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Monitoring methods for *Hamatocaulis vernicosus* Mitt. Hedenäs (Slender Green feather-moss) in the Republic of Ireland

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Cover photo: *Hamatocaulis vernicosus* © Neil Lockhart

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Contents

Executive Summary

Hamatocaulis vernicosus is a pleurocarpous moss listed on Annex II of the EU Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna). *H. vernicosus*, commonly known as the Slender Green feather-moss, has distinctive hooked shoot tips and leaves that are strongly curved, are often pleated length-ways and are frequently tinged with red at the bases. It occurs in mesotrophic fens and flushes. *H. vernicosus* can appear similar to other fen species, such as *Warnstorfia exannulata* and in the past has also been confused with other species, such as *Scorpidium cossonii* and *Palustriella commutata*. *H. vernicosus* is dioicous and sporophytes are rare across its distribution and have never been reported in Ireland. It has a circumboreal distribution and although widespread in Europe, it is rarely common.

It is scattered and rare in the Republic of Ireland, with 11 extant populations in the counties of Waterford, Galway, Wexford, Meath, Westmeath, Wicklow, Donegal, Cavan and Mayo, occurring in lowland transition mires and upland flushes. Wetlands in Cos. Mayo and Galway form the main stronghold for this species, with only scattered records elsewhere. *H. vernicosus* is categorised as *Near Threatened* on the Irish Red List of rare and threatened bryophytes. However, Ireland has an international obligation to conserve the species and its habitats and it is protected under the Flora (Protection) Order, 2015.

Ireland also has a responsibility to monitor *H. vernicosus* populations under Article 11 of the EU Habitats Directive and, under Article 17 of the Directive, to report on the species conservation status every six years under the parameters Range, Population, Habitat for the Species and Future Prospects. The current overall conservation status of the species in the Republic of Ireland is Favourable.

A field survey of 7 of the 11 *H. vernicosus* localities was undertaken in 2009–2011 to record information on population size, structure, associated vegetation and environmental variables. From analysis of data collected, ecological indicators and associated targets were derived to assess the condition of each locality and monitoring methods were developed.

Acknowledgements

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Introduction

Description of *Hamatocaulis vernicosus*

Hamatocaulis vernicosus Mitt. Hedenäs is a pleurocarpous moss of mesotrophic fens known by the common names Slender Green feather-moss, Shining Sickle-moss and Varnished Hook-moss. Other synonyms for the species are *Drepanocladus vernicosus* (Mitt.) Warnst., *Drepanocladus vernicosus* var. *gracile* G. Roth, *Harpidium vernicosum* (Mitt.) C.E.O. Jensen, *Hypnum aduncum* var. *vernicosum* (Mitt.) Molendo, *Hypnum lycopodioides* var. *vernicosum* (Mitt.) Sanio, *Limprichtia vernicosa* Loeske and *Scorpidium vernicosum* (Mitt.) Tuom. (www.theplantlist.org). The species was known as *Drepanocladus vernicosus* (Mitt.) Warnst. before Hedenäs (1989a) transferred it to *Hamatocaulis*, a new genus.

H. vernicosus is a medium-sized perennial moss with pinnately branched shoots with branches that are held *circa* 90° to the stem (Atherton *et al*., 2010) that forms green to yellowish-green patches. It has distinctive hooked shoot tips and the etymology of the genus name reflects this, as *hamatus* means 'hook-like' and *caulis* means 'stem' (Hedenäs, 1989a). The leaves are strongly falcate-secund, are often longitudinally plicate and frequently tinged with red at the bases (Smith, 2004). The function of the red pigmentation is thought to be protection against damaging levels of solar radiation (Hedenäs, 2003). There are two species in the genus, the other species being *H. lapponicus*, a Boreal species that does not occur in Ireland and differs from *H. vernicosus* mainly in its leaf morphology (Smith, 2004; Hedenäs, 2003). *H. vernicosus* can appear similar to other fen species, such as *Warnstorfia exannulata*, but differs in the lack of a central strand and hyalodermis, lack of differentiated alar cells and distinctly plicate leaves (Hedenäs, 2003; 1989a). In the past, it has also been confused with other species, such as *Scorpidium cossonii* and *Palustriella commutata*, which led to many erroneously labelled herbarium specimens (Blockeel, 1997).

H. vernicosus is a dioicous species and sporophytes have never been recorded in Ireland (or Britain) and are very rare across its distribution, maturing in summer where they do occur (Smith, 2004; Hedenäs, 1989a). Specialised vegetative propagules are unknown, thus asexual reproduction must be the means of propagation and dispersal through gametophytic fragmentation. Fragment dispersal is usually effective only over short distances, unless the fragments are spread by birds or large mammals (Štechová & Kučera, 2007; Hedenäs, 1989b).

Hedenäs & Eldenäs (2007) found two clades within the species from DNA sequence analysis. The first clade included specimens from southern Sweden, Denmark, Austria, Switzerland, N. Italy, central Spain, Britain, Russia and Peru, while the second clade was found in specimens from northern Sweden, USA, Poland, S. Sweden, Denmark, Switzerland and Austria. No difference in morphology was discernible between the two clades. It is not known to which clade the Irish populations belong.

Figure 1. Stems of *Hamatocaulis vernicosus* showing hooked tips and almost 90° branching from main stems.

Figure 2. Stems of *Hamatocaulis vernicosus* showing red pigmentation at base of leaves on main stems.

Conservation obligations

H. vernicosus is listed on Appendix I of *The Convention on the Conservation of European Wildlife and Natural Habitats* (Bern Convention, 1991), and Annex IIb of *The European Community Directive on the conservation of natural habitats and of wild fauna and flora* (the 'EU Habitats Directive'), which came into force in 1994. *H. vernicosus* is also listed as 'Vulnerable' on the Red Data Book of European Bryophytes (European Committee for the Conservation of Bryophytes, 1995), although this list is in the process of being updated (Hodgetts, 2015). Since then, a better understanding of the plant has led to a better knowledge of its distribution in Europe as targeted fieldwork increased. *H. vernicosus* is now included on lists of specially protected species in all signatory countries to the Bern Convention and the Habitats Directive. The EU Habitats Directive aims to maintain or restore habitats (listed on Annex I) and species (listed on Annexes II, IV & V) of conservation concern to a 'Favourable Conservation Status' (European Commission, 1992; Evans & Arvella, 2011). The Directive was transposed into Irish legislation in 1997 under the European Communities (Natural Habitats) Regulations (S.I. No. 94 of 1997).

Under Article 11 of the EU Habitats Directive, member states must carry out surveillance/monitoring of annexed species and under Article 17, each member state must report to the European Commission, every six years, on the measures taken under the Directive and on the conservation status of the listed species and habitats (European Commission, 1992; Evans & Arvela, 2011). The conservation status of a species is defined as the sum of influences acting on the target species that may affect the long-term distribution and abundance of its populations. There are four parameters (Range, Population, Habitat for the Species and Future Prospects) that must be met in a favourable way, i.e. given a classification of 'Favourable', for the conservation status to be given an overall classification of 'Favourable'. Member states are also required to designate Special Areas of Conservation for Annex I habitats and Annex II species. All of the eleven populations of *H. vernicosus* in the Republic of Ireland are contained within nine SACs, in eight of which it is listed as a qualifying interest. Populations that are listed as qualifying interests in SACs are protected by the Habitat Regulations (S.I. No. 477 of 2011), which regulates any plans or projects that might negatively impact on *H. vernicosus* populations. NPWS provide a list of Activities Requiring Consent (ARCs) that are only granted if they do not negatively impact on any qualifying interests within an SAC. Although there is currently one SAC containing *H. vernicosus* where it is not yet listed as a qualifying interest (Cuilcagh-Anierin Uplands SAC), it is however also protected under other directives and legal instruments. It is afforded protected by the Environmental Liability directive (2004/35/EC, transposed into Irish law in the European Committees (Environmental Liability) Regulations 2008 (S.I. No. 547 of 2008)), which prevents and remedies environmental damage to natural habitats and protected species. It is also protected through listing on the Flora (Protection) Order, 2015 (S.I. No. 356 of 2015).

As a result of its listing on Annex II of the EU Habitats Directive, targeted fieldwork on *H. vernicosus* across Europe increased and it is now clear that *H. vernicosus*, although rather rare and habitat-specific, is not as rare in Europe as was once thought. It is, for example, now regarded as *Nationally Scarce* in Britain (Church *et al*., 2001; Preston, 2006), rather than a Red Listed species. In Ireland, *H. vernicosus* is considered *Near Threatened* (Lockhart *et al*., 2012a; 2012b). Recent revision of herbarium specimens (Blockeel, 1997) and fieldwork has shown that it is certainly much rarer in Ireland than it is in Wales, for example, which appears to be its centre of distribution in Britain (Turner, 2003; Bosanquet *et al*., 2006).

International distribution of *Hamatocaulis vernicosus*

According to Hill *et al.* (1994), *H. vernicosus* is a circumboreal species ranging from the Arctic, south to western, central and eastern Europe, Turkey, Caucasus, central Asia and northern USA, with a disjunct occurrence in the Dominican Republic. Hill & Preston (1998) include *H. vernicosus* in the Circumpolar Boreal-montane element in their classification of floristic elements in Britain and Ireland.

According to Hedenäs (2003), *H. vernicosus* is widely distributed, but rarely common in the northern temperate to arctic zones (his map shows it in most European countries), and scattered in the mountains of central and northern South America. He also includes Africa in parentheses and with a question-mark, having noted that it had been reported in Wijk *et al.* (1962). However, *H. vernicosus* is not included in the latest version of the African moss checklist (O'Shea, 2006), so it can probably be concluded that it has not definitely been recorded there. Hedenäs (1989a) shows *H. vernicosus* to be widely distributed in northern Europe, being especially frequent in southern Finland and southern Sweden, but much less so in Norway, where it appears on the national Red List as *Vulnerable* (Kålås *et al*., 2010).

There is now quite a large amount of information available on the distribution of *H. vernicosus* in individual European countries:

- Czech Republic: declined somewhat (Štechová, 2005) and as of 2012, *H. vernicosus* has been recorded at 54 localities in the Czech Republic, while its occurrence was not verified at 75 historical localities supported by specimens, nor at 14 unsupported localities (Štechová *et al*., 2012).
- France: several localities in the east and south, but has apparently disappeared from many other areas, particularly the west of the country. Declined greatly in the past century due to degradation of wetlands and changes in agricultural practice (e.g. abandonment of wet meadows), including intensification (Hugonnot *et al*., 2012).
- Germany: a range map shows *H. vernicosus* occurring in eastern and southern Germany, but not in the west (Walder, 2006).
- Spain: known from five localities, two in Ávila, one in Madrid and two in Zamora, all other specimens having been misidentified (Heras & Infante, 2000). Here, the species is decreasing "because of excessive cattle rearing. ….As a result of grazing and constant mechanical disturbance by the cattle, these areas become drained and eutrophicated, while the vegetation is gradually transformed into pasture".
- Switzerland: widely distributed, but declined to some extent (NISM, 2003).
- United Kingdom: as of 2012, it was present in 13 10 km² squares in Scotland, 13 in England, 4 in Northern Ireland and 45 in Wales, where it is locally frequent (Joint Nature Conservation Committee, 2013). However, it has declined substantially in some areas (notably northern and southern England), and is almost certainly extinct in East Anglia (British Bryological Society Threatened Bryophyte Database). In Northern Ireland, there is an old record (1901) from Lisburn in Co. Down (Blockeel & Long, 1998) and in 2012, four new localities were found in Co. Antrim by N. Hodgetts.

The EUNIS database (European Nature Information System) gave the following information on *H. vernicosus* in EU countries:

- Austria: 11 sites
- Belgium: 3 sites
- Bulgaria: 4 sites
- Croatia: 1 site
- Czech Republic: 22 sites
- Denmark: 13 sites
- Estonia: 14 sites
- Finland: 48 sites
- France: 23 sites
- Germany: 60 sites
- Ireland: 8 sites
- Italy: 4 sites
- Latvia: 21 sites
- Lithuania: 27 sites
- Netherlands: 1 site
- Poland: 47 sites
- Romania: 8 sites
- Slovakia: 1 site
- Spain: 3 sites
- Sweden: 79 sites
- United Kingdom: 11 sites

Source:
http://eunis.eea.europa.eu/species/14002/conservation_status;jsessionid=0ED147553B5FDCD6C7E1B5DD36F2D352?d-49653-s=2&tab=conservation_status&d-49653-o=2&d-49653-p=1&idSpecies=14002

Presumably these are 'key sites' and/or Special Areas of Conservation (SACs) for *H. vernicosus* in the Natura 2000 network, rather than a comprehensive population list for each country. However, different countries may have interpreted EUNIS criteria in different ways.

H. vernicosus is also known from Bosnia-Herzegovina, Macedonia, Montenegro, Slovenia and Serbia (Sabovljević *et al*., 2008; Erzberger & Papp, 2007; Sabovljević, 2006; Sabovljević & Stevanović, 1999). *H. vernicosus* is extinct in Luxembourg (Werner, 2009) and is thought to have disappeared from Hungarian wet meadows due to eutrophication and drainage (Papp *et al*., 2002).

H. vernicosus has also been reported from the Faroe Islands (Boesen *et al*., 1975) and from Belarus, Ukraine, Georgia, Armenia, Kazakhstan, Kyrgyzstan and Russia (including Siberia) (Ignatov *et al*., 2006), as well as Turkey (Uyar & Çetin, 2004).

In North America, Crum & Anderson (1981) list *H. vernicosus* from Greenland to Alaska, south to Oregon, Montana, Iowa, Ohio, Pennsylvania and Connecticut. Lawton (1971) lists it from British Columbia, Washington, Idaho, Minnesota; Prince Edward Island and New England.

Distribution of *Hamatocaulis vernicosus* in the Republic of Ireland

H. vernicosus was first reported from Ireland in 1872 at Lough Bray by D. Moore (Moore, 1872). Unfortunately however, this record is not supported by a specimen. The first record for the Republic of Ireland supported by a specimen was in 1946 at Portnashangan, Co. Westmeath, by K.C. Harris; this was presumably from the locality now known as Scragh Bog. It is scattered and rare in the Republic of Ireland, with records from the counties of Waterford, Galway, Wexford, Meath, Westmeath, Wicklow, Donegal, Cavan and Mayo. Wetlands in Cos. Mayo and Galway form the main stronghold for this species, with only scattered records elsewhere. There are a few places in the east of the country with only old records, not all of them confirmed, and it has probably disappeared from most of these. Many of the older records (and some of the recent ones) are errors. Blockeel (1997) revised herbarium material of *H. vernicosus* and found that a high proportion of Irish material was referable to *Scorpidium* (formerly *Drepanocladus*) *cossonii*, a related species that is, however, much more frequent and more strongly basiphilous than *H. vernicosus*. The Irish distribution of *S. cossonii* was further clarified by Blockeel (2000).

H. vernicosus has been recorded in recent (post-1998) fieldwork as part of the NPWS programme of rare and threatened bryophyte surveys at 11 localities in the following counties: Waterford (three localities); Galway (one locality); Westmeath (one locality); Mayo (four localities); Donegal (one locality) (Sources: NPWS database; Holyoak, 2002; Holyoak, 2003). A locality is a discrete location where a *H. vernicosus* population has been recorded. An additional locality in Cavan was discovered in 2012 by Dr Rory Hodd. The distribution of *H. vernicosus* in the Republic of Ireland, as currently understood, is shown in Figure 3. Only confirmed records are mapped.

The 11 extant populations (localities) of *Hamatocaulis vernicosus* in the Republic of Ireland, which occur within 9 SACs, are listed in Table 1. The location of the numbered extant localities in the Republic of Ireland can be seen in Figure 4.

Table 1: *Hamatocaulis vernicosus* locality names with the county, Special Area of Conservation (SAC) names and SAC codes.

Locality name	**County**	**Special Area of Conservation (SAC) name**	**SAC code**
1. Meentygrannagh	Donegal	Meentygrannagh Bog	IE000173
2. Rathavisteen	Mayo	Glenamoy Bog Complex	IE000500
3. Largan More	Mayo	Carrowmore Lake Complex	IE000476
4. Uggool	Mayo	Owenduff/Nephin Complex	IE000534
5. Owenbrin	Mayo	Lough Carra/Mask Complex	IE001774
6. NW of Gortachalla Lough	Galway	Lough Corrib	IE000297
7. Scragh Bog	Westmeath	Scragh Bog	IE000692
8a. Below Sgilloge Loughs, 8b. Nire River Valley & 8c. Coumtay	Waterford	Comeragh Mountains	IE001952
9. Commas*	Cavan	Cuilcagh-Anierin Uplands	IE000584

* Recent find of *Hamatocaulis vernicosus*, not yet selected as a qualifying interest for SAC IE000584.

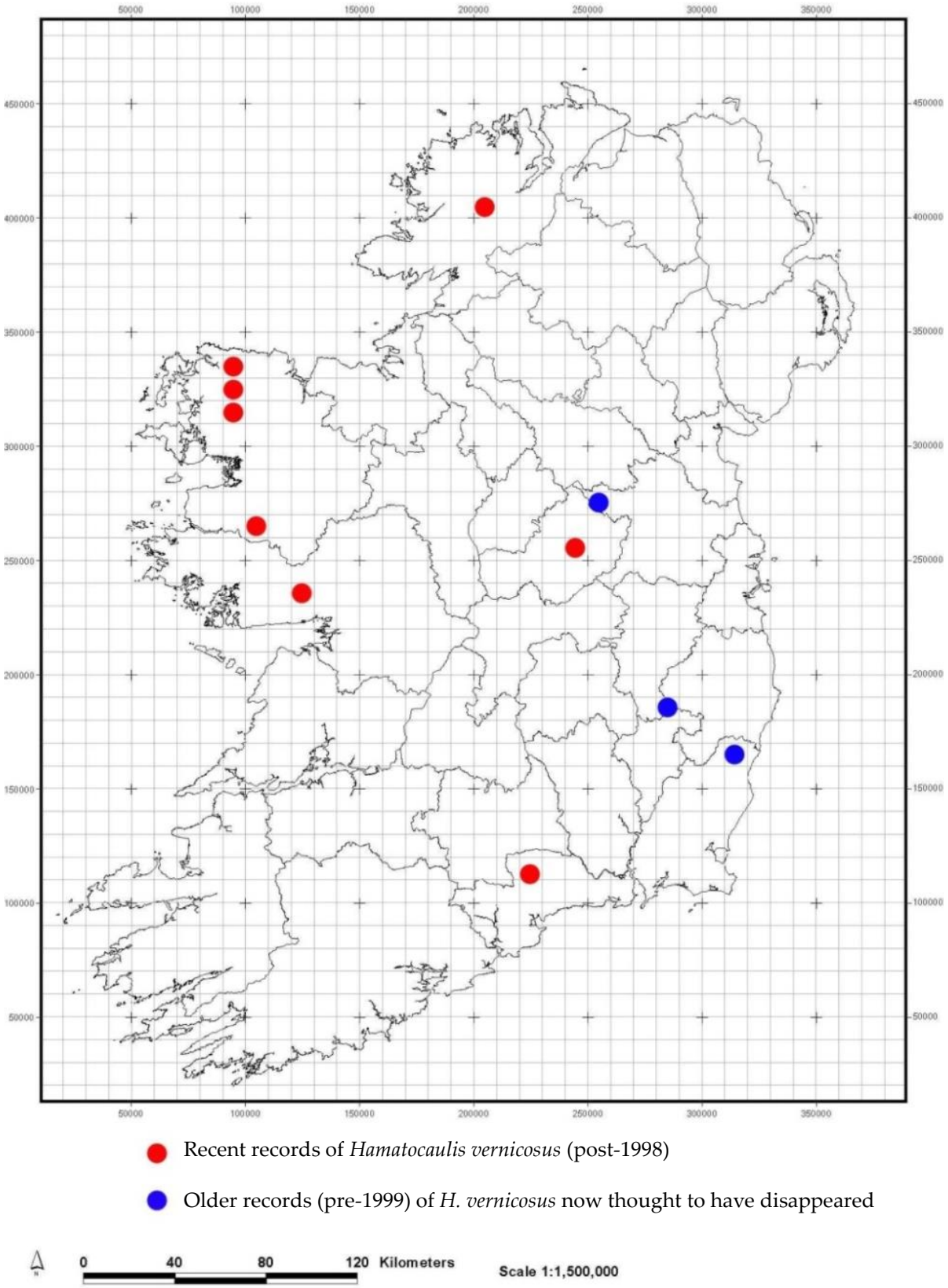

Figure 3. Distribution map of *Hamatocaulis vernicosus* in the Republic of Ireland.

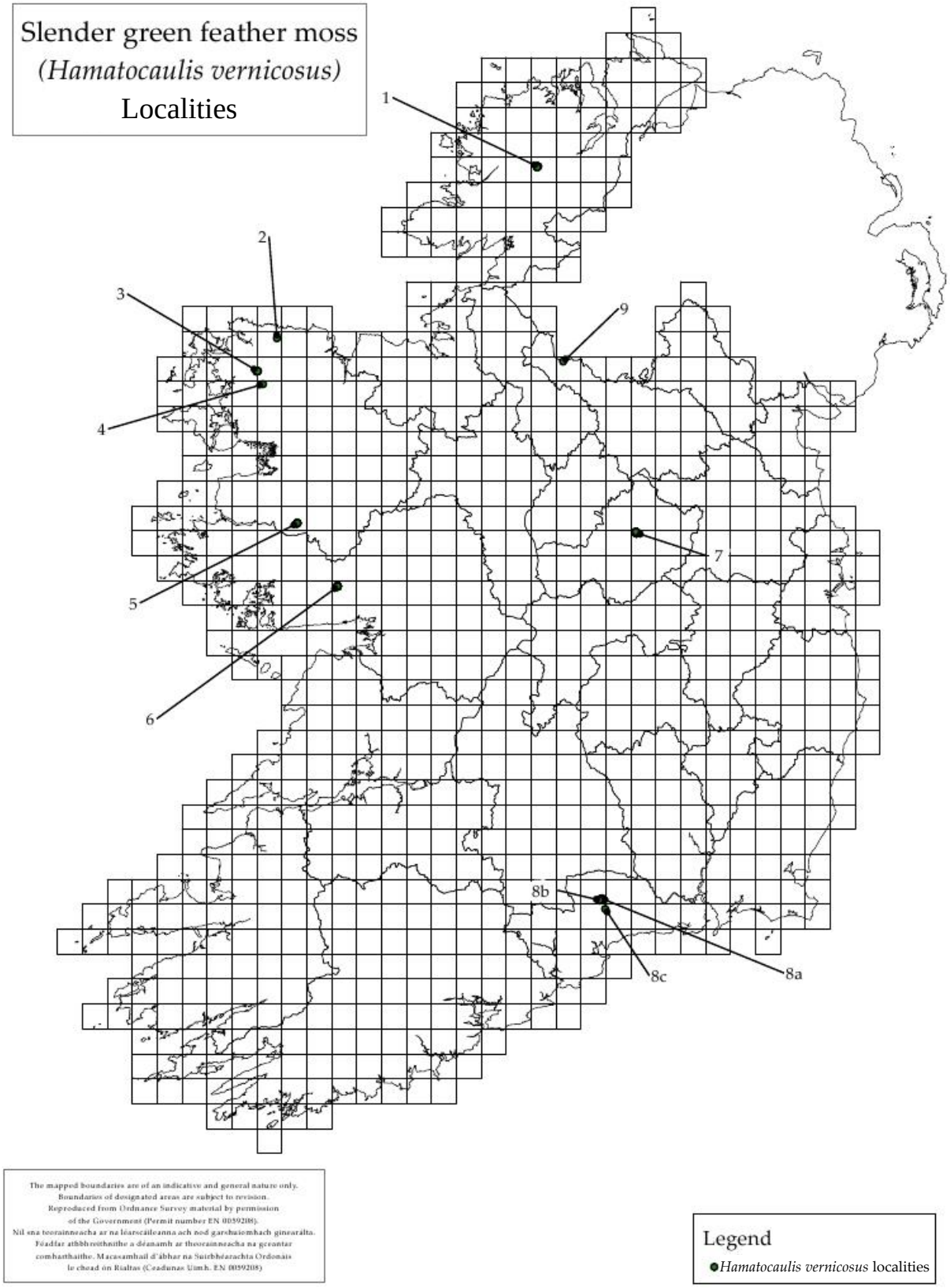

Figure 4. Localities of *Hamatocaulis vernicosus* in the Republic of Ireland (see Table 1 for key to locality details).

There are four localities where confirmed records of *H. vernicosus* have been reported, but where it is now thought to be extinct, or not seen in over 25 years.

1. Near Yellowford Crossroads, Co. Wicklow (Holdenstown Bog SAC (IE0001757))

This location (grid ref. S8884) appears to be the site of Roy Perry's 1975 record of *H. vernicosus* (small bog *ca.* ¼ mile east of Yellowford Crossroads) (Blockeel, 1997). However, it has not been seen since.

Notes from SAC Site Synopsis and Curtis & Harrington (1976):

This site consists of two kettleholes over which small raised bogs have developed. There is also a small area of open water along the western fringe of the southern kettlehole. Bog margins are dominated by alder and willow. Under the trees, *Menyanthes trifoliata* and *Caltha palustris* are found on the soft mud, with some *Carex hirta*. There are also areas of scraw on the bog margins dominated by rushes (*Juncus subnodulosus, J. effusus* and *J. articulatus*). Other species present: *Hydrocotyle vulgaris, Lathyrus pratensis, Ranunculus flammula, Cirsium palustre, Scutellaria galericulata, Mentha aquatica, Potentilla palustris, Carex nigra, C. otrubae, C. diandra, C. hirta, C. echinata*. Bog surfaces are dominated by hummocks of *Calluna vulgaris* and *Vaccinium oxycoccus*, with *Sphagnum* spp. Alternating with these hummocks are hollows dominated by *Sphagnum* spp., with *Molinia caerulea* and *Menyanthes trifoliata*. Young *Betula pubescens* is frequent in the raised bog.

The southern part of the site has open water surrounded by alder and willow. A floating mat of *Carex rostrata* and *Menyanthes trifoliata* occurs with *Lemna* spp., *Polygonum amphibium* and *Potamogeton natans*. Pastures fringing the area are separated from the bog by ditches with *Veronica scutellata, Myosotis secunda* agg., *Equisetum fluviatile* and *Menyanthes trifoliata*.

Damage: infilling at edge of wetland to provide a turning/parking area for trucks. Surrounding fields mainly improved grassland and used for grazing by cattle. The fields slope down towards the site. Continued agricultural improvement in the form of high fertiliser application or increased stocking rates could result in an increased nutrient content of the run-off which would flow towards the bog.

Field notes from Neil Lockhart & Mike Wyse Jackson (17 November 2000):

Searched here for *circa* 1 hour for *H. vernicosus* without success. *Calliergonella cuspidata*, *Aulacomnium palustre*, *Sphagnum teres* and *Straminergon stramineum* present.

2. Dromone-Lough Bane, Co. Meath

H. vernicosus was recorded at this location (grid ref. N560743) by D.M. Synnott, 13 September 1978, in 'cut-over bog' (Blockeel, 1997).

According to Mhic Daeid (1995), "it was discovered that it was not located at L. Bane, but at a site about 6 km to the north, near the village of Dromone. The site consisted of a small area of fen carr. It has since been destroyed by drainage and afforestation".

3. Pallis Bridge, Co. Wicklow

H. vernicosus was recorded at this location (T16) by J.W. and R.D. Fitzgerald, 15 September 1969, in 'marshy ground' (Blockeel, 1997).

Field notes from Neil Lockhart & Mike Wyse Jackson (17 November 2000):

Only a very small amount of suitable ground seen here - 30 x 10 m, of which most is grasses. In the wettest parts there are *Salix* spp. & *Betula pubescens*. Various wetland plants here, but no *H. vernicosus* found.

4. Lough Nambrackkeagh, Co. Mayo

Recorded at this location (grid ref. F943154) by Neil Lockhart, 25 September 1987, "wet moss carpet with *Saxifraga hirculus* in an upland flush, *ca*. 480 ft" (Lockhart, 1989). Not refound during more recent survey (Holyoak, 2003). Site certainly destroyed by drainage and afforestation (N. Lockhart, pers. comm.).

A further two records remain unconfirmed in the absence of specimens (see below), and at least 14 other reported finds are known to be errors of misidentification.

1. Maam Cross, Bunscannive, Co. Galway

Recorded at this location (grid ref. L9495) by C. Douglas and H. Grogan in 1987, in a bog (NPWS files). A specimen apparently exists (NMK) but has not been re-examined. The locality was revisited recently by David Holyoak (Holyoak, 2004), but the site looked unlikely to support *H. vernicosus* anymore, if it ever did (D. Holyoak, pers. comm.).

2. Lough Bray, Co. Wicklow

Recorded by D. Moore in 1872 but not supported by a specimen (Moore, 1872). No further information exists. The locality was surveyed on 26 June 2007 by N.G. Hodgetts, but *H. vernicosus* was not refound and the original record was noted as a probable error.

There are 14 other records of *H. vernicosus* in the Republic of Ireland, including one referred to by Wyse Jackson *et al.* (1995), but are erroneous or have been disregarded because they are not supported by a specimen and are too vague for there to be any hope of relocating them (Blockeel, 1997). Briefly, these are:

Castlegregory dunes, Co. Kerry, grid. ref. Q61: specimen is *Drepanocladus cossonii*; only *D. cossonii* seen in recent survey (Hodgetts, 2006).

near **Killarney**, Co. Kerry, grid ref. V99?: no specimen, vague record.

Lough Bunny, Co. Clare, grid ref. R3__9__: specimen is *Drepanocladus cossonii*; only *D. cossonii* seen in recent survey (Hodgetts, 2004).

Menlough, Co. Galway, grid ref. M2__2__: specimen is *Drepanocladus cossonii*; only *D. cossonii* seen in recent survey (Holyoak, 2004).

Newbridge Fen, Co. Kildare, grid ref. N7__1__: specimen is *Drepanocladus cossonii*.

Louisa Bridge, Leixlip, Co. Kildare, grid ref. N9__3__?: specimen is *Drepanocladus cossonii*.

Cloughran, Co. Dublin, grid ref. O1__4__: specimen is *Drepanocladus aduncus*.

Lough Ennell, Co. Westmeath, grid ref. N4__4__: no specimen; should be rejected according to an e-mail in NPWS files from Neil Lockhart to Ciaran O'Keeffe. Site visited by Mike Wyse Jackson in 1999, but only *Drepanocladus cossonii* was found.

Cashel Wood, Co. Longford, grid ref. N0__6__: specimen is *Drepanocladus cossonii*.

Barry Beg, Co. Roscommon, grid ref. N0__4__: specimen is *Drepanocladus cossonii*; only *D. cossonii* seen in recent survey (Hodgetts, 2002).

Benbulbin, Co. Sligo, grid ref. G6__4__: no specimen; only *Drepanocladus cossonii* seen in recent survey (Hodgetts, 2003).

Ballinlig, Co. Leitrim, grid ref. G7__4__: specimen is *Drepanocladus cossonii*; only *D. cossonii* seen in recent survey (Holyoak, 2001).

Malin Head, Co. Donegal, grid ref. C39_59_: recorded by Megaw (1933) and specimen apparently in BEL, but not examined by Blockeel (1997) – probable error; site visited by Neil Lockhart (2 March 1999), but no *H. vernicosus* found.

Mullaghderg Lough, The Rosses, Co. Donegal, grid ref. B7__2__: specimen is *Drepanocladus cossonii*; only *D. cossonii* seen in recent survey (Holyoak, 2002).

Habitat of *Hamatocaulis vernicosus*

H. vernicosus is found in intermediate fens and flushes where there is an influence of mineral-rich, but not calcium-rich, groundwater (Hodgetts, 2007; Hedenäs, 1989a; 2003). It is found in somewhat base-rich springs in upland districts while in the lowlands, it generally occurs in spring-influenced sites in mildly basic small-sedge fens (Hill *et al*., 1994).

The EU Habitats Directive classification of intermediate fens and flushes is 'Transition mire and quaking bog', given the habitat code 7140. In Ireland, this habitat can occur in lowland topogenous depressions such as at Scragh Bog, Co. Westmeath and also soligenous types occur on valley slopes and hillsides, such as at Meentygrannagh, Co. Donegal. This habitat can be very wet with a quaking surface, in some cases a floating raft of sedges and bryophytes develop and sphagna that are more base-tolerant are replaced with *Sphagnum fallax*, *S. squarrosum* and *S. palustre* (McBride *et al*., 2011). The nutrient status of this type of peatland is oligo- to mesotrophic with a basic to slightly basic pH (Raeymaekers, 1999), in the range of 5.0–7.5 (Doyle & Ó'Críodáin, 2003).

H. vernicosus occurs in upland flushes in counties Donegal, Mayo, Waterford and Cavan, and in lowland fens and sedge meadows in counties Mayo, Galway and Westmeath. The area covered by the populations range from a few square meters to extensive patches over several thousand square meters at Scragh Bog, Co. Westmeath. The first Irish record of *H. vernicosus* supported by a specimen originated from this location (Portnashangan) in 1946, collected by K.C. Harris and the plant was refound there many times. Scragh Bog is a fen 1.34 km long and 0.24 km wide with a floating raft of vegetation (Schwingmoor) in an oval-shaped depression overlying Carboniferous limestone surrounded by eskers (Foss & Crushell, 2007; Beltman *et al*., 2002; O'Connell, 1980). The site contains most of the stages of a classical hydroseral succession from submerged and emergent communities through to fen carr and an embryonic raised bog community (O'Connell, 1980). The site also contains excellent examples of alkaline fen and transition mire, which support the largest known population of *H. vernicosus* in Ireland (Anonymous, 2003). The fen is fed by weak calcium-rich surface springs near the south-east end and a single artificial outlet drains the system in the north-east corner (Anonymous, 2003; Beltman *et al*., 2002; O'Connell, 1981). Occasionally the fen is flooded, with water levels up to 50 cm above the soil surface (Beltman *et al*., 2002).

A detailed field survey of seven *H. vernicosus* localities, including the largest sites and those representing the geographic distribution in the Republic of Ireland, was undertaken in 2009–2011 to record information on population structure, associated vegetation and environmental variables (Campbell, 2013). Thirty-one 2 x 2 m plots were recorded. The pH of water samples taken at the plots ranged from 5.11 to 6.8 and the most frequently occurring associated species in all plots were *Juncus acutiflorus* (occurring in 87.1% of all plots), *Calliergonella cuspidata* (80.6%), *Agrostis stolonifera* (71%), *Ranunculus flammula* (71%), *Carex echinata* (61,3%), *Juncus bulbosus* (61.3%), *Cardamine pratensis* (61.3%) and *Galium palustre* (54.8%).

Figure 5. Plot (2 x 2 m) containing *Hamatocaulis vernicosus* in a flush at Largan More, Co. Mayo.

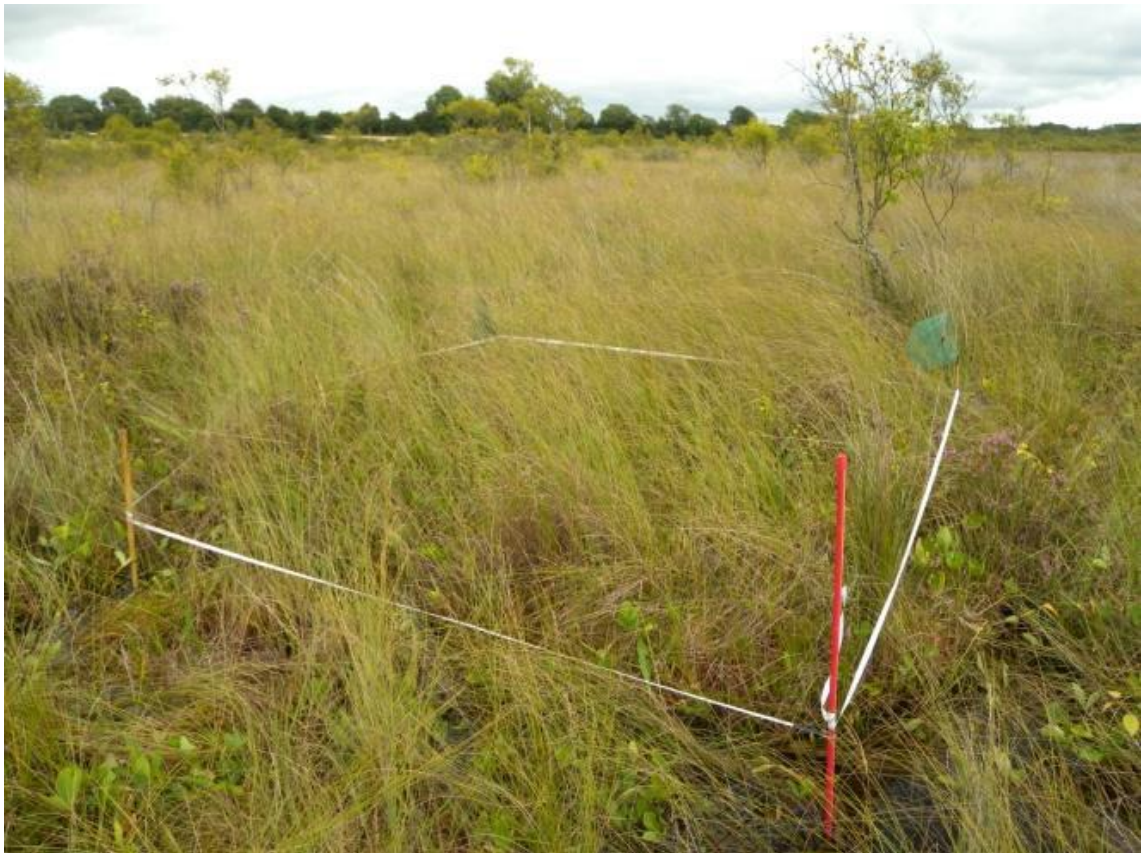

Figure 6. Plot (2 x 2 m) containing *Hamatocaulis vernicosus* at Scragh Bog, Co. Westmeath.

Introduction to monitoring of *Hamatocaulis vernicosus*

The ultimate goal of rare species conservation is the maintenance of viable populations in their natural habitat. Knowledge of a rare bryophyte's biology and environmental requirements, and the variations within them, is necessary to propose accurate conservation measures (Söderström *et al*., 1992), i.e. to maintain or re-establish the conditions that allow the long-term survival of the particular species (Bisang & Hedenäs, 2000). The effectiveness of the measures should be evaluated through monitoring (Hallingbäck & Hodgetts, 2000). Monitoring of abiotic and biotic parameters at regular time intervals is essential for good management (Fojt, 1995) and can highlight any problems that can then be addressed.

Article 11 of the EU Habitats Directive requires each Member State to undertake 'surveillance' of the conservation status of listed habitats and species. According to Jones *et al.* (2006), "The overall purpose of surveillance and reporting is to identify, and draw attention to, weaknesses in the state of the environment which will need to be addressed if the vision and strategic goals are to be achieved". This document goes on to say that surveillance, which is considered an essential companion to monitoring, is "systematic sampling designed to produce a series of measurements in time and the term is used here to encompass monitoring when the need is to know whether a particular state or standard is being achieved".

According to the Joint Nature Conservation Committee's *Common Standards Monitoring for Designated Sites: First Six Year Report* (Joint Nature Conservation Committee, 2006), monitoring performs the following functions:

- it indicates the degree to which current conservation measures are proving effective in achieving the objectives of the designation at site level, and identifies any need for further measures;
- it indicates the effectiveness of current conservation action and investment at country level, and identifies priorities for future action;
- it enables Government to undertake its national and international reporting commitments in relation to designated sites, and more widely, and helps identify any areas of shortfall in implementation.

Under Article 17 of the EU Habitats Directive, every six years, each member state must report to the European Commission on the measures taken under the Directive and on the conservation status of the listed species and habitats (Evans & Arvela, 2011; European Commission, 1992). 'Favourable Conservation Status' (FCS) is the overall objective to be reached for all habitat types and species of community interest and can be described simply as a situation where a habitat type or species is prospering (in both quality and extent per population) and with good prospects to do so in future as well, without any change to existing management or policies (Evans & Arvela, 2011).

The conservation status of a listed species is defined as the sum of influences acting on the target species that may affect the long-term distribution and abundance of its populations. There are four parameters - Range, Population, Habitat for the Species and Future Prospects - that must be met in a favourable way for the species' conservation status to be given an overall classification of 'Favourable'.

The four parameters of Range, Population, Habitat for the Species and Future Prospects are considered Favourable when:

- the natural range of the target species is neither declining nor is likely to decline in the foreseeable future;
- population dynamics data suggest that the target species populations are maintaining themselves on a long-term basis as a viable component of its natural habitat;
- there is, and will continue to be, a sufficiently large habitat for the populations to maintain themselves into the long-term future and
- future prospects for their overall survival must also be deemed favourable.

If any of these parameters are not in 'Favourable' condition then an 'Unfavourable' status must be given following a rules-based approach (Evans & Arvela, 2011). There are two categories of Unfavourable status: 'Unfavourable - Inadequate', where a change in management or policy is required to return the species to Favourable status and 'Unfavourable - Bad', where the species is in serious danger of becoming extinct (at least regionally) (Evans & Arvela, 2011). There is also an 'Unknown' category, where there is insufficient information available to allow an assessment (Evans & Arvela, 2011). For a 'Favourable' Overall Assessment (colour-coded Green) all parameters must be assessed as 'Favourable' (with one 'unknown' acceptable); if any one of the parameters is assessed 'Unfavourable - Bad' the Overall Assessment is also 'Unfavourable - Bad' (colour-coded Red); any other combination would result in an 'Unfavourable - Inadequate' Overall Assessment (colour-coded Amber).

The national assessment to determine overall conservation status of Annex II species brings together information on Range, Population, Habitat for the Species and Future Prospects. The last reporting round was 2007–2012, with reports submitted to the European Commission in 2013. The next submission will be in 2019 (reporting on the conservation status in the period 2013–2018).

Full details of the Article 17 Species Conservation Assessment for *H. vernicosus*, 2007–2012, can be accessed at http://www.npws.ie/publications/2013-article-17-conservation-status-assessments.

Introduction to Range Assessment for *Hamatocaulis vernicosus*

The parameter 'Range' is the outer limits of the overall area in which a species is found at present and can be considered as an envelope within which areas actually occupied occur, as in many cases not all the range will actually be occupied by the species (Evans & Arvela, 2011; European Commission, 1992). This can be a difficult concept for bryophytes, which tend to occur in often very scattered or disjunct populations, the plants occupying small 'micro-habitats' within larger, more generally recognised habitats. *H. vernicosus* grows in at least two different, but rather poorly defined, habitats: upland transitional flushes and wet lowland sedge meadows and mesotrophic fens.

Favourable Reference Values are set for Range and Population; these are targets against which current values are judged. These reference values should be at least equal to the value when the Directive came into force, unless this value is not deemed to be enough to ensure the long term survival of the species being assessed. Favourable Reference Values should be based purely on scientific grounds and

may have to change between reporting cycles as our understanding of a habitat type or species changes (Evans & Arvela, 2011).

Favourable Reference Value for Range is the total geographical area within which all significant ecological variations of the habitat or species are included and which is sufficiently large to allow the long-term survival of the species.

The Favourable Reference Range (FRR) for *H. vernicosus* in the Republic of Ireland is taken to be its present range i.e. a polygon drawn around all the 10 km^2 squares from which *H. vernicosus* has been recorded recently (1998–2012). This is thought to encompass the ecological range of variation for the species in the Republic of Ireland.

The distribution and consequential Range value derived from the 1998–2012 field surveys (Campbell (2013) and additional NPWS records) is considered to be the baseline for *H. vernicosus.* As there is no evidence of a decline since the Directive came in to force, the current range is set as the Favourable Reference Range. There is an assumption that the current range is large enough to encompass all the ecological variation and ensure the long term survival of the species.

Comparison between detailed surveys from 2009–2011 (Campbell, 2013) and NPWS bryophyte files indicate that there have been no losses across the distribution in the recent past (1998–2012), therefore the short-term trend for Range is considered to be stable.

At present, as the 2007–2012 range of the species is the same as the FRR, it is allocated a Favourable conservation status in this respect.

- **Species Range Area:** Can be considered as either the area of the grid cells occupied by the habitat which is 1,100 km^2 (11 grid cells x 100 km^2) or the area of the polygon which contains all of the grid cells, which is also 1,100km^2
- **Favourable Reference Range:** 1,100 km^2 (11 grid cells x 100 km^2)

The 2013 conservation assessment Range map consists of 11 current range cells (including distribution cells). The range of *H. vernicosus* in the Republic of Ireland can be seen in Figure 7.

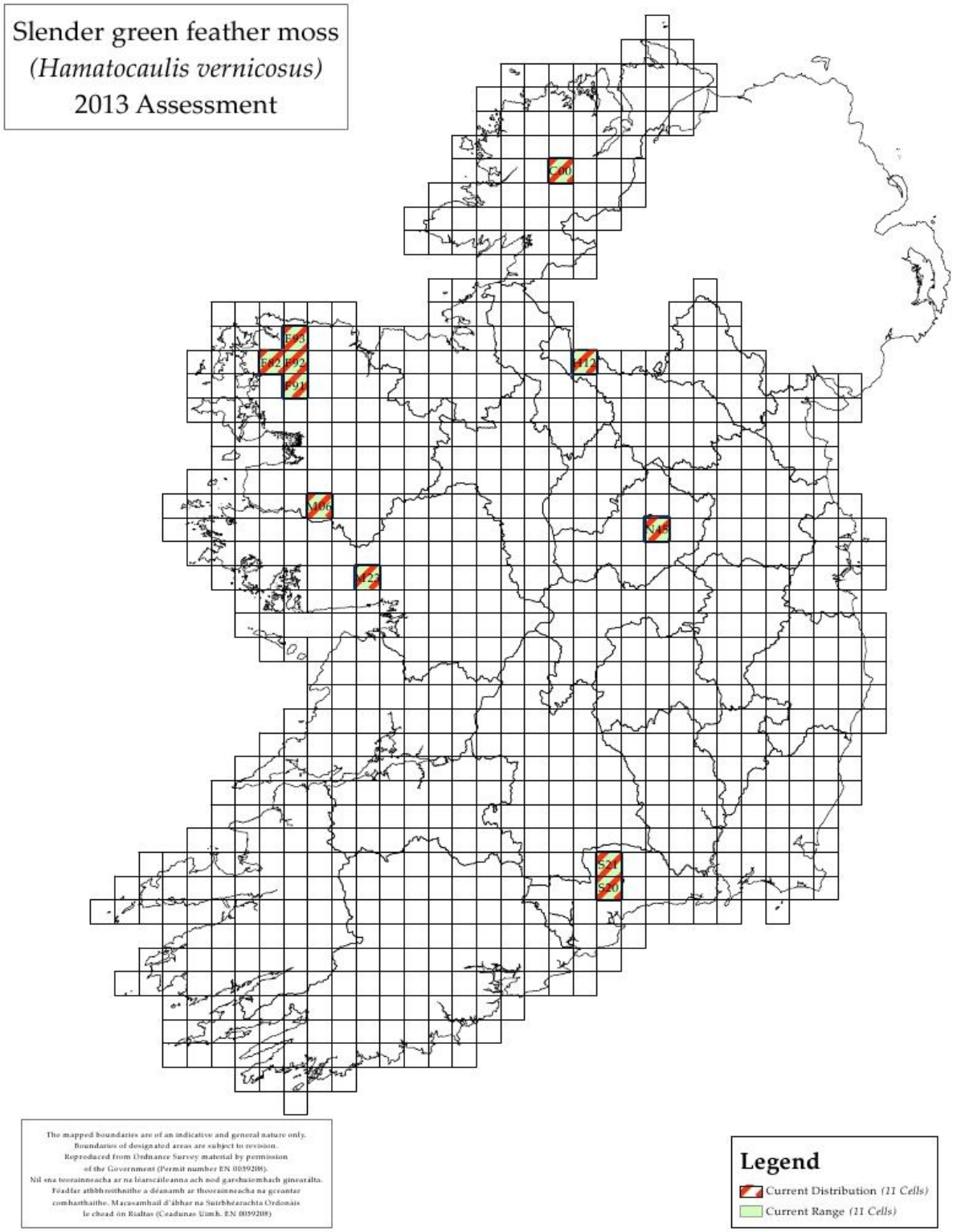

Figure 7. The distribution and range of *Hamatocaulis vernicosus* in the Republic of Ireland.

Introduction to Population Assessment for *Hamatocaulis vernicosus*

There are a number of problems in estimating bryophyte populations, notably the difficulty in deciding what constitutes 'an individual'. On the one hand, 'an individual' could be defined as a single shoot, while on the other it might refer to a large genetically homogenous colony comprising thousands or even millions of individual shoots. In practice, a pragmatic solution is required, which often means a very rough estimation of the number of shoots or, more usually, an estimation of the area of ground covered by the plant at each site (Hallingbäck *et al*., 1996).

For the 2001–2006 reporting period for Article 17 of the EU Habitats Directive, the measure of population estimation for *H. vernicosus* was 'number of localities' (Evans & Arvela, 2011). A locality is defined as a discrete location where a *H. vernicosus* population has been recorded. At that time there were 9 known localities, in 8 SACs, in the Republic of Ireland. Since then, two additional localities have been reported, so there are now 11 localities, in 9 SACs. For the 2007–2012 reporting period, and to facilitate comparison between EU Member States, the recommended unit for estimating population of *H. vernicosus* is now the 'area covered by the population in m^2' (Evans & Arvela, 2011). To measure this, Campbell (2013) delimited the extent of occurrence of 7 of the largest known localities by recording the GPS positions at the extent of where *H. vernicosus* occurred at these localities. The area covered by the population (m^2) within the area of extent of occurrence was then estimated from the mean cover of *H. vernicosus* in sample 2 x 2 m plots recorded at each locality. The number of plots recorded depended on the area of extent of occurrence and ranged from 2 to 7 plots per locality. The area covered by *H. vernicosus* in the 4 remaining localities, all of which were small in extent, was calculated from estimates made in the field from NPWS surveys.

Campbell (2013) also quantified shoot density (number of shoots per 100 cm^2) in sample 2 x 2 m plots at each of the 7 largest localities. The average number per locality was extrapolated to an average number per m^2, and this figure was then multiplied by the area covered by the population (m^2) to give a shoot count per population. Observations on the abundance of *H. vernicosus* at its other 4 localities were made from estimates made in the field from NPWS surveys. Overall calculations for the national population of *H. vernicosus*, in terms of individual shoots, is clearly only very approximate, but it seems that there must be millions of individual shoots covering several hectares of ground in total, with the largest population probably being at Scragh Bog (see Table 2). From NPWS surveys and the studies by Campbell (2013), mean number of shoots is estimated to be *ca*. 675,994,000 in total.

Location and population estimates (in terms of number of shoots and area covered by population (m^2)) for *Hamatocaulis vernicosus* at its 11 localities in the Republic of Ireland for the 2013 Conservation Assessment, are listed in Table 2.

Table 2: Population estimates in terms of number of shoots and area covered by the population (m^2) for *Hamatocaulis vernicosus* localities in the Republic of Ireland.

Locality	**County**	**Estimate of number of shoots at each population for 2007-2012 Assessment**	**Area covered by the population for 2007-2012 Assessment**
1. Meentygrannagh	Donegal	~6,314,000 (2009–2011 survey; Campbell)	619 m^2
2. Rathavisteen	Mayo	~ 1,000 (1999 survey; Lockhart)	10 m^2
3. Largan More	Mayo	~ 3,979,000 (2009–2011 survey; Campbell)	478 m^2
4. Uggool	Mayo	~ 320 (1999 survey; Lockhart)	20 x 20 cm
5. Owenbrin	Mayo	~106,117,000 ((2009–2011 survey; Campbell)	5,637 m^2
6. NW of Gortachalla Lough	Galway	~153,377,000 (2009–2011 survey; Campbell)	3,725 m^2
7. Scragh Bog	Westmeath	~323,294,000 (2009–2011 survey; Campbell)	17,833 m^2
8a. Below Sgilloge Loughs	Waterford	~54,756,000 (2009–2011 survey; Campbell)	3,401 m^2
8b. Nire River Valley	Waterford	~28,156,000 (2009–2011 survey; Campbell)	762 m^2
8c. Coumtay	Waterford	~60 (2007 survey; Hodgetts)	~ 1 m^2
9. Commas	Cavan	~ 100 (2012 survey; Hodd)	~ 2 m^2
Total		**675,994,480 i.e. *ca*. 675,994,000 shoots**	**32,468 m^2 i.e. *ca*. 32,500 m^2**

Because of the lack of historical population estimates, it is impossible to assess population trends in individual colonies of *H. vernicosus* at this stage. It can however be inferred that the total population of this plant in Ireland has declined in historic times due to the loss of suitable habitat with the decline of intact peatlands. At present, the population is considered stable however, as there is no evidence to suggest that there have been losses in area covered by the population or the number of localities since the EU Habitats Directive came into force.

The Favourable Reference Population (FRP) is '*the population in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the species'* (Evans & Arvela, 2011). Several of the populations are considered large, covering hundreds of metres squared, and these are thought to be robust and stable. The smaller populations, in the uplands, are in remote locations and are not considered threatened.

The area covered by population (m^2) calculated in the 2013 Conservation Assessment report to the EU is *circa* 32,500 m^2. At present there are at least eleven localities in the Republic of Ireland (see Table 2). This number of localities is considered adequate to ensure a favourable population conservation status in the future and should remain stable. The area covered by the population of *ca.* 32,500 m^2 at the 11 localities is considered to represent the population baseline.

Following the General Evaluation Matrix for assessing the Conservation Status of Annex II Species (Evans & Arvela, 2011); because the Estimated Present Population is the same as the Favourable

Reference Population, the Conservation Status of *H. vernicosus* in the Republic of Ireland is Favourable.

- **Species Population:** 11 localities of *Hamatocaulis vernicosus* (covering 32,500 m^2)
- **Favourable Reference Population:** 11 localities of *H. vernicosus* (covering 32,500 m^2)

Introduction to Habitat for the Species Assessment for *Hamatocaulis vernicosus*

The extent and quality of suitable habitat is assessed to determine whether the long-term survival of the species is assured. The current area of habitat niche occupied by *H. vernicosus* is believed to be stable. Furthermore, the localities supporting *H. vernicosus*, several of which are large, are considered to be in good condition and are not considered under threat.

The habitat occupied by *H. vernicosus* has been mapped and visited by NPWS staff and other workers frequently in recent years. The extent of occurrence at 7 of the 11 localities studied by Campbell (2013) was measured by recording GPS co-ordinates along the perimeter of a polygon of the area of extent of *H. vernicosus*. The area covered by the population (m^2) within the extent of occurrence was estimated by multiplying the area of extent of occurrence by the percentage mean cover of *H. vernicosus* in sample 2 x 2 m plots recorded in each locality (ranging from 2 to 7 plots per locality). The area covered by *H. vernicosus* in the 4 remaining localities, all of which were small in extent, was calculated from estimates made in the field from NPWS surveys.

The total national area covered by the populations, i.e. Habitat for the Species, was calculated at 32,500 m^2 or 3.25 hectares (see Table 2).

Habitat quality appeared good at all of 7 localities visited in 2009–2011 (Campbell, 2013). Although there is limited data on habitat area and quality for the other four localities, there is no evidence of loss or decline in the recent past.

Overall, observations suggest that the transition mire and flush habitats that support *H. vernicosus* are still extensive and in good condition to support the species.

Therefore it was inferred that the conservation status for the 2007–2012 assessment of Habitat for the Species is Favourable.

From surveys carried out on 7 of the 11 localities in 2009–2011, habitat quality indicators were determined (Campbell, 2013) for assessment of Habitat for the Species for future assessments (see Section C).

Introduction to Future Prospects Assessment of *Hamatocaulis vernicosus*

Any major impact of pressures (impacting activities) or threats (potential impacting activities in the foreseeable future) to the species survival are also identified and assessed to determine the Future Prospects.

With the recent decline in commercial afforestation on peatlands, the remote localities for *H. vernicosus* in the uplands are not thought to be currently threatened, except perhaps by wind farm developments. The large localities in the lowlands (at Lough Corrib, Owenbrin and Scragh Bog) are potentially at risk from agricultural activities, particularly eutrophication. However, all are within SACs and Scragh Bog is also a Nature Reserve.

While recent (1999–2012) fieldwork at several of the localities for *H. vernicosus* revealed that there are no threats at present, it seems likely that this species was threatened at other sites in the past, and some populations have probably disappeared as a result of human activity. The main potential threats to *H. vernicosus* come under four broad headings:

- **Pollution**

  The main form of pollution affecting *H. vernicosus* is eutrophication from agricultural activities. The increased nutrient input resulting from high levels of nitrogen in the environment favours a few vigorous species at the expense of more ecologically demanding species. In the case of vascular plants, typical species favoured are nettles *Urtica dioica* and hogweed *Heracleum sphondylium*, which can smother less competitive and less nutrient-demanding species. In the case of bryophytes, *Calliergonella cuspidata* is the most common beneficiary of increased nutrient input in wet grassland and fens, particularly in conditions that are neither strongly acidic nor strongly basic (Hedenäs, 2003). Prime sources of eutrophication are agricultural run-off from adjacent fields, and over-stocking.

  Other forms of pollution may also adversely affect *H. vernicosus* flushes, but there has been little research into this. Dumping, a serious problem in some areas, may also be regarded as a form of pollution.

- **Land use**

  A number of land use changes threaten and have threatened *H. vernicosus* habitats in the past. Of these, the most important is drainage, which destroys the wetland as a precursor to conversion to agricultural use by re-seeding or to forestry.

  Numerous other land use changes, any of which can threaten specific localities, include urbanisation, golf courses, development of wind farms and dumping. *H. vernicosus* populations may be at particular risk from wind farm developments, as they tend to occur on hillsides with little other obvious economic potential.

  Commercial peat abstraction has destroyed huge swathes of peatlands in the Republic of Ireland. It is very likely that some undiscovered populations of *H. vernicosus* have been destroyed by this activity.

  Management also comes under this broad heading. A regime of light seasonal grazing is appropriate for most wetland sites managed for nature conservation. If grazing is increased, this can result in changes in the vegetation structure, physical damage such as poaching, and eutrophication. If grazing is removed altogether, this may lead to a succession that ultimately results in woodland.

Removal of mosses for horticultural use could potentially affect *H. vernicosus*, as it tends to be an indiscriminate activity.

- **Climatic change**

  There is now little doubt that the climate is undergoing dramatic changes, and that this is at least partly due to human activities. The effects of this on individual species are unpredictable, but it is likely that the ranges of species will shift, and probably contract.

- **Invasive species**

  The accidental or deliberate introduction of invasive alien species is a general problem in many parts of the world. In Ireland, vigorous introductions such as Rhododendron (*Rhododendron ponticum*) constitute a major problem on acid soils, particularly in the uplands. While not a particular identified threat to *H. vernicosus* populations, it could become so at some localities. Invasion of wetlands by introduced conifers is often a serious problem, resulting in significant abstraction of water to the detriment of the populations.

Introduction to Overall Conservation Assessment of *Hamatocaulis vernicosus*

The Overall Conservation Condition Assessment of each individual locality is derived from combining the results from each of the assessments (Population, Habitat for the Species and Future Prospects) to provide an overall rating of Favourable, Unfavourable – Inadequate or Unfavourable – Bad.

The proposed framework for assessing the condition at a locality level allows for the amalgamation of results to assess an Overall Conservation Status at a national level, as required under Article 17 of the Habitats Directive. Evans & Arvela (2011) detail the approach that should be undertaken to assess Overall Conservation Status at the national level.

Although the range of *H. vernicosus* has declined historically, the current range is the same as the Favourable Reference Range. Therefore for the 2007–2012 assessment, Range was given a Favourable Conservation Status.

The population of *H. vernicosus* in the Republic of Ireland has almost certainly declined in historic times due largely to the loss of suitable habitat through the decline of intact peatlands. However, it is still substantial, and the estimated present Population is the same as the Favourable Reference Population. Therefore, Population was given a Favourable Conservation Status for the 2007–2012 assessment.

The area of suitable habitat niche for *H. vernicosus* in the Republic of Ireland is *ca*. 3.25 ha. The habitats that support populations are considered to be in good condition and several hold extensive populations. Habitat therefore was given a Favourable Conservation Status for the 2007–2012 assessment.

Considering the measures in place that will assist its protection, it is expected that *H. vernicosus* will survive in the Republic of Ireland. The Overall Conservation Status for the 2007–2012 assessment given for Future Prospects of *H. vernicosus* was therefore Favourable.

The Overall Conservation Assessment for *H. vernicosus* during the 2007–2012 reporting round was given a Favourable status as each of the parameters of Range, Population, Habitat for the Species and Future Prospects were given a status of Favourable (Green).

Methodology for monitoring of *Hamatocaulis vernicosus*

Broad-scale monitoring of *Hamatocaulis vernicosus*

In order to accurately monitor the ecological health and conservation status of *H. vernicosus* localities on an on-going basis, a two-tiered approach to monitoring is suggested: broad-scale monitoring and fine-scale monitoring.

The Joint Nature Conservation Committee (JNCC) consider monitoring to be a 'quick and dirty' exercise that can be done frequently, by non-specialists, to provide an early warning of designated features on sites slipping into an Unfavourable conservation status. It does not require specialist knowledge of taxa, so tends to use a series of 'indirect attributes'. For example, a quick visit to a woodland to monitor the state of bryophytes might have to ascertain (a) that the trees have not been felled, (b) that the canopy structure is still more or less intact, and (c) that there is still a dominance of bryophytes on wet ground, rocks, banks and trees.

For *Hamatocaulis vernicosus*, Table 3 (adapted by N. Hodgetts) might be a guide to broad-scale monitoring (Hodgetts, 2007).

Table 3. Proposed guide to broad-scale monitoring of *Hamatocaulis vernicosus* in the Republic of Ireland (Hodgetts, 2007).

Attribute	Measure	Target	Comments
Hydrology	Visual assessment	High water table necessary all year round to support sedge-rich fen, springs and flushes	Fluctuations in water table can occur, particularly at lowland sites
Shade	Visual assessment	Does not tolerate shading from woody species	
Sward	Management	Summer grazing on lowland fens. All year grazing in uplands	Extensive grazing often practiced on sites, apart from Scragh Bog
Vegetation	Visual assessment	Maintain scrub-free fens and flushes	
Eutrophication (negative attribute)	Visual assessment	No green algae; *Calliergonella cuspidata* not dominant in moss layer	

If one parameter fails, the population is not in a favourable condition. Broad-scale monitoring of this sort should be done annually at each *H. vernicosus* population if possible, either by NPWS staff, other conservation professionals or volunteers.

Fine-scale monitoring of *Hamatocaulis vernicosus*

In tandem with broad-scale monitoring, there should be a supporting programme of fine-scale monitoring. Fine-scale monitoring is considered to be an activity that is done mainly by specialists, and less frequently than broad-scale monitoring. It is recommended that fine-scale monitoring be carried out every six years, in accordance with the six-yearly reporting on the national conservation status of this Annex II species as required under Article 17 of the EU Habitats Directive (European Commission, 1992; Evans & Arvela, 2011).

As part of the field study and monitoring of seven *H. vernicosus* localities in 2009–2011, the above broad-scale monitoring guidelines were investigated and amended to provide more specific fine-scale monitoring guidelines. After analysis of the data, it was necessary to outline some small differences in the monitoring techniques in the lowland transition mire localities at NW of Gortachalla Lough, Owenbrin and Scragh Bog and those in the upland flush localities at Meentygrannagh, Largan More, Uggool, Rathavisteen, Commas, Coumtay, Below Sgilloge Loughs and Nire River Valley.

For *H. vernicosus*, fine-scale monitoring should consist of a visit to its localities by a bryologist, at least once every six years, to check (a) that *H. vernicosus* is still present, and (b) to assess the health and extent of its population, habitat and associated species. Naturally, the fine-scale monitoring visit should double as a broad-scale monitoring visit.

Each locality should be visited and assessed using the 'Locality Survey Card' (Table 4 & Appendix I) and Assessment sheets (Tables 6–8 & Appendix I) and digital photographs should be taken, so that future monitoring can be compared with the baseline data collected in 2009–2011 (Campbell, 2013) and from other NPWS surveys.

Each Site Assessment comprises a Population Assessment, Habitat for the Species Assessment, Future Prospects Assessment and Overall Conservation Status Assessment.

Preparation for fine-scale monitoring visit

Prior to the fine-scale monitoring being carried out, the surveyor should ensure that they have the necessary skills to identify *H. vernicosus*, including its reproductive structures and information on similar species in the field, such as *Scorpidium scorpioides*, *Scorpidium revolvens*, *Warnstorfia exannulata* and *Palustriella commutata*. Identification of associate species should also be included in preparation, particularly of associated bryophyte species such as *Calliergonella cuspidata*, *Calliergon giganteum* and *Campylium stellatum*. The surveyors must also ensure that they have a licence from NPWS that allows them to visit *H. vernicosus* localities and collect material for identification purposes if necessary.

A thorough familiarisation with previous surveys and monitoring visits to the locality under investigation is also required as this will highlight any changes in status or threats from the previous visits.

Field equipment should include:

- An adequate number of Locality Survey Cards and Assessment sheets (see Appendix I)
- Maps showing location of populations (see Appendices I & II)
- A handheld GPS receiver capable of differential corrections accurate to 50 cm or less with post processing (e.g. Trimble GeoExplorer range)
- Photographs of locality and locations of target species (see Appendix I)
- Hand lens (x 10+)
- 2 metre bamboo canes (approx. 10)
- Measuring tape to mark out 2 x 2 m plots in the field with bamboo canes
- Ruler
- Compass
- Digital camera
- Collection bags/envelopes/packets
- A waterproof field notebook
- Plant identification guides (e.g. Atherton *et al*., 2010)

Note: Care should be taken during all visits to minimise impact on these populations. Many of the *H. vernicosus* flushes contain vulnerable and highly localised bryophyte and vascular plants, e.g. *Saxifraga hirculus*.

The timing of visits should occur in late summer/early autumn, as associated species (sedges in particular) are easier to identify then and the water table is likely to be lower than in the spring, making excessive drainage easier to register. It also allows the extent of *H. vernicosus* to be seen more easily. Gametangia (and possibly sporophytes) are more likely to be present at this time of year also.

All questions on the field survey sheets should be filled in on site to the best ability of the surveyor. The aim is to record the extent of the moss and any pressures or threats on an individual locality basis. It is recommended that the recording sheets containing the previous monitoring results be compared in the field with the latest monitoring results. This will enable the surveyor to ascertain if any changes have taken place between surveys.

Locality Survey Card and Assessment sheets

During each locality visit, a Locality Survey Card is completed (see Table 4 & Appendix I) which includes information on 2 x 2 m plots to be recorded. The data from these are used to complete the Assessment sheets for each locality (see Tables 6–8 & Appendix I) which comprises the Population Assessment, Habitat for the Species Assessment and Future Prospects Assessment, full details of which are set out in Sections A–C below. The combined data allows for the Overall Conservation Condition Assessment of each locality to be determined, i.e. Favourable, Unfavourable – Inadequate, Unfavourable – Bad (Section D). From the individual locality assessments a national Overall Conservation Status can be derived (Section E).

Extent of occurrence and area covered by the population (m²)

The first thing to be carried out during a fine-scale monitoring visit is to delimit the area of extent of occurrence of *H. vernicosus* at the particular locality. The methodology for mapping the extent of occurrence at (a) the lowland localities, where there is more continuity of suitable habitats, is somewhat different from mapping that of (b) the upland flush localities, which consist of discrete patches of suitable habitat within 'unsuitable' blanket bog. The two methods of determining the area of extent of occurrence are outlined below.

(a) Determining area of extent of occurrence and percentage cover of *H. vernicosus* in lowland fen localities

For the lowland transition mire *H. vernicosus* localities at Owenbrin, Gortachalla and Scragh Bog, the limits of the extent of the occurrence of *H. vernicosus* should be outlined with bamboo sticks and then GPS points recorded. A polygon can subsequently be drawn around the GPS points and the area measured using GIS software such as ArcGIS.

Plots of 2 x 2 m (3–5 in number) should be placed randomly within the extent of occurrence, ensuring *H. vernicosus* is present in the plot. If the species is not present, a further random location should be selected until presence of *H. vernicosus* in the plot is determined. The GPS position of each plot should be recorded. The percentage cover of *H. vernicosus* should be determined to the nearest 1% within each plot. The mean percentage cover within the plots per locality can then be multiplied by the area of extent of occurrence to estimate the area covered by the population (m^2).

(b) Determining area of extent of occupancy and percentage cover of *H. vernicosus* in upland flush localities

At the localities at Meentygrannagh, Largan More, Uggool, Rathavisteen, Commas, Coumtay, Below Sgilloge Loughs and Nire River Valley, where the species occurs in discrete flushes/springheads and in areas of upland mesotrophic mire, these areas should be refound by GPS, marked and measured with further GPS points, and 1–5 plots of 2 x 2 m per locality should be located within them, ensuring that *H. vernicosus* is present within the plot area. The GPS position of each plot should be recorded. Any other flushes apparently suitable from aerial photography should also be examined. The percentage cover of *H. vernicosus* should be determined to the nearest 1% within each plot. The mean percentage cover within the plots per locality can then be multiplied by the area of extent of occurrence to estimate the area covered by the population (m^2).

2 x 2 m plots for Population Assessment and Habitat for the Species Assessment

It is suggested that one to three 2 x 2 m plots be recorded at the small upland localities at Uggool, Rathavisteen, Coumtay and Commas and that three to five 2 x 2 m plots be recorded at the larger localities of Meentygrannagh, Largan More, Below Sgilloge Loughs, Nire River Valley, Scragh Bog, NW of Gortachalla Lough and Owenbrin.

The parameters to be recorded in the 2 x 2 m plots are:

- The GPS co-ordinates and altitude (in metres above sea level (m.s.l.)) of each plot should be recorded on the hand-held GPS device and also noted on the Locality Survey Card.
- The surface water depth (cm) should be measured with a ruler at five points within the plot and the mean calculated and noted. A hand should also be pressed into the vegetation and a tick given on the Locality Survey Card (in the appropriate section) if the hand is covered with surface water.
- The mean vegetation height (cm) should be calculated by averaging the length of 5 stems in the plot measured with a ruler or a measuring tape.
- Cover of trees, shrubs, grasses and bryophytes should be recorded to the nearest 5% within each 2 x 2 m plot.
- Cover of *Calliergonella cuspidata* should be recorded to the nearest 5% within each 2 x 2 m plot.
- The cover of *H. vernicosus* should be estimated to the nearest 1% within each plot. The mean percentage cover obtained in the one to five plots per locality can then be compared with the target for the locality (see individual Locality Assessment sheets, Appendix I). This percentage can then be multiplied by the area of extent of occurrence to obtain the result for area covered by the population (m^2).
- In order to estimate density of *H. vernicosus* shoots, within each plot a 10 x 10 cm area containing *H. vernicosus* should be chosen and each shoot within that should be counted. The density in the one to five plots can be averaged per locality and extrapolated by the area covered by the population to give a final density estimate for the overall population. The mean percentage density in 10 x 10 cm areas in the plots per locality can be compared with the target for the locality (see individual Locality Assessment sheets, Appendix I).
- Photographs should be taken of each plot facing north, south, east and west and a final one from above to give an overview of the plot.
- If availability of plant material allows, a shoot sample containing 100+ shoots should be collected from various points within each plot and placed in labelled plastic bags for examination in the laboratory for male and female gametangia (see next section).
- Any associated species within the plot should be noted.

Table 4 shows an example of a completed Locality Survey Card for Scragh Bog, Co. Westmeath.

Table 4: Locality Survey Card for *Hamatocaulis vernicosus* fine-scale monitoring for Scragh Bog, Co. Westmeath.

Locality name: Scragh Bog	**Surveyor:** C. Campbell	**Date:** 26.08.2009
County (vice): Westmeath (H23)	**Aerial Photo ID:** 02631-D & 02701-B	
SAC: Scragh Bog (SAC code: IE000692)	**Discovery Series OS Map No.:** 41	
Extent of occurrence mapped (✓): ✓	**Time spent on site:** 9 hours	
Brief site description: Scragh Bog is a fen 1.34 km long and 0.24 km wide with a floating raft of vegetation (Schwingmoor) in an oval-shaped depression overlying Carboniferous limestone surrounded by eskers containing most of the stages of a classical hydroseral succession from submerged and emergent communities through to fen carr and an embryonic raised bog community.		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:	N4243859144	N4331759176	N4255758952	N4225059372	N4231959295
Altitude (m.s.l.):	108.4	107.7	104.8	101.7	106.6
Surface water depth (cm):	13.5	27	14.3	7.1	17.8
Hand covered when pressed into vegetation (✓):	✓	✓	✓	✓	✓
Cover of *Hamatocaulis vernicosus* (to nearest 1%)**:**	20%	3%	12%	8%	70%
No. of shoots in 10 x 10 cm area:	169	20	421	103	116
Tree cover (to nearest 5%)**:**	0	5	10	25	25
Shrub cover (to nearest 5%)**:**	15	25	0	40	10
Grass cover (to nearest 5%)**:**	15	10	15	5	10
Bryophyte cover (to nearest 5%)	75	75	55	100	75
Cover of *Calliergonella cuspidata* (to nearest 5%)**:**	40	0	55	75	75
Mean vegetation height (cm) (mean height of 5 stems):	65.0	82.0	79.0	94.3	52.8
Photo ID (N, S, E, W, overview):	SBP1-5	SBP6-10	SBP11-15	SBP16-20	SBP21-25
Shoot (100+) sample taken (✓):	✓	✓	✓	✓	✓

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**
Agrostis stolonifera	✓		✓	✓	✓	*Galium palustre*			✓	✓	✓
Angelica sylvestris	✓		✓	✓	✓	*Galium uliginosum*	✓				
Aulocomnium palustre	✓	✓		✓		*Holcus lanatus*	✓		✓		✓
Betula pubescens		✓	✓		✓	*Juncus acutiflorus*			✓	✓	✓
Calliergonella cuspidata	✓	✓	✓	✓	✓	*Lemna minor*			✓		
Calliergonella giganteum	✓	✓	✓	✓	✓	*Lychnis flos-cuculi*	✓				
Calluna vulgaris		✓				*Mentha aquatica*	✓		✓	✓	✓
Campylium stellatum		✓				*Menyanthes trifoliata*	✓	✓	✓	✓	✓
Carex appropinquata	✓	✓	✓	✓	✓	*Molinia caerulea*		✓			
Carex lasiocarpa	✓	✓	✓	✓	✓	*Pedicularis palustris*				✓	
Carex limosa	✓				✓	*Poa trivialis*	✓		✓		
Cardamine pratensis			✓	✓		*Polytrichum strictum*		✓			
Climacium dendroides	✓		✓			*Potentilla erecta*		✓			
Drepanocladus revolvens		✓				*Potentilla palustris*	✓		✓	✓	✓
Drosera rotundifolia		✓				*Salix cinerea* subsp. *oleifolia*			✓	✓	✓
Epipactis palustris	✓		✓	✓	✓	*Salix repens*		✓			✓
Equisetum fluviatile	✓	✓	✓		✓	*Schoenus nigricans*		✓		✓	
Erica tetralix		✓		✓		*Sphagnum subnitens*		✓			
Festuca rubra	✓					*Succisa pratensis*	✓	✓		✓	✓
Filipendula ulmaria	✓		✓			*Vaccinium oxycoccus*	✓	✓		✓	✓
Galium aparine				✓		*Valeriana officinalis*	✓			✓	✓

Sampling of shoots for identification of male and female gametangia

Sporophytes of *H. vernicosus* have never been recorded in Ireland. Capsules have been documented as maturing in summer where sporophytes of *H. vernicosus* do occur (Hedenäs, 2003) and special care must be taken to observe the presence of sporophytes during surveying. Determination of the structure of the population and whether or not there is the potential for sexual reproduction to take place can be carried out at each locality.

When availability of plant material allows, a shoot sample containing 100+ shoots should be examined in the laboratory for identification of male and female gametangia, if present. While the presence of gametangia on shoots can be determined in the field with a hand lens, whether or not they contain archegonia or antheridia can be better established through examination under a microscope. The determination of sex is also time-consuming and better undertaken in the laboratory. Perichaetical leaves should be removed to reveal red flask-shaped archegonia. Male gametangia may appear somewhat larger and rounder, and dissection under the microscope should uncover the presence of sac-like antheridia. In some cases, the gametangia may not be verified as male or female, particularly in cases where they occur further down the shoot, and so should be noted as indeterminate. Each shoot collected (to a maximum of 100 per sample) should be examined under the microscope, noted as male, female, indeterminate or sterile (no gametangia present) and percentages of each category should be calculated per sample and for the locality overall. Results should be entered into the results table on the Assessment sheet for each locality (see Appendix I). Information accumulated over the reporting cycles will also determine if trends exist in the structure of the population. Table 5 shows an example determination of male and female shoots results table filled out for Scragh Bog.

Table 5: Determination of male and female shoot numbers from Scragh Bog.

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1	10.08.11	21	60	0	19	n = 100
2	10.08.11	13	27	1	59	n = 100
3	10.08.11	11	21	2	66	n = 100
4	10.08.11	24	31	4	41	n = 100
5	10.08.11	15	8	2	75	n = 100
Total numbers		84	147	9	260	500
Total percentage		16.8%	29.4%	0.02%	52%	100%

Section A – Population Assessment of Hamatocaulis vernicosus

'Area covered by the population in m²' is an accepted method of assessing populations of bryophytes (Evans & Arvela, 2011), as it can be difficult to determine what constitutes an individual because of the clonal nature of many species (Hallingbäck *et al.*, 1998). Results from a preliminary genetic fingerprinting (amplified fragment length polymorphism) analysis (Campbell, 2013) showed the range of genetic variation in populations of *H. vernicosus* in the Republic of Ireland to be larger than would be hypothesised for a species that is not known to reproduce sexually. 'Area covered by the population (m²)' is also used to assess the parameter of area for 'Habitat for the Species' in the EU Conservation Assessment report. Thus, both area covered by the population and shoot counts (density) are to be assessed.

Thus both area of extent of occurrence (from which area covered by the population (m²) can be derived) and density of shoots are to be assessed in order to determine the Population status at each locality. The details of how to assess both area of extent of occurrence for both upland and lowland localities and how to assess the area covered by the population (m²) and the density were outlined above. The overall aim of these approaches is to generate a set of standardised and comparable data that can be used to determine trends in the area covered by the species and density of the shoots.

The data collected on the seven localities studied by Campbell (2013) are used as the baseline data against which all future monitoring will be based. A 20% reduction from the baseline data of the area of extent of occurrence and of shoot density numbers has been applied to allow for machine (GPS) and human error and observed recording variability over field sampling. A 20% reduction from the baseline data for *H. vernicosus* percentage cover in the plots has also been applied to allow for machine error (GIS mapping) and human error.

For the Population Assessment at the localities at Meentygrannagh, Largan More, Owenbrin, NW of Gortachalla Lough, Below Sgilloge Loughs, Nire River Valley and Scragh Bog the following criteria should be used:

- 3 passes = Favourable
- 2 passes = Unfavourable - Inadequate
- 0 – 1 passes = Unfavourable - Bad

Targets for percentage cover and shoot density have not yet been set for Rathavisteen, Uggool, Coumtay and Commas and therefore, if the target for area of extent of occurrence is met then the locality can be given a Favourable status. If the target is not met, but the Habitat for the Species Assessment is Favourable, then again, a Favourable status can be given to the Population Assessment.

Further monitoring at Rathavisteen, Uggool, Coumtay and Commas will contribute to setting the targets for percentage cover and shoot density for these localities for future assessments.

Table 6 shows an example of a completed Population Assessment sheet for Scragh Bog.

Table 6: Population Assessment indicators, methods of assessment and targets for Scragh Bog.

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occurrence	Area of polygon around GPS points	≥ 47,550 m²	59,442 m²	Pass
Percent cover (%)	Mean percentage cover within 3-5 plots	20%	40%	Pass
Density	Mean number of shoots in 10 x 10 cm area in 3-5 plots	≥ 145 shoots	179 shoots	Pass
Population Assessment for Scragh Bog			**Result**	**Condition**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad			3 passes	Favourable

Section B – Habitat for the Species Assessment

There should be sufficient habitat to ensure the species' survival. 'Area covered by the population (m²)' is also used to assess this parameter as part of the Habitat for the Species assessment. This is calculated by multiplying the area of occurrence (m²) by the mean percentage cover of *H. vernicosus* averaged over the plots per locality. The target is different for each locality.

Floristic work on the habitats of *H. vernicosus* by Campbell (2013) suggested positive and negative indictors to monitor. The indicators used to assess habitat quality are hydrology, tree cover, shrub cover, bryophyte cover, cover of *Calliergonella cuspidata* and mean vegetation height (cm). These should be assessed within the 2 x 2 m plots. GPS positions and photographs of all plots and any other features of interest (e.g. illegal dumping) should be taken.

From the parameters recorded on the Locality Survey Card, the Habitat Assessment table (see Table 7) can be filled out and the indicators assessed.

The indicators and how to assess them are outlined below.

Hydrology

From a study by Campbell (2013), it appears that *H. vernicosus* can withstand larger fluctuations in water table level than previously thought, particularly in the lowland localities where the most extensive populations of *H. vernicosus* occur. During dry spells, the water level can drop considerably below the surface level of the root mat vegetation (up to 40+ cm) in the lowland localities of Gortachalla, Scragh Bog, and particularly at the Owenbrin locality on the Lough Mask floodplain. At the upland localities there may not be much discernible change in the water level, although it is suspected that the whole vegetation mat rises and falls with changes in the water level, particularly in the spring head flushes at Largan More. The change in level was greater at Nire River Valley where the water table fell below the surface of the root mat.

Measurements of water table level over a longer monitoring time-period (> 10 years) will further elucidate temporal fluctuations (McBride *et al*., 2011). The depth of surface water measurements are recorded on the Locality Survey Card.

Sufficient moisture at the localities can be assessed by pressing a hand into the vegetation at each plot and the water level should cover it.

Tree cover and shrub cover

H. vernicosus does not tolerate shading from woody species, so both tree cover and shrub cover should be monitored. Tree cover and shrub cover within each 2 x 2 m plot should be estimated to the nearest 5%. Mean tree cover over the five plots should not exceed 15% and mean shrub cover should not exceed 20% per locality.

Grass cover

Increased nutrients and/or undergrazing can change the vegetation composition; tall-herbs and grasses can begin to dominate at the expense of brown mosses (McBride *et al*., 2011). Grass cover should be estimated to the nearest 5% within each plot and mean grass cover should not exceed 25%.

Bryophyte cover

In a study by Campbell (2013), a statistically significant positive relationship was found between bryophyte cover and density of *H. vernicosus*, suggesting that the species performs better in open conditions in moss-dominated carpets. Bryophyte cover should be estimated to the nearest 5% within each plot and a mean cover of > 50% should be obtained.

Cover of *Calliergonella cuspidata*

C. cuspidata has been reported as becoming dominant when nutrient levels are elevated (Hedenäs, 2003; Kooijman, 1993). Cover of *C. cuspidata* should be estimated to the nearest 5% in each plot and a mean cover of *C. cuspidata* should not exceed 15% in all localities apart from Scragh Bog, where mean cover of *C. cuspidata* should not exceed 60%.

Mean vegetation height

Shading and/or competition from surrounding vegetation can have a negative effect on the cover of *H. vernicosus*, which is a poor competitor in tall vegetation (Turner, 2003).

The height of 5 shoots in each 2 x 2 m plot (including hummock-forming species) should be measured with a ruler or a measuring tape (cm) and averaged per plot. The mean vegetation height found in the plots should not exceed 80 cm at Scragh Bog and should not exceed 40 cm at all the other localities.

For the overall Habitat for the Species Assessment per population the following criteria should be used:

- 7 – 8 passes = Favourable
- 4 – 6 passes = Unfavourable - Inadequate
- 0 – 3 passes = Unfavourable - Bad

Table 7 gives an example of a completed Habitat for the Species Assessment sheet for Scragh Bog.

Table 7: Habitat for the Species Assessment table for Scragh Bog, Co. Westmeath.

Indicator	**Method of assessment**	**Target**	**Result**	**Pass/Fail**
Area covered by the population (m^2)	Multiply area of occurrence by mean percentage cover	≥ 9,510 m^2	17,065.8 m^2	
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation	Hand covered	Pass
Tree cover	Estimation of tree cover to nearest 5% averaged over 3–5 plots	Mean percent tree cover should **not** exceed 15%	10%	Pass
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3–5 plots	Mean percent shrub cover should **not** exceed 20%	15%	Pass
Grass cover	Estimation of grass cover to nearest 5% averaged over 3–5 plots	Mean percent grass cover should not exceed 25%	10%	Pass
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3–5 plots	Mean percent bryophyte cover should exceed 50%	80%	Pass
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3–5 plots	Mean percent *C. cuspidata* cover should **not** exceed 60%	45%	Pass
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3–5 plots	Mean vegetation height should **not** exceed 80 cm	69.5cm	Pass
Habitat for the Species Assessment:			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad			7 passes	Favourable

Section C – Assessment of Future Prospects

The Future Prospects Assessment table contains sections to record current pressures and potential threats to the species at each locality. Impacting activities are considered to be pressures if they are currently negatively impacting the species and are considered threats if they are likely to impact the species in the foreseeable future (foreseeable future is taken to be 12 years, i.e. the length of two reporting rounds (Evans & Arvela, 2011)). Not all impacting activities are negative and some may have a positive impact on the species. Continued and standardised assessment of the local threat status will be important in monitoring trends over time, and will ultimately help inform management decisions. The future prospects of *H. vernicosus* are believed to be stable in the short/medium term.

Impacting activities should be recorded using the standardised EU-devised list of impacts and their codes (Ssymank, 2010). Activities and their location (either within or outside the extent of occurrence), influence (positive, negative or neutral), intensity (high, medium or low) and area affected (0 – 10 m^2, 11 – 50 m^2, 51 – 100 m^2 or > 100 m^2) should also be recorded (see Table 8). If the influence of, the intensity of or the area affected by the impact cannot be measured or if there is no current impact, then 'Unknown' can be filled in for influence, intensity and area affected. Again, this is to highlight any potential issues that may arise based on the impacting activity and allows for such pressures and threats to be monitored at future visits to the localities.

The assessment of Future Prospects is more subjective. If there is no significant impact of the activities the Future Prospects should be assessed as Favourable, moderate impact should be assessed as Unfavourable - Inadequate and severe impact as Unfavourable - Bad. For populations where there are more than one impacting activity recorded, if any of the impacting activities are having a moderate impact, the overall Future Prospects assessment is 'Unfavourable – Inadequate' for that locality. Similarly, if any of the impacting activities are having a severe impact on an individual locality, the overall Future Prospects assessment is recorded as 'Infavourable – Bad' for that locality.

Table 8: Future Prospects Assessment table for Scragh Bog, Co. Westmeath.

Activity (EU code)	**Pressure (P) or Threat (T)***	**Location (Inside/outside extent of occurrence)**	**Influence (Positive/ Negative/ Neutral)**	**Intensity (High/ Medium/ Low)**	**Area affected (0-10 m²; 11-50 m²; 51-100 m²; > 100 m²)**
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					
Future Prospects Assessment:			**Result**		**Status**
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact			Not significant		Favourable

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Section D – Assessing Conservation Condition at the individual locality level

To derive a Conservation Condition Assessment for each individual locality, the Population, Habitat and Future Prospect Assessments (see Tables 6–8) are combined to derive and an overall rating of Favourable, Unfavourable - Inadequate or Unfavourable - Bad.

Targets for Population, Habitat for the Species and Future Prospects should be assessed at a locality-by-locality level. The raw data for each locality assessment can then be used to derive a national Conservation Status assessment.

The Conservation Condition assessment of each locality is carried out by combining the results from all the other assessments and is assessed using the following criteria.

- All Favourable = Favourable
- 1 – 3 Unfavourable - Inadequate = Unfavourable - Inadequate
- 1 Unfavourable - Bad = Unfavourable - Bad

Table 9: Example of a Conservation Condition Assessment for the locality at Scragh Bog, Co. Westmeath.

Parameter	**Assessment**
Population	Favourable
Habitat for the Species	Favourable
Future Prospects	Favourable
Overall	Favourable

Section E – Assessing Overall Conservation Status for Hamatocaulis vernicosus *in the Republic of Ireland*

The Overall Conservation Status for the Republic of Ireland is derived by combining the results from each of the individual locality assessments and extracting details on population numbers, habitat quality and also impact of pressures using the criteria set out in Table 10. However, expert judgement should be used when assessing these criteria, i.e. where there is a localised issue that is not considered a pressure or threat at a national level, this pressure or threat should be highlighted for that locality, but may not necessarily reflect a negative impact on the national conservation status.

The 7 of 11 localities visited in the 2009–2011 study (Campbell, 2013) are a representative sample across the natural range of the species in the Republic of Ireland. It is recommended that all 11 localities be visited to ensure accurate values for Range and Population are being reported. Any locality that is lost since the Directive came into force will result in a downgrading of the Population parameter to 'Unfavourable – Inadequate' or 'Unfavourable – Bad' following the rules-based approach in Evans & Arvela (2011).

Range may also be affected by any locality losses, although this will depend where the locality is located. Any new discoveries of *H. vernicosus* populations may result in an adjustment of Favourable Reference Values. New discoveries are likely to be localities that were overlooked rather than an expansion of the Range.

The Habitat for the Species assessment for the localities should be combined and considered at a national level to assess if the overall status is Favourable. If an Unfavourable – Inadequate condition is given to 2 of the localities (~20%), then the overall status for 'Habitat for the Species' should be given an Unfavourable – Inadequate status. If 2 or more localities (~20%+) are given an Inadequate – Bad condition then an overall conservation status for Habitat for the Species of 'Unfavourable – Bad' must be given.

The list of pressures reported for each locality should be amalgamated to determine whether there are any pressures that are being repeatedly observed and at an intensity that is resulting in a decline in Population or Habitat for the Species. The severity of the impact will determine whether to assess as Unfavourable – Inadequate or Unfavourable – Bad overall. It is recommended that the impact of pressures be taken into account over the six years of the reporting period and threats be assessed for twelve years into the future (two reporting periods). Table 10 shows the ranking of the relative importance of any pressure or threat evident at the localities (taken from Evans & Arvela, 2011).

Table 10: Ranking of importance of threats/pressures.

Code	Importance	Comment
H	High importance/impact	Important direct or immediate influence and/or acting over large areas
M	Medium importance/impact	Medium direct or immediate influence, mainly direct influence or acting over moderate part of the area/acting only regionally
L	Low importance/impact	Low direct or immediate influence, indirect influence and/or acting over small part of the area/acting only regionally

Based on the surveys carried out in 2009–2011 (Campbell, 2013) no pressures or threats were evident at any of the seven localities surveyed.

The Overall Conservation Status is discerned by combining the results from all the other national assessments (Range, Population, Habitat for the Species and Future Prospects) and is assessed using the following criteria.

- All Favourable (Green) = Favourable (Green)
- 1 – 4 Unfavourable - Inadequate (Amber) = Unfavourable - Inadequate (Amber)
- 1 Unfavourable - Bad (Red) = Unfavourable - Bad (Red).

If an individual parameter is given an Unfavourable status, the assessment should be qualified to indicate if the status is improving, stable , declining or unknown by adding a plus, equal, minus or 'x'

respectively. The qualifier should be based on trends over the reporting period that are expected to continue (Evans & Arvela, 2011). If the Overall conservation status assessment is Unfavourable this should also have a qualifier to indicate the overall trend, for example a status of 'Unfavourable – Inadequate +' would mean although the status is Unfavourable, it is improving.

Conclusion

The present Overall Conservation Status of *Hamatocaulis vernicosus* in the Republic of Ireland is Favourable. Future monitoring and reporting to the European Commission will ensure that this status will be examined every 6 years and maintained, as action can be taken to safeguard against any changes to the status through early intervention.

H. vernicosus is relatively frequent in parts of northern Europe and more detailed studies of its distribution and habitat requirements across Europe have been due to its inclusion on Annex II (Štechová *et al*., 2008). Hedenäs & Eldenäs state the widespread clade of this cryptic species occurs in northern Sweden where its habitat is in good conservation status, whereas further south in Sweden populations of the rarer clade are under threat. They argue it should be kept on Annex II as it is impractical to sequence every population in Europe and changing the designation to include one or other of the clades is unfeasible (Hedenäs & Eldenäs, 2007). It is not known to which clade the Irish populations of *H. vernicosus* belong and this requires sequence analysis. However, the two clades were not shown to have significantly different ecological requirements (Hedenäs & Eldenäs, 2007), so it may not be entirely relevant for its *in situ* conservation in Ireland.

Although *H. vernicosus* does not appear to be as threatened in the Republic of Ireland as some other species, the continuance of Favourable conservation status is imperative as the habitats within which it grows are among the most threatened habitat types in Ireland. Many other rare species that do not have legal protective status occur at the *H. vernicosus* sites such as *Pseudocalliergon trifarium*, *Sphagnum teres* and *Tomentypnum nitens.* The Republic of Ireland also has a European, as well as international, obligation to monitor and conserve the species.

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Appendix I – Individual locality information

This appendix contains information on each of the 11 *Hamatocaulis vernicosus* localities in the Republic of Ireland comprising information from previous surveys, Locality Survey Cards and Assessment sheets, overview Discovery maps highlighting the location of the populations and aerial photographs showing the GPS location of records at each locality.

Individual population Locality Survey Cards and Assessment sheets have been compiled for the following *H. vernicosu*s localities:

1. Meentygrannagh, Co. Donegal – Upland locality
2. Rathavisteen, Co. Mayo – Upland locality
3. Largan More, Co. Mayo – Upland locality
4. Uggool, Co. Mayo – Upland locality
5. Owenbrin, Co. Mayo – Lowland locality
6. NW of Gortachalla Lough, Co. Galway – Lowland locality
7. Scragh Bog, Co. Westmeath – Lowland locality

8a. Below Sgilloge Lough, Co. Waterford – Upland locality

8b. Nire River Valley, Co. Waterford– Upland locality

8c. Coumtay, Co. Waterford – Upland locality

9. Commas, Co. Cavan – Upland locality

Meentygrannagh Bog SAC (IE000173)

Locality No. 1: Meentygrannagh, Co. Donegal; Grid ref. C02_06_

Field notes from Neil Lockhart (26 January 1999):

Below rocky knoll, 7 m from its base. *H. vernicosus* forms a lawn at the edge of a water track in a mesotrophic mire, with *Carex rostrata*. Water table is more or less at the surface level of the fen and the ground is slightly quaking. Vegetation height: *ca.* 35 cm (herbs); *ca.* 10 cm (bryophytes).

Associates (with Braun-Blanquet cover):

[*Hamatocaulis vernicosus*	2]	*Pellia endiviifolia*	+
Calliergonella cuspidata	1	*Potamogeton polygonifolius*	1
Campylium stellatum	+	*Potentilla palustris*	1
Carex nigra	2	*Sphagnum contortum*	3
Carex rostrata	+	*Sphagnum teres*	1
Juncus acutiflorus	2	*Sphagnum warnstorfii*	1
Molinia caerulea	1	*Warnstorfia exannulata*	1

Field notes from Neil Lockhart (22 June 2004):

H. vernicosus found in several more places here:

1. The original location (*ca.* 7 m from knoll) contains a band or strip of *H. vernicosus* at the edge of the fen/mineral transition and runs for the entire length from the knoll to the forestry.
2. New populations found in association with *Carex paniculata* tussocks near the edge of the fen/mineral transition on the opposite side of the bog - very near the *Tomentypnum nitens* main population.
3. Further populations seen in the wet fields and drains to the north (above the forestry).

Associates (general list from area of fen where *H. vernicosus* was originally found):

Anagallis tenella	*Carex pulicaris*
Aneura pinguis	*Carex rostrata*
Anthoxanthum odoratum	*Cirsium palustre*
Brachythecium rivulare	*Drosera rotundifolia*
Bryum pseudotriquetrum	*Equisetum* cf. *palustre*
Calliergonella cuspidata	*Festuca rubra*
Cardamine pratensis	*Galium palustre*
Carex curta	*Holcus lanatus*
Carex dioica	*Hylocomnium splendens*
Carex echinata	*Hyocomium armoricum*
Carex limosa	*Juncus acutiflorus*
Carex nigra	*Luzula multifolia*
Carex panicea	*Menyanthes trifoliata*
Carex paniculata	*Pedicularis palustris*

Pellia endiviifolia
Polytrichum commune
Potamogeton polygonifolius
Potentilla erecta
Potentilla palustris
Ranunculus flammula
Rhytidiadelphus loreus
Rhytidiadelphus squarrosus
Schoenus nigricans
Scorpidium revolvens
Sphagnum contortum
Sphagnum fallax
Sphagnum inundatum
Sphagnum palustre
Sphagnum squarrosum
Sphagnum subnitens
Sphagnum subsecundum
Sphagnum teres
Sphagnum warnstorfii
Splachnum ampullaceum
Stellaria alsine
Straminergon stramineum
Veronica anagallis-aquatica
Viola palustris
Warnstorfia exannulata

Field notes from Christina Campbell & Neil Lockhart (4 August 2009 [with Carl Byrne] & 24 August 2010):

Meentygrannagh Bog is situated about 15 km south-west of Letterkenny, Co. Donegal. *Hamatocaulis vernicosus* was first discovered at this site by N. Lockhart, C. Douglas and C. Byrne of NPWS in late January 1999 and refound by Douglas and Lockhart in June 2004 when further sub-populations were discovered. The site is protected as an SAC (Meentygrannagh Bog SAC) and contains good examples of blanket bog, alkaline fen and transition mire. Drainage occurred on part of the fen in 1998, but through the intervention of NPWS (known as Dúchas at that time) the drains were blocked up by the owner (Anonymous, 2000). *H. vernicosus* occurs in the transition mire areas of the site. Notably, the rare boreal relict moss *Tomentypnum nitens* is also present. The site is grazed by sheep, and deer were also observed. A commercial forestry plantation occurs to the south-east of the population. Six plots (2 x 2 m) were recorded at this population. Plot 1 was recorded in a water track in aqueous peat in August 2009. Plot 2 was recorded in an area with a very scattered distribution of *H. vernicosus* on a quaking mesotrophic mire. The location of Plot 3 was on a firmer surface; not as quaking as the other locations. Plot 4 was recorded in an area of low density of *H. vernicosus* in local patches in very wet places. The rare moss *Sphagnum teres* occurred in Plot 5. Plot 6 was dominated by *Carex limosa* and *H. vernicosus* occurred growing with *Warnstorfia exannulata*.

Meentygrannagh	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**
Year	2009	2010	2010	2010	2010	2010
Altitude (m.s.l.)	156	155	158	156	154	152
Slope (degrees)	10	0	0	3	2	0
Aspect	SSE	-	-	SSE	E	-
Surface water depth (cm)	2.0	3.2	1.6	3.4	2.0	4.0
Surface water pH	5.82	5.73	5.37	5.86	6.30	5.87
Surface water conductivity (μS/cm)	102.5	102.0	70.5	65.0	162.0	78.0
Ammonium (NH_4) (mg/l)	0.050	0.200	0.040	0.130	0.105	0.119
Nitrate (NO_3) (mg/l)	0.370	0.090	0.160	0.090	0.178	0.129
Orthophosphate (O-P) (mg/l)	0.012	0.025	0.015	0.005	0.014	0.015
Total phosphate (TP) (mg/l)	0.154	0.265	0.163	0.067	0.162	0.164
Peat depth (cm)	79	>240	>240	117.5	>240	>240
No. of shoots in 10 x 10 cm area	386	19	4	12	172	19
Hamatocaulis vernicosus cover (%)	28.5	4	0.0025	8	55	24
Mean vegetation height (cm)	53.2	53.4	23.0	28.0	27.0	23.0
Max. vegetation height (cm)	77	101	82	53	78	74
Cover (Domin):						
Total cover	10	10	10	10	10	9
Grass cover	4	8	3	1	4	5
Rush cover	7	5	5	6	5	1
Sedge cover	8	4	6	8	8	7
Forb cover	8	4	5	5	4	5
Fern/ fern allies cover	0	2	1	1	1	1
Bryophyte cover	8	9	8	8	8	8
Litter cover	1	2	5	3	4	3
Surface water cover	6	1	3	4	1	5
Dung cover	0	0	0	+	0	0
Associated species cover (Domin):						
Agrostis stolonifera	2	5	1	1	4	0
Anagallis tenella	3	0	0	0	0	0
Aneura pinguis	0	0	0	0	2	0
Anthoxanthum odoratum	2	1	0	0	1	0
Aulacomnium palustre	0	0	0	4	0	1
Brachythecium rivulare	0	0	0	0	2	0
Brachythecium rutabulum	0	0	0	1	0	0
Bryum pseudotriquetrum	2	0	0	1	1	0
Carex paniculata	0	0	6	0	6	0
Calliergonella cuspidata	3	2	3	4	4	0
Campylium stellatum	2	1	0	0	1	0
Cardamine pratensis	4	1	0	1	1	0
Carex demissa	7	4	0	0	0	0
Carex echinata	5	2	4	4	0	3
Carex lepidocarpa	2	0	0	0	5	0
Carex limosa	0	1	0	4	2	6
Carex nigra	1	2	0	6	0	0
Carex panicea	3	0	4	0	+	4
Carex pulicaris	0	0	1	1	0	0
Carex rostrata	6	0	0	4	0	1
Cerastium fontanum	0	0	0	0	2	0
Cirsium palustre	1	0	3	0	+	0
Cynosuros cristatus	2	0	0	0	0	0
Epilobium palustre	2	0	0	1	0	0
Equisetum fluviatile	0	2	1	1	0	1
Equisetum palustre	0	0	0	+	1	0
Festuca ovina	2	1	1	0	0	0
Fissidens adianthoides	1	0	0	0	0	0

Meentygrannagh (continued) **Associated species cover (Domin):**	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**
Galium palustre	0	0	+	+	1	0
Holcus lanatus	4	2	0	1	1	0
Hylocomium splendens	4	2	0	4	0	0
Juncus acutiflorus	7	5	5	6	5	1
Juncus bulbosus	1	0	2	2	0	0
Leontodon autumnalis	0	+	2	1	0	0
Lophocolea bidentata	2	0	0	1	0	0
Luzula multiflora	0	0	1	1	0	0
Lychnis flos-cuculi	0	0	0	0	1	0
Menyanthes trifoliata	0	+	0	3	3	4
Mnium undulatum	2	0	0	0	0	0
Molinia caerulea	0	8	2	0	1	5
Pedicularis palustris	+	0	0	0	2	1
Philonotis fontana	3	0	0	0	2	0
Plantago lanceolata	3	0	0	0	0	0
Plagiomnium undulatum	1	0	0	0	0	0
Potentilla erecta	3	0	3	2	0	1
Potentilla palustris	0	2	2	4	0	2
Potamogeton polygonifolius	0	0	0	4	0	4
Pseudoscleropodium purum	3	0	0	0	0	0
Ranunculus flammula	5	3	3	4	1	2
Rhytidiadelphus squarrosus	4	2	4	4	0	0
Riccardia multifida	2	0	0	0	0	0
Rumex acetosa	0	0	0	0	1	0
Sagina nodosa	2	0	5	0	0	0
Sphagnum fallax	0	6	0	0	0	0
Sphagnum inundatum	0	0	8	0	0	4
Sphagnum palustre	0	6	2	0	0	1
Sphagnum papillosum	0	0	0	2	0	0
Sphagnum squarrosum	0	0	0	2	0	0
Sphagnum subsecundum	0	0	0	5	0	0
Sphagnum subnitens	0	4	0	0	0	4
Sphagnum teres	0	0	0	0	5	0
Straminergon stramineum	0	2	1	2	0	0
Triglochin palustris	1	0	0	0	2	0
Trifolium repens	3	0	2	0	0	0
Utricularia intermedia	0	1	0	0	0	0
Veronica scutellata	0	0	0	1	0	0
Viola palustris	0	0	3	1	0	0
Warnstorfia exannulata	0	2	2	3	0	4

Locality Survey Card for *Hamatocaulis vernicosus* at Meentygrannagh Co. Donegal

Locality name: Meentygrannagh	**Surveyor:**	**Date:**
County (vice): (West) Donegal (H35)	**Aerial Photo ID:**	
SAC: Meentygrannagh Bog (IE000173)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Meentygrannagh, Co. Donegal (Meentygrannagh Bog SAC, IE000173)

Population Assessment for Meentygrannagh, Co. Donegal

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occurrence	Area of polygon around GPS points	≥ 2,450 m²		
Percent cover (%)	Mean percentage cover within 3–5 plots	≥ 15%		
Density	Mean number of shoots in 10 x 10 cm area in 3–5 plots	≥ 80 shoots		
Population Assessment for Meentygrannagh			**Result**	**Status**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad				

Habitat for the Species Assessment for Meentygrannagh, Co. Donegal

Indicator	Method of assessment	Target	Result	Pass/Fail
Area covered by the population (m²)	Multiply area of occurrence by mean percentage cover	≥ 365 m²		
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 3–5 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3–5 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 3–5 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3–5 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3–5 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3–5 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Meentygrannagh			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Meentygrannagh, Co. Donegal

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m^2; 11–50 m^2; 51–100 m^2; > 100 m^2)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Meentygrannagh	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

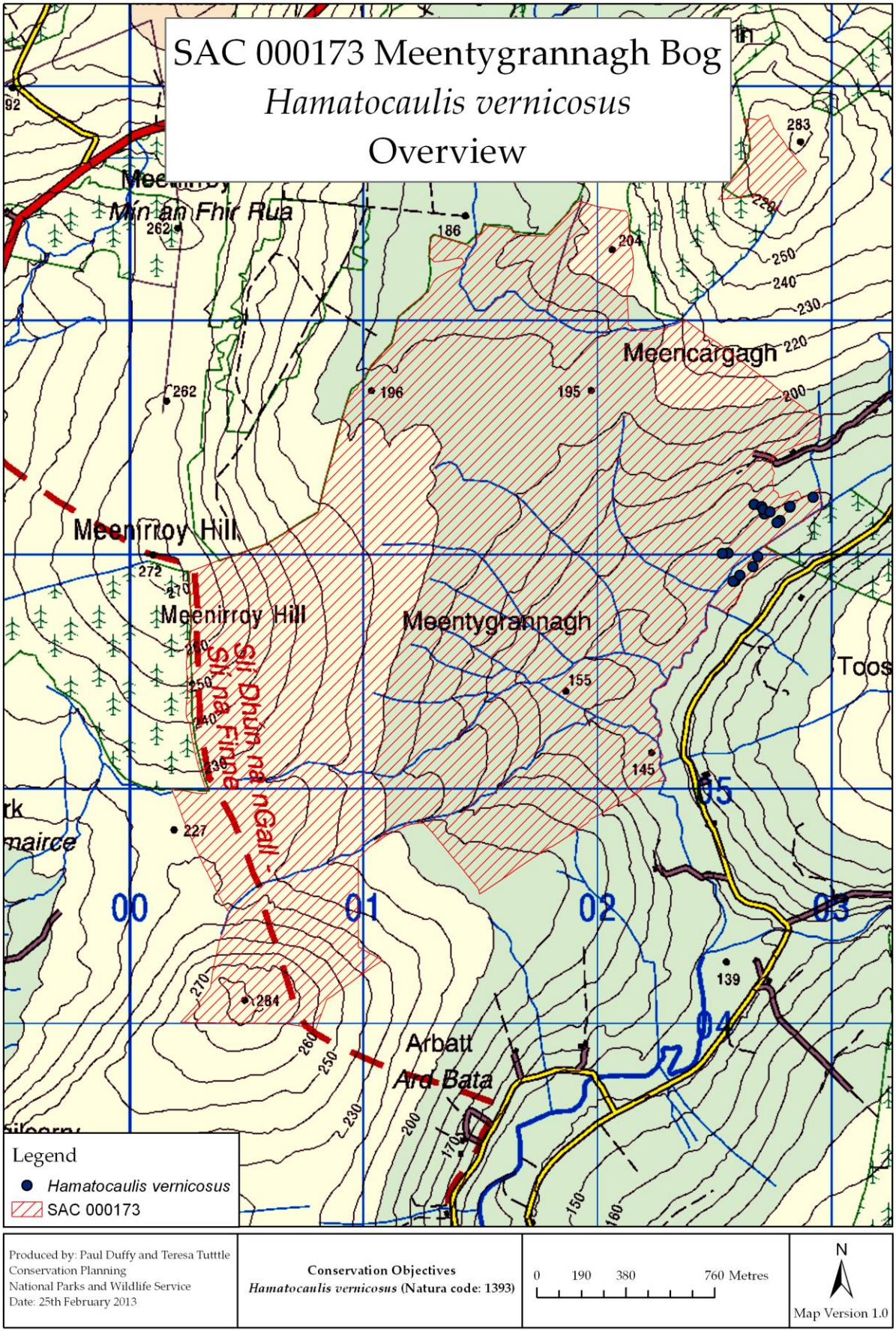
Overall Conservation Assessment for Meentygrannagh, Co. Donegal

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

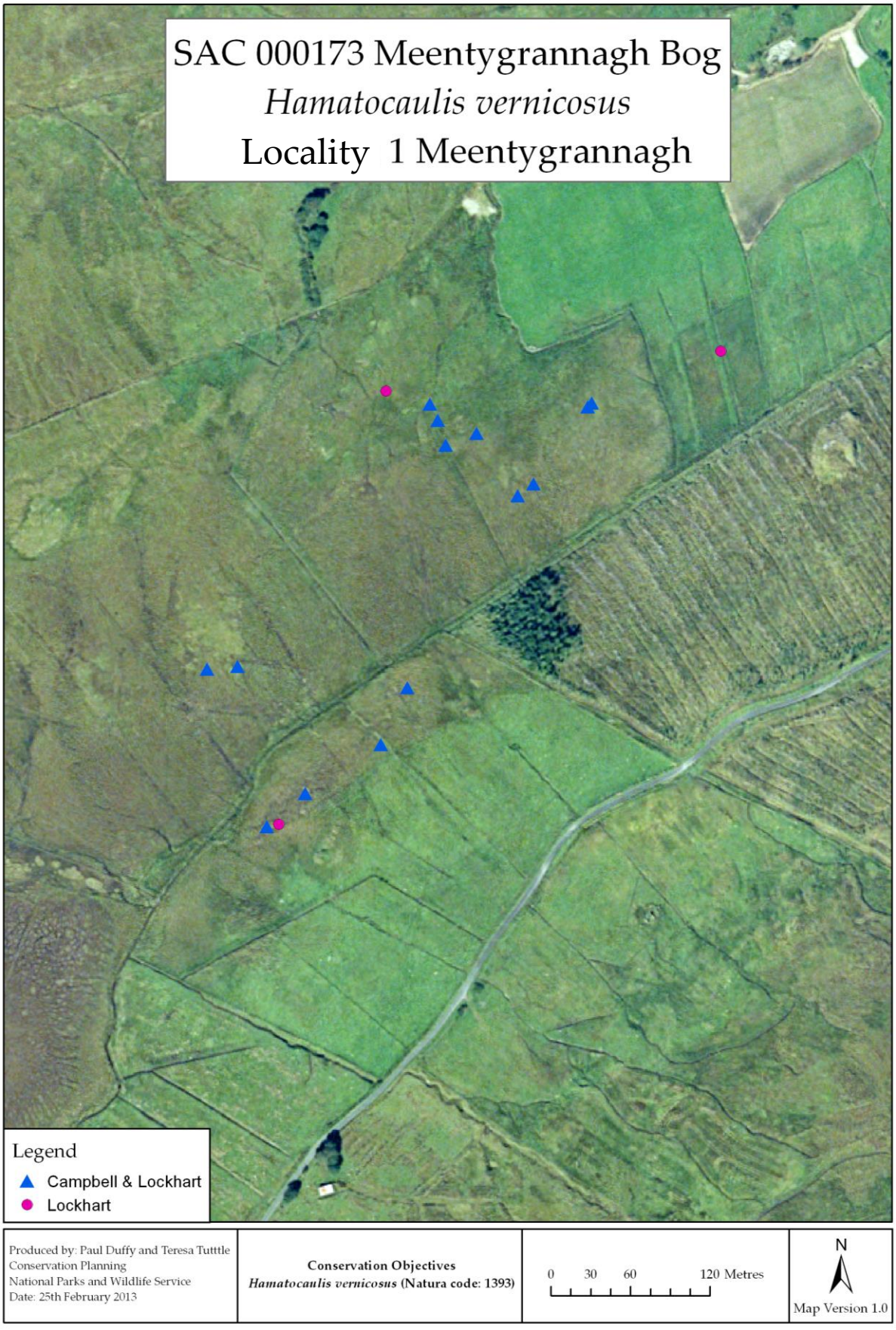
Determination of male and female shoot numbers from Meentygrannagh, Co. Donegal

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:



Discovery map: 6



Aerial photograph: O0302-D & O0324-B (2005 Orthos)

Glenamoy Bog Complex SAC (IE000500)

Locality No. 2: Rathavisteen, Co. Mayo; Grid ref. F982371

Field notes from Neil Lockhart (10 June 1999):

A small patch (*ca.* 10 x 1 m) of *H. vernicosus* confined to the bases of *Carex paniculata* and other tussocky vegetation on the upper eastern margin of the fen. No threats at present. This part of the marsh/fen is a floating scragh, dominated mostly by *Sphagnum* spp. with lenses of tussocky sedges and grasses, open to grazing cattle, but not damaged from the botanical viewpoint at present.

Associates:

Carex dioica
Carex echinata
Carex limosa
Carex panacea
Carex paniculata
Eriophorum angustifolium
Molinia caerulea
Schoenus nigricans
Sphagnum contortum
Sphagnum squarrosum

Locality Survey Card for *Hamatocaulis vernicosus* at Rathavisteen, Co. Mayo

Locality name: Rathavisteen	**Surveyor:**	**Date:**
County (vice): (West) Mayo (H27)	**Aerial Photo ID:**	
SAC: Glenamoy Bog Complex (IE000500)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Rathavisteen, Co. Mayo (Glenamoy Bog Complex SAC IE000500)

Population Assessment for Rathavisteen, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 8 m^2		
Percent cover (%)	Mean percentage cover within 1–3 plots	NA		NA
Density	Mean number of shoots in 10 x 10 cm area in 1–3 plots	NA		NA

Population Assessment for Rathavisteen	Population Status	Result (✓)
1 pass	Favourable	
0 passes & Habitat for the Species Assessment is Favourable	Favourable	
0 passes & Habitat for the Species Assessment is Unfavourable – Inadequate	Unfavourable – Inadequate	
0 passes & Habitat for the Species Assessment is Unfavourable – Bad	Unfavourable – Bad	

Determination of male and female shoot numbers from Rathavisteen, Co. Mayo

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:

Habitat for the Species Assessment for Rathavisteen, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 1–3 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 1–3 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 1–3 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 1–3 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 1–3 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 1–3 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Rathavisteen			**Result**	**Status**
7 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Rathavisteen, Co. Mayo

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

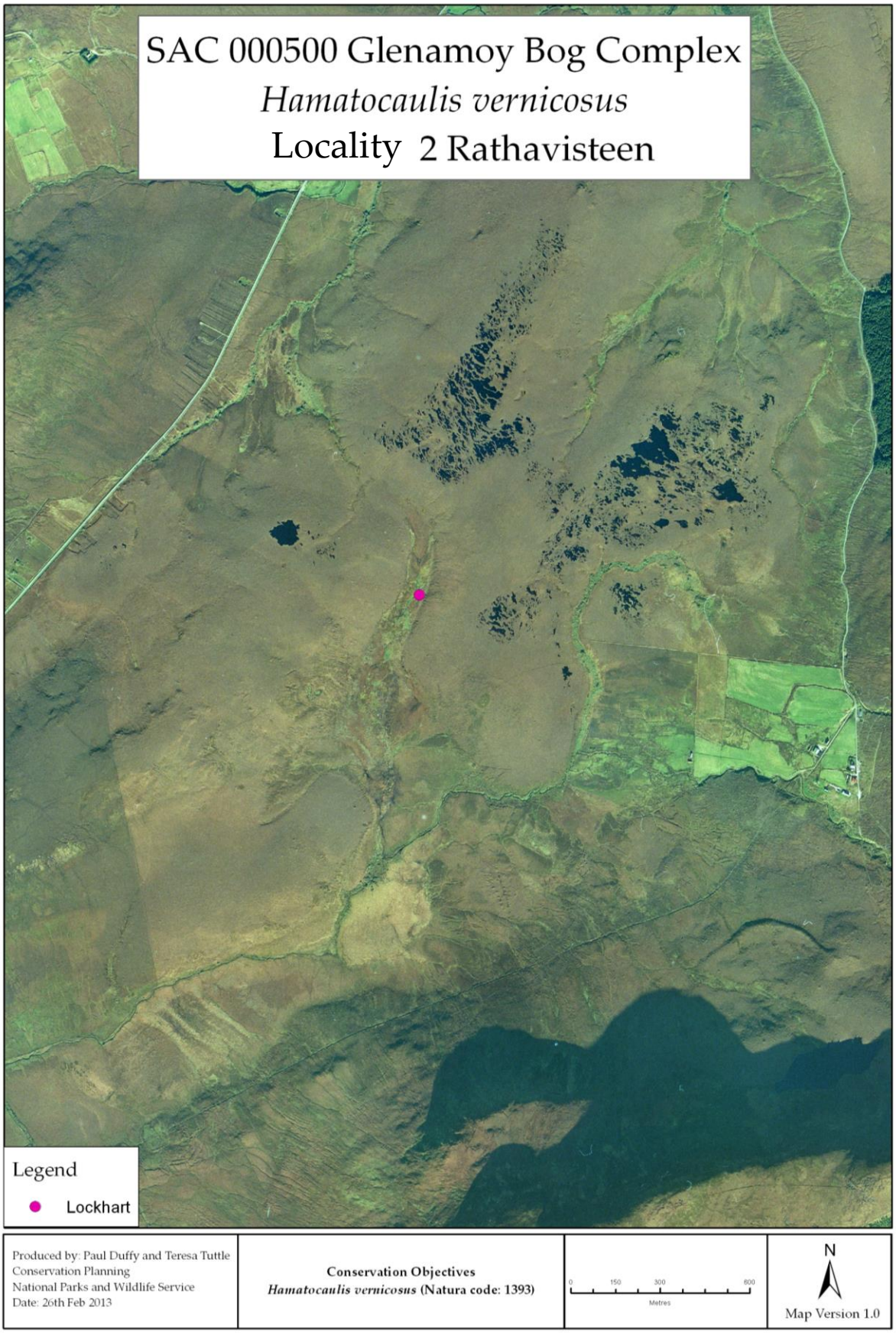
Future Prospects Assessment for Rathavisteen	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Overall Conservation Assessment for Rathavisteen, Co. Mayo

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

Discovery Map: 23



Aerial photograph: O0939-D (2005 Orthos)

Carrowmore Lake Complex SAC (000476)

Locality No. 3: Largan More, Co. Mayo; Grid ref. F902240

Field notes from Neil Lockhart (21 July 1999):

H. vernicosus abundant over a small area (*ca.* 10 x 5 m) in the vicinity of *Saxifraga hirculus* and mixed with *Scorpidium revolvens, Warnstorfia exannulata* and *Cratoneuron filicinum*. This area is quite heavily poached and grazed by cattle.

Associates:

Agrostis stolonifera
Carex diandra
Cratoneuron filicinum
Dicranella palustris
Juncus effusus
Philonotis fontana
Saxifraga hirculus
Scorpidium revolvens
Sphagnum recurvum s.l.
Warnstorfia exannulata

Field notes from Christina Campbell & Neil Lockhart (5 August 2009 & 25 August 2010):

Four plots (2 x 2 m) were recorded at this locality. Plot 1 was recorded in a moss lawn in a flush surrounded by blanket bog. Plot 2 was recorded in a lawn at the edge of a water track that joined a stream, the flow through which was more perceptible in springtime. *Scorpidium cossonii* achieved high cover in this plot (Domin 8) indicating base-rich conditions. Plot 3 was recorded on a swelling mound on a spring head that sloped in all directions (but the plot sloped west). Plot 4 was taken in a very wet area on the edge of a stream with a perceptible flow of water through the plot where it was a bit deeper. Grazing during the summer at the locality appeared heavy.

Largan More	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Year	2009	2010	2010	2010
Altitude (m.s.l.)	159.3	165.6	164.1	162.1
Slope (degrees)	2	1	8	3
Aspect	W	N	W	W
Surface water depth (cm)	1.0	3.6	3.6	5.6
Surface water pH	6.29	5.77	5.21	6.06
Surface water conductivity (µS/cm)	243	71	60	126
Ammonium (NH_4) (mg/l)	0.04	0.10	0.10	0.08
Nitrate (NO_3) (mg/l)	0.09	0.09	0.09	0.09
Orthophosphate (O-P) (mg/l)	0.025	0.005	0.005	0.012
Total phosphate (TP) (mg/l)	0.408	0.023	0.020	0.150
Peat depth (cm)	240	98	240	240
No. of shoots in 10 x 10 cm area	208	11	81	33
Hamatocaulis vernicosus cover (%)	55	1	27	35
Mean vegetation height (cm)	13.8	21.0	5.0	15.0
Max. vegetation height (cm)	31	34	16	33
Cover (Domin):				
Total cover	10	10	10	10
Grass cover	3	1	4	2
Rush cover	6	4	5	5
Sedge cover	5	7	1	7
Forb cover	5	5	9	4
Fern/ fern allies cover	0	2	0	0
Bryophyte cover	9	9	8	7
Litter cover	1	1	1	1

Largan More (continued)	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Bare soil cover	+	0	2	2
Surface water cover	5	2	2	4
Dung cover	2	2	0	0
Agrostis stolonifera	3	0	4	2
Anagallis tenella	4	0	0	0
Aneura pinguis	0	2	2	3
Aulacomnium palustre	1	0	0	0
Brachythecium rivulare	3	0	0	0
Bryum pseudotriquetrum	0	2	1	3
Calliergonella cuspidata	2	0	0	1
Caltha palustris	3	1	5	1
Cardamine pratensis	2	0	0	1
Carex demissa	0	0	0	1
Carex diandra	0	0	0	2
Carex dioica	4	0	0	0
Carex echinata	4	0	1	0
Carex lepidocarpa	3	1	0	1
Carex limosa	0	0	0	6
Carex nigra	0	7	0	0
Carex panicea	0	1	0	0
Chiloscyphus polyanthos	0	0	4	0
Cratoneuron filicinum	1	0	0	0
Dicranella palustris	6	0	0	0
Drosera rotundifolia	0	1	0	0
Epilobium palustre	1	0	5	0
Equisetum palustre	0	2	0	0
Galium palustre	1	0	0	0
Galium saxatile	0	0	1	0
Holcus lanatus	+	1	0	0
Juncus acutiflorus	5	0	1	2
Juncus bulbosus	6	4	5	5
Linum catharticum	1	0	0	0
Menyanthes trifoliata	2	2	0	1
Montia fontana	0	0	4	0
Pellia endiviifolia	2	2	2	3
Philonotis fontana	5	1	2	3
Potentilla erecta	0	0	0	1
Potentilla palustris	0	0	1	0
Potamogeton polygonifolius	4	5	7	4
Ranunculus flammula	3	0	2	1
Rhizomnium pseudopunctatum	4	0	0	1
Riccardia multifida	1	0	0	0
Sagina nodosa	2	0	5	0
Saxifraga hirculus	5	0	0	0
Scapania undulatum	0	3	0	1
Scorpidium cossonii	0	8	0	0
Sphagnum denticulatum	0	2	0	2
Sphagnum inundatum	0	5	3	0
Sphagnum palustre	0	1	0	0
Sphagnum papillosum	0	0	0	2
Sphagnum teres	0	0	4	0
Straminergon stramineum	0	2	0	0
Triglochin palustris	0	1	0	0
Utricularia intermedia	0	1	0	0
Viola palustris	0	0	0	1
Warnstorfia exannulata	2	4	2	1

Locality Survey Card for *Hamatocaulis vernicosus* at Largan More, Co. Mayo

Locality name: Largan More	**Surveyor:**	**Date:**
County (vice): (West) Mayo (H27)	**Aerial Photo ID:**	
SAC: Carrowmore Lake Complex (IE000476)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Largan More, Co. Mayo (Carrowmore Lake Complex SAC IE000476)

Population Assessment for Largan More, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 1,270 m²		
Percent cover (%)	Mean percentage cover within 3–5 plots	≥ 24%		
Density	Mean number of shoots in 10 x 10 cm area in 3–5 plots	≥ 65 shoots		
Population Assessment for Largan More			**Result**	**Status**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad				

Habitat for the Species Assessment for Largan More, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Area covered by the population (m²)	Multiply area of occurrence by mean percentage cover	≥ 305 m²		
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 3–5 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3–5 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 3–5 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3–5 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3–5 plots	Mean percent *C. cuspidata* cover should **not** exceed 60%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3–5 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Largan More			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Largan More, Co. Mayo

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Largan More	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

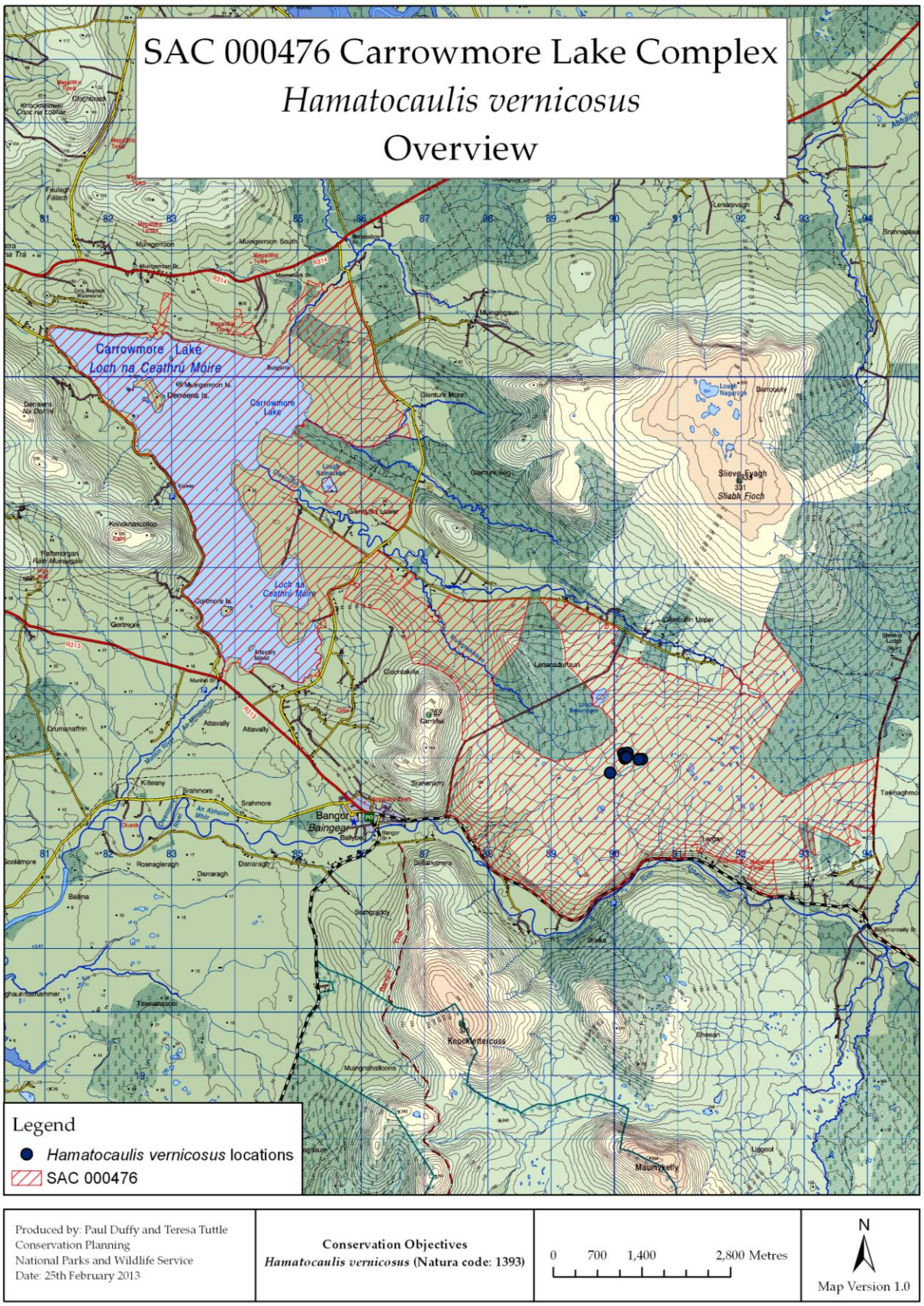
Overall Conservation Assessment for Largan More, Co. Mayo

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

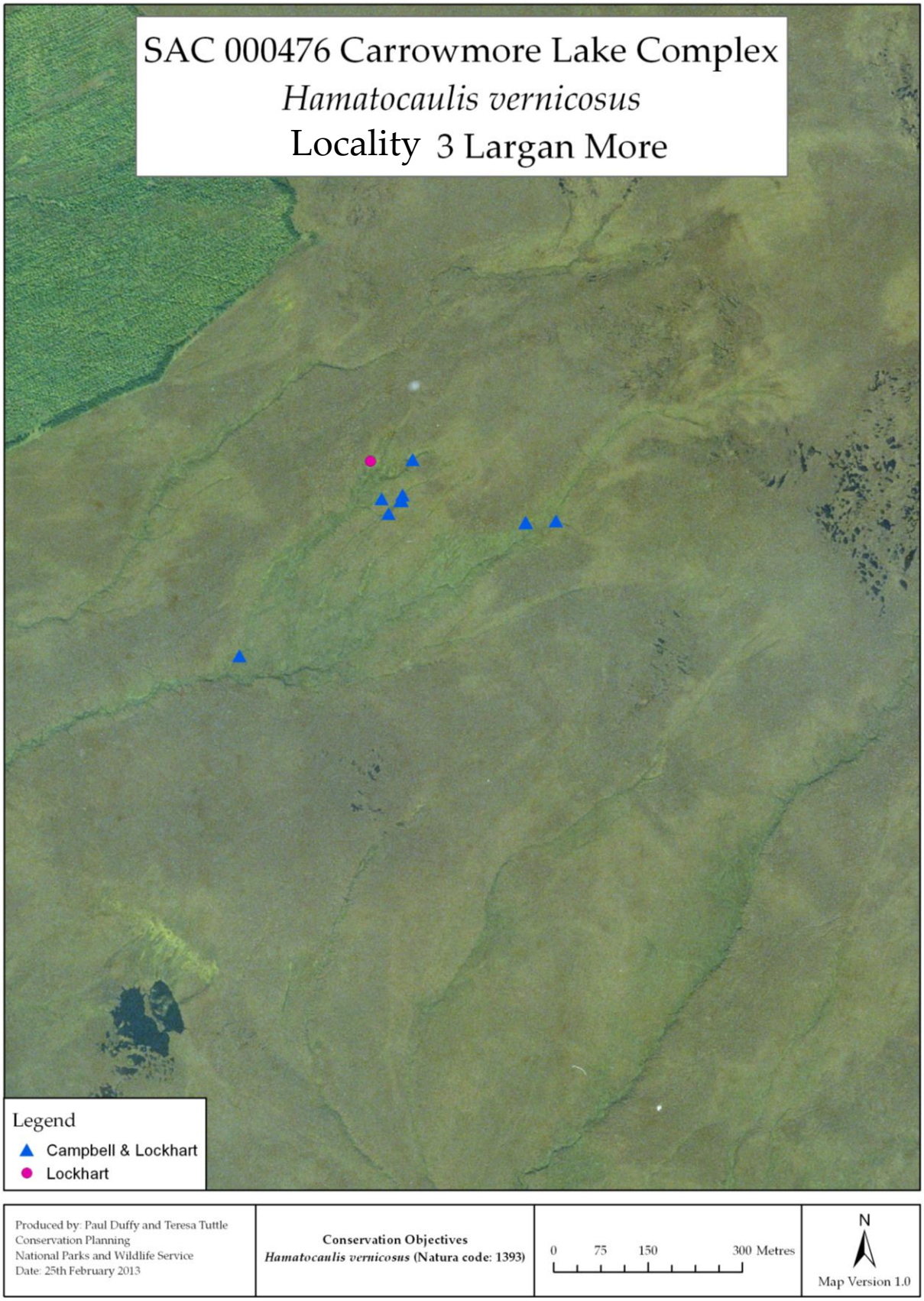
Determination of male and female shoot numbers from Largan More, Co. Mayo

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:



Discovery Series Map: 23



Aerial photographs: O1239-A & O1239-B (2005 orthos)

Owenduff/Nephin Complex SAC (IE000534)

Locality No. 4: Uggool, Co. Mayo; Grid ref. F927187

Field notes from Neil Lockhart (28 May 1999):

A small patch (< 20 x 20 cm) at the edge of more spring-dominated vegetation. i.e. *Cratoneuron* spp., *Warnstorfia exannulata*, etc. Only a very small patch seen, despite a careful search. This occurs at the edge of a swelling lawn of mosses, with *Saxifraga hirculus* about 5 m away. No threats at present, although the only other confirmed record in the flush to the south was destroyed by afforestation (i.e. Lough Nambrackkeagh).

Associates:

Aneura pinguis
Carex limosa
Cratoneuron filicinum
Juncus bulbosus
Montia fontana
Palustriella commutata
Philonotis fontana
Saxifraga hirculus
Scorpidium revolvens
Warnstorfia exannulata

Locality Survey Card for *Hamatocaulis vernicosus* at Uggool, Co. Mayo

Locality name: Uggool	**Surveyor:**	**Date:**
County (vice): (West) Mayo (H27)	**Aerial Photo ID:**	
SAC: Owenduff/Nephin Complex (IE000534)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N ,S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Uggool, Co. Mayo (Owenduff/Nephin Complex SAC IE000534)

Population Assessment for Uggool, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 0.8 m^2		
Percent cover (%)	Mean percentage cover within 1–3 plots	NA		NA
Density	Mean number of shoots in 10 x 10 cm area in 1–3 plots	NA		NA

Population Assessment for Uggool	Population Status	Result (✓)
1 pass	Favourable	
0 passes & Habitat for the Species Assessment is Favourable	Favourable	
0 passes & Habitat for the Species Assessment is Unfavourable – Inadequate	Unfavourable – Inadequate	
0 passes & Habitat for the Species Assessment is Unfavourable – Bad	Unfavourable – Bad	

Determination of male and female shoot numbers from Uggool, Co. Mayo

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments

Habitat for the Species Assessment for Uggool, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 1–3 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 1–3 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 1–3 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 1–3 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 1–3 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 1–3 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Uggool			**Result**	**Status**
7 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Uggool, Co. Mayo

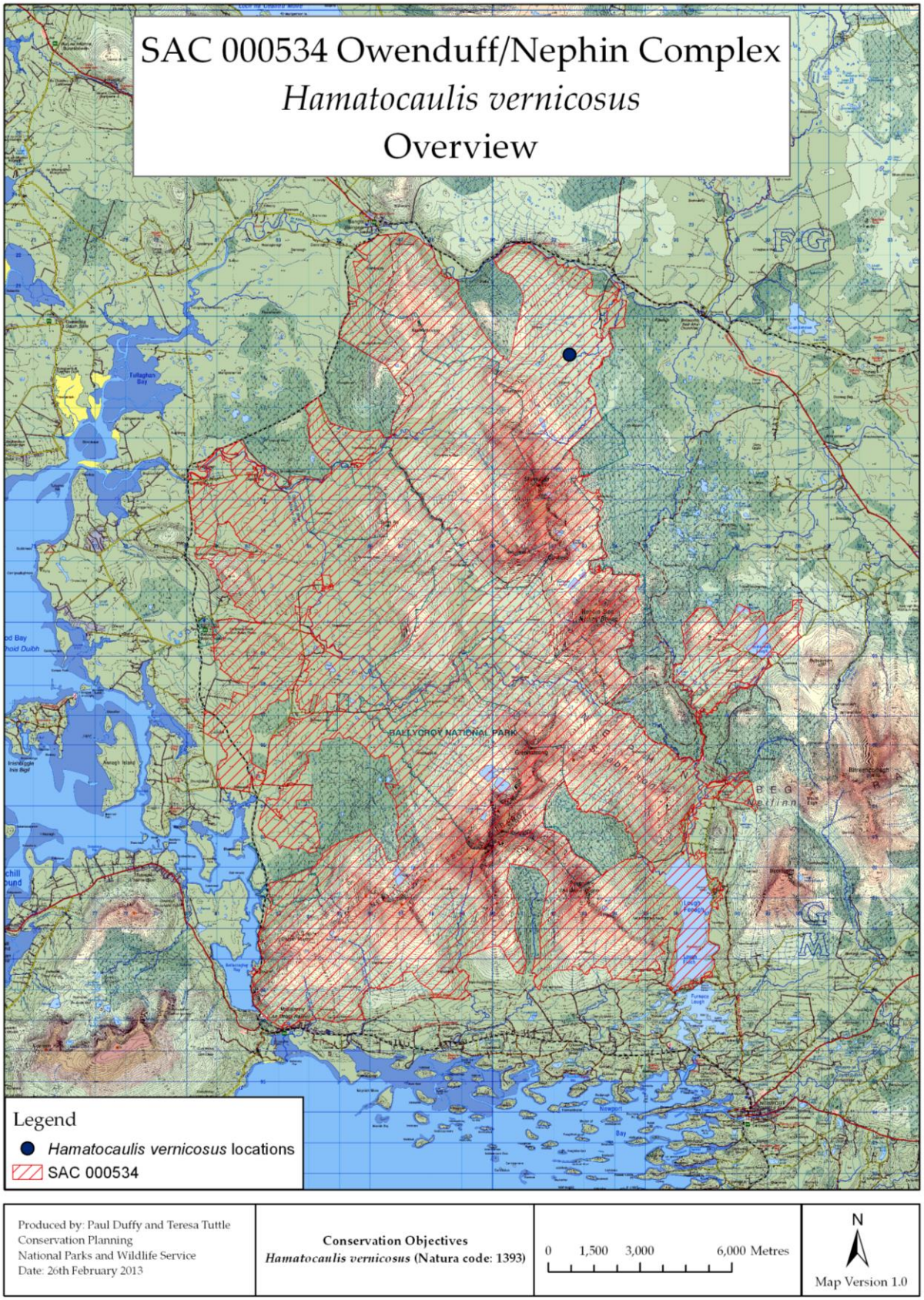
Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Uggool	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

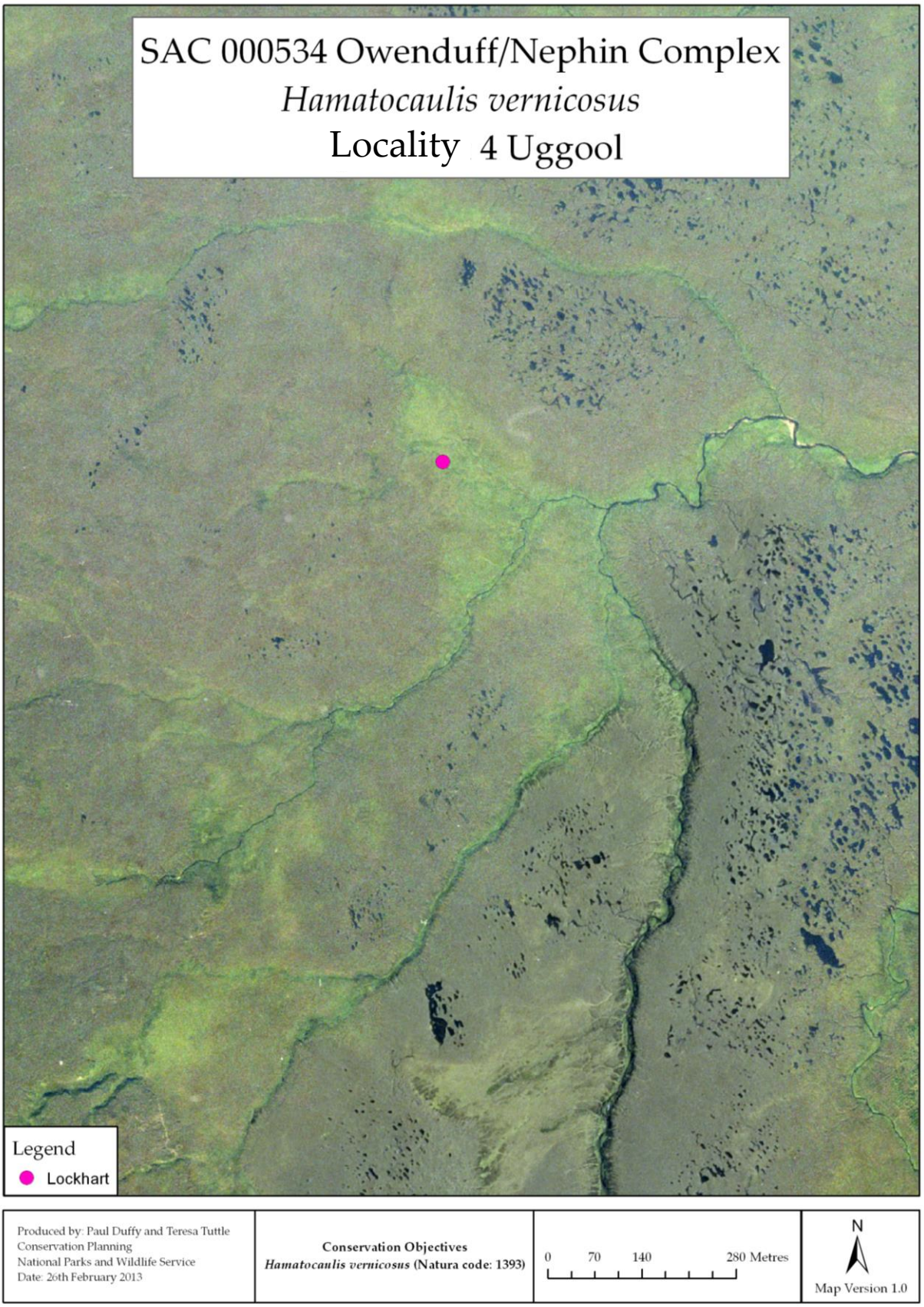
*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Overall Conservation Assessment for Uggool, Co. Mayo

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	



Discovery Series Map: 23



Aerial photograph: O1378-A (2005 Orthos)

Lough Carra/Mask Complex SAC (IE001774)

Locality No. 5: Owenbrin, Lough Mask, Co. Mayo; Grid ref. M062628

Field notes from Neil Lockhart (28 March 2000):

H. vernicosus forming a more or less pure lawn over an area 10 x 20 m and mixed with *Calliergonella cuspidata* around the edges of open lawns in a *Juncus articulatus* sward. Extensive in patches over a wider area of *ca.* 1 ha. This is most likely the location of Jury *et al.*'s record of *H. vernicosus*. A report that the habitat has been destroyed (Mhic Daeid, 1995) is clearly not true. Main threat would be from land reclamation/re-seeding or land drainage. Continued management of light grazing is beneficial. Prospects for survival are good, but a watch needs to be kept on agricultural improvements.

Associates:

Agrostis stolonifera
Calliergonella cuspidata
Festuca rubra
Juncus articulatus
Juncus bulbosus
Ranunculus flammula
Sphagnum auriculatum
Warnstorfia exannulata

Field notes from Christina Campbell & Neil Lockhart (6 August 2009 [with Eoin McGreal], 26 August 2010 & 17 February 2011):

Four plots (2 x 2 m) were recorded at this population. Plot 1 was situated in an area of waterlogged silty loam that did not appear grazed at all. An algal scum was visible when the location was revisited in February 2010. Plot 2 was poached and grazed when recorded in August 2009 and it appeared that the area had been mown, removing a lot of litter and rushes, and keeping the area open. In August 2010, poaching by cattle was evident at this location and there were tractor marks through the plot that had compressed the vegetation. The location was very much drier and *Fossombronia* sp. was observed growing on a cattle hoof print beside plot 2. Plot 3 was recorded in a sedge meadow. Plot 4 was recorded in an area that appeared grazed. The water level in August 2010 was very low, in some cases *circa* 40 cm below the surface level of the soil. When the population was re-visited in February 2011 the population was inundated (mean water depth was 16.6 cm across the four plots).

Owenbrin, Lough Mask	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Year	2009	2009	2010	2010
Altitude (m.s.l)	15.76	18.74	21.28	17.97
Slope (degrees)	0	0	0	4
Aspect	-	-	-	N
Surface water depth (cm)	6.4	8.8	-40.0	-40.0
Surface water pH	5.11	5.36	5.55	5.40
Surface water conductivity (µS/cm)	59.0	70.5	26.0	23.5
Ammonium (NH_4) (mg/l)	0.10	0.05	0.04	0.06

Owenbrin, Lough Mask (continued)	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Nitrate (NO_3) (mg/l)	0.09	5.35	0.09	1.84
Orthophosphate (O-P) (mg/l)	0.005	0.005	0.005	0.005
Total phosphate (TP) (mg/l)	0.030	0.032	0.037	0.033
Peat depth (cm)	36	25	29	9
No. of shoots in 10 x 10 cm area	82	243	234	194
Hamatocaulis vernicosus cover (%)	15	91	60	40
Mean vegetation height (cm)	37.4	36.3	26.0	28.6
Max. vegetation height (cm)	53	56	46	46
Cover (Domin)				
Total cover	10	10	10	10
Grass cover	4	4	4	5
Rush cover	5	8	4	6
Sedge cover	9	5	9	5
Forb cover	6	4	4	4
Bryophyte cover	5	9	8	8
Litter cover	2	2	2	5
Bare soil cover	0	1	0	2
Surface water cover	8	10	0	0
Associated species cover (Domin):				
Achillea ptarmica	0	+	0	0
Agrostis stolonifera	4	4	4	3
Calliergonella cuspidata	2	1	2	1
Calliergon giganteum	1	2	0	0
Cardamine pratensis	1	1	1	1
Carex echinata	1	2	0	4
Carex nigra	8	5	9	4
Carex panicea	2	1	0	2
Climacium dendroides	0	0	2	0
Epilobium palustre	0	0	3	2
Festuca rubra	3	1	4	5
Galium palustre	1	+	0	0
Galium saxatile	0	0	1	1
Hydrocotyle vulgaris	4	3	4	4
Juncus acutiflorus	4	8	1	5
Juncus bulbosus	3	4	3	3
Juncus effusus	0	+	0	1
Leontodon autumnalis	0	0	2	0
Lotus uliginosum	1	0	1	0
Mentha aquatica	2	0	0	0
Nardus stricta	2	0	2	0
Potentilla anserina	+	0	0	0
Potentilla erecta	0	0	1	1
Ranunculus flammula	4	3	3	2
Ranunculus repens	2	0	1	0
Sphagnum fallax	0	0	0	2
Sphagnum inundatum	0	0	0	2
Sphagnum palustre	0	1	0	0
Sphagnum squarrosum	1	0	0	0
Veronica scutellata	1	2	0	0
Warnstorfia exannulata	2	3	0	6

Locality Survey Card for *Hamatocaulis vernicosus* at Owenbrin, Co. Mayo

Locality name: Owenbrin	**Surveyor:**	**Date:**
County (vice): (West) Mayo (H16)	**Aerial Photo ID:**	
SAC: Lough Carra/Mask Complex (IE001774)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Owenbrin, Co. Mayo (Lough Carra/Mask Complex SAC IE001774)

Population Assessment for Owenbrin, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 9,010 m²		
Percent cover (%)	Mean percentage cover within 3–5 plots	≥ 40%		
Density	Mean number of shoots in 10 x 10 cm area in 3–5 plots	≥ 150 shoots		
Population Assessment for Owenbrin			**Result**	**Status**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad				

Habitat for the Species Assessment for Owenbrin, Co. Mayo

Indicator	Method of assessment	Target	Result	Pass/Fail
Area covered by the population (m²)	Multiply area of occurrence by mean percentage cover	≥ 3600 m²		
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 3-5 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3-5 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 3-5 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3-5 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3-5 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3-5 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Owenbrin			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Owenbrin, Co. Mayo

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Owenbrin	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Overall Conservation Assessment for Owenbrin, Co. Mayo

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

Determination of male and female shoot numbers from Owenbrin, Co. Mayo

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:

Discovery Series Map: 38

Aerial photograph: O2530-D (2005 Orthos)

Lough Corrib SAC (000297)

Locality No. 6: NW of Gortachalla Lough, Co. Galway; Grid ref. M225375

Field notes from David Holyoak (25 June 2004; Holyoak 2004):

Extensive intermediate fen NW of Gortachalla Lough. Area bounded to the west by acid bog, with a variety of interesting transitional habitats along the boundary. Abundant *Calliergon trifarium*, recorded almost continuously from M22473740 to M22493763. Also (M22493763) *C. trifarium* growing among unshaded *Scorpidium scorpioides* and sparser *C. stellatum* in a mat in shallow water of intermediate fen, with rather sparse cover of *Carex lasiocarpa*, with *Eriophorum angustifolium, Carex viridula* ssp. *brachyrrhyncha, Equisetum palustre, Mentha aquatica, Ranunculus flammula, Carex panicea, Eleocharis multicaulis*.

Strong population of *H. vernicosus* at M22523753 at base of sparse sedges in unshaded wet intermediate fen. A varied flora of vascular plants in the fen and on the bog close by included *Rhynchospora fusca*.

Field notes from Neil Lockhart & David Holyoak (5 July 2004):

Vegetation is a tall (to 50 cm) sward of mainly *Carex nigra*, with lots of *Holcus* and *Equisetum palustre*. *H. vernicosus* is dominant in the moss layer over several 10s of m². Widespread around the margins of this fen - a very large and significant population in the national context.

Associates:

Anagallis tenella
Briza media
Calliergon giganteum
Calliergonella cuspidata
Campylium stellatum
Carex hostiana
Carex nigra
Carex panicea
Carex pulicaris
Cirsium palustre
Cynosurus cristatus
Eleocharis multicaulis
Eleocharis palustris
Eleocharis quinqueflora
Equisetum palustre
Eriophorum angustifolium
Galium palustre
Holcus lanatus
Hydrocotyle vulgaris
Juncus acutiflorus
Juncus bulbosus
Juncus conglomeratus
Juncus effusus
Lythrum salicaria
Mentha aquatica
Myosotis laxa
Poa trivialis
Ranunculus flammula
Senecio aquaticus
Succisa pratensis
Trifolium repens
Triglochin palustris

Field notes from Christina Campbell & Neil Lockhart (7 August 2009 & 27 August 2010 [with Rebecca Teesdale]):

The site at NW of Gortachalla Lough occurs in a former lake basin where acid bog and transitional fen habitats overlie limestone. *H. vernicosus* occurs here to the east of the bog area, in areas of transitional fen, with a very deep root-mat. The Red Listed moss *Pseudocalliergon trifarium*, which is Vulnerable in Ireland, also occurs here and, like *H. vernicosus*, is a plant of lowland fens, including intermediate ones with low calcium levels. Light grazing occurs at the locality, mainly by rabbits. Four plots (2 x 2 m) were recorded at this population. Plot 1 was recorded in transition mire to the south of the area of occupancy. Plot 2 was very wet with a high cover of *Hippuris vulgaris* and *Equisetum palustre*. Plots 3 and 4 were recorded in transition mire.

NW of Gortachalla Lough	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Year	2009	2009	2010	2010
Altitude (m.s.l.)	6.54	13.92	8.49	9.05
Slope (degrees)	0	0	0	0
Aspect	0	0	0	0
Surface water depth (cm)	6.8	14.2	-1.0	1.5
Surface water pH	5.44	5.55	5.89	5.65
Surface water conductivity (µS/cm)	105.0	135.5	133.0	78.0
Ammonium (NH_4) (mg/l)	0.07	0.07	0.06	0.07
Nitrate (NO_3) (mg/l)	0.09	0.09	0.15	0.11
Orthophosphate (O-P) (mg/l)	0.005	0.005	0.005	0.005
Total phosphate (TP) (mg/l)	0.118	0.028	0.019	0.055
Peat depth (cm)	20	240	54	30.5
No. of shoots in 10 x 10 cm area	873	491	229	54
Hamatocaulis vernicosus cover (%)	85	67	85	8
Mean vegetation height (cm)	60.4	50.7	23.8	25
Max. vegetation height (cm)	69	87	62	88
Cover (Domin):				
Total cover	10	10	10	10
Shrub cover	0	0	0	1
Grass cover	4	2	0	4
Rush cover	4	4	3	3
Sedge cover	7	3	8	8
Forb cover	5	8	2	3
Fern/ fern allies cover	0	7	1	1
Bryophyte cover	9	10	9	7
Litter cover	6	3	5	6
Surface water cover	4	4	0	+
Associated species cover (Domin):				
Agrostis stolonifera	1	2	0	0
Anthoxanthum odoratum	2	0	0	0
Bryum pseudotriquetrum	0	0	2	1
Calliergonella cuspidata	3	0	0	0
Calliergon giganteum	4	6	2	3
Campylium stellatum	0	0	0	2
Cardamine pratensis	+	1	0	0
Carex echinata	0	2	8	7
Carex nigra	7	0	0	0
Carex panicea	2	0	3	4
Carex pulicaris	1	0	0	0

NW of Gortachalla Lough (continued) **Associated species cover (Domin):**	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Cirsium dissectum	+	0	1	0
Eleocharis quinqueflora	2	0	3	3
Equisetum fluviatile	0	0	0	1
Equisetum palustre	0	7	1	1
Eriophorum angustifolium	4	3	2	4
Galium palustre	+	1	0	0
Hippuris vulgaris	0	6	0	0
Holcus lanatus	1	0	0	0
Hydrocotyle vulgaris	4	6	0	0
Hylocomium splendens	3	0	0	0
Juncus acutiflorus	4	4	1	0
Juncus bulbosus	0	0	1	3
Juncus effusus	1	0	0	0
Lythrum salicaria	1	1	0	0
Mentha aquatica	4	5	0	1
Molinia caerulea	4	1	0	4
Myosotis laxa	0	2	0	0
Pedicularis palustris	0	5	2	2
Potamogeton polygonifolius	0	0	0	1
Ranunculus flammula	1	1	0	2
Salix cinerea	0	0	0	1
Schoenus nigricans	0	0	2	0
Scorpidium revolvens	0	0	3	2
Scorpidium scorpioides	0	0	3	5
Succisa pratensis	1	0	0	1
Triglochin palustris	0	0	0	2
Utricularia vulgaris	0	1	0	0
Veronica scutellata	1	2	0	0
Warnstorfia exannulata	0	4	0	0

Locality Survey Card for *Hamatocaulis vernicosus* at NW of Gortachalla Lough, Co. Galway

Locality name: NW of Gortachalla Lough	**Surveyor:**	**Date:**
County (vice): (West) Galway (H16)	**Aerial Photo ID:**	
SAC: Lough Corrib SAC (IE000297)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of NW of Gortachalla Lough, Co. Galway (Lough Corrib SAC IE000297)

Population Assessment for NW of Gortachalla Lough, Co. Galway

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 4,960 m²		
Percent cover (%)	Mean percentage cover within 3–5 plots	≥ 45%		
Density	Mean number of shoots in 10 x 10 cm area in 3–5 plots	≥ 325 shoots		
Population Assessment for NW of Gortachalla Lough			**Result**	**Status**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad				

Habitat for the Species Assessment for NW of Gortachalla Lough, Co. Galway

Indicator	Method of assessment	Target	Result	Pass/Fail
Area covered by the population (m²)	Multiply area of occurrence by mean percentage cover	≥ 2,230 m²		
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 3-5 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3-5 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 3-5 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3-5 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3-5 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3-5 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Meentygrannagh:			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for NW of Gortachalla Lough, Co. Galway

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for NW of Gortachalla Lough	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Overall Conservation Assessment for NW of Gortachalla Lough, Co. Galway

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

Determination of male and female shoot numbers from NW of Gortachalla Lough, Co. Galway

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:

Discovery Series map: 45

Aerial photographs: O1349-B (2005 Orthos)

Scragh Bog SAC (IE000692)

Locality No. 7: Scragh Bog (Portnashangan), Co. Westmeath; Grid ref. N423589

Field notes from Neil Lockhart (13 July 2004):

Tall *Carex appropinquata* sedge meadow. Very extensive population of *H. vernicosus* covering hectares of the fen and associated with the *C. appropinquata*/*C. lasiocarpa* zone. Possibly the largest population that I've seen.

Vegetation ungrazed, *ca.* 40 cm tall.
Herbs 100%
Bryophytes 60%

Associates (with Braun-Blanquet cover):

[*Hamatocaulis vernicosus*	3]	*Filipendula ulmaria*	2
Agrostis stolonifera	2	*Galium palustre*	1
Calliergon giganteum	2	*Galium uliginosum*	1
Calliergonella cuspidata	1	*Holcus lanatus*	1
Caltha palustris	2	*Lychnis flos-cuculi*	1
Carex appropinquata	2	*Menyanthes trifoliata*	4
Carex lasiocarpa	1	*Plagiomnium* sp.	1
Climacium dendroides	1	*Potentilla palustris*	2
Epilobium palustre	1	*Trifolium repens*	+
Equisetum fluviatile	1	*Valeriana officinalis*	1

Field notes from Nick Hodgetts, David Holyoak, Naomi Kingston & Neil Lockhart (10 September 2007):

H. vernicosus growing in shallow water in fen, amongst sedges and herbs and large patches at base of *Carex* and *Menyanthes* in wet fen. Locally plentiful, with patches extending over several m^2, e.g. at N4247/5900.

Associates:

Bryum pseudotriquetrum
Calliergonella cuspidata
Calliergon giganteum
Carex spp.
Climacium dendroides
Menyanthes trifoliata

Field notes from Christina Campbell, Neil Lockhart & Noeleen Smyth (26 August 2009 & 1 & 8 September 2010):

Seven plots (2 x 2 m) containing *H. vernicosus* were recorded at the population site, three in August 2009 and four in August 2010. All plots were recorded on a floating scraw with a peat depth of over 240 cm. (The maximum depth of peat at Scragh Bog found by O'Connell (1980) was 8.7 m.) Plot 1 was recorded in the north-eastern side of the fen in the vicinity of a *Salix aurita* shrub. Plot 2 was in the centre of the fen; *Calluna vulgaris* and *Erica tetralix* were recorded within it. Plot 3 was recorded near the boardwalk at the north-east end and contained *Salix cinerea* subsp. *oleifolia*. Plot 4 had the highest cover (Domin 7) of *Vaccinium oxycoccus* and also contained *Erica tetralix*. The highest cover of *Betula pubescens* was recorded in plot 5; plot 6 was recorded in more open conditions and had the highest cover of *H. vernicosus*. Plot 7 was also recorded near the centre of the fen, but not as many species of acidic bog were present as in Plot 2.

Scragh Bog	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**	**Plot 7**
Year	2009	2009	2009	2010	2010	2010	2010
Altitude (m.s.l)	108.41	107.7	104.89	101.71	106.68	106.46	103.99
Slope (degrees)	0	0	0	0	0	0	0
Aspect	0	0	0	0	0	0	0
Surface water depth (cm)	13.5	27.0	14.3	7.1	17.8	20.0	19.8
Surface water pH	6.50	6.48	6.77	6.34	6.55	6.54	6.52
Surface water conductivity (µS/cm)	405.5	324.0	526.0	278.5	306.5	433.0	384.5
Ammonium (NH_4) (mg/l)	0.10	0.02	0.09	6.00	0.02	0.04	0.01
Nitrate (NO_3) (mg/l)	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Orthophosphate (O-P) (mg/l)	0.031	0.005	0.021	0.083	0.036	0.005	0.005
Total phosphate (TP) (mg/l)	0.067	0.015	0.144	0.109	0.059	0.017	0.012
Peat depth (cm)	240	240	240	240	240	240	240
No. of shoots in 10 x 10 cm area	169	20	421	103	116	384	56
Hamatocaulis vernicosus cover (%)	20	3	12	8	70	85	3
Mean vegetation height (cm)	65.0	82.0	79.0	94.3	52.8	51.0	62.8
Max. vegetation height (cm)	95	130	220	114	225	75	118
Cover (Domin):							
Total cover	10	10	10	10	9	10	9
Tree cover	0	2	4	6	6	0	4
Shrub cover	5	6	0	7	4	0	4
Grass cover	5	4	5	3	4	0	0
Rush cover	0	0	4	8	5	1	1
Sedge cover	8	7	6	7	8	9	8
Forb cover	8	5	7	5	7	7	5
Fern/ fern allies cover	3	1	4	0	1	0	0
Bryophyte cover	9	9	8	10	9	10	9
Litter cover	4	4	3	5	2	2	2
Bare soil cover	0	0	0	5	0	0	0
Surface water cover	3	5	6	3	7	7	6
Associated spp. cover (Domin):							
Agrostis stolonifera	4	0	4	3	1	0	0
Andromeda polifolia	0	0	0	1	0	0	0
Aneura pinguis	0	0	0	0	0	0	3
Angelica sylvestris	1	0	1	1	1	0	4
Apium nodiflorum	0	0	0	0	0	0	1
Aulacomnium palustre	4	5	0	3	0	0	0
Betula pubescens	0	2	1	0	5	0	0
Calliergonella cuspidata	7	2	8	9	9	8	5

Scragh Bog (continued) **Associated spp. cover (Domin):**	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**	**Plot 5**	**Plot 6**	**Plot 7**
Calliergon giganteum	2	4	4	6	5	5	8
Calypogeia muelleriana	0	2	0	0	0	0	0
Caltha palustris	0	0	0	0	0	2	2
Calluna vulgaris	0	4	0	0	0	0	0
Campylium stellatum	0	4	0	0	0	0	4
Cardamine pratensis	0	0	+	1	0	0	0
Carex appropinquata	5	0	5	0	0	0	0
Carex echinata	3	0	0	0	0	0	0
Carex lasiocarpa	5	7	4	7	8	8	7
Carex limosa	4	0	0	0	2	4	2
Carex nigra	0	0	1	0	0	0	0
Carex rostrata	0	0	0	0	0	2	0
Climacium dendroides	4	0	2	0	0	0	0
Drosera rotundifolia	0	3	0	0	0	0	0
Epilobium palustre	3	0	2	1	1	0	0
Equisetum fluviatile	3	1	4	0	1	0	0
Eriophorum angustifolium	0	0	0	1	0	1	1
Erica tetralix	0	4	0	1	0	0	0
Festuca rubra	4	0	0	0	0	0	0
Filipendula ulmaria	2	0	4	0	0	0	0
Galium aparine	0	0	0	1	0	0	0
Galium palustre	0	0	3	2	4	1	0
Galium uliginosum	4	0	0	0	0	0	0
Holcus lanatus	3	0	2	0	4	0	0
Hydrocotyle vulgaris	0	0	0	0	0	2	0
Hylocomium splendens	0	2	0	0	0	0	0
Juncus acutiflorus	0	0	4	8	5	1	1
Lemna minor	0	0	3	0	0	0	0
Lemna trisulca	0	0	2	0	0	0	0
Lychnis flos-cuculi	6	0	0	0	0	0	0
Mentha aquatica	+	0	2	2	5	1	1
Menyanthes trifoliata	8	5	5	4	6	7	5
Molinia caerulea	0	4	0	0	0	0	0
Parnassia palustris	0	0	0	0	0	0	1
Pedicularis palustris	0	0	0	4	0	0	0
Plagiomnium elatum	1	0	0	0	0	0	0
Poa trivialis	1	0	3	0	0	0	0
Polytrichum strictum	0	5	0	0	0	0	0
Potentilla erecta	0	1	0	0	0	0	0
Potentilla palustris	6	0	4	3	4	0	0
Salix cinerea subsp. *oleifolia*	0	0	4	6	5	0	4
Salix repens	0	3	0	0	1	0	1
Schoenus nigricans	0	2	0	1	0	0	2
Scorpidium cossonii	0	4	0	0	0	0	0
Scorpidium revolvens	0	4	0	0	0	0	4
Scorpidium scorpioides	0	3	0	0	0	0	6
Sphagnum subnitens	0	7	0	0	0	0	0
Succisa pratensis	2	3	0	4	2	0	0
Trifolium repens	2	0	0	0	0	0	0
Vaccinium oxycoccus	5	4	0	7	4	0	4
Valeriana officinalis	1	0	0	1	3	0	0
Veronica scutellata	0	0	+	0	1	0	0
Viola palustris	0	0	0	0	1	0	0

Locality Survey Card for *Hamatocaulis vernicosus* at Scragh Bog, Co. Westmeath

Locality name: Scragh Bog	**Surveyor:**	**Date:**
County (vice): Westmeath (H23)	**Aerial Photo ID:**	
SAC: Scragh Bog (IE000692)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Scragh Bog, Co. Westmeath (Scragh Bog SAC IE000692)

Population Assessment for Scragh Bog, Co. Westmeath

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 47,550 m²		
Percent cover (%)	Mean percentage cover within 3–5 plots	≥ 20%		
Density	Mean number of shoots in 10 x 10 cm area in 3–5 plots	≥ 145 shoots		
Population Assessment for Scragh Bog			**Result**	**Status**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad				

Habitat for the Species Assessment for Scragh Bog, Co. Westmeath

Indicator	Method of assessment	Target	Result	Pass/Fail
Area covered by the population (m²)	Multiply area of occurrence by mean percentage cover	≥ 9,510 m²		
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 3–5 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3–5 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 3–5 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3–5 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3–5 plots	Mean percent *C. cuspidata* cover should **not** exceed 60%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3–5 plots	Mean vegetation height should **not** exceed 80 cm		
Habitat for the Species Assessment for Scragh Bog			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Scragh Bog, Co. Westmeath

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m^2; 11–50 m^2; 51–100 m^2; > 100 m^2)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Scragh Bog	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Overall Conservation Assessment for Scragh Bog, Co. Westmeath

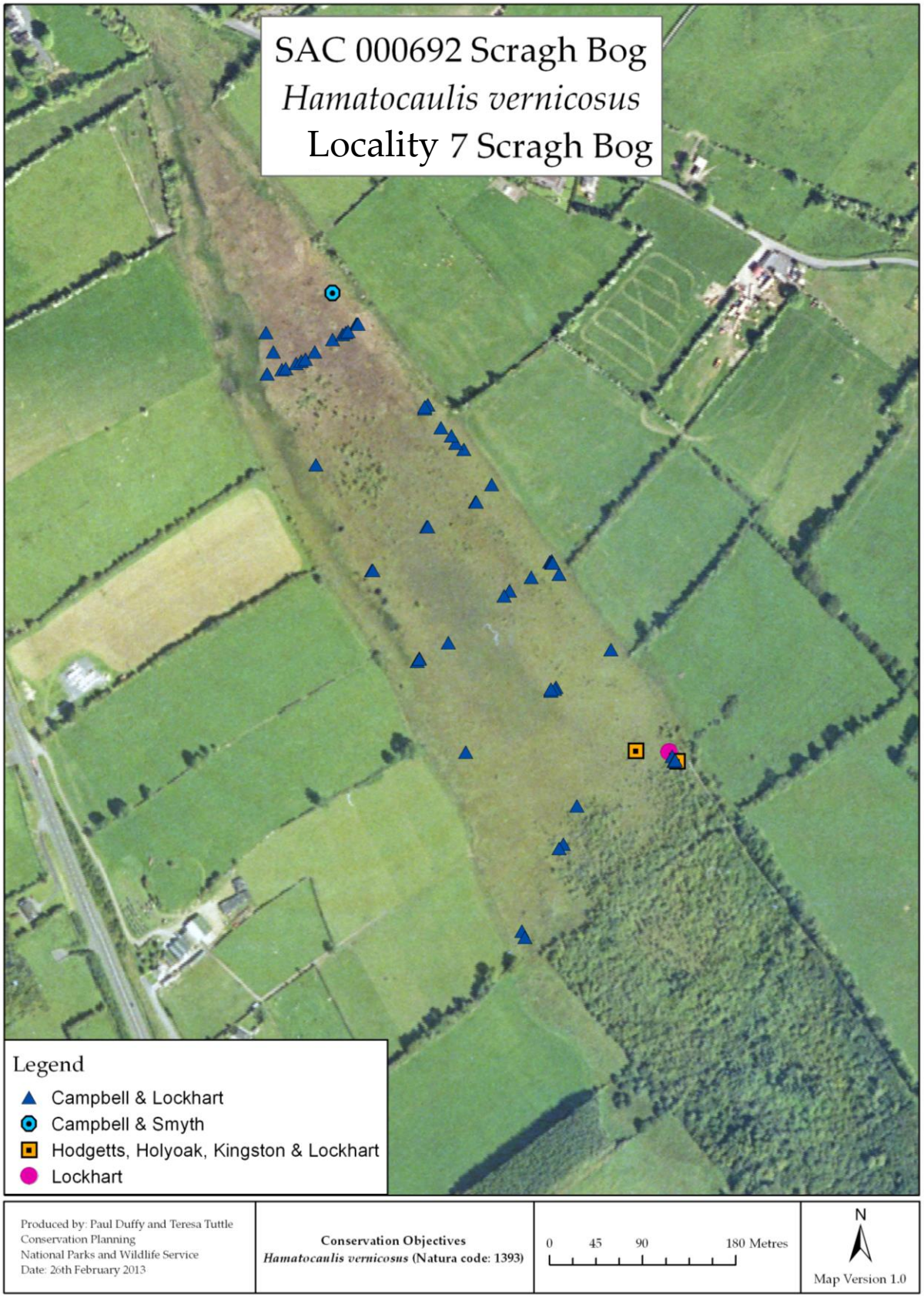
Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

Determination of male and female shoot numbers from Scragh Bog, Co. Westmeath

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:

Discovery Series map: 41



Aerial photographs: O2631-D & O2701-B (2005 Orthos)

Comeragh Mountains SAC (001952)

Locality No. 8a: Below Sgilloge Loughs, Co. Waterford; Grid ref. S286123

Field notes from Neil Lockhart (16 September 1998):

H. vernicosus mixed with *Warnstorfia exannulata, Scorpidium revolvens* and other mosses at the edge of a large *Carex paniculata/Juncus effusus* flush extending for several hundred metres on the sloping bog below Sgilloge Loughs. Possibly the location of Appleyard's record in the National Museum of Wales (NMW) from 1966. No threats at present. The area is only moderately grazed as evidenced by the vigorous growth of *Calluna* in the general vicinity.

Field notes from Nick Hodgetts (12 September 2007):

H. vernicosus in flushes on north-facing slopes amongst wet heath, 320-370 m alt. Abundant over a large area, with many thousand shoots over several hectares. Westernmost ('new') colony in patch *ca.* 7 x 3 cm in diameter. No immediate threats identified; forestry and overgrazing are potential threats; sheep-grazed at present, but not too heavily.

Associates:

Brachythecium rivulare

Calliergonella cuspidata

Carex echinata

Carex lepidocarpa

Carex paniculata

Chrysosplenium oppositifolium

Juncus acutiflorus

Juncus effusus

Rhytidiadelphus squarrosus

Scorpidium revolvens

Sphagnum contortum

Warnstorfia exannulata

Field notes from Christina Campbell & Neil Lockhart (11 August 2009 & 30 August 2010):

Four plots (2 x 2 m) were recorded from below Sgilloge Loughs. Plot 1 was recorded in an open lawn amongst *Carex paniculata* tussocks on aqueous peat. Plot 2 was taken in a moss-dominated lawn, with some tussocks of *Festuca ovina* present. Plot 3 was located in a similar flushed area with a perceptible flow through the plot. Plot 4 was recorded on a swelling, moss-dominated springhead in an open lawn, again amongst *C. paniculata* tussocks, beside a stream. There was evidence of low grazing at this locality.

Below Sgilloge Loughs	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Year	2010	2010	2010	2010
Altitude (m.s.l)	322.0	331.9	330.2	298.3
Slope (degrees)	6	8	4	1
Aspect	1	1	1	1
Surface water depth (cm)	-3.5	-6.0	1.3	2.0
Surface water pH	5.79	5.98	6.07	6.63
Surface water conductivity (μS/cm)	119.5	162.5	81.0	210.5
Ammonium (NH_4) (mg/l)	0.06	0.02	0.01	0.02
Nitrate (NO_3) (mg/l)	0.11	0.20	0.09	0.09
Orthophosphate (O-P) (mg/l)	0.005	0.005	0.005	0.005
Total phosphate (TP) (mg/l)	0.017	0.033	0.011	0.014
Peat depth (cm)	151	94.5	90	36
No. of shoots in 10 x 10 cm area	374	161	35	74
Hamatocaulis vernicosus cover (%)	85	18	14	8.5
Mean vegetation height (cm)	23.0	38.0	23.0	7.7
Max. vegetation height (cm)	49	111	70	12
Cover (Domin):				
Total cover	10	10	9	10
Shrub cover	0	1	0	0
Grass cover	2	5	3	4
Rush cover	6	5	4	4
Sedge cover	5	8	7	7
Forb cover	5	3	7	7
Bryophyte cover	10	7	8	8
Litter cover	1	2	4	4
Bare soil cover	0	4	4	0
Surface water cover	0	0	1	1
Dung cover	0	0	0	1
Associated species cover (Domin):				
Agrostis stolonifera	0	0	3	4
Anagallis tenella	0	1	4	3
Angelica sylvestris	0	0	1	0
Anthoxanthum odoratum	1	2	2	0
Brachythecium rivulare	0	1	1	1
Bryum pseudotriquetrum	0	1	3	3
Calliergonella cuspidata	3	4	4	4
Calliergon giganteum	0	0	0	5
Calypogeia muelleriana	1	0	0	0
Calluna vulgaris	0	1	0	0
Campylium stellatum	0	2	0	0
Cardamine pratensis	2	1	0	2
Carex demissa	0	0	1	0
Carex dioica	4	1	1	0
Carex echinata	5	3	0	1
Carex flacca	0	5	0	0

Below Sgilloge Loughs (continued) **Associated species cover (Domin):**	**Plot 1**	**Plot 2**	**Plot 3**	**Plot 4**
Carex nigra	0	0	4	0
Carex panicea	0	3	1	2
Carex paniculata	0	5	4	7
Carex pulicaris	1	4	0	0
Carex rostrata	0	0	6	0
Cerastium fontanum	1	0	0	1
Chrysosplenium oppositifolium	0	0	0	4
Cirsium palustre	0	1	0	0
Cratoneuron filicinum	0	0	0	2
Cynosuros cristatus	0	1	1	0
Dactylorhiza maculata	0	0	0	4
Dicranella palustris	0	2	2	0
Epilobium palustre	0	1	0	0
Eriophorum angustifolium	3	3	2	0
Festuca ovina	0	4	0	0
Festuca rubra	2	0	0	1
Galium palustre	1	0	1	1
Holcus lanatus	2	1	1	1
Hydrocotyle vulgaris	4	0	6	5
Hylocomium splendens	0	1	0	0
Isolepis setacea	1	0	0	0
Juncus acutiflorus	6	5	4	4
Juncus bulbosus	1	2	1	1
Leontodon autumnalis	2	1	2	0
Lysimachia nemorum	1	0	0	0
Marchantia polymorpha	0	0	0	4
Mentha aquatica	0	0	0	4
Montia fontana	0	0	0	4
Palustriella commutata	0	0	0	5
Pedicularis palustris	1	2	5	0
Pellia endiviifolia	0	3	1	0
Philonotis fontana	3	4	0	5
Plantago lanceolata	1	0	0	0
Plagiomnium undulatum	1	2	0	0
Potentilla erecta	0	1	1	0
Potamogeton polygonifolius	0	0	5	0
Pseudoscleropodium purum	0	4	0	0
Ranunculus ficaria	0	1	0	0
Ranunculus flammula	3	1	3	1
Ranunculus repens	3	0	0	0
Rhizomnium pseudopunctatum	2	0	0	0
Rhytidiadelphus squarrosus	1	4	0	0
Rumex acetosella	0	0	0	5
Sagina nodosa	0	0	0	2
Scorpidium revolvens	0	1	1	0
Sphagnum contortum	0	0	4	0
Sphagnum fallax	0	0	5	0
Succisa pratensis	0	1	1	0
Thuidium tamariscinum	0	2	0	0
Triglochin palustris	2	0	2	0
Viola palustris	0	1	4	0

Locality Survey Card for *Hamatocaulis vernicosus* at Below Sgilloge Loughs, Co. Waterford

Locality name: Below Sgilloge Loughs	**Surveyor:**	**Date:**
County (vice): Waterford (H6)	**Aerial Photo ID:**	
SAC: Comeragh Mountains SAC (IE001952)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Below Sgilloge Loughs, Co. Waterford (Comeragh Mountains SAC IE001952)

Population Assessment for Below Sgilloge Loughs, Co. Waterford

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 9,070 m²		
Percent cover (%)	Mean percentage cover within 3–5 plots	≥ 25%		
Density	Mean number of shoots in 10 x 10 cm area in 3–5 plots	≥ 125 shoots		
Population Assessment for Below Sgilloge Loughs			**Result**	**Status**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad				

Habitat for the Species Assessment for Below Sgilloge Loughs, Co. Waterford

Indicator	Method of assessment	Target	Result	Pass/Fail
Area covered by the population (m²)	Multiply area of occurrence by mean percentage cover	≥ 2,265 m²		
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 3–5 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3–5 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 3–5 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3–5 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3–5 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3–5 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Below Sgilloge Loughs			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Below Sgilloge Loughs, Co. Waterford

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Below Sgilloge Loughs	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

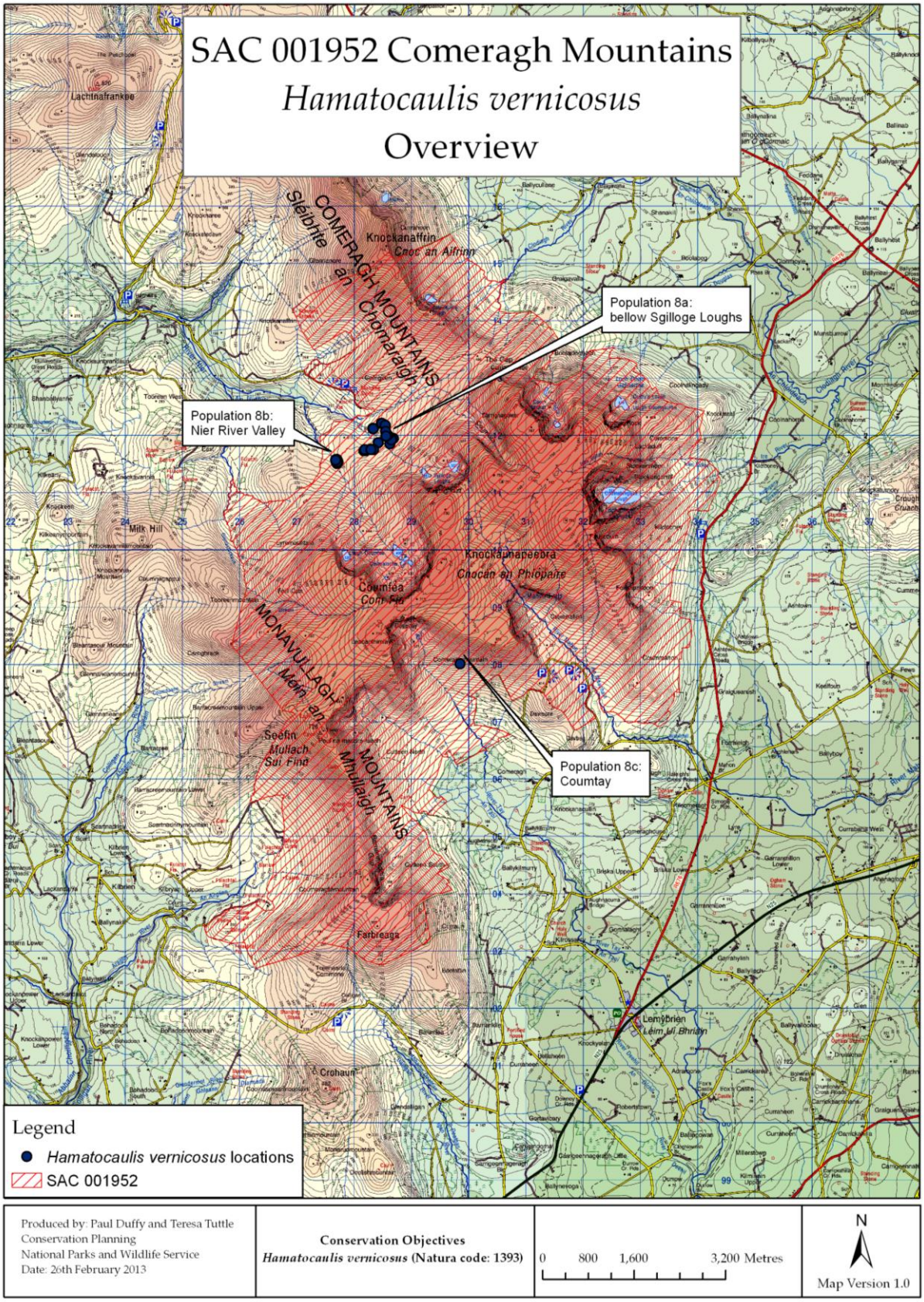
Overall Conservation Assessment for Below Sgilloge Loughs, Co. Waterford

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

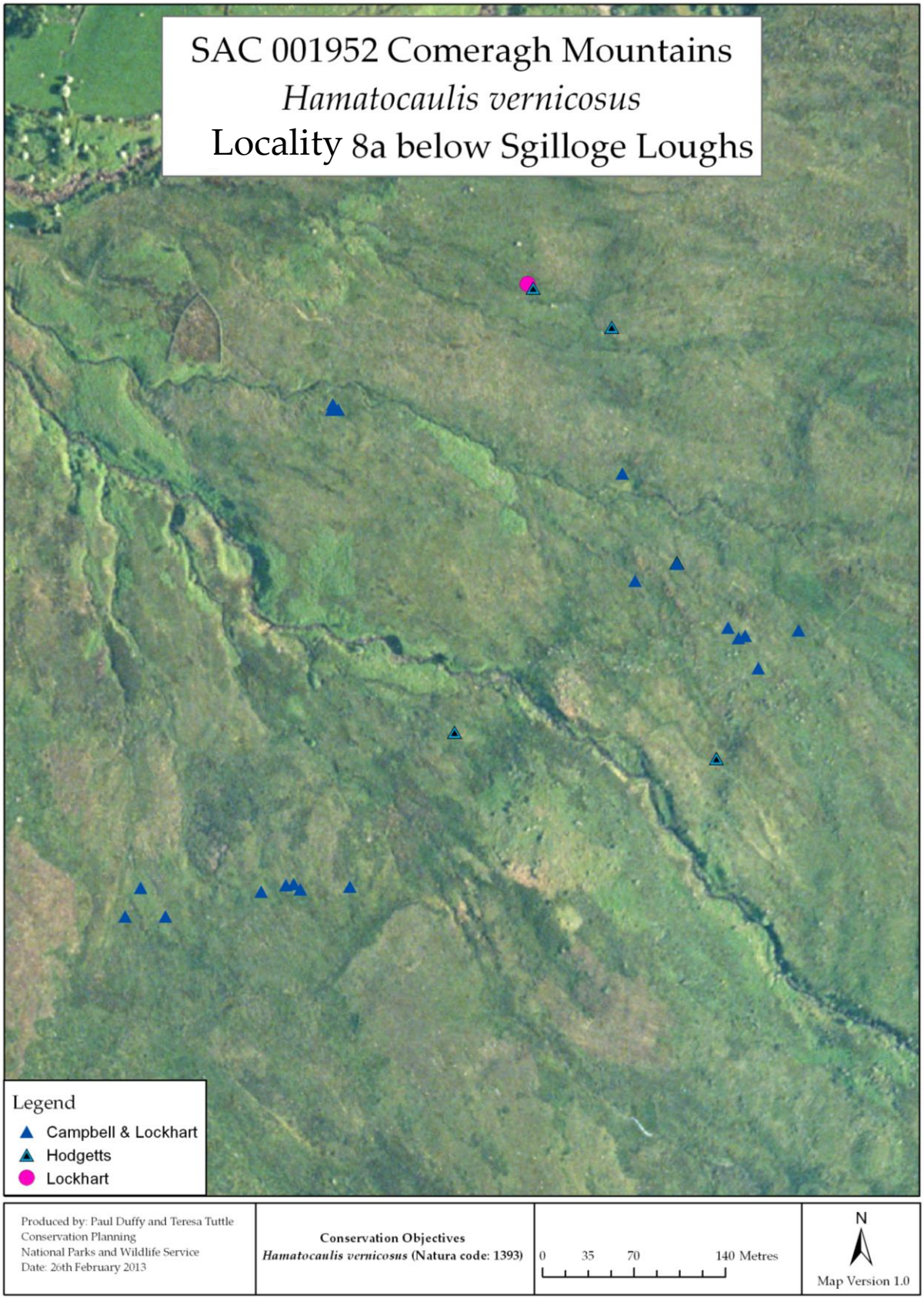
Determination of male and female shoot numbers from Below Sgilloge Loughs, Co. Waterford

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:



Discovery Series map: 73



Aerial photographs: O5624-C & O5694-A (2005 Orthos)

Comeragh Mountains SAC (001952)

Locality No. 8b: Nire River Valley, Co. Waterford; Grid ref. S279116

Field notes from Neil Lockhart (16 September 1998):

H. vernicosus forming pure swards and mixed with *Sphagnum fallax* over an area of *ca.* 1 ha, very abundant and dominant in places. This is probably the location of Derek Ratcliffe's record in 1963. The area where *H. vernicosus* occurs is very wet, lightly grazed. No threat at present - the flush has obviously survived since described in 1963 and has good prospects for the future, provided it remains free of forestry or other development.

Field notes from Nick Hodgetts (14 September 2007):

Flush on north-facing slope just above riverbank. Abundant over *ca*. 1 ha, locally dominant in the bryophyte layer: thousands of shoots. No immediate threats identified; forestry and overgrazing are potential threats; sheep-grazing at present, but not too heavily.

Associates:

Anagallis tenella
Aulacomnium palustre
Bryum pseudotriquetrum
Calliergonella cuspidata
Carex echinata
Cephaloziella hampeana
Chiloscyphus polyanthus
Chrysosplenium oppositifolium
Dicranella palustris
Eurhychium praelongum
Fissidens adianthoides
Juncus acutiflorus
Juncus bulbosus
Juncus effusus
Lophocolea bidentata
Molinea caerulea
Myosotis sp.
Nardus stricta
Pellia neesiana
Philonotis fontana
Ranunculus flammula
Rhizomnium pseudopunctatum
Rhytidiadelphus squarrosus
Sphagnum contortum
Sphagnum fallax
Sphagnum palustre
Sphagnum squarrosum
Sphagnum subnitens
Sphagnum teres

Field notes from Christina Campbell & Neil Lockhart (11 August 2009 & 30 August 2010):

The population at Nire River Valley is approximately 500 m away from the population below Sgilloge Loughs, in an adjacent valley. The locality appeared grazed by sheep, but not heavily. Two plots (2 x 2 m) were recorded at this population. Plot 1 was recorded on an aqueous root-mat on peat in August 2009. The following summer conditions were notably drier. Plot 2 was taken in a water runnel flowing into a tributary of the Nire River and *H. vernicosus* was confined in this plot to the areas where there was a water flow. The bank opposite this location to the west was searched as it looked potentially suitable, but *H. vernicosus* was not found there.

Nire River Valley	**Plot 1**	**Plot 2**
Year	2009	2010
Altitude (m.s.l.)	303	298
Slope (degrees)	5	5
Aspect	7	8
Surface water depth (cm)	5.9	-10.0
Surface water pH	5.37	5.29
Surface water conductivity (µS/cm)	50	62
Ammonium (NH_4) (mg/l)	0.03	0.03
Nitrate (NO_3) (mg/l)	0.09	0.09
Orthophosphate (O-P) (mg/l)	0.083	0.005
Total phosphate (TP) (mg/l)	0.110	0.022
Peat depth (cm)	156	41
No. of shoots in 10 x 10 cm area	404	335
Hamatocaulis vernicosus cover (%)	80	30
Mean vegetation height (cm)	49.3	23.5
Max. vegetation height (cm)	133	69
Cover (Domin):		
Total cover	10	10
Grass cover	6	4
Rush cover	6	5
Sedge cover	5	6
Forb cover	5	4
Bryophyte cover	10	9
Algae cover	0	1
Litter cover	2	4
Bare soil cover	0	1
Surface water cover	1	0
Associated species cover (Domin):		
Agrostis stolonifera	5	3
Anagallis tenella	1	4
Anthoxanthum odoratum	4	2
Aulacomnium palustre	0	1
Brachythecium rivulare	1	0
Bryum pseudotriquetrum	0	2
Carex paniculata	4	0
Calliergonella cuspidata	2	1
Calypogeia muelleriana	1	0
Cardamine pratensis	3	1
Carex echinata	4	5
Carex nigra	3	4
Carex panicea	0	1
Chrysosplenium oppositifolium	1	0
Cynosuros cristatus	4	2
Dicranella palustris	4	0

Nire River Valley (continued) **Associated species cover (Domin):**	**Plot 1**	**Plot 2**
Drosera rotundifolia	0	1
Epilobium palustre	1	1
Eriophorum angustifolium	+	2
Festuca ovina	4	0
Galium palustre	2	1
Holcus lanatus	4	0
Hydrocotyle vulgaris	2	1
Juncus acutiflorus	5	5
Juncus bulbosus	2	1
Juncus effusus	0	+
Leontodon autumnalis	1	2
Lophocolea bidentata	2	0
Luzula multiflora	+	0
Molinia caerulea	4	0
Myosotis laxa	+	0
Nardus stricta	3	3
Pedicularis palustris	0	1
Pellia endiviifolia	3	0
Philonotis fontana	2	1
Polytrichum strictum	0	4
Potentilla erecta	2	2
Ranunculus flammula	3	3
Ranunculus repens	0	1
Rhizomnium pseudopunctatum	2	0
Rhytidiadelphus squarrosus	0	2
Rumex acetosa	1	0
Scorpidium revolvens	0	1
Sphagnum contortum	0	1
Sphagnum fallax	4	5
Sphagnum palustre	0	5
Sphagnum papillosum	0	4
Sphagnum squarrosum	1	0
Sphagnum subnitens	1	0
Trifolium repens	4	0
Veronica scutellata	1	0
Viola palustris	1	1
Warnstorfia exannulata	3	0

Locality Survey Card for *Hamatocaulis vernicosus* at Nire River Valley, Co. Waterford

Locality name: Nire River Valley	**Surveyor:**	**Date:**
County (vice): Waterford (H6)	**Aerial Photo ID:**	
SAC: Comeragh Mountains (IE001952)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Nire River Valley, Co. Waterford (Comeragh Mountains SAC IE001952)

Population Assessment for Nire River Valley, Co. Waterford

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 1,100 m²		
Percent cover (%)	Mean percentage cover within 3–5 plots	≥ 40%		
Density	Mean number of shoots in 10 x 10 cm area in 3–5 plots	≥ 290 shoots		
Population Assessment for Nire River Valley			**Result**	**Status**
3 passes = Favourable 2 passes = Unfavourable - Inadequate 0 – 1 passes = Unfavourable - Bad				

Habitat for the Species Assessment for Nire River Valley, Co. Waterford

Indicator	Method of assessment	Target	Result	Pass/Fail
Area covered by the population (m²)	Multiply area of occurrence by mean percentage cover	≥ 440 m²		
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 3–5 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 3–5 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 3–5 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 3–5 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 3–5 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 3–5 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Nire River Valley			**Result**	**Status**
7 – 8 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Nire River Valley, Co. Waterford

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m^2; 11–50 m^2; 51–100 m^2; > 100 m^2)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Nire River Valley	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

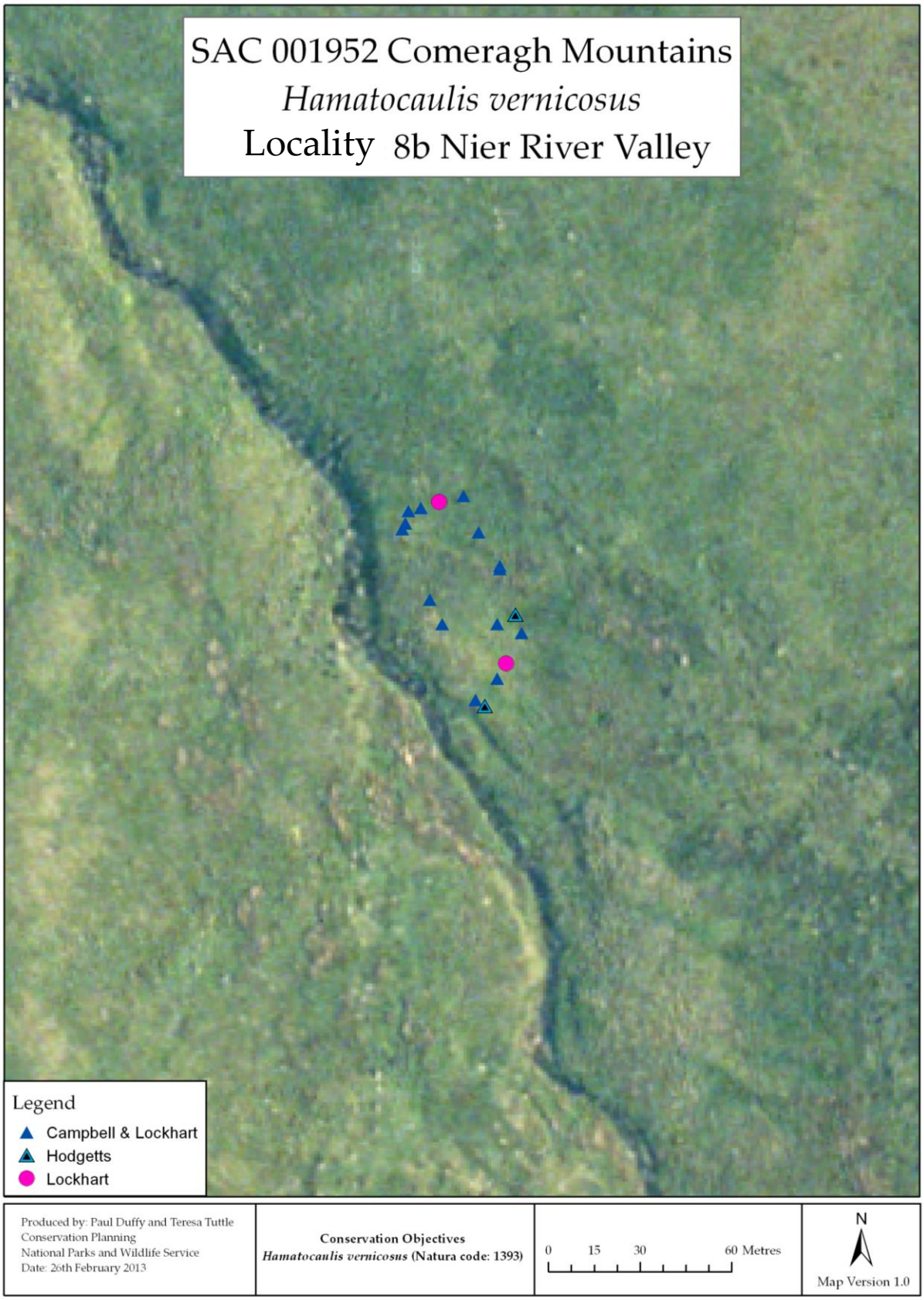
Overall Conservation Assessment for Nire River Valley, Co. Waterford

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

Determination of male and female shoot numbers from Nire River Valley, Co. Waterford

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments:



Aerial photograph: O5693-B (2005 Orthos)

Comeragh Mountains SAC (001952)

Locality No. 8c: Coumtay, Co. Waterford; Grid ref. S29850801

Field notes from Nick Hodgetts (18 September 2007):

A small colony, with several dozen shoots in an area of *circa* 1 m^2 on flush on south-facing slope. Site not immediately threatened. The area is overgrazed by sheep. Some nearby areas have been burned, and this might constitute a potential threat. Afforestation is another potential threat.

Associates:

Anagallis tenella
Bryum pseudotriquetrum
Campylium stellatum
Carex echinata
Juncus articulates
Philonotis Fontana
Ranunculus flammula
Sphagnum contortum
Warnstorfia exannulata

Locality Survey Card for *Hamatocaulis vernicosus* at Coumtay, Co. Waterford

Locality name: Coumtay	**Surveyor:**	**Date:**
County (vice): Waterford (H6)	**Aerial Photo ID:**	
SAC: Comeragh Mountains (IE001952)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Coumtay, Co. Waterford (Comeragh Mountains SAC IE001952)

Population Assessment for Coumtay, Co. Waterford

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 0.8 m^2		
Percent cover (%)	Mean percentage cover within 1–3 plots	NA		NA
Density	Mean number of shoots in 10 x 10 cm area in 1–3 plots	NA		NA

Population Assessment for Coumtay	Population Status	Result (✓)
1 pass	Favourable	
0 passes & Habitat for the Species Assessment is Favourable	Favourable	
0 passes & Habitat for the Species Assessment is Unfavourable – Inadequate	Unfavourable – Inadequate	
0 passes & Habitat for the Species Assessment is Unfavourable – Bad	Unfavourable – Bad	

Determination of male and female shoot numbers from Coumtay, Co. Waterford

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments

Habitat for the Species Assessment for Coumtay, Co. Waterford

Indicator	Method of assessment	Target	Result	Pass/Fail
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 1-3 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 1-3 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 1-3 plots	Mean percent grass cover should not exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 1-3 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 1-3 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 1-3 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Coumtay			**Result**	**Status**
7 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Coumtay, Co. Waterford

Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Coumtay	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Overall Conservation Assessment for Coumtay, Co. Waterford

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	

Aerial photograph: O5765-A (2005 Orthos)

Cuilcagh-Anierin Uplands SAC (000584)

Locality No. 9: Commas, Co. Cavan; Grid ref. H1296727857

Field notes by Rory Hodd (20 August 2012):

Found in springhead at top of rich flush, Commas, east of the summit of Cuilcagh, Co. Cavan, at *circa* 450 m altitude. Relatively abundant over an area of *ca*. 2 m^2. Threats appeared relatively minor; grazing pressure was not having any real impact, although there were signs of some bare soil and minor erosion on the sides of the small valley in which the flush occurred. The immediate surrounding vegetation was acid grassland, while the dominant vegetation type in the area was poor *Juncus* flush. There was a rich flush with *Scorpidium revolvens* and *Campylium stellatum* directly below the location of *H. vernicosus*.

Associates:

Calliergonella cuspidata

Locality Survey Card for *Hamatocaulis vernicosus* at Commas, Co. Cavan

Locality name: Rathavisteen	**Surveyor:**	**Date:**
County (vice): Cavan (H30)	**Aerial Photo ID:**	
SAC: Cuilcagh-Anierin Uplands (IE000584)	**Discovery Series OS Map No.:**	
Extent of occurrence mapped (✓):	**Time spent on site:**	
Brief site description:		
Details of pressures/threats noted (including photos, GPS, etc.):		
Other notes:		

Plot (2 x 2 m) Number:	**1**	**2**	**3**	**4**	**5**
GPS co-ordinates:					
Altitude (m.s.l.):					
Surface water depth (cm):					
Hand covered when pressed into vegetation (✓):					
Cover of *Hamatocaulis vernicosus* (to nearest 1%):					
No. of shoots in 10 x 10 cm area:					
Tree cover (to nearest 5%):					
Shrub cover (to nearest 5%):					
Grass cover (to nearest 5%):					
Bryophyte cover (to nearest 5%)					
Cover of *Calliergonella cuspidata* (to nearest 5%):					
Mean vegetation height (cm) (mean height of 5 stems):					
Photo ID (N, S, E, W, overview):					
Shoot (100+) sample taken (✓):					

Species present (✓)	**1**	**2**	**3**	**4**	**5**	**Species present (✓)**	**1**	**2**	**3**	**4**	**5**

Assessment of Commas, Co. Cavan (Cuilcagh-Anierin Uplands SAC IE000584)

Population Assessment for Commas, Co. Cavan

Indicator	Method of assessment	Target	Result	Pass/Fail
Total area of extent of occupancy	Area of polygon around GPS points	≥ 1.6 m^2		
Percent cover (%)	Mean percentage cover within 1–3 plots	NA		NA
Density	Mean number of shoots in 10 x 10 cm area in 1–3 plots	NA		NA

Population Assessment for Commas	Population Status	Result (✓)
1 pass	Favourable	
0 passes & Habitat for the Species Assessment is Favourable	Favourable	
0 passes & Habitat for the Species Assessment is Unfavourable – Inadequate	Unfavourable – Inadequate	
0 passes & Habitat for the Species Assessment is Unfavourable – Bad	Unfavourable – Bad	

Determination of male and female shoot numbers from Commas, Co. Cavan

Plot No.	Date	No. of male shoots	No. of female shoots	No. of indeterminate shoots	No. of sterile shoots	Total no. of shoots
1						
2						
3						
4						
5						
Total numbers						
Total percentage						

Additional comments

Habitat for the Species Assessment for Commas, Co. Cavan

Indicator	Method of assessment	Target	Result	Pass/Fail
Hydrology	Hand should be pressed into vegetation	Water level should cover hand when pressed into vegetation		
Tree cover	Estimation of tree cover to nearest 5% averaged over 1–3 plots	Mean percent tree cover should **not** exceed 15%		
Shrub cover	Estimation of shrub cover to nearest 5% averaged over 1–3 plots	Mean percent shrub cover should **not** exceed 20%		
Grass cover	Estimation of grass cover to nearest 5% averaged over 1–3 plots	Mean percent grass cover should **not** exceed 25%		
Bryophyte cover	Estimation of bryophyte cover to nearest 5% averaged over 1–3 plots	Mean percent bryophyte cover should exceed 50%		
Cover of *Calliergonella cuspidata*	Estimation of *C. cuspidata* cover to nearest 5% averaged over 1–3 plots	Mean percent *C. cuspidata* cover should **not** exceed 15%		
Mean vegetation height	Mean height (cm) of 5 shoots per plot averaged over 1–3 plots	Mean vegetation height should **not** exceed 40 cm		
Habitat for the Species Assessment for Commas			**Result**	**Status**
7 passes = Favourable 4 – 6 passes = Unfavourable - Inadequate 0 – 3 passes = Unfavourable - Bad				

Future Prospects Assessment for Commas, Co. Cavan

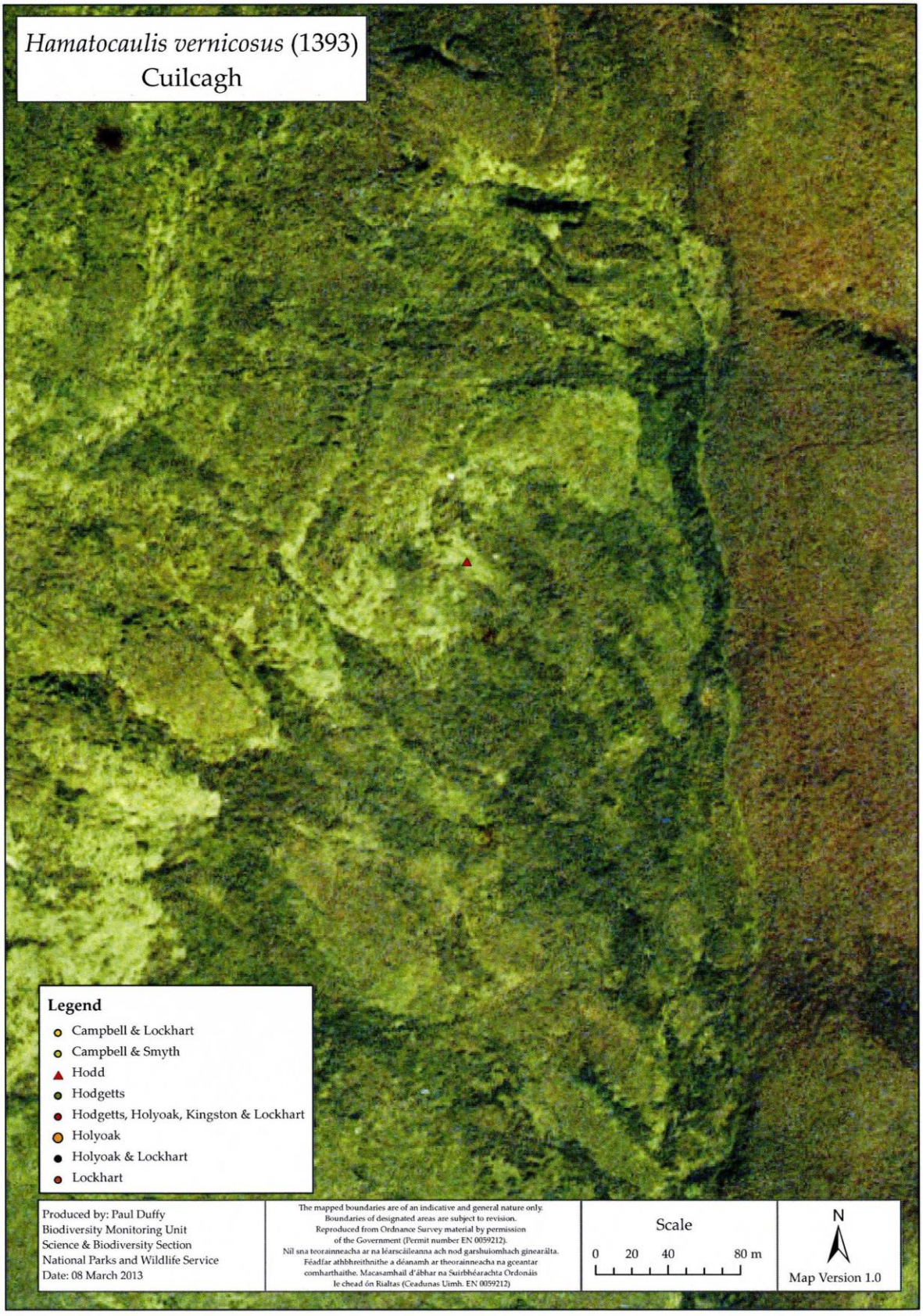
Activity (EU code)	Pressure (P) or Threat (T)*	Location (Inside/outside extent of occupancy)	Influence (Positive/ Negative/ Neutral)	Intensity (High/ Medium/ Low)	Area affected (0–10 m²; 11–50 m²; 51–100 m²; > 100 m²)
Intensive grazing (A04.01)					
Excessive poaching (Trampling, overuse G05.01)					
Lack of grazing (A04.03)					
Fertilisation (A08)					
Diffuse pollution to surface waters due to agricultural and forestry activities (H01.05)					
Water abstractions from groundwater (J02.07)					
Hand cutting of peat (C01.03.01)					
Mechanical removal of peat (C01.03.02)					
Forest planting on open ground (B01)					
Motorised vehicle damage (G01.03)					
Dumping (Discharges E03)					
Biocenotic evolution, succession (incl. enlargement of scrub vegetation area) (K02)					
Species composition change (succession) (K02.01)					
Other:					

Future Prospects Assessment for Commas	Result	Status
Favourable: No significant impact Unfavourable – Inadequate: Moderate impact Unfavourable – Bad: Severe impact		

*Pressure (P) – activity currently impacting the species or habitat; Threat (T) – activity likely to impact the species or habitat.

Overall Conservation Assessment for Commas, Co. Cavan

Parameter	Assessment
Population	
Habitat for the Species	
Future Prospects	
Overall	



Aerial photograph: O1204-A (2005 Orthos)

Overall Conservation Assessment of each *Hamatocaulis vernicosus* locality

Locality	Population Assessment	Habitat for the Species Assessment	Future Prospects Assessment	Overall Assessment	Comments
Meentygrannagh					
Rathavisteen					
Largan More					
Uggool					
Owenbrin					
Gortachalla					
Scragh Bog					
Below Sgilloge Loughs					
Nire River Valley					
Coumtay					
Commas					

Appendix II

GPS points and associated data for maps

Locality No.	Locality (SAC)	X	Y	10km Grid Sq.	1km Grid Sq.	Date	Year	Source	Accuracy	Notes
1	Meentygrannagh (Meentygrannagh Bog)	202587	405889	C00	C0205	26/01/1999	1999	Lockhart	From Map / Ortho	Derived from Ortho in accompanying file; Site 1 from notes
1	Meentygrannagh	202668	406216	C00	C0206	22/06/2004	2004	Lockhart	From Map	Derived from 1:50,000 Map; Site 2 from notes
1	Meentygrannagh	202920	406246	C00	C0206	22/06/2004	2004	Lockhart	From Map	Derived from 1:50,000 Map; Site 3 from Notes - Later moved from original location (202967, 406338) following expert opinion
1	Meentygrannagh	202779	406146	C00	C0206	04/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
1	Meentygrannagh	202701	406206	C00	C0206	04/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
1	Meentygrannagh	202713	406175	C00	C0206	04/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
1	Meentygrannagh	202707	406194	C00	C0206	04/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 1 (M1)
1	Meentygrannagh	202664	405949	C00	C0205	04/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 2 (M2)
1	Meentygrannagh	202820	406204	C00	C0206	04/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 3 (M3)
1	Meentygrannagh	202736	406184	C00	C0206	04/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 4 (M4)
1	Meentygrannagh	202556	406008	C00	C0206	24/08/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 5 (M5)
1	Meentygrannagh	202578	405887	C00	C0205	24/08/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 6 (M6)
1	Meentygrannagh	202823	406207	C00	C0206	04/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
1	Meentygrannagh	202767	406137	C00	C0206	15/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
1	Meentygrannagh	202533	406006	C00	C0206	24/08/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
1	Meentygrannagh	202684	405992	C00	C0205	15/02/2011	2011	Campbell & Lockhart	GPS	*H. vernicosus*
1	Meentygrannagh	202607	405912	C00	C0205	15/02/2011	2011	Campbell & Lockhart	GPS	*H. vernicosus*
2	Rathavisteen (Glenamoy Bog Complex)	98138	337147	F93	F9837	10/06/1999	1999	Lockhart	From Map / Ortho	Derived from Notes & Ortho - Includes relevé data
3	Largan More (Carrowmore Lake Complex)	90140	324077	F92	F9024	21/07/1999	1999	Lockhart	From Map / Ortho	Derived from 1995 Ortho - Includes relevé data
3	Largan More	90169	323994	F92	F9023	25/08/2010	2010	Campbell & Lockhart	GPS	Extent of cover
3	Largan More	90158	324017	F92	F9024	05/08/2009	2009	Campbell & Lockhart	GPS	*H .vernicosus*; Plot 1 (LM1)
3	Largan More	90435	323982	F92	F9023	05/08/2009	2009	Campbell & Lockhart	GPS	*H .vernicosus*; Plot 2 (LM2)
3	Largan More	90207	324079	F92	F9024	05/08/2009	2009	Campbell & Lockhart	GPS	*H .vernicosus*; Plot 3 (LM3)
3	Largan More	90190	324014	F92	F9024	25/08/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 4 (LM4)
3	Largan More	90191	324023	F92	F9024	05/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
3	Largan More	90188	324014	F92	F9024	15/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
3	Largan More	89932	323768	F82	F8923	15/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
3	Largan More	90387	323980	F92	F9023	16/02/2011	2011	Campbell & Lockhart	GPS	*H. vernicosus*
3	Largan More	90387	323979	F92	F9023	16/02/2011	2011	Campbell & Lockhart	GPS	*H. vernicosus*
4	Uggool (Owenduff/Nephin Complex)	92513	318750	F91	F9218	28/05/1999	1999	Lockhart	From Ortho	Derived from Notes & Ortho - Includes Relevé data
5	Owenbrin (Lough Carra / Mask Complex)	106189	262854	M06	M0662	28/03/2000	2000	Lockhart	From Ortho	Derived from Notes & Ortho - Includes Relevé data
5	Owenbrin	106209	262853	M06	M0662	06/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
5	Owenbrin	106166	262855	M06	M0662	06/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
5	Owenbrin	106352	262938	M06	M0662	06/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 1 (O1)
5	Owenbrin	106171	262899	M06	M0662	06/08/2009	2009	Campbell & Lockhart	GPS	*H .vernicosus*; Plot 2 (O2)
5	Owenbrin	106222	262910	M06	M0662	26/08/2010	2010	Campbell & Lockhart	GPS	*H .vernicosus*; Plot 3 (O3)
5	Owenbrin	106207	262853	M06	M0662	06/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 4 (O4)

Locality No.	Locality (SAC)	X	Y	10km Grid Sq.	1km Grid Sq.	Date	Year	Source	Accuracy	Notes
5	Owenbrin (Lough Carra / Mask Complex)	106149	262924	M06	M0662	06/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
5	Owenbrin	106278	263041	M06	M0663	06/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
5	Owenbrin	106185	262914	M06	M0662	17/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
5	Owenbrin	106255	262920	M06	M0662	17/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
5	Owenbrin	106258	262920	M06	M0662	17/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
5	Owenbrin	106245	262967	M06	M0662	17/02/2010	2010	Campbell & Lockhart	GPS	Extent of cover
5	Owenbrin	106257	262919	M06	M0662	17/02/2010	2010	Campbell & Lockhart	GPS	Extent of cover
5	Owenbrin	106245	262946	M06	M0662	17/02/2011	2011	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough (Lough Corrib)	122520	237530	M23	M2237	25/06/2004	2004	Holyoak	GPS	Corresponds to Recorder location for the species
6	NW of Gortachalla Lough	122480	237710	M23	M2237	05/07/2004	2004	Holyoak & Lockhart	GPS	Includes relevé data
6	NW of Gortachalla Lough	122526	237521	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
6	NW of Gortachalla Lough	122543	237536	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
6	NW of Gortachalla Lough	122529	237563	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
6	NW of Gortachalla Lough	122535	237559	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
6	NW of Gortachalla Lough	122520	237579	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
6	NW of Gortachalla Lough	122430	237645	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
6	NW of Gortachalla Lough	122435	237660	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover; Moved from original location (122434, 237666) on foot of expert opinion PD 19/02/13
6	NW of Gortachalla Lough	122517	237490	M23	M2237	17/02/2010	2010	Campbell & Lockhart	GPS	Extent of cover
6	NW of Gortachalla Lough	122529	237557	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 1 (G1)
6	NW of Gortachalla Lough	122497	237701	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*: Plot 2 (G2)
6	NW of Gortachalla Lough	122496	237614	M23	M2237	27/08/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*: Plot 3 (G3)
6	NW of Gortachalla Lough	122441	237638	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*: Plot 4 (G4)
6	NW of Gortachalla Lough	122519	237521	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122516	237595	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122495	237612	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122486	237631	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122495	237696	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122448	237673	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122449	237656	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122443	237641	M23	M2237	07/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122517	237490	M23	M2237	17/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122516	237490	M23	M2237	17/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122497	237629	M23	M2237	17/02/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
6	NW of Gortachalla Lough	122516	237491	M23	M2237	17/02/2011	2011	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog (Scragh Bog)	242552	258959	N45	N4259	13/07/2004	2004	Lockhart	From Ortho	Includes relevé data
7	Scragh Bog	242560	258950	N45	N4258	10/09/2007	2007	Hodgetts, Holyoak, Kingston & Lockhart	GPS	Record A from Site Card
7	Scragh Bog	242520	258960	N45	N4258	10/09/2007	2007	Hodgetts, Holyoak, Kingston & Lockhart	GPS	Record B from Site Card
7	Scragh Bog	242463	258907	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242450	258870	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover

Locality No.	Locality (SAC)	X	Y	10km Grid Sq.	1km Grid Sq.	Date	Year	Source	Accuracy	Notes
7	Scragh Bog (Scragh Bog)	242446	258866	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242356	258959	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242443	259022	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242496	259058	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242437	259143	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242309	259047	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242265	259135	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242365	259201	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242381	259218	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242354	259252	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242319	259295	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242163	259365	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242164	259325	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242250	259373	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
7	Scragh Bog	242555	258955	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242557	258950	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242410	258786	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242439	259144	N45	N4259	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 1 (SB1)
7	Scragh Bog	242318	259177	N45	N4259	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 2 (SB2)
7	Scragh Bog	242558	258951	N45	N4258	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 3 (SB3)
7	Scragh Bog	242251	259373	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 4 (SB3)
7	Scragh Bog	242319	259295	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 5 (SB5)
7	Scragh Bog	242311	259050	N45	N4259	08/09/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 6 (SB6)
7	Scragh Bog	242438	259018	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 7 (SB7)
7	Scragh Bog	242413	258780	N45	N4258	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242442	259020	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242446	259131	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242439	259142	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242440	259142	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242419	259128	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242398	259115	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242398	259115	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242393	259110	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242339	259065	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242266	259135	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242319	259177	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242366	259201	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242346	259258	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242342	259265	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242332	259273	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242316	259291	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242211	259237	N45	N4259	31/07/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*

Locality No.	Locality (SAC)	X	Y	10km Grid Sq.	1km Grid Sq.	Date	Year	Source	Accuracy	Notes
7	Scragh Bog (Scragh Bog)	242170	259346	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242164	259325	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242178	259329	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242182	259330	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242192	259335	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242197	259337	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242201	259339	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242210	259346	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242227	259358	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242237	259363	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242240	259365	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242242	259366	N45	N4259	13/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242558	258951	N45	N4258	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242316	259293	N45	N4259	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242252	259373	N45	N4259	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242311	259049	N45	N4259	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242438	259020	N45	N4259	26/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
7	Scragh Bog	242227	259403	N45	N4259	07/03/2011	2011	Campbell & Smyth	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs (Comeragh Mountains)	228476	112213	S21	S2812	16/09/1998	1998	Lockhart	From Ortho	Derived from Ortho - Includes Relevé data
8a	Below Sgilloge Loughs	228480	112210	S21	S2812	12/09/2007	2007	Hodgetts	GPS	
8a	Below Sgilloge Loughs	228590	112000	S21	S2812	12/09/2007	2007	Hodgetts	GPS	
8a	Below Sgilloge Loughs	228540	112180	S21	S2812	12/09/2007	2007	Hodgetts	GPS	
8a	Below Sgilloge Loughs	228620	111850	S21	S2811	12/09/2007	2007	Hodgetts	GPS	
8a	Below Sgilloge Loughs	228420	111870	S21	S2811	12/09/2007	2007	Hodgetts	GPS	
8a	Below Sgilloge Loughs	228326	112117	S21	S2812	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228327	112121	S21	S2812	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228629	111950	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228683	111948	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228302	111750	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228297	111754	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228272	111748	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228199	111729	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228642	111944	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8a	Below Sgilloge Loughs	228637	111942	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8a	Below Sgilloge Loughs	228652	111919	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8a	Below Sgilloge Loughs	228340	111752	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8a	Below Sgilloge Loughs	228168	111729	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8a	Below Sgilloge Loughs	228180	111751	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 1 (BSL1)
8a	Below Sgilloge Loughs	228291	111753	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 2 (BSL 2)
8a	Below Sgilloge Loughs	228590	111999	S21	S2811	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 3 (BSL 3)

Locality No.	Locality (SAC)	X	Y	10km Grid Sq.	1km Grid Sq.	Date	Year	Source	Accuracy	Notes
8a	Below Sgilloge Loughs (Comeragh Mountains)	228331	112117	S21	S2812	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 4 (BSL 4)
8a	Below Sgilloge Loughs	228548	112068	S21	S2812	30/08/2010	2010	Campbell & Lockhart	GPS	*H. vernicosus*
8a	Below Sgilloge Loughs	228558	111986	S21	S2811	21/02/2011	2011	Campbell & Lockhart	GPS	*H. vernicosus*
8b	Nire River Valley (Comeragh Mountains)	227685	111577	S21	S2711	16/09/1998	1998	Lockhart	From Ortho	Derived from Notes & Ortho - Corresponds to Relevé 2
8b	Nire River Valley	227707	111524	S21	S2711	16/09/1998	1998	Lockhart	From Ortho	Derived from Notes & Ortho - Corresponds to Relevé 1
8b	Nire River Valley	227710	111540	S21	S2711	14/09/2007	2007	Hodgetts	GPS	
8b	Nire River Valley	227700	111510	S21	S2711	14/09/2007	2007	Hodgetts	GPS	
8b	Nire River Valley	227705	111556	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227698	111567	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227679	111575	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227675	111574	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227673	111568	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227682	111545	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227686	111537	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227693	111579	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227697	111512	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227704	111519	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227712	111534	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	Extent of cover
8b	Nire River Valley	227705	111555	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*
8b	Nire River Valley	227704	111537	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 1 (NV1)
8b	Nire River Valley	227674	111570	S21	S2711	11/08/2009	2009	Campbell & Lockhart	GPS	*H. vernicosus*; Plot 2 (NV2)
8c	Coumtay (Comeragh Mountains)	229850	108010	S20	S2908	18/09/2007	2007	Hodgetts	GPS	
9	Commas (Cuilcagh-Anierin Uplands)	212985	327848	H12	H1227	20/08/2012	2012	Hodd	GPS	National Survey of Uplands Habitats (Phase 3, 2012-2013) BEC