of the sites surveyed). PM07 *Natural processes without direct or indirect influence from human activities or climate change* refers to encroachment by *Betula pubescens*, *Salix* spp. and *Phragmites australis*. PA13 *Application of natural or synthetic fertilisers on agricultural land* related to improved grassland likely to receive fertiliser. PA25 *Agriculture activities not referred to above*, in this case, refers to tractor tracks across the habitat. PD01 *Wind, wave and tidal power (including infrastructure)* was recorded for an upland windfarm development. PF13 *Drainage, land reclamation and conversion of wetlands, marshes, bogs, etc. for built-up areas* was assigned for the clearance of a roadside drain, which removed suitable habitat. PF17 *Active abstraction of water for built-up areas* referred to groundwater abstraction for one-off houses on adjacent sites. PL01 *Abstraction from groundwater, surface water or mixed water* was used in relation to the drying out of VgCAM24 Duleek Commons. PL05 *Modification of hydrological flow* was recorded as a positive pressure for VgCAM08 Sheskinmore for the use of a sluice to manage lake levels for fen habitat and *V. geyeri*.

3.3.4.1 Negative pressure/threats

In terms of the intensity of the negative effect of the recorded pressures and threats, and the area affected, PA08 *Extensive grazing or undergrazing by livestock* was considered to be having the most extensive High intensity effect on *V. geyeri habitat* (15.73 ha) (Table 26). This was followed by PL01 *Abstraction from groundwater, surface water or mixed water* (11.09 ha) and PJ03 *Changes in precipitation regimes due to climate change* (8.35 ha) in the High intensity category. The remaining High intensity negative effects were PA22 *Drainage for use as agricultural land* (4.94 ha), PA07 *Intensive grazing or overgrazing by livestock* (0.23 ha) and PF13 *Drainage, land reclamation and conversion of wetlands, marshes, bogs, etc. for built-up areas* (0.02 ha). See Table 26 for more details.

Of the Medium intensity negative effects, PJ03 *Changes in precipitation regimes due to climate change* was the most widespread at 31.92 ha. This was followed by PA08 *Extensive grazing or undergrazing by livestock* (18.78 ha) and PX03 *Unknown pressures or threats* (1.81 ha). The remaining Medium intensity negative effects were PA07 *Intensive grazing or overgrazing by livestock* (0.38 ha) and PA25 *Agriculture activities not referred to above* (0.06 ha).

The remaining negative effects were of Low intensity, with the most extensive being PA08 *Extensive grazing or undergrazing by livestock* (21.29 ha), followed by PA13 *Application of natural or synthetic fertilisers on agricultural land* (0.26 ha) and PX03 *Unknown pressures or threats* (0.27 ha). The remaining Low intensity negative effects were PI02 *Other invasive alien species (other than species of Union concern)* (0.22 ha), PF17 *Active abstraction of water for built-up areas* (0.14 ha) and PM07 *Natural processes without direct or indirect influence from human activities or climate change* (0.14 ha).

Table 26 Pressures and threats recorded as having a negative influence at *Vertigo geyeri* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PA08	Extensive grazing or undergrazing by livestock	High	15.73	1
PL01	Abstraction from groundwater, surface water or mixed water	High	11.09	1
PJ03	Changes in precipitation regimes due to climate change	High	8.35	5
PA22	Drainage for use as agricultural land	High	4.94	4
PA07	Intensive grazing or overgrazing by livestock	High	0.23	1
PF13	Drainage, land reclamation and conversion of wetlands, marshes, bogs, *etc.* for built-up areas	High	0.02	1
PJ03	Changes in precipitation regimes due to climate change	Medium	31.92	4
PA08	Extensive grazing or undergrazing by livestock	Medium	18.78	4
PX03	Unknown pressures or threats	Medium	1.81	1
PA07	Intensive grazing or overgrazing by livestock	Medium	0.38	1
PA25	Agriculture activities not referred to above	Medium	0.06	1
PA08	Extensive grazing or undergrazing by livestock	Low	21.29	1
PA13	Application of natural or synthetic fertilisers on agricultural land	Low	0.56	1
PX03	Unknown pressures or threats	Low	0.27	1
PI02	Other invasive alien species (other than species of Union concern)	Low	0.22	3
PF17	Active abstraction of water for built-up areas	Low	0.14	1
PM07	Natural processes without direct or indirect influence from human activities or climate change	Low	0.14	1

3.3.4.2 Positive pressures/threats

Four positive pressures were identified during the current survey; two at Medium intensity and two at Low intensity (Table 27). PA07 *Intensive grazing or overgrazing by livestock* was the most the most widespread Medium intensity pressure, affecting 85.76 ha of *V. geyeri* habitat across eight sites. At one site (VgCAM08 Sheskinmore) this is considered a conservation measure, as it has been implemented by NPWS. Similarly, PL05 *Modification of hydrological flow* (16.41 ha) is also a Medium intensity pressure that is considered a conservation measure at VgCAM08 Sheskinmore, where the control of a sluice by NPWS maintains the lake water levels and a suitable level for fen habitat and *V. geyeri* habitat.

Low intensity positive pressures recorded were PA07 *Intensive grazing or overgrazing by livestock* (6.54 ha) and PI03 *Problematic native species* (4.12 ha), which, in this case, refers to light grazing by deer keeping the habitat more open that it might otherwise be.

Table 27 Pressures and threats recorded as having a positive influence at *Vertigo geyeri* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PA07	Intensive grazing or overgrazing by livestock	Medium	85.76	8
PL05	Modification of hydrological flow	Medium	16.41	1
PA07	Intensive grazing or overgrazing by livestock	Low	6.54	3
PI03	Problematic native species	Low	4.12	2

3.3.4.3 Neutral pressures/threats

Two Low intensity neutral pressures and threats were identified during the current survey (Table 28). The most extensive pressure was PA07 *Intensive grazing or overgrazing by livestock* (11.09 ha), which related to light cattle grazing, followed by PD01 *Wind, wave and tidal power (including infrastructure)* (0.34 ha) referring to an adjacent upland windfarm.

Table 28 Pressures and threats recorded as having a neutral influence at *Vertigo geyeri* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PA07	Intensive grazing or overgrazing by livestock	Low	11.09	1
PD01	Wind, wave and tidal power (including infrastructure)	Low	0.34	1

3.3.5 *Vertigo geyeri* site conservation assessments

Individual site conservation assessments were carried out for *Vertigo geyeri* sites surveyed during the current monitoring project. The assessment of Population and Habitat for each site was based on criteria set by Moorkens & Killeen (2011) and Long & Brophy (2019), with Future Prospects based on the future trends of Population and Habitat considering the pressures and threats relevant to the site and the effect of any conservation measures that have been implemented or will be implemented in the future (DG Environment, 2023). The Overall Conservation Assessment is based on the lowest score achieved across the three elements. Table 29 presents the site conservation assessments for the 19 *V. geyeri* sites assessed during the current monitoring period, with the 2007-2012 and 2013-2018 results included for comparison.

There has been a clear decline in the conservation status of the *V. geyeri* sites across the three monitoring period. In 2007-2012, there were 14 Green sites, two Amber sites and one Red site, which dropped to three Green sites (including VgCAM23 Waterstown Lough, which was assessed for the first time), six Amber sites and 10 Red sites in 2013-2018. In the current round of monitoring, there were two Green sites, five Amber sites and 12 Red sites. Only one site, VgCAM01 Meenaphuil, remained Green across the three monitoring periods, while VgCAM08 Sheskinmore dropped from Green to Red between 2007-2012 and 2013-2018, but recovered to Green in the current monitoring period.

Full details of the criteria used in carrying out the Population and Habitat assessments are presented in the *V. geyeri* site reports in Appendix III.

Table 29 Site conservation assessments for *Vertigo geyeri* across the last three monitoring periods for the sites surveyed during the current monitoring period. Pop = Population, Hab = Habitat, FP = Future Prospects

Site ID	Site name	2007-2012				2013-2018				2019-2024			
		Pop	Hab	FP	Overall	Pop	Hab	FP	Overall	Pop	Hab	FP	Overall
VgCAM01	Meenaphuil	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
VgCAM02	Tievebaun	Green	Green	Green	Green	Green	Green	Green	Green	Green	Amber	Amber	Amber
VgCAM03	Brackloon	Amber	Amber	Amber	Amber	Red	Amber	Amber	Red	Red	Amber	Red	Red
VgCAM04	Clonaslee Eskers	Red	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
VgCAM05	Dooaghtry	Green	Green	Green	Green	Amber	Amber	Green	Amber	Amber	Green	Amber	Amber
VgCAM06	Drimmon Lough	Green	Green	Green	Green	Red	Amber	Green	Red	Red	Red	Red	Red
VgCAM08	Sheskinmore Lough	Green	Green	Green	Green	Green	Red	Amber	Red	Green	Green	Green	Green
VgCAM09	Annaghmore Lough	Green	Green	Green	Green	Red	Amber	Amber	Red	Red	Red	Red	Red
VgCAM10	Ballyness Bay	Green	Green	Green	Green	Red	Green	Green	Red	Red	Amber	Red	Red
VgCAM13	Easkey Valley	Green	Green	Green	Green	Red	Green	Green	Red	Red	Red	Red	Red
VgCAM14	Polaguil Bay	Green	Green	Green	Green	Amber	Amber	Green	Amber	Amber	Amber	Amber	Amber
VgCAM15	Silver River	Green	Green	Green	Green	Green	Amber	Green	Amber	Red	Red	Red	Red
VgCAM16	Fermoyle	Green	Green	Green	Green	Green	Amber	Green	Amber	Amber	Red	Red	Red
VgCAM18	Fin Lough (Offaly)	Green	Green	Green	Green	Green	Green	Amber	Amber	Red	Green	Red	Red
VgCAM20	Lisduff Fen	Green	Green	Green	Green	Red	Green	Amber	Red	Red	Red	Red	Red
VgCAM21	Ox Mountains	Green	Green	Green	Green	Amber	Green	Green	Amber	Amber	Green	Amber	Amber
VgCAM22	Pollardstown Fen	Green	Amber	Amber	Amber	Red	Amber	Red	Red	Red	Red	Red	Red
VgCAM23	Waterstown Lough	NA	NA	NA	NA	Green	Green	Green	Green	Amber	Green	Amber	Amber
VgCAM24	Duleek Commons	NA	NA	NA	NA	Green	Red	Amber	Red	Red	Red	Red	Red

3.4 *Vertigo moulinsiana* results

3.4.1 *Vertigo moulinsiana* overview

Twenty-one sites were surveyed for *Vertigo moulinsiana* across the field seasons of 2022 and 2023. This included 18 sites that were previously surveyed by Long & Brophy (2019), while three were added to the monitoring schedule for the first time: Gollierstown in Co. Dublin, Louisa Bridge (South) in Co. Kildare, and Loughmerans in Co. Kilkenny.

Vertigo moulinsiana was recorded at all 21 sites surveyed (Table 30), though two sites that were negative in the 2013-2018 monitoring period were not revisited in the current survey due to a lack of any suitable habitat and no positive records for two monitoring periods. The site VmCAM01 Borris was negative in 2013-18, but positive in the current survey.

Table 30 List of *Vertigo moulinsiana* sites surveyed during the 2019-2024 monitoring period, and whether the site was positive or negative for the species in this round of monitoring and the previous two rounds

Site code	Site name	2007-12	2013-18	2019-24
VmCAM01	Borris	Positive	Negative	Positive
VmCAM02	Fin Lough (Offaly)	Positive	Positive	Positive
VmCAM03	Lough Owel	Positive	Positive	Positive
VmCAM04	Mountmellick	Positive	Positive	Positive
VmCAM05	Louisa Bridge	Positive	Positive	Positive
VmCAM06	Ballybeg Lough	Positive	Positive	Positive
VmCAM08	Cappankelly	Positive	Positive	Positive
VmCAM09	Waterstown Lough	Positive	Positive	Positive
VmCAM10	Ballynafagh Lake	Positive	Positive	Positive
VmCAM11	Charleville Lake	Positive	Positive	Positive
VmCAM12	Curragh Chase	Positive	Positive	Positive
VmCAM14	Kildallan Bridge	Positive	Positive	Positive
VmCAM16	Lisduff Fen	Positive	Positive	Positive
VmCAM17	The Murrough	Positive	Positive	Positive
VmCAM18	Pollardstown Fen	Positive	Positive	Positive
VmCAM19	Portumna	Positive	Positive	Positive
VmCAM21	Royal Canal, Longford Bridge	N/A	Positive	Positive
VmCAM23	Castletown	N/A	Positive	Positive
VmCAM24	Gollierstown	N/A	N/A	Positive
VmCAM25	Louisa Bridge (South)	N/A	N/A	Positive
VmCAM26	Loughmerans	N/A	N/A	Positive

3.4.2 *Vertigo moulinsiana* population

In contrast to *V. angustior* and *V. geyeri*, the results presented in Section 3.4.1 show a slight (6%) increase in the number of positive sites for *V. moulinsiana* as compared to the 2013-2018 monitoring period (when comparing sites that were surveyed in both periods). However, this does not fully describe the situation with regard to the *V. moulinsiana* populations at the survey sites. Even at sites that were positive for the species, many of them have shown a decline in the number or percentage of positive samples as compared to previous monitoring periods. These declines are detailed in the individual site reports (Appendix IV).

A broad comparison of the percentage of positive samples at the surveyed *V. moulinsiana* sites across the three monitoring periods is presented in Table 31. *Vertigo moulinsiana* is showing a more mixed picture than the other two species, with nine sites showing an increase in the percentage of positive sites, eight sites showing a decrease and one site stable/unchanged.

Table 31 A comparison of the percentage (%) of positive samples locations at *V. moulinsiana* sites surveyed across the 2007-12, 2013-18 and 2019-24 monitoring periods

Site ID	Site name	2007-12 (% positive)	2013-18 (% positive)	2019-24 (% positive)
VmCAM01	Borris	61	0	19
VmCAM02	Fin Lough	57	35	28
VmCAM03	Lough Owel	68	29	18
VmCAM04	Mountmellick	83	20	10
VmCAM05	Louisa Bridge	42	16	10
VmCAM06	Ballybeg Lough	71	35	46
VmCAM08	Cappankelly	100	75	100
VmCAM09	Waterstown Lough	63	30	41
VmCAM10	Ballynafagh Lake	67	28	13
VmCAM11	Charleville Lake	100	68	68
VmCAM12	Curragh Chase	33	30	50
VmCAM14	Kildallan Bridge	54	40	42
VmCAM16	Lisduff Fen	52	42	32
VmCAM17	The Murrough	30	17	27
VmCAM18	Pollardstown Fen	84	17	19
VmCAM19	Portumna	56	59	69
VmCAM21	Royal Canal Longford Branch	NA	72	60
VmCAM23	Castletown	NA	66	36
VmCAM24	Gollierstown	NA	NA	60
VmCAM25	Louisa Bridge (South)	NA	NA	100
VmCAM26	Loughmerans	NA	NA	86

The Population status for each site was assessed based mainly on the criteria of Moorkens & Killeen (2011), with occasional additions or amendments by Long & Brophy (2019). Due to the nature of the assessment criteria (detailed in the individual site reports), in some cases the number or percentage of positive samples may remain unchanged, but a criterion may now fail due to the distribution of the positive samples within the site. The reason for any change in Population status at a site level is presented in Table 32.

Table 32 A comparison of the Population status at *V. moulinsiana* sites surveyed across the 2013-18 and 2019-24 monitoring periods, including the reason for any change

Site ID	Site name	2013-18	2019-24	Reason for change
VmCAM01	Borris	Red	Red	No change
VmCAM02	Fin Lough	Red	Red	No change
VmCAM03	Lough Owel	Amber	Red	Drop in status due to the number of positive samples within Polygon B dropping to one
VmCAM04	Mountmellick	Red	Red	No change
VmCAM05	Louisa Bridge	Red	Red	No change
VmCAM06	Ballybeg Lough	Amber	Red	Drop in status due to a drop in the number of positive samples on transects 3 and 4
VmCAM08	Cappankelly	Amber	Green	Increase in status due to an increase in the number of samples with 20 or more snails
VmCAM09	Waterstown Lough	Red	Red	No change
VmCAM10	Ballynafagh Lake	Red	Red	No change
VmCAM11	Charleville Lake	Green	Green	No change
VmCAM12	Curragh Chase	Amber	Amber	No change
VmCAM14	Kildallan Bridge	Amber	Amber	No change
VmCAM16	Lisduff Fen	Amber	Red	Drop in status due to a decrease in the number of samples with 5 or more snails
VmCAM17	The Murrough	Amber	Amber	No change
VmCAM18	Pollardstown Fen	Red	Red	No change
VmCAM19	Portumna	Green	Green	No change
VmCAM21	Royal Canal Longford Branch	Green	Amber	Drop in status due to the number of positive samples within Polygon C dropping to zero
VmCAM23	Castletown	Green	Green	No change
VmCAM24	Gollierstown	NA	Green	NA
VmCAM25	Louisa Bridge (South)	NA	Green	NA
VmCAM26	Loughmerans	NA	Green	NA

3.4.3 *Vertigo moulinsiana* habitat

A total of 195.38 ha of *V. moulinsiana* habitat was included in the current survey of 21 sites, with 194.04 ha having some suitability for supporting the snail (Suboptimal-Unsuitable or better) and 1.34 ha considered Unsuitable (Table 33).

Table 33 A breakdown of *Vertigo moulinsiana* habitat suitability class, in hectares (ha) and percent (%), surveyed during the 2019-2024 monitoring period.

Habitat suitability class	Area (ha)	Area (%)
Optimal	33.34	17.06
Optimal-Suboptimal	68.10	34.86
Suboptimal	57.61	29.49
Suboptimal-Unsuitable	34.99	17.91
Unsuitable	1.34	0.69
TOTAL	195.38	

The total area surveyed increased slightly from 194.99 ha in 2013-2018 to 195.38 ha in the current survey. This is due to several additions and omissions made to the 2019-2024 survey site list compared to the 2013-2018 survey site list. VmCAM15 Lisbigney Bog and VmCAM22 Fiagh Bog were omitted from the current survey as no suitable habitat was recorded during the last survey, while three new sites were added that were discovered since the last survey: VmCAM24 Gollierstown, VmCAM25 Louisa Bridge (South) and VmCAM26 Loughmerans. In addition, Polygon C of VmCAM18 Pollardstown Fen was not surveyed during the current survey, nor was Polygon K of VmCAM19 Portumna, due to accessibility issues.

The comparison of habitat suitability areas between the current and previous monitoring periods (2013-2018 and 2019-2024) is slightly complicated by the fact that the list of sites surveyed differs between monitoring periods. For this reason, the comparison is based on the figures relating to the surveyed sites that both monitoring periods have in common (Table 34).

Table 34 A comparison *Vertigo moulinsiana* habitat suitability area in hectares (ha) between the 2013-2018 and 2019-2024 monitoring periods. Both ecological and interpreted changes are included

Habitat suitability class	2013-2018	2019-2024	Difference (ha)	Difference (%)
Optimal	37.19	39.77	+2.58	+6.9
Optimal-Suboptimal	70.03	51.64	-18.39	-26.3
Suboptimal	29.86	42.94	+13.08	+43.8
Suboptimal-Unsuitable	28.45	34.99	+6.54	+23.0
Unsuitable	0.00	1.34	+1.34	-
TOTAL	165.53	170.68	+5.15	+3.1

The total area surveyed at the sites during the two monitoring periods changed due to redrawing of polygon boundaries at VmCAM10 Ballynafagh Lake, VmCAM12 Curragh Chase and VmCAM17 The Murrough. There has been an increase in the area of Optimal (+6.9%), Suboptimal (+43.8%) and Suboptimal-Unsuitable (+23.1%) habitat between the monitoring periods, while a decrease in the area of Optimal-Suboptimal (-26.3%) habitat was recorded.

The Habitat status for each site was assessed based mainly on the criteria of Moorkens & Killeen (2011), with occasional additions or amendments by Long & Brophy (2019). Due to the nature of the assessment criteria (detailed in the individual site reports), in some cases the area of suitable habitat may change, but a criterion may still pass or fail as the change in the area of suitable habitat is not sufficient to change the result. The reason for any change in Habitat status at a site level is presented in Table 35.

Table 35 A comparison of the Habitat status at *V. moulinsiana* sites surveyed across the 2013-18 and 2019-24 monitoring periods, including the reason for any change

Site ID	Site name	2013-18	2019-24	Reason for change
VmCAM01	Borris	Green	Amber	Drop in status due to a drop in the suitable vegetation cover along transect
VmCAM02	Fin Lough	Green	Green	No change
VmCAM03	Lough Owel	Amber	Red	Drop in status due to a drop in the suitable vegetation cover along transect and suitable habitat across the site
VmCAM04	Mountmellick	Amber	Red	Drop in status due to a drop in the suitable vegetation cover along transect and suitable habitat across the site
VmCAM05	Louisa Bridge	Green	Red	Drop in status due to a drop in the suitable habitat at sample locations and across the site
VmCAM06	Ballybeg Lough	Green	Green	No change
VmCAM08	Cappankelly	Green	Green	No change
VmCAM09	Waterstown Lough	Green	Green	No change
VmCAM10	Ballynafagh Lake	Red	Red	No change
VmCAM11	Charleville Lake	Green	Green	No change
VmCAM12	Curragh Chase	Amber	Green	Improvement in status due to increase in the suitable vegetation at sample locations
VmCAM14	Kildallan Bridge	Green	Green	No change
VmCAM16	Lisduff Fen	Green	Green	No change
VmCAM17	The Murrough	Amber	Amber	No change
VmCAM18	Pollardstown Fen	Red	Red	No change
VmCAM19	Portumna	Green	Green	No change
VmCAM21	Royal Canal Longford Branch	Green	Green	No change
VmCAM23	Castletown	Red	Red	No change
VmCAM24	Gollierstown	NA	Green	NA
VmCAM25	Louisa Bridge (South)	NA	Amber	NA
VmCAM26	Loughmerans	NA	Green	NA

The reasons for the changes to the habitat suitability class are divided into those that are ecological in nature (*e.g.* drying out, grazing level altering the vegetation structure) and interpretation (*e.g.* view that the previous assessment was inaccurate, but no ecological change is thought to have occurred). The positive and negative changes that have affected the area covered by the five habitat suitability classes are set out in Table 36 and Table 37, respectively.

Table 36 A breakdown of the positive *Vertigo moulinsiana* habitat suitability changes recorded in 2019-2024 with reason for change. *O = Optimal, O-SO = Optimal-Suboptimal, SO = Suboptimal, SO-U = Suboptimal-Unsuitable, U = Unsuitable. **Eco = Ecological, Int = Interpreted

Site ID	Site name	2013-2018*	2019-2024*	Area (ha)	Change**
VmCAM10	Ballynafagh Lake	SO	O-SO	12.75	Int - Boundary change to include additional suitable habitat
VmCAM11	Charleville Lake	O-SO	O	7.55	Int - More accessible suitable habitat and positive spots in northeast
VmCAM17	The Murrough	O-SO	O	3.78	Int - Area reassessed, with abundant suitable vegetation along drain dominated by *Phragmites australis*
VmCAM17	The Murrough	SO-U	O-SO	3.71	Int & Eco - Wetter due to drain blocking, with rank *Schoenus nigricans*. Area reassessed
VmCAM19	Portumna	O-SO	O	0.24	Int - The polygon is dominated by *Cladium mariscus* and so should be considered Optimal

Table 37 A breakdown of the negative *Vertigo moulinsiana* habitat suitability changes recorded in 2019-2024 with reason for change. *O = Optimal, O-SO = Optimal-Suboptimal, SO = Suboptimal, SO-U = Suboptimal-Unsuitable, U = Unsuitable. **Eco = Ecological, Int = Interpreted

Site ID	Site name	2013-2018*	2019-2024*	Area (ha)	Change
VmCAM03	Lough Owel	O-SO	SO	1.58	Eco - Southeast section dominated by *Iris pseudacorus* now drier and grassier than previously
VmCAM03	Lough Owel	SO	SO-U	0.19	Eco - Drier, more grassy with scrub developing
VmCAM05	Louisa Bridge	SO	SO-U	0.21	Eco - Drier, with sward dominated by *Molinia caerulea* with reduced *Carex* spp. cover
VmCAM06	Ballybeg Lough	O	O-SO	5.5	Eco - Some of tall vegetation has been lost by horse trampling/grazing and apparent vehicle movements
VmCAM10	Ballynafagh Lake	SO	SO-U	1.02	Eco - Drying out and scrubbing over with *Pteridium aquilinum* and Salix spp.
VmCAM10	Ballynafagh Lake	SO-U	U	0.41	Eco - Drying out with extremely sparse and scattered suitable plant species
VmCAM10	Ballynafagh Lake	O-SO	SO	0.73	Eco - Drying out
VmCAM12	Curragh Chase	O	SO	0.29	Int & Eco - Habitat along lake edge is scrubbing over with *Salix cinerea*. Boundary change.
VmCAM12	Curragh Chase	O	O	0.76	Int - Boundary change leading to reduction in area
VmCAM19	Portumna	O-SO	SO	0.26	Eco - The woodland has further developed and resulted in the loss of much of the *Carex* spp. understorey.
VmCAM19	Portumna	O	O-SO	0.21	Eco - Grazing appears to have caused the loss of some tall vegetation and broken up the floating scraw that was previously present, with mostly open water between plants now.
VmCAM21	Royal Canal, Longford Branch	SO	SO-U	0.63	Eco - Vegetation cover lost due to shading from trees growing along banks and possibly increase in water levels
VmCAM23	Castletown	SO	SO-U	10.61	Eco - Drying out and being invaded by *Rubus fruticosus* agg.

3.4.4 *Vertigo moulinsiana* pressures and threats

The pressures and threats relevant to the *V. moulinsiana* population at the survey sites were recorded following the pressures list 2019-2024 reporting period for Articles 12 and 17. A total of 19 pressures or threats were recorded across the 21 *V. moulinsiana* sites (Table 38) and all sites had at least one negative pressure recorded.

The most frequently recorded pressure was PM07 *Natural processes without direct or indirect influence from human activities or climate change.* This is a broad category that was recorded from 62% of surveyed sites, with this negative pressure mainly referring to the encroachment of scrub, occasionally with associated drying out.

The second most frequently recorded pressure was PA07 *Intensive grazing or overgrazing by livestock*, which affected 38% of sites, mostly in a negative way. Overgrazing affects *V. moulinsiana* habitat by removing the tall vegetation on which the species depends. Where this was considered positive, the grazing and associated trampling was helping to control the spread of scrub.

PF03 *Creation or development of sports, tourism and leisure infrastructure* occurred at 10% of sites, and refers to an extant small boat jetty at one site, and the potential development of a walking/cycling path along a canal at another site.

PF17 *Active abstraction of water for built-up areas* was recorded from 10% of sites. This refers to existing water abstractions for adjacent one-off houses at one site, and the proposed Water Supply Project – Eastern and Midlands Region, which is planned to abstract from Lough Derg at another.

PH08 *Other human intrusions and disturbance not mentioned above* was also recorded from 10% of sites and relates to vehicle tracks crisscrossing a significant portion of one site, and the cutting of canal fringe vegetation at another.

PI03 *Problematic native species* was similarly recorded from 10% of sites, both referring to deer grazing, with one site being negative and one neutral.

PL02 *Drainage* was recorded from 10% of sites and refers to large drains causing the drying out of habitat.

Other pressures and threats recorded from 10% of sites are: PL05 *Modification of hydrological flow*, which relates to the positive effect of drain blocking and the associated rewetting at one site, and the negative effect of the drying out due to the closure of the flow along the Blackwood Feeder for another; PA25 *Agriculture activities not referred to above*, which, in this case, refers to the positive effect of scrub clearance at one site and the negative effect of spoil dumping to create a silage bale storage area immediately adjacent to a canal back drain containing suitable habitat at another; and PX03 *Unknown pressures or threats* referring to the apparent reduction in the suitability of habitat where no cause could be discerned.

The remaining nine pressures and threats have been recorded affecting a single site each (5% of the total number of sites). PA05 *Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming)* relates to the removal of prior grazing causing a build-up of litter and the spread of scrub. PA08 *Extensive grazing or undergrazing by livestock* refers to increased trampling by cattle and horses increasing soil moisture and is so considered a positive effect. PA13 *Application of natural or synthetic fertilisers on agricultural land* has affected water quality and resulted in the growth of filamentous green algae in the waters in one site. PF07 *Residential and commercial activities and structures generating pollution to surface or ground waters* was assigned to the use of herbicides adjacent to the *V. moulinsiana* habitat. PA19 *Agricultural activities generating soil pollution* occurred where dumping of cuttings caused eutrophication and the growth of nettles. PA22 *Drainage for use as agricultural land* relates to a large drain affecting *V. moulinsiana* habitat and causing drying out. PF01 *Conversion from other land uses to built-up areas* has been assigned to the threats of a proposed housing development for adjacent land that has received planning permission, but has not proceeded. PK01 *Mixed source pollution to surface and ground waters (limnic and terrestrial)* refers to filamentous green algae within lakes supporting *V. moulinsiana* habitat. Finally, PM02 *Flooding* was a pressure recorded where Lough Ree appears to regularly flood the site that supports *V. moulinsiana* habitat.

Table 38 List of the pressures and threats recorded at the *Vertigo moulinsiana* sites surveyed during the 2019-2024 monitoring period in decreasing order of frequency of occurrence

Pressure/ threat code	Pressure/threat name	Positive	Negative	Neutral	Total
PM07	Natural processes without direct or indirect influence from human activities or climate change	0	13	0	13
PA07	Intensive grazing or overgrazing by livestock	1	6	1	8
PF03	Creation or development of sports, tourism and leisure infrastructure	0	2	0	2
PF17	Active abstraction of water for built-up areas	0	2	0	2
PH08	Other human intrusions and disturbance not mentioned above	0	2	0	2
PI03	Problematic native species	0	1	1	2
PL02	Drainage	0	2	0	2
PL05	Modification of hydrological flow	1	1	0	2
PA25	Agriculture activities not referred to above	0	2	0	2
PX03	Unknown pressures or threats	0	2	0	2
PA05	Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming)	0	1	0	1
PA08	Extensive grazing or undergrazing by livestock	1	0	0	1
PA13	Application of natural or synthetic fertilisers on agricultural land	0	1	0	1
PF07	Residential and commercial activities and structures generating pollution to surface or ground waters	0	1	0	1
PA19	Agricultural activities generating soil pollution	0	1	0	1
PA22	Drainage for use as agricultural land	0	1	0	1
PF01	Conversion from other land uses to built-up areas	0	1	0	1
PK01	Mixed source pollution to surface and ground waters (limnic and terrestrial)	0	1	0	1
PM02	Flooding	0	1	0	1

3.4.4.1 Negative pressures/threats

In terms of the intensity of the negative effect of the recorded pressures and threats, and the area affected, PM07 *Natural processes without direct or indirect influence from human activities or climate change* was considered to be having the most widespread effect on *V. moulinsiana* habitat, with a High intensity recorded on 24.42 ha across four sites (Table 39).

This was followed by PL02 *Drainage* (17.32 ha) and PA22 *Drainage for use as agricultural land* (9.86 ha) in the High intensity category. The remaining High intensity negative pressures were PL05 *Modification of hydrological flow* (2.53 ha), PA25 *Agriculture activities not referred to above* (0.25 ha), PA07 *Intensive grazing or overgrazing by livestock* (0.06 ha), PA19 *Agricultural activities generating soil pollution* (0.01 ha), and PF07 *Residential and commercial activities and structures generating pollution to surface or ground waters* (0.003 ha).

Of the Medium intensity negative effects, PA13 *Application of natural or synthetic fertilisers on agricultural land* was the most extensive at 9.03 ha. This was followed by PA07 *Intensive grazing or overgrazing by livestock* (4.89 ha) and PH08 *Other human intrusions and disturbance not mentioned above* (2.77 ha). The remaining Medium intensity negative effects were PM07 *Natural processes without direct or indirect influence from human activities or climate change* (2.53 ha), PX03 *Unknown pressures or threats* (1.28 ha) and PF03 *Creation or development of sports, tourism and leisure infrastructure* (0.09 ha).

The remaining negative effects are of Low intensity, with the most extensive being PA05 *Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming)* at 18.86 ha, followed by PF17 Active abstraction of water for built-up areas (12.06 ha) and PI03 *Problematic native species* (11.30 ha). The remaining low intensity negative effects were PM07 *Natural processes without direct or indirect influence from human activities or climate change* (5.9 ha), PF01 *Conversion from other land uses to built-up areas* (2.96 ha), PA07 *Intensive grazing or overgrazing by livestock* (1.82 ha), PK01 *Mixed source pollution to surface and ground waters (limnic and terrestrial)* (0.86 ha), PM02 *Flooding* (0.42 ha) and PF03 *Creation or development of sports, tourism and leisure infrastructure* (0.17 ha).

Table 39 Pressures and threats recorded as having a negative influence at *Vertigo moulinsiana* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PM07	Natural processes without direct or indirect influence from human activities or climate change	High	24.42	4
PL02	Drainage	High	17.32	2
PA22	Drainage for use as agricultural land	High	9.86	1
PL05	Modification of hydrological flow	High	2.53	1
PA25	Agriculture activities not referred to above	High	0.25	1
PA07	Intensive grazing or overgrazing by livestock	High	0.06	1
PA19	Agricultural activities generating soil pollution	High	0.01	1
PF07	Residential and commercial activities and structures generating pollution to surface or ground waters	High	0.003	1
PA13	Application of natural or synthetic fertilisers on agricultural land	Medium	9.03	1
PA07	Intensive grazing or overgrazing by livestock	Medium	4.89	2
PH08	Other human intrusions and disturbance not mentioned above	Medium	2.77	2
PM07	Natural processes without direct or indirect influence from human activities or climate change	Medium	2.53	6
PX03	Unknown pressures or threats	Medium	1.28	2
PF03	Creation or development of sports, tourism and leisure infrastructure	Medium	0.09	1
PA05	Abandonment of management/use of grasslands and other agricultural and agroforestry systems (*e.g.* cessation of grazing, mowing or traditional farming)	Low	18.86	1
PF17	Active abstraction of water for built-up areas	Low	12.16	2
PI03	Problematic native species	Low	11.30	1
PM07	Natural processes without direct or indirect influence from human activities or climate change	Low	5.90	3
PF01	Conversion from other land uses to built-up areas	Low	2.96	1
PA07	Intensive grazing or overgrazing by livestock	Low	1.82	3
PK01	Mixed source pollution to surface and ground waters (limnic and terrestrial)	Low	0.86	1
PM02	Flooding	Low	0.42	1
PF03	Creation or development of sports, tourism and leisure infrastructure	Low	0.17	1

3.4.4.2 Positive pressures/threats

Four positive pressures were identified during the current survey; two at Medium intensity and two at Low intensity (Table 40). PL05 *Modification of hydrological flow* was the most extensive Medium intensity pressure, affecting 6.63 ha at one site. This related to drain blocking for conservation purposes on VmCAM17 The Murrough. The second Medium intensity pressure was PA25 *Other agricultural activities not mentioned above* (3.32 ha) and refers to scrub clearance on the same site.

Low intensity positive pressures recorded were PA08 *Extensive grazing or undergrazing by livestock* (9.95 ha) and PA07 *Intensive grazing or overgrazing by livestock* (1.48 ha). The former relates to agricultural cattle grazing at VmCAM16 Lisduff Fen, while the latter relates to conservation grazing by cattle and ponies at VmCAM18 The Murrough to control scrub.

Table 40 Pressures and threats recorded as having a positive influence at *Vertigo moulinsiana* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PL05	Modification of hydrological flow	Medium	6.63	1
PA25	Other agricultural activities not mentioned above.	Medium	3.32	1
PA08	Extensive grazing or undergrazing by livestock	Low	9.95	1
PA07	Intensive grazing or overgrazing by livestock	Low	1.48	1

3.4.4.3 Neutral pressures/threats

Two low intensity neutral pressures and threats were identified during the current survey (Table 41). The most extensive pressure was PI03 Problematic native species (22.67 ha), which related to low-level deer grazing, followed by PA07 *Intensive grazing or overgrazing by livestock* (2.96 ha), which relates to cattle grazing that does not appear to be affecting the *V. moulinsiana* habitat suitability.

Table 41 Pressures and threats recorded as having a neutral influence at *Vertigo moulinsiana* sites during the 2019-2024 monitoring survey, ranked in order of Intensity (High to Low) and Area affected (High to Low)

Pressure/ threat code	Pressure/threat name	Intensity	Area affected (ha)	No. of sites
PI03	Problematic native species	Low	22.67	1
PA07	Intensive grazing or overgrazing by livestock	Low	2.96	1

3.4.5 *Vertigo moulinsiana* site conservation assessments

Individual site conservation assessments were carried out for *Vertigo moulinsiana* sites surveyed during the current monitoring project. The assessments of Population and Habitat were based on criteria set by Moorkens & Killeen (2011) and Long & Brophy (2019) for previously surveyed sites, and newly established criteria for sites that have been fully surveyed for the first time as part of a monitoring project. Future Prospects were based on the future trends of Population and Habitat considering the pressures and threats relevant to the site and the effect of any conservation measures that have been implement or will be implemented in the future (DG Environment, 2023). The Overall Conservation Assessment is based on the lowest score achieved across the three elements. Table 42 presents the site conservation assessments for the 21 *V. moulinsiana* sites assessed during the current monitoring period, with the 2007-2012 and 2013-2018 results included for comparison.

There has been a clear decline in the conservation status of the *V. moulinsiana* sites across the three monitoring period. In 2007-2012, there were 14 Green sites, one Amber site and one Red site, which dropped to three Green sites (including VmCAM21 Royal Canal Longford Branch, which was assessed for the first time), six Amber sites and nine Red sites in 2013-2018 (including VmCAM23 Castletown, which was assessed for the first time). In the current round of monitoring, there were five Green sites (including VgCAM24 Gollierstown and VgCAM26 Loughmerans, which were assessed for the first time), five Amber sites (including VgCAM25 Louisa Bridge (South), which was assessed for the first time) and 11 Red sites. Two sites, VmCAM11 Charleville Lake and VmCAM19 Portumna, remained Green across the three monitoring periods, while VmCAM08 Cappankelly dropped from Green to Amber between 2007-2012 and 2013-2018, but recovered to Green in the current monitoring period.

Full details of the criteria used in carrying out the Population and Habitat assessments are presented in the *V. moulinsiana* site reports in Appendix IV.

Table 42 Site conservation assessments for *Vertigo moulinsiana* across the last three monitoring periods for the sites surveyed during the current monitoring period. Pop = Population, Hab = Habitat, FP = Future Prospects.

Site ID	Site name	2007-2012				2013-2018				2019-2024			
		Pop	Hab	FP	Overall	Pop	Hab	FP	Overall	Pop	Hab	FP	Overall
VmCAM01	Borris	Amber	Green	Amber	Amber	Red	Green	Amber	Red	Red	Amber	Red	Red
VmCAM02	Fin Lough (Offaly)	Green	Green	Green	Green	Red	Green	Green	Red	Red	Green	Red	Red
VmCAM03	Lough Owel	Green	Green	Green	Green	Amber	Amber	Green	Amber	Red	Red	Red	Red
VmCAM04	Mountmellick	Green	Green	Green	Green	Red	Amber	Amber	Red	Red	Red	Red	Red
VmCAM05	Louisa Bridge	Green	Green	Green	Green	Red	Green	Green	Red	Red	Red	Red	Red
VmCAM06	Ballybeg Lough	Green	Green	Green	Green	Red	Green	Green	Red	Red	Green	Amber	Red
VmCAM08	Cappankelly	Green	Green	Green	Green	Amber	Green	Green	Amber	Green	Green	Green	Green
VmCAM09	Waterstown Lough	Green	Green	Green	Green	Red	Green	Green	Red	Red	Green	Green	Red
VmCAM10	Ballynafagh Lake	Green	Green	Green	Green	Red	Red	Amber	Red	Red	Red	Red	Red
VmCAM11	Charleville Lake	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
VmCAM12	Curragh Chase	Red	Green	Green	Red	Amber	Amber	Green	Amber	Amber	Green	Green	Amber
VmCAM14	Kildallan Bridge	Green	Green	Green	Green	Amber	Green	Green	Amber	Amber	Green	Amber	Amber
VmCAM16	Lisduff Fen	Green	Green	Green	Green	Amber	Green	Amber	Amber	Red	Green	Red	Red
VmCAM17	The Murrough	Green	Green	Green	Green	Amber	Amber	Amber	Amber	Amber	Amber	Amber	Amber
VmCAM18	Pollardstown Fen	Green	Green	Green	Green	Red	Red	Amber	Red	Red	Red	Red	Red
VmCAM19	Portumna	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
VmCAM21	Royal Canal Longford Branch	NA	NA	NA	NA	Green	Green	Green	Green	Amber	Green	Amber	Amber
VmCAM23	Castletown	NA	NA	NA	NA	Green	Red	Amber	Red	Green	Red	Red	Red
VmCAM24	Gollierstown	NA	NA	NA	NA	NA	NA	NA	NA	Green	Green	Green	Green
VmCAM25	Louisa Bridge (South)	NA	NA	NA	NA	NA	NA	NA	NA	Green	Amber	Amber	Amber
VmCAM26	Loughmerans	NA	NA	NA	NA	NA	NA	NA	NA	Green	Green	Green	Green

4 Discussion

The results of the current survey show that *V. angustior*, *V. geyeri* and *V. moulinsiana* populations and habitats are under pressure, though to varying degrees. Due to ecological differences between the three species, the different pressures they each face, and the differing measures required to restore their populations and habitats, each species will be discussed separately.

4.1 *Vertigo angustior*

Vertigo angustior continues to show a decline in terms of the number of sites at which the whorl snail was recorded, the percentage of positive samples at sites, and in the fine-scale quality of habitat for the species. This decline has seen a 35% drop in the number of positive sites, and a drop in the percentage of positive samples at 74% of sites (with a further 16% of sites stable at 0% positive since the 2013-18 monitoring period). In contrast, there has been an increase in the percentage of habitat across the 19 *V. angustior* sites that is considered Optimal-Suboptimal or better. The cause of this increase in area of higher suitability habitat includes better developed *Festuca rubra* swards due to reduced grazing in some areas of fixed dune (VaCAM07 Maharees) and likely increased grazing, creating a more open upper saltmarsh sward (VaCAM14 Streedagh Point Dunes). The drop in the amount of Suboptimal habitat is explained by areas either increasing or decreasing in suitability and so transitioning to another category. Negative changes in suitability have been mainly attributed to overgrazing, which removes the *F. rubra* thatch and exacerbates the effects of drying by reducing the sward height and opening up the sward. The reason that an overall increase in habitat of higher suitability has occurred in contrast to the decline in the distribution of *V. angustior* is likely related to intermittent effects, such as drying out, which are not always persistent or sufficient enough to alter the overall habitat, but have resulted in the loss of the snail from areas that have subsequently not been recolonised.

The main pressures affecting *V. angustior* habitat within the survey site network are reflective of the above changes, with changes in precipitation regimes due to climate change the most widespread negative pressure affecting the largest habitat area, followed by overgrazing. Confirming climate change as the cause of the reduction in *V. angustior* distribution is difficult, but it is generally becoming accepted that climate change is causing measurable effects on the Irish environment with more extreme precipitation events and an increase in spring, summer and autumn temperatures (Murphy *et al*., 2023). During the current survey, it was often noted that, even in areas of suitable habitat, the *F. rubra* thatch was too dry to be optimal for *V. angustior*. It is suggested that this is the result of less stable rainfall patterns, with more intense downfalls followed by longer periods of low rainfall amounts. This pressure is likely to affect the majority of *V. angustior* sites and is not one that can be managed at a site, or even national level.

Overgrazing is the second most important negative pressure affecting *V. angustior* habitat in the High intensity category and most important in the Medium intensity category. Overgrazing removes the *F. rubra* thatch and can even result in greatly reduced cover of *Ammophila arenaria*. This removes suitable habitat for *V. angustior* by causing a loss of thatch and creating drier conditions in the sward. An example of overgrazing and its effect on *V. angustior* habitat can be seen at VaCAM01 Beal Point in Polygon C, which is outside the farm plan area. This polygon is very heavily grazed by sheep to the point that there is virtually no grass left, with the sward being dominated by broadleaved herbs. This leaves virtually no suitable habitat within this area and will require a significant reduction in the level of grazing to restore habitat suitability.

Erosion is another significant pressure affecting *V. angustior* habitat within dune systems. The loss of dune habitat from the seaward edge of dune systems was noted at several sites, including VaCAM12 Malin Dunes and VaCAM08 Dog's Bay, along with associated blown sand affecting the habitat further back into the dunes. Thus, this erosion reduces the area of suitable habitat for *V. angustior* by direct removal and also reduces the suitability of portions of the remaining habitat by creating a substratum of dry, clean sand rather than friable soil. While erosion and deposition of soft coastlines is part of the natural cycle, climate change is causing an increase in winter storm frequency and intensity (Loureiro & Cooper, 2018), which will lead to increased erosion and the associated *V. angustior* habitat loss.

When compared with 2013-2018, the number of sites that are considered Favourable (green) has dropped from four to one (VaCAM15 Bartraw). The main cause of this decline is the failure to meet the population assessment criteria. In some cases, the habitat has also declined. Due to the nature of the assessments, there is often a weighting towards the habitat along the transect and so localised impacts can have a disproportionate effect on the conservation assessment. In the cases of the *V. angustior* sites that dropped from Favourable (green) to Unfavourable-Bad (red), VaCAM10 Killanley Glebe saw a population assessment drop, as no *V. angustior* were recorded during the current survey, despite the habitat appearing suitable and no significant pressures visible on-site. VaCAM20 Ballysadare Bay failed for both the population and habitat criteria, with a decline in positive samples both along the transect and across the site in general, and a reduction in habitat suitability along the transect. VaCAM22 Waterstown Lough had an extremely limited population even in 2013-2018, but the snail was not recorded from the site during the current survey and the habitat suitability appears to have been affected by grazing impacting the litter layer.

Several *V. angustior* sites have conservation measures, either underway or planned, that will improve the habitat condition in a way that should benefit the snail. Generally, the aim of these measures are to improve the habitat more broadly, rather than specifically for *V. angustior*, but the species will benefit nonetheless. At VaCAM02 Derrynane, a rabbit cull has been implemented in order to control the rabbit population at the site. This is required as a recent population explosion has resulted in a rabbit population that has grazed the dune system extremely tightly and created extensive bare sand areas due to burrowing activities (JBA Consulting, 2024). Reducing this grazing pressure will allow the re-establishment of an *Ammophila arenaria – Festuca rubra* sward with good *Festuca* thatch.

Chestnut fencing has been installed at VaCAM08 Dog's Bay and forms part of a conservation management plan being implemented by a local conservation group (Heffernan, 2022). This plan aims at addressing coastal erosion, overgrazing and the spread of problematic native species (*Jacobaea vulgaris*), and was granted conditional planning permission in 2023 (planning ref: 2260606). Relieving these pressures will improve the area of suitable habitat for *V. angustior*, which is currently extremely limited. Chestnut fencing has also been erected by Mayo County Council at VaCAM15 Bartraw (NPWS, 2011). Though this measure has been in place at Bartraw for some time and appears to have helped to trap sand, it has not been able to create enough stability for this area to re-vegetate.

The specific restoration measures required to address declines in the *V. angustior* population or habitat across the monitoring site network are noted in the individual site reports in Appendix II. One broadly applicable measure is the management of grazing within V*. angustior* sites to achieve a balance that allows the restoration and maintenance of the snail's habitat. The general recommendation made by Moorkens & Killeen (2011) for grazing of fixed dune habitat for *V. angustior* is less than 0.8 livestock units (LU) per hectare in spring to autumn, with animals removed in winter. Lower grazing rates are recommended for sand dunes in other sources, as low as 0.1-0.3 LU/ha (Chapman, 2007). Any grazing management plan should consider these stocking rates at the outset, with grazing adjusted to attain the desired result. Supplementary feeding should be avoided on site, as it brings in nutrients and unwanted species.

Countering the cause of climate change-induced effects on *V. angustior* is beyond any restoration plan for this species; however, measures to address erosion can be implemented at a site level. Coastal protection measures, such as hard coastal defences or beach nourishment, may be appropriate to prevent further loss of sand dune habitat to coastal erosion, but both are significant endeavours and would require the appropriate planning and consent.

When it comes to climate change-related drying out of habitat, options are more limited than for erosion. No reasonable measure can be taken to increase the moisture levels of sand dune habitats generally; however, ensuring that the habitat is allowed to form a good *F. rubra* thatch around scattered *A. arenaria* tussocks would go some way to creating conditions that would retain more moisture within the fixed dune vegetation than a shorter sward will.

The decline in the overall conservation status of the sites within the monitoring programme for *V. angustior* is significant and is one that will be challenging to reverse. The situation at some sites can be improved by managing the grazing of livestock at an appropriate level so that the area of suitable habitat increases and thus allow the population to expand its range and numbers. Widespread pressures associated with climate change, particularly the reduction in the moisture of the habitat, pose a significant challenge and their direct alleviation is beyond the scope of any site-level action. Again, improving the sward for *V. angustior* by management of grazing represents the best method of providing habitat resilience against this pressure into the future.

4.2 Vertigo geyeri

Vertigo geyeri continues to show a decline in terms of the number of sites at which the snail was recorded, the percentage of positive samples from positive sites, and in the quality of habitat for the species. This decline has seen a 37% drop in the number of positive sites, and a drop in the percentage of positive samples at 68% of sites (with a further 16% of sites stable at 0% positive since the 2013-18 monitoring period). The drop in the percentage of positive samples is generally reflected in the assessment of habitat quality, with drops in Optimal, Suboptimal and Unsuitable habitat, and increases in Optimal-Suboptimal and Suboptimal-Unsuitable habitat. Most of the increases are considered to represent interpretation rather than ecological changes, whereby small patches of suitable habitat were found within polygons which appear to have been missed previously (*e.g.* VgCAM13 Easkey Valley). The losses in suitable habitat are mostly ecological in nature and include drying out of habitat due to drainage (VgCAM15 Silver River) and likely climate change effects (*e.g.* VgCAM06 Drimmon Lough and VgCAM09 Annaghmore Lough), vegetation becoming rank (*e.g.* VgCAM22 Pollardstown Fen), and poaching by cattle (*e.g.* VgCAM08 Fin Lough and VgCAM23 Waterstown Lough). These losses in habitat suitability have contributed to the drop in the *V. geyeri* population across the monitoring network since the 2013-2018 monitoring period.

The main pressures affecting *V. geyeri* habitat within the survey site network are reflective of the above changes, with undergrazing, leading to vegetation becoming rank and unsuitable for the snail, being the most important in terms of area affected at High intensity. *V. geyeri* requires short, open vegetation and is quickly lost when grazing is removed and vegetation becomes tall and overshadows the ground-level vegetation. Light exposure has been shown to be important for *V. geyeri* habitat suitability (Schenková *et al.*, 2011). Undergrazing was also an important pressure at the lower intensity levels.

Vertigo geyeri depends on a stable hydrology, with the water table at, or just below, the ground surface, but not extremely waterlogged sites, due to the species' preference for low-growing sedges (Schenková *et al*., 2011). For this reason, the effects of several high intensity pressures (abstraction, drainage, and changes in precipitation regimes due to climate change) all reduce the hydrological suitability of *V. geyeri* habitat. Confirming climate change as the cause for the reduction in *V. geyeri* distribution is difficult, but it is generally becoming accepted that climate change is causing measurable effects on the Irish environment with more extreme precipitation events and an increase in spring, summer and autumn temperatures (Murphy *et al*., 2023). During the current survey, it was often noted that, even in areas of otherwise suitable habitat, the bryophyte layer was too dry to be optimal for *V. geyeri*. It is suggested that this is the result of less stable rainfall patterns, with more intense downfalls followed by longer periods of low rainfall amounts. This pressure is likely to affect the majority of *V. geyeri* sites over time and is not one that can be managed at a site, or even national level.

When compared with 2013-2018, only one of the three sites considered Favourable (green) has maintained this status (VgCAM01 Meenaphuil), while two sites (VgCAM02 Tievebaun and VgCAM23 Waterstown Lough) have dropped to Unfavourable-Inadequate (amber). One site (VgCAM08 Sheskinmore) has improved from Unfavourable-Inadequate (amber) to Favourable (green). The drop in status for VgCAM02 is related to a decline in habitat quality due to the loss of suitable habitat and wetness along the transect. Other polygons away from the transect continue to support good areas of suitable habitat and a good population of *V. geyeri*. In contrast, the drop in status for VgCAM23 Waterstown Lough was due to a decline in the number of positive samples away from the transect, indicating issues across the whole site.

Positive pressures acting on *V. geyeri* sites can be split into two categories: active conservation measures, and activities that have an incidental positive effect for the snail and its habitat. The most important positive pressure acting on *V. geyeri* sites is agricultural grazing by sheep and occasionally cattle and horses. Sheep are the ideal grazer for *V. geyeri* habitat, as they graze the vegetation low, meaning that an open sward, exposed to light, is created, and they are light, meaning that poaching is rarely an issue on what is generally a soft, wet, fragile substratum. In one instance (VgCAM08 Sheskinmore), the grazing by a small number of cattle and Polish Konik ponies is specifically for conservation purposes and is similarly maintaining an open sward with minimal poaching. Such grazing is generally required to maintain *V. geyeri* habitat and the removal of grazing from a site will likely lead to the loss of the species from that site.

As noted above, stable hydrology is critical to the survival of *V. geyeri* in its habitat. Another positive pressure, which is also an active conservation measure, is the operation of a sluice to control water levels at VgCAM08 Sheskinmore. This sluice maintains a stable water level within Sheskinmore Lough and so within the groundwater in the immediate surrounds. The implementation of this control measure, along with the conservation grazing noted above, has resulted in VgCAM08 Sheskinmore being the only *V. geyeri* site that has improved since the 2013-2018 monitoring period. This illustrates the importance of such active conservation measures in the recovery of the species and its habitat.

The specific restoration measures required to address declines in the *V. geyeri* population or habitat across the monitoring site network are noted in the individual site reports in Appendix III. One broadly applicable measure is the management of grazing within *V. angustior* sites to achieve a balance that allows the restoration and maintenance of the snail's habitat. Due to the sensitive and often patchy nature of *V. geyeri* habitat, it is not possible to provide general grazing prescriptions that can be applied, but rather site-specific measure will be needed (Cameron *et al*., 2003). The maintenance of appropriate grazing by sheep where it already occurs will be critical to preventing any further loss to the *V. geyeri* population.

Countering the cause of climate change-induced effects on *V. geyeri* is beyond any restoration plan for this species; however, measures to reduce effects on the hydrology of the snail's sites from drainage and abstraction would help develop some resilience within the hydrological system of the fens and flushes that the *V. geyeri* is found.

The decline in the overall conservation status of the sites within the monitoring programme for *V. geyeri* is significant and is one that will be challenging to reverse. The situation at some site can be improved by managing the grazing of livestock at an appropriate level so that the area of suitable habitat increases and thus allow the population to expand its range and numbers. Widespread pressures associated with climate change, particularly the reduction in the moisture of the habitat, pose a significant challenge and their direct alleviation is beyond the scope of any site-level action. Removing other pressures that affect the hydrology of the sites and result in drying out will go some way to improving the resilience of *V. geyeri* habitat to the effects of climate change.

4.3 *Vertigo moulinsiana*

Vertigo moulinsiana has shown more apparent resilience than the other Annex II *Vertigo* species, and was recorded from all sites surveyed during the current project, including VmCAM01 Borris, which was negative for the species in 2013-18. In terms of the percentage of positive samples at each site, the picture is mixed, with almost equal increases and decreases being recorded across the 18 sites that were surveyed in both 2013-18 and the current survey. The picture when it comes to habitat suitability is also mixed, with increases noted for Optimal, Suboptimal, and Suboptimal-Unsuitable categories, and a decrease in the area of Optimal-Suboptimal habitat, while Unsuitable remained unchanged. The cause of the positive changes mainly related to changes in the boundaries of habitat polygons to incorporate additional areas of suitable habitat, while negative changes were predominately caused by drying out or vegetation change due to shading. The main negative pressures identified for *V. moulinsiana* and its habitat reflect these changes with drainage and succession/scrubbing over being recorded as affecting the largest area within the site network. Several of the positive pressures identified were habitat conservation measures being implemented by Birdwatch Ireland on the site at The Murrough (VmCAM17), where conservation grazing and drain-blocking has been carried out, with further measures required across the survey sites to counter the negative trends noted for population and habitat at many sites.

When compared with 2013-2018, the number of sites that are considered Favourable (green) has remained unchanged for the sites that were surveyed during both monitoring periods. While VmCAM11 Charleville Lake and VmCAM19 Portumna have remained Favourable (green) across both monitoring periods, VmCAM08 Cappankelly has improved from Unfavourable-Inadequate (amber) to Favourable (green) due to an improvement in the Population and VmCAM21 Royal Canal, Longford Branch has declined from Favourable (green) to Unfavourable-Inadequate (amber) due to a decrease in Population and negative Future Prospects due to shading. The remaining sites were Unfavourable-Inadequate (amber) or Unfavourable-Bad (red) in 2013-2018 and have remained as such, or further declined.

The causes for the continued decline in the Overall Conservation Assessments for the surveyed *V. moulinsiana* sites are often site-specific, and so the individual site reports should be referred to in order to gain a better understanding of the situation for a particular site. Some common significant pressures that are acting on *V. moulinsiana* populations and their habitat include scrubbing over, which can be a sign of drying out and further exacerbate the situation, as well as shading out the suitable vegetation favoured by *V. moulinsiana*, and drainage, which reduces the ground moisture, thus reducing the suitability of an area, even where suitable vegetation continues to occur.

A small number of sites had threats noted for them, which could result in negative pressures in the future. VmCAM06 Ballybeg Lough has had planning permission for a housing development granted in the past (Planning ref: 08987), though it does not appear to have progressed since the conditional granting in 2008. Should this proposed development be revived, it could result in the loss of *V. moulinsiana* habitat and other construction and operation-related pressures.

VmCAM19 Portumna extends around the shores of Lough Derg. The Water Supply Project, Eastern and Midlands Region proposes to extract water from the southern end of Lough Derg at Parteen and pump it across the midlands, supplying Dublin and its surrounds, and is at the pre-planning stage. As such, there is no set timeline for this project. The abstraction of water from Lough Derg has the potential to affect the lake water levels, which could have knock-on effects on the wetness of *V. moulinsiana* habitat around the lake. This issue should be addressed at the Environmental Impact Assessment (EIA) of the project, but it is important to flag it at this stage.

Finally, VmCAM24 Gollierstown occurs along the Grand Canal in Co. Dublin. South Dublin County Council has plans for the Grand Canal Greenway - Hazelhatch to 12th Lock, which will involve the construction of a durable surface shared walking and cycle-path, with subsurface ducting (Clifton Scannell Emerson Associates, 2018). This project has the potential to affect subsurface water moving from the Grand Canal to the pond around which the *V. moulinsiana* habitat is found, though the impact assessment concluded that it would not constitute a significant negative impact (Clifton Scannell Emerson Associates, 2018).

Addressing the decline in the population and habitat of *V. moulinsiana* will pose a challenge at many of the sites. For some sites, such as VmCAM04 Mountmellick, one of the main issues is that the site is drying out. Mountmellick is drying out as it is a disused canal with a limited input of water. The options for rewetting this site, and others like it, are likewise limited. Options that are available are unlikely to be self-sustaining and would require ongoing intervention (*e.g.* installation of a water source to raise the soil moisture level). Sites where drainage is a clear issue (*e.g.* VmCAM23 Castletown) would benefit from drain blocking to raise the groundwater level and encourage the reestablishment of tall wetland vegetation across more of the site. The sites that have seen trees and scrub develop to a problematic level, or will develop if not addressed, would benefit from some ecologically sensitive scrub/tree removal. For example, VmCAM21 Royal Canal, Longford Branch has seen the growth of tall trees along the banks and within stretches of the bed of the dried out canal, which has resulted in the tall vegetation on which *V. moulinsiana* depends being shaded out and becoming sparse. The removal of trees from stretches along the eastern and southern stretches of bank would allow sunlight to penetrate to the bed of the canal and encourage the growth of suitable vegetation. Further details of the types of interventions required to improve the status of the *V. moulinsiana* sites can be found in the individual site reports.

While the decline in the Favourable Conservation Status of the sites within the monitoring programme for *V. moulinsiana* is significant, it is not quite as stark as for *V. angustior* and *V. geyeri*. This is likely due to the fact that *V. moulinsiana* habitat often develops, or has persisted, in more marginal areas with reduced disturbance from humans and grazers. Also, while the species requires a high ground moisture level, it is likely to be more tolerant to occasional fluctuations in the water levels that may accompany changes to rainfall patterns. The reversal of the negative trend noted for the species will require restoration interventions, in collaboration with landowners, on sites where such interventions are likely to be possible and sustainable. New locations for the species continue to be found, so the range and distribution of *V. moulinsiana* could be improved by surveys focussed on potentially suitable areas away from the known sites.

One of the challenges related to the monitoring of *V. angustior*, *V. geyeri* and *V. moulinsiana* in Ireland is the difficulty in differentiating genuine population decline from natural population variability. Due to the nature of the current monitoring methodology, statistical analysis cannot be applied to the resulting data. In order to change this, the surveys would need to involve an approach such as random stratified sampling, adhering to the assumptions inherent to the statistical tests applied. The difficulty in implementing this approach is that, unlike the current survey methods, the results would not be directly comparable to the previous rounds of monitoring and would likely also be more labour/time-intensive.

With remote sensing using Unmanned Aerial Vehicles (UAVs) becoming more prevalent in surveying habitats (Cruz *et al*., 2023), the possibility of using such technology in the monitoring of *Vertigo* spp. should be explored. The ground-truthing of Optimal and Suboptimal *Vertigo* spp. habitat across a number of sites, combined with concurrent high-resolution UAV imagery, could be used to build a library of training data for a machine-learning tool that would then be able to identify and map areas of suitable habitat. Once a model has been established, this would allow for the production of maps of suitable habitat over time (annual or every six years with monitoring) to investigate how these areas change over the years/seasons at *Vertigo* sites. In addition, UAV images can be used to produce accurate digital terrain maps of sites and to monitor parameters such as biomass and soil moisture.

As both of these actions would require a significant deviation from the existing monitoring methodologies, and the development of new methodologies and implementation of new technologies, it is recommended that any such changes be piloted on a small number of sites to confirm their practicality for the task of monitoring *Vertigo* spp. This would be run in tandem with the existing monitoring surveys to ensure continuity of results for Article 17 reporting until the new methodologies are finalised.

5 Conclusion

All three *Vertigo* species listed on Annex II of the Habitats Directive are under threat in Ireland due a range of pressures including inappropriate grazing levels, climate change and drainage. The on-going decline across the last three monitoring periods indicates that active measures are required, where feasible, to reverse these trends and return the species to Favourable Conservation Status. NPWS will need to engage with landowners and managers in order to implement the appropriate conservation measures, which include altering grazing levels, blocking drains and removing scrub.

Addressing potential issues facing *V. angustior* and *V. geyeri* that may be related to climate change will pose a particular challenge given that the pressure cannot be mitigated to any great degree at a site or even national level. However, immediate action must be taken to implement, where possible, practical measures to improve the habitat for these species in terms of quality and distribution, and to build resilience into the network of sites across which they are found.

While *V. moulinsiana* is not quite as dependent on a very stable water table as the other two species, it is still sensitive to ground moisture levels. Managing the general wetness of *V. moulinsiana* sites and maintaining the tall wetland vegetation are critical to preserving the current distribution. The preservation of wetland areas that could be considered ‘marginal’ or ‘unproductive’, especially outside SACs, will require engagement with landowners. Recent additions to the *V. moulinsiana* site list suggest that further sites for the species may be found.

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