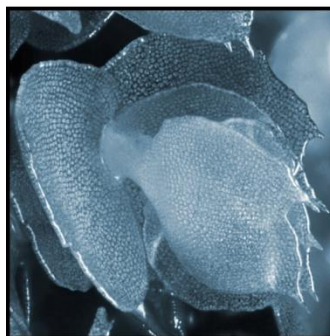


---

## Bryophyte survey of Newborough Warren – Ynys Llanddwyn, Anglesey

---



---

Dr Des Callaghan  
51 Bishopdale Dr, Rainhill, Prescot, Merseyside  
L35 4QQ

E [des.callaghan@outlook.com](mailto:des.callaghan@outlook.com)

T 07545 198711

---

**Authored by:**

Dr Des Callaghan



06/11/2014

**Disclaimer**

This Report was completed by the author on the basis of an agreed scope of works and under terms and conditions agreed with the Client. I confirm that in preparing this Report I have exercised all reasonable skill and care. The author accepts no responsibility to any parties whatsoever for any matters arising outside the agreed scope of works. This Report is issued in confidence to the Client and the author has no responsibility to any third parties to whom this Report may be circulated, in part or in full, and any such parties rely on the contents of the Report solely at their own risk.

# CONTENTS

---

Introduction .....	1
Work instruction.....	1
Survey area.....	1
Previous bryophyte surveys.....	2
Taxonomy .....	2
Method.....	3
Species inventory .....	3
Notable species.....	3
Site evaluation.....	3
Results and discussion .....	4
Survey coverage .....	4
Species inventory .....	4
SSSI assessment .....	4
Notable species.....	4
Management notes .....	11
Dune mobility .....	11
Conifer plantations .....	11
Grazing .....	12
Acknowledgements.....	15
Bibliography .....	16
Appendix 1 – Maps of survey locations .....	17
Appendix 2 – Species inventory by location .....	22
Appendix 3 – Summary species inventory.....	32
Appendix 4 – GPS locations of notable species .....	34
Appendix 5 – Photographic locations of notable species.....	43
Appendix 6 – Grid-maps of notable species.....	56

# INTRODUCTION

## Work instruction

The purpose of the present study is to: (i) provide an inventory of the bryophyte flora of focal survey areas within Newborough Warren – Ynys Llanddwyn NNR/SSSI; (ii) document the distribution and abundance of any species of conservation interest; and (iii) evaluate the importance of the bryophyte assemblage.

## Survey area

The survey area mainly comprises the dune slacks of Newborough Warren, but also includes relict slacks within Newborough Forest, two small springs and a short length of upper saltmarsh (Figure 1; Appendix 1). Whilst the boundaries drawn around individual slacks is sometimes rather

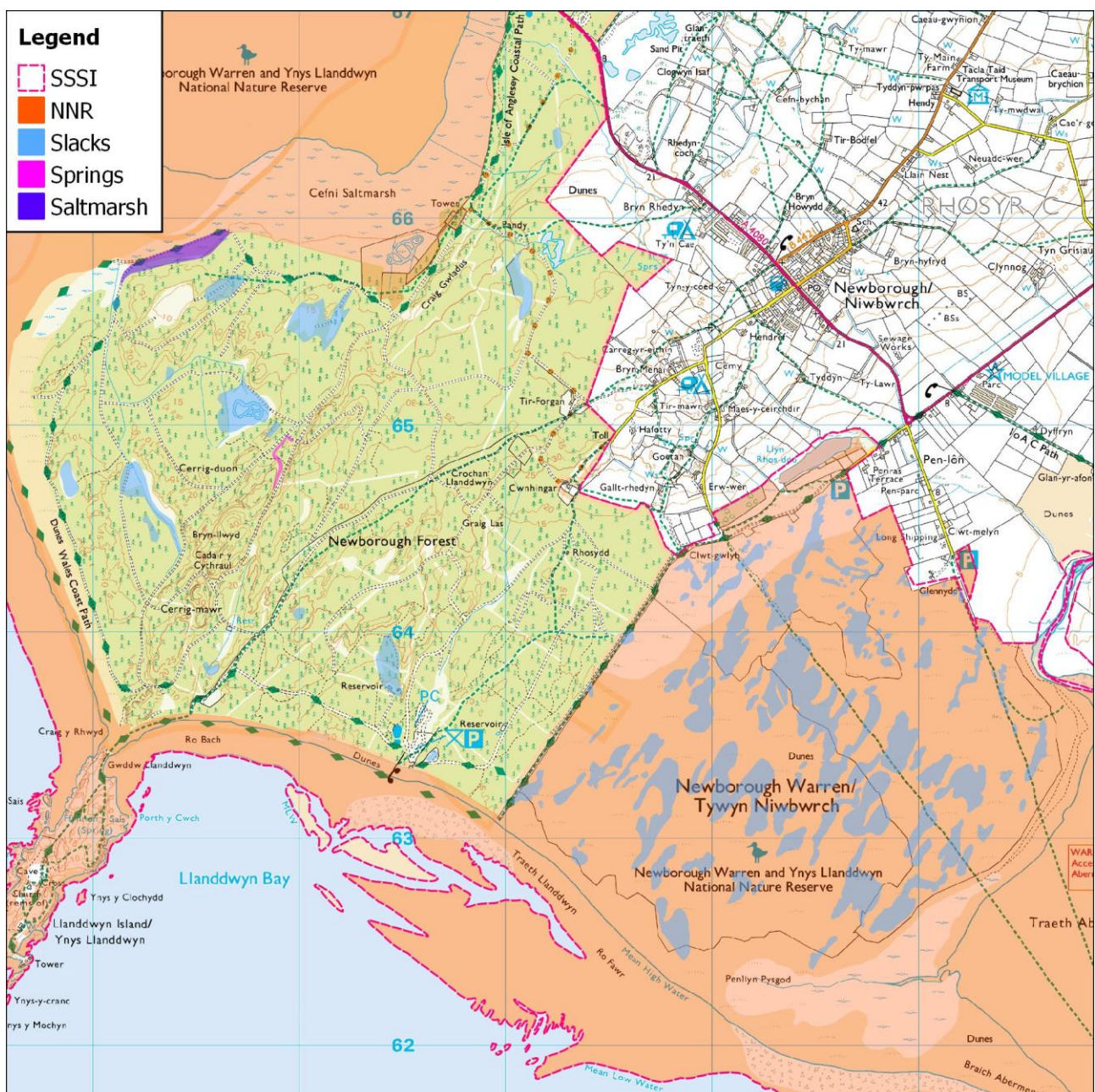


Figure 1. Location of slacks, springs and saltmarsh surveyed at Newborough Warren – Ynys Llanddwyn (see Appendix 1 for more detailed maps and location numbering system).

subjective, 120 slacks are recognised in the present survey, having a total area of 975,000 m<sup>2</sup> (range = 54-123,000 m<sup>2</sup>; median = 1760 m<sup>2</sup>). Appendix 1 shows detailed maps of these locations and the associated numbering system used within this report.

### **Previous bryophyte surveys**

To date, there has been no comprehensive bryophyte survey of Newborough Warren – Ynys Llanddwyn NNR/SSSI. The national bryophyte recording database of The British Bryological Society contains 210 records attributed to the area. These date from 1885 and are mostly unlocalised. Newton (1995), Rumsey & Stevens (2004) and Creer (2012) surveyed *Petalophyllum ralfsii* and Holyoak (2002) made an unsuccessful search for rare *Bryum* species, whilst in 2012 S.D.S. Bosanquet undertook a one-day search for the rarer dune slack specialists.

### **Taxonomy**

Taxonomy follows Hill *et al.* (2008).

## METHOD

---

### **Species inventory**

Fieldwork was undertaken in favourable conditions over eleven days (5-11 May, 6-8 August and 5 November 2014). The survey trail was logged with a Garmin GPSMAP 62s unit, providing a positional accuracy of about 3 m. Each target location was searched and a list of the bryophyte species present was compiled. At locations that were clearly of little bryological interest, only a quick list of species was made in order to concentrate effort in the more interesting areas.

### **Notable species**

GPS coordinates were collected for all notable species encountered, including those that are considered to be nationally threatened (Bosanquet and Dines, 2011; Hodgetts, 2011), nationally rare (Preston, 2010) or nationally scarce (Preston, 2006). Annotated photographic images were produced in order to accurately document the locations of notable species, their local abundance and habitat conditions. Using the GPS locations and a GIS system (Quantum GIS), site-based grid-maps of notable species were generated at a resolution of 10 x 10 m, aligning with the OS grid. Counts of the number of OS 10 m and 100 m grid cells occupied by species were calculated, providing a standardised proxy measure of abundance that can be used to compare species, sites and years (see Callaghan 2013 for further details).

### **Site evaluation**

The survey results were used to assess the importance of the site for bryophytes against the SSSI selection criteria for lower plants (Hodgetts, 1992), updated to follow the taxonomy of Hill *et al.* (2008).

# RESULTS AND DISCUSSION

## Survey coverage

No significant survey constraints were encountered.

## Species inventory

A total of 95 species were found. An inventory of the species for each location is provided in Appendix 2 and a summary species list is shown in Appendix 3. All species records will be submitted to the national bryophyte recording scheme of The British Bryological Society.

## SSSI assessment

Table 1 provides an assessment of the SSSI and NNR against the SSSI criteria for bryophytes. It includes consideration of species seen during the present survey and excludes a number of scoring species that have been recorded from the site historically but for which there are no recent records, including *Abietinella abietina*, *Bryum calophyllum*, *B. warneum*, *Catoscopium nigratum*, *Distichium inclinatum*, *Southbya tophacea* and *Tortula wilsonii*. The overall score for the SSSI is 750 and for the NNR is 650, the latter lacking *Bryum intermedium* and *Fossombronia incurva*, both far exceeding the SSSI threshold of 200.

**Table 1. Site assessment against the SSSI selection criteria for bryophytes.**

Criterion	Qualifying species	Scores	
		SSSI	NNR
Schedule 8	<i>Petalophyllum ralfsii</i>	200	200
Red Data Book <sup>1</sup>	Nil	0	0
Nationally Rare	Nil	0	0
Nationally Scarce	<i>Amblyodon dealbatus</i> , <i>Bryum intermedium</i> <sup>2</sup> , <i>Campyliadelphus elodes</i> , <i>Drepanocladus sendtneri</i> , <i>Fossombronia incurva</i> <sup>2</sup> , <i>Moerckia flotoviana</i> , <i>Petalophyllum ralfsii</i> , <i>Pleurochaete squarrosa</i> , <i>Pseudocalliergon lycopodioides</i> , <i>Riccardia incurvata</i> , <i>Riccia cavernosa</i> , <i>Tortella inclinata</i>	550	450
Atlantic	n/a	n/a	n/a
Sub-Atlantic	n/a	n/a	n/a
Western British	n/a	n/a	n/a
Endemic	Nil	n/a	n/a
Large populations of species with a restricted distribution at the edge of their range	Nil	n/a	n/a
Phenotypically distinct populations	Nil	n/a	n/a
	<b>SSSI selection threshold</b>	<b>200</b>	<b>200</b>
	<b>Site score</b>	<b>750</b>	<b>650</b>

<sup>1</sup>Species treated as CR, EN or VU by Hodgetts (2011).

<sup>2</sup>Absent from NNR.

## Notable species

Three appendices provide details of the most notable species seen during the present survey:

- Appendix 4 – GPS locations
- Appendix 5 – Annotated photographic locations
- Appendix 6 – Site-based grid maps

Table 2 provides a summary of the status of notable bryophytes that have been recorded from Newborough Warren – Ynys Llanddwyn, each of which is discussed below. OS grid-cell counts of the most notable species, derived from the mapping exercise presented in Appendix 6, are shown in Table 3. The area of saltmarsh visited was ungrazed and bryologically dull. It was searched in the hope of finding *Bryum marratii*, not previously recorded from Anglesey and which is a rare moss that appears to favour cattle-grazed upper saltmarsh in areas with freshwater seepage and wind-blown sand input (Bosanquet, 2012; Holyoak, 2002).

**Table 2. Status of notable bryophytes recorded from Newborough Warren – Ynys Llanddwyn.**

Species	Site status			National status						
	Year of first record	Year of last record	Current status	EC Habs Dir Annex II	UK Red List	Wales Red List	NERC s42	W&C Act Sch 8	Nationally Rare	Nationally Scarce
<i>Abietinella abietina</i>	1890	1970	Extinct?			EN				x
<i>Amblyodon dealbatus</i>	1908	2014	Rare			EN				x
<i>Bryum calophyllum</i>	1908	1908	Extinct		VU	CR	x		x	
<i>Bryum intermedium</i> <sup>1</sup>	1908	2014	Very rare		DD	CR	x			x
<i>Bryum warneum</i>	1908	1908	Extinct		NT	EN	x			x
<i>Campyliadelphus elodes</i>	1907	2014	Locally frequent							x
<i>Catoscopium nigratum</i>	1907	1978	Extinct			VU				x
<i>Distichium inclinatum</i>	1908	1976	Extinct							x
<i>Drepanocladus sendtneri</i>	1907	2014	Very rare			EN				x
<i>Fossombronia incurva</i> <sup>1</sup>	2014	2014	Very rare							x
<i>Moerckia flotoviana</i>	1907	2014	Rare		DD					x
<i>Petalophyllum ralfsii</i>	1908	2014	Rare	x			x	x		x
<i>Pleurochaete squarrosa</i>	1908	2014	Rare							x
<i>Pseudocalliergon lycopodioides</i>	1907	2014	Locally abundant		NT	EN	x			x
<i>Riccardia incurvata</i>	1907	2014	Rare							x
<i>Riccia cavernosa</i>	1934	2014	Very rare							x
<i>Southbya tophacea</i>	1978	1978	Extinct		VU				x	
<i>Tortella inclinata</i>	1908	2014	Locally frequent			NT				x
<i>Tortula wilsonii</i>	1908	1908	Extinct		VU	EN	x			x

<sup>1</sup>Absent from the NNR.

**Table 3. OS grid-cell counts of notable species based on the results of the present survey.**

Species	Within NNR		Outside NNR		Total	
	10 m cells	100 m cells	10 m cells	100 m cells	10 m cells	100 m cells
<i>Amblyodon dealbatus</i>	28	4	0	0	28	4
<i>Bryum intermedium</i>	0	0	2	2	2	2
<i>Drepanocladus sendtneri</i>	3	2	0	0	3	2
<i>Fossombronia incurvata</i>	0	0	1	1	1	1
<i>Moerckia flotoviana</i>	14	6	0	0	14	6
<i>Petalophyllum ralfsii</i>	8	4	1	1	9	5
<i>Pseudocalliergon lycopodioides</i>	721	100	0	0	721	100
<i>Riccardia incurvata</i>	15	10	0	0	15	10
<i>Riccia cavernosa</i>	1	1	0	0	1	1



*Abietinella abietina* (Nationally Scarce)

This moss has not been seen at Newborough since 1970. Details of its locations are lacking and it may have occurred within the slacks or in dryer calcareous dune grassland. It was not found in any of the slacks during the present survey.

*Amblyodon dealbatus* (Nationally Scarce; Wales Red List - Endangered)

This moss of dune slacks and upland basic flushes is rare within Wales. There are recent records from only five sites, including Abberfraw, Kenfig, Newborough, Pembrey and an upland flush in Carmarthenshire. It may still occur at Morfa Dyffryn and Morfa Harlech, where further surveys are needed (S.D.S. Bosanquet pers. comm.).

Historically, it has been known from

Newborough Forest, where it was recorded by D.A. Jones in 1908 and M.O. Hill in 1974. The location of the latter record (SH410648) appears to have been a ditch bank associated with a small forestry fire pond which subsequently became over-grown by willow. The scrub was cleared recently but the general vegetation development and associated litter build-up has made the location highly unsuitable for *A. dealbatus*. The present survey found the plant within two slacks. At Slack 29 a small patch (20 x 10 cm with about 20 sporophytes) is present at the northern tip of the slack, where the turf is very thin and damp (Appendix 5, Photograph 5.1). One of the most interesting finds of the survey, however, was at Slack 37 where a very large population of the moss is scattered across 22 10 x 10 m OS grid cells (Appendix 5, Photograph 5.2). The habitat is well-grazed, thin damp turf with significant wind-blown sand input. The population of this endangered moss in Slack 37 is, by far, the largest presently known in Wales, with many hundreds of sporophytes and thousands of plants.

*Bryum calophyllum* (Nationally Rare; Wales Red List – Critically Endangered; UK Red List - Vulnerable; NERC 42)

This specialist of young slacks is often one of the first species to disappear as dune systems become more stable. It was recorded at Newborough Warren by D.A. Jones in 1908 and has not been seen since.



Figure 2. Well-grazed, thin damp turf at Slack 37 with significant wind-blown sand input, habitat of the largest population of *Amblyodon dealbatus* in Wales.

*Bryum intermedium* (Nationally Scarce; Wales Red List – Critically Endangered; UK Red List - Data Deficient)

Whilst this moss can occupy a range of early-successional base-rich conditions, dune slacks are one of its typical habitats. It is especially rare in Wales, having undergone a historic decline. In fact, until the present survey it had only been seen at one site recently, at Kenfig in 2012 by S.D.S. Bosanquet. It was reported from Newborough Warren by D.A. Jones in 1908, though the precise location is unknown and there have been no subsequent records until now. A small population is present along the banks of a base-rich spring within a pony-grazed paddock in Newborough Forest (Appendix 5, Photograph 5.3), an area also supporting a well-known population of *Rumex rupestris*. The banks of the stream here are sandy, damp and thinly vegetated. The spring is seemingly associated with the pre-Cambrian rock ridge that runs through this area of the site and in parts of the stream there is some minor tufa development.

*Bryum warneum* (Nationally Scarce; Wales Red List – Endangered; UK Red List - Near-threatened; UK BAP; NERC 41)

D.A. Jones recorded this rare dune slack specialist from Newborough Warren in 1908 and there have been no subsequent records. It is one of the species that soon disappears once dune systems become more stable and it has been lost from many locations in Britain over the past 100 years or so.

*Campyliadelphus elodes* (Nationally Scarce)

This moss of base-rich slacks and fens can be locally frequent and this is certainly the case at Newborough Warren, where it is widespread across the slacks and sometimes forms a continuous carpet across significant areas. It is most abundant in mature slacks (Appendix 5, Photograph 5.4), tending to occur only in small amounts in young slacks.

*Catoscopium nigritum* (Nationally Scarce; Wales Red List – Vulnerable)

Hill (1988) described the status of this moss in North Wales as “very rare and only present in a few slacks, but quite plentiful where it does occur”, citing Aberffraw and Newborough as the only two known locations. It was last recorded from Newborough Warren by M.O. Hill in 1978 from a ‘dune slack’. A careful search of all potentially suitable habitat for the species was made during the present survey, but it was not refound and it seems to have become extinct. It has been lost from many other dune systems in Britain as they have become less mobile. It could be extinct in Wales since the last record from Tywyn Aberffraw dates back to 1968.

*Distichium inclinatum* (Nationally Scarce)

J.G. Duckett last reported this moss from Newborough Warren in 1976, though there are no further details. It seems unlikely to have occurred outside the earlier successional dune slacks and given the absence of any records during the present survey appears to have become extinct.

*Drepanocladus sendtneri* (Nationally Scarce; Wales Red List – Endangered)

Last reported from Newborough Warren in 1973, this rare moss can be tricky to find when growing thinly in mature slacks amongst low *Salix repens* and other vegetation, so it was pleasing to eventually re-find it during the last day of surveying in the dunes. A very small population occurs, spread between two very mature slacks at the north end of the system, Slack 7g (Appendix 5, Photograph 5.5) and the nearby Slack 8o. The closely related and much commoner look-alike *Drepanocladus aduncus* also occurs and is also rare, present in one mature slack at the front of the system (Slack 49b).

*Fossombronia incurva* (Nationally Scarce)

A very tiny amount of this liverwort, just five thalli (male and female), was found at the edge of a path through a mature slack (Slack F15) in Newborough Forest. This is the first record of the plant on Anglesey, but it is not a plant of high conservation concern.

*Moerckia flotoviana* (Nationally Scarce; UK Red List - Data Deficient)

This liverwort appears to have undergone more of a decline in dune systems in Britain than it has in its other main habitat of upland base-rich flushes. It occurs in two large and mature slacks in the centre of the dune system at Newborough, Slacks 19a and 38, plus a small slack at the front of the dunes (Slack 45a). A total of about 80 thalli were seen, including male and female. Anthills within damp slacks provide an interesting niche for the plant. It grows on the sides of the mounds, which remain moist, well-grazed and are not as frequently trampled by ponies as the surrounding turf (Appendix 5, Photograph 5.6).

*Petalophyllum ralfsii* (Nationally Scarce; NERC 42; W&C Act Sch 8; Annex II)

Following the discovery of the liverwort at Newborough by D.A. Jones in 1908, the plant has often been re-found, sometimes in abundance (Hill, 1988). Newton (1995) searched the site specifically for the plant in November 1995, but was only able to spend one day on the dunes and at a time when many of the slacks were flooded, finding it in three locations at two slacks (Slacks 4a and 19a). Rumsey & Stevens (2004) undertook the first detailed survey of the plant at Newborough, recording it in six slacks (Slacks F15, 15, 19a, 35b, 38 and 43). These areas were revisited by Creer (2012), who re-found it in three (Slacks F15, 38 and 43) and suggested that a significant decline had occurred due to vegetation succession and dryer conditions at some locations. In March 2014, G. Williams found a small amount in Slack 45b, a new location for the plant at the front of the dune system. During the present survey, the plant was re-found only in Slacks F15, 38 and 45b (Appendix 5, Photographs 5.5-5.12). At all locations it was in very small amounts, with a total of just 37 non-fertile thalli. All of the other locations where the plant has been seen were searched carefully without success. It seems clear that over the past few decades this liverwort has undergone a large decline at Newborough. Of note is the apparent loss of the plant from Slack



Figure 3. An enormous population of the rare *Pseudocalliergon lycopodioides* occurs within the mature slacks of Newborough Warren.

43, where a reasonable population was present in 2012 (about 194 thalli), but where very little apparently suitable habitat could be found in November 2014.

*Pleurochaete squarrosa* (Nationally Scarce)

This moss was seen only once during the survey (SH4275762804, Slack 43), but it generally occupies drier calcareous ground that was largely ignored during the present survey. It is certainly more frequent than the single record suggests and its status within the site is likely to be favourable.

*Pseudocalliergon lycopodioides* (Nationally Scarce; UK Red List - Near-threatened; Wales Red List – Endangered; NERC Act Section 42)

This rare moss (Figure 3) survives at only Kenfig and Newborough in Wales, and so a special effort was made to document its status during the present survey. The moss is absent from the relict slacks in Newborough Forest but is locally abundant across the warren (Appendix 5, Photograph 5.13). Found to be present in 721 OS 10 m grid cells, it can form extensive carpets across some of the large, mature, wet slacks located in the upper half of the dune system (e.g. Slacks 15, 19a, 21, 24 and 25). Pony grazing certainly seems to favour the plant, as does the less mobile dune conditions. The Kenfig population, documented by Bosanquet (2012), is far smaller.

*Riccardia incurvata* (Nationally Scarce)

There are very few records of this liverwort at Newborough. When growing thinly and amongst other bryophytes, it can be tricky to detect and the plant is probably more frequent than the records suggest from the present survey. It was found in small and very scattered amounts in three slacks (Slacks 19a, 29 and 37).

*Riccia cavernosa* (Nationally Scarce)

There are only two, both unlocalised, historic records of this liverwort at Newborough, from 1934 (H.A. Hyde) and 1960 (D.S. Ranwell). About five tiny thalli were found during the present survey, in an old poached wheel-rut at the north tip of Slack 8r, with *Bryum klinggraeffii* (Appendix 5, Photograph 5.14).

*Southbya tophacea* (Nationally Rare; UK Red List - Vulnerable)

There is only one record of this rare liverwort at Newborough, by G.G. Geyman in 1978. There are no details, but it would likely have been from a younger slack. All potentially suitable habitat was covered during the present survey without success. It appears to be extinct.

*Tortella inclinata* (Nationally Scarce; Wales Red List – Near-threatened)

Newborough may be the premier site for this plant in Wales, which has undergone a decline over the past few decades and has been lost from several sites. It was not mapped in detail during the present survey due to its high frequency of occurrence, occurring both in the damper slacks and drier dune grassland. Whilst the vast bulk of the population is on Newborough Warren, the moss also occurs within slacks and along tracks in Newborough Forest.

*Tortula wilsonii* (Nationally Scarce; UK Red List – Vulnerable; Wales Red List – Endangered; NERC 42)

This moss has been lost from many sites in England and Wales, and it appears as though Newborough is no exception. It has been recorded from the site only once, by D.A. Jones in 1908.

# MANAGEMENT NOTES

---

## Dune mobility

Since the account of Ranwell (1958), when most of the dune system at Newborough was mobile, there has been a general stabilization of the system. This has resulted in a loss of >90% of bare sand areas (G. Williams pers. comm.), which will likely have had a dramatic negative effect of the specialist bryophytes of young slacks. This may well be the main cause of the local extinctions of *Bryum calophyllum*, *B. warneum*, *Catascopium nigratum*, *Distichium inclinatum*, *Southbya tophacea* and, perhaps, *Tortula wilsonii*. Some efforts to remobilise parts of the dunes have recently been undertaken (Figure 4) and further work is planned. This may be especially useful at the front of the dune system, combined with breaches of the frontal dunes.

## Conifer plantations

The large-scale coniferisation of the western half of the dunes during the 1940s-1960s ('Newborough Forest') will have had a tremendous negative effect on the bryophyte interest. Prior to this activity the bryophyte flora was not documented and so the losses will remain unknown. The relict dune habitat and slacks that remain within the forest are now bryologically very poor (Figures 5 and 6). One significant exception is a small area of base-rich springs within a grazed paddock,



Figure 4. Recent stripping of closed turf in Slack 38, close to populations of *Moerckia flotoviana* and *Petalophyllum ralfsii*.



Figure 5. An example of a relict and ungrazed dune slack (Slack F10) amongst conifer forestry in Newborough Forest, of no bryological interest.

supporting the only recently confirmed Welsh location for *Bryum intermedium* (Appendix 5, Photograph 5.3). The negative effects of the conifer plantations apparently stretch beyond their boundary, significantly lowering the water table in adjacent dune habitat (G. Williams pers. comm.). The removal of conifers has begun on a small scale and further efforts are to be encouraged, though any benefits to bryophytes of special interest may take many years to materialise.

### **Grazing**

There has been a long history of grazing on the dunes at Newborough (Ranwell, 1959) and the current grazing regime is essential to maintaining the bryophyte interest. The herd of ponies do an excellent job of creating tightly grazed, thin turf. Without such grazing, most bryophytes of particular interest would decline rapidly as coarser vegetation soon developed.



Figure 6. Bare, relict dunes beneath mature conifers in Newborough Forest.





Figure 7. The close-grazed damp turf of slacks created by ponies, here supporting *Moerckia flotoviana* in Slack 19a, is essential to maintaining the special bryophyte interest of the site.

# ACKNOWLEDGEMENTS

---

Many thanks to Graham Williams, Jules Creer and Sam Bosanquet (NRW) for various help and support, and to Jo Denyer for help with accessing literature.

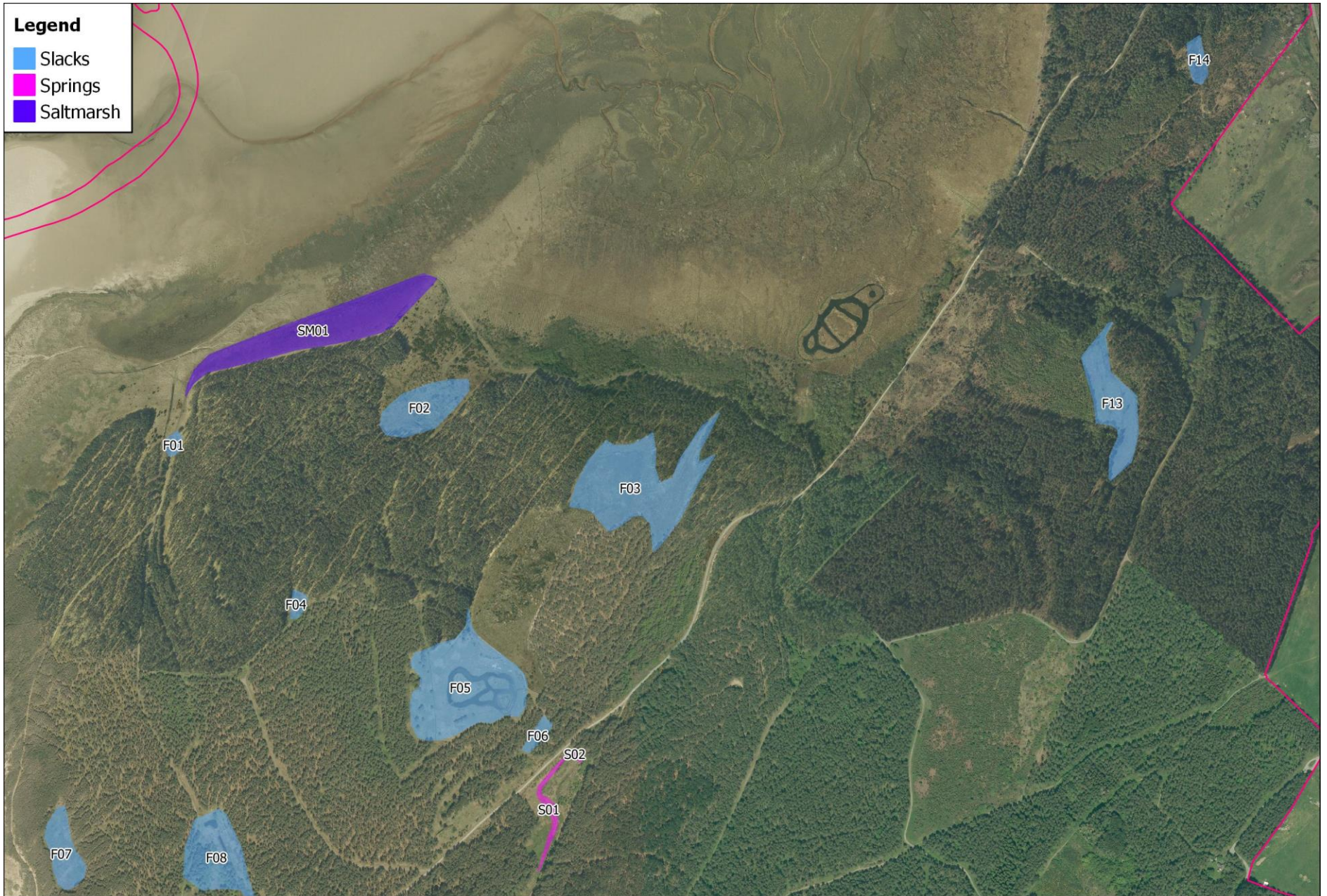
## BIBLIOGRAPHY

---

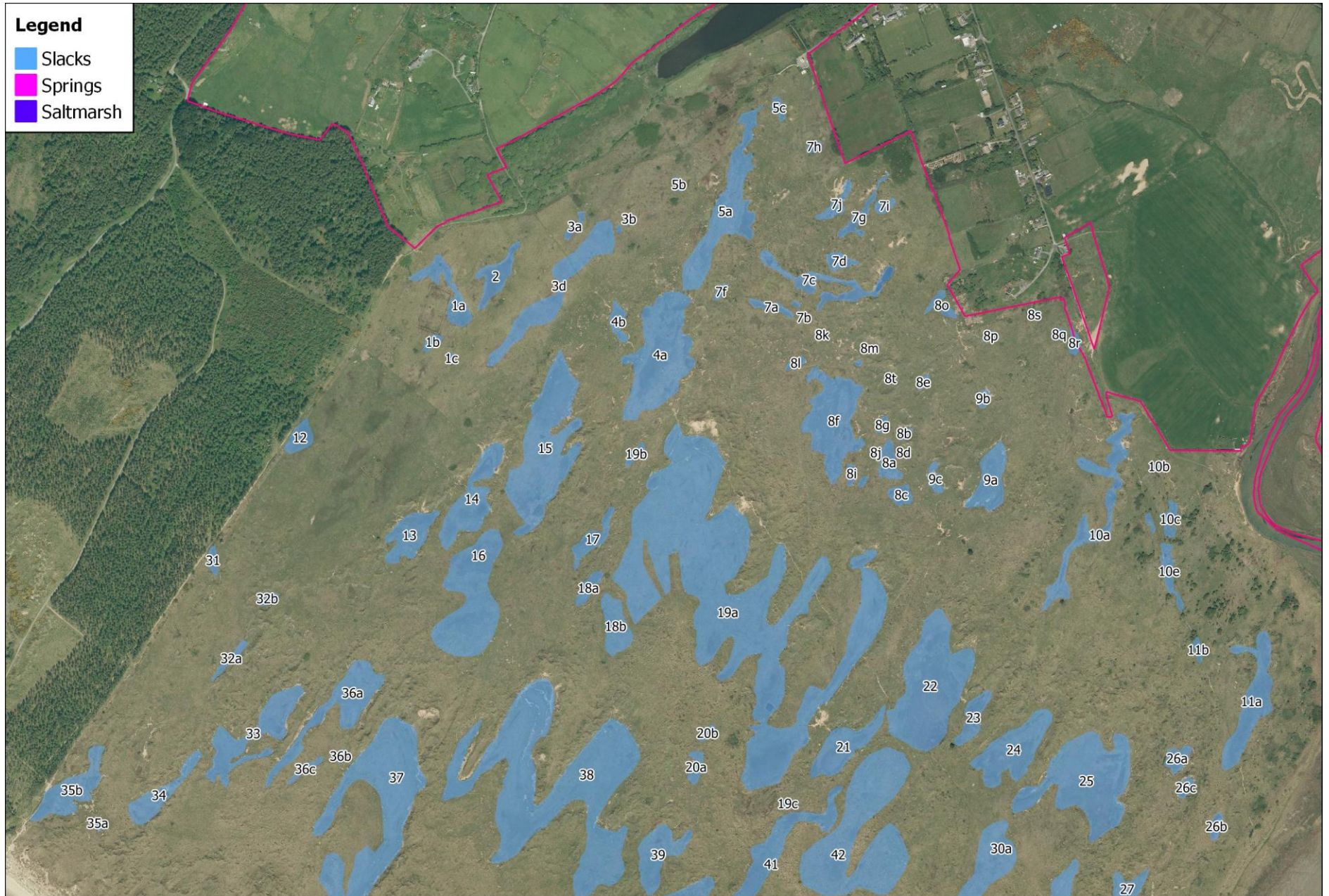
- Bosanquet, S. (2012a). *Baltic Bryum (Bryum marratii) in south Wales*. The Countryside Council for Wales.
- Bosanquet, S. (2012b). *Dune slack bryophytes at Kenfig NNR*. The Countryside Council for Wales.
- Bosanquet, S., & Dines, T. (2011). *A Bryophyte Red Data List for Wales*. Salisbury: Plantlife.
- Callaghan, D. (2013). The grid-mapping of species at sites. *British Wildlife*, 24, 334-338.
- Creer, J. (2012). *Abermenai to Aberffraw Dunes SAC. 1395: Petalophyllum ralfsii. SAC monitoring report*. Bangor: The Countryside Council for Wales.
- Hill, M. (1988). A bryophyte flora of North Wales. *Journal of Bryology*, 15, 377-491.
- Hill, M., Blackstock, T., Long, D., & Rothero, G. (2008). *A checklist and census catalogue of British and Irish bryophytes*. Cardiff: The British Bryological Society.
- Hodgetts, N. G. (1992). *Guidelines for the selection of biological SSSIs: non-vascular plants*. Peterborough: Joint Nature Conservation Committee.
- Hodgetts, N. G. (2011). A revised Red List of bryophytes in Britain. *Field Bryology*, 103, 40-49.
- Holyoak, D. (2002). *Coastal mosses of the genus Bryum: report to Plantlife of work carried in Wales in 2001*. Salisbury: Plantlife.
- JNCC. (1998). *Statement on Common Standards Monitoring (CSM)*. Peterborough: JNCC.
- JNCC. (2004). *Common Standards Monitoring: introduction to the guidance manual*. Peterborough: JNCC.
- JNCC. (2005). *Common standards monitoring guidance for bryophytes and lichens*. Peterborough: Joint Nature Conservation Committee.
- Newton, M. (1995). *Survey and monitoring of Petalwort, Petalophyllum ralfsii in Gwynedd and Clwyd, January 1995*. Countryside Council for Wales.
- Preston, C. D. (2006). A revised list of nationally scarce bryophytes. *Field Bryology*, 90, 22-29.
- Preston, C. D. (2010). A revised list of nationally rare bryophytes. *Field Bryology*, 100, 32-40.
- Ranwell, D. (1958). Movement of vegetated sand dunes at Newborough Warren, Anglesey. *Journal of Ecology*, 46, 83-100.
- Ranwell, D. (1959). Newborough Warren, Anglesey. I. The dune system and dune slack habitat. *Journal of Ecology*, 47, 571-601.
- Rumsey, F., & Stevens, G. (2004). *Assessment of the condition of Petalophyllum ralfsii (Wils.) Nees & Gottsche at the Twyni o Abermenai i Aberffraw cSAC*. Bangor: The Countryside Council for Wales.

## **APPENDIX 1 – MAPS OF SURVEY LOCATIONS**

---











## APPENDIX 2 – SPECIES INVENTORY BY LOCATION

Taxon	Location
Brachythecium rivulare	1a
Calliergonella cuspidata	1a
Brachythecium rivulare	1b
Calliergonella cuspidata	1b
Calliergonella cuspidata	1c
Brachythecium rivulare	2
Bryum pseudotriquetrum	2
Calliergonella cuspidata	2
Brachythecium rivulare	3a
Calliergonella cuspidata	3a
Rhytidiadelphus triquetrus	3a
Calliergonella cuspidata	3b
Campyliadelphus elodes	3b
Campylium stellatum	3b
Ctenidium molluscum var. molluscum	3b
Pseudocalliergon lycopodioides	3b
Pseudoscleropodium purum	3b
Brachythecium rivulare	3c
Calliergonella cuspidata	3c
Pseudoscleropodium purum	3c
Rhytidiadelphus squarrosus	3c
Rhytidiadelphus triquetrus	3c
Brachythecium rivulare	3d
Brachythecium rutabulum	3d
Bryum pseudotriquetrum	3d
Calliergonella cuspidata	3d
Climacium dendroides	3d
Plagiomnium elatum	3d
Pseudoscleropodium purum	3d
Rhytidiadelphus squarrosus	3d
Rhytidiadelphus triquetrus	3d
Barbula convoluta var. convoluta	4a
Brachythecium mildeanum	4a
Bryum algovicum	4a
Bryum pseudotriquetrum	4a
Calliergonella cuspidata	4a
Campyliadelphus chrysophyllus	4a
Campylium stellatum	4a
Climacium dendroides	4a
Dicranum scoparium	4a
Ditrichum gracile	4a
Fissidens adianthoides	4a
Hypnum cupressiforme var. lacunosum	4a
Pseudocalliergon lycopodioides	4a
Rhytidiadelphus triquetrus	4a
Thuidium tamariscinum	4a
Tortella inclinata	4a
Trichostomum crispulum	4a
Brachythecium mildeanum	4b
Bryum dichotomum	4b
Bryum pseudotriquetrum	4b
Calliergonella cuspidata	4b

Taxon	Location
Campyliadelphus chrysophyllus	4b
Climacium dendroides	4b
Hylocomium splendens	4b
Hypnum cupressiforme var. lacunosum	4b
Pseudoscleropodium purum	4b
Rhytidiadelphus triquetrus	4b
Brachythecium mildeanum	5a
Brachythecium rivulare	5a
Bryum pseudotriquetrum	5a
Calliergonella cuspidata	5a
Climacium dendroides	5a
Pseudocalliergon lycopodioides	5a
Pseudoscleropodium purum	5a
Rhytidiadelphus squarrosus	5a
Rhytidiadelphus triquetrus	5a
Brachythecium rivulare	5c
Calliergonella cuspidata	5c
Climacium dendroides	5c
Calliergonella cuspidata	7a
Hypnum cupressiforme var. lacunosum	7a
Pseudocalliergon lycopodioides	7a
Rhytidiadelphus triquetrus	7a
Calliergonella cuspidata	7b
Bryum capillare	7c
Calliergonella cuspidata	7c
Hylocomium splendens	7c
Pseudocalliergon lycopodioides	7c
Rhytidiadelphus triquetrus	7c
Climacium dendroides	7d
Calliergonella cuspidata	7e
Calliergonella cuspidata	7f
Hylocomium splendens	7f
Pseudoscleropodium purum	7f
Rhytidiadelphus squarrosus	7f
Rhytidiadelphus triquetrus	7f
Calliergonella cuspidata	7g
Campylium stellatum	7g
Drepanocladus sendtneri	7g
Rhytidiadelphus triquetrus	7g
Brachythecium rivulare	7h
Calliergonella cuspidata	7h
Calliergonella cuspidata	7i
Dicranum scoparium	7i
Homalothecium lutescens	7i
Hylocomium splendens	7i
Hypnum cupressiforme var. lacunosum	7i
Rhytidiadelphus squarrosus	7i
Rhytidiadelphus triquetrus	7i
Calliergonella cuspidata	7j
Climacium dendroides	7j
Hylocomium splendens	7j
Calliergonella cuspidata	8a

Taxon	Location
Campylium stellatum	8a
Calliergonella cuspidata	8b
Calliergonella cuspidata	8c
Campylium stellatum	8c
Hylocomium splendens	8c
Pseudoscleropodium purum	8c
Rhytidiadelphus triquetrus	8c
Calliergonella cuspidata	8d
Hylocomium splendens	8d
Hypnum cupressiforme var. lacunosum	8d
Hylocomium splendens	8e
Rhytidiadelphus triquetrus	8e
Pseudocalliergon lycopodioides	8f
Pseudoscleropodium purum	8f
Calliergonella cuspidata	8g
Pseudocalliergon lycopodioides	8g
Calliergonella cuspidata	8h
Rhytidiadelphus squarrosus	8h
Calliergonella cuspidata	8i
Calliergonella cuspidata	8j
Pseudoscleropodium purum	8j
Rhytidiadelphus triquetrus	8j
Calliergonella cuspidata	8k
Climacium dendroides	8k
Hylocomium splendens	8k
Pseudoscleropodium purum	8k
Rhytidiadelphus triquetrus	8k
Calliergonella cuspidata	8l
Campylium stellatum	8l
Scorpidium cossonii	8l
Calliergonella cuspidata	8m
Hylocomium splendens	8m
Rhytidiadelphus squarrosus	8m
Calliergonella cuspidata	8n
Aneura pinguis	8o
Calliergonella cuspidata	8o
Campylium stellatum	8o
Drepanocladus sendtneri	8o
Pseudocalliergon lycopodioides	8o
Calliergonella cuspidata	8p
Climacium dendroides	8p
Calliergonella cuspidata	8q
Pseudocalliergon lycopodioides	8q
Bryum dichotomum	8r
Bryum klinggraeffii	8r
Calliergonella cuspidata	8r
Campylium stellatum	8r
Didymodon insularis	8r
Riccia cavernosa	8r
Calliergonella cuspidata	8s
Dicranum scoparium	8t
Hylocomium splendens	8t
Pseudoscleropodium purum	8t
Rhytidiadelphus squarrosus	8t
Aneura pinguis	9a

Taxon	Location
Barbula convoluta var. convoluta	9a
Calliergonella cuspidata	9a
Campylium stellatum	9a
Fissidens adianthoides	9a
Hypnum cupressiforme var. lacunosum	9a
Pseudocalliergon lycopodioides	9a
Pseudoscleropodium purum	9a
Tortella inclinata	9a
Barbula convoluta var. convoluta	9b
Bryum pseudotriquetrum	9b
Campyliadelphus chrysophyllus	9b
Homalothecium lutescens	9c
Hylocomium splendens	9c
Hypnum cupressiforme var. lacunosum	9c
Pseudoscleropodium purum	9c
Rhytidiadelphus squarrosus	9c
Rhytidiadelphus triquetrus	9c
Bryum argenteum	10a
Bryum capillare	10a
Bryum dichotomum	10a
Bryum pseudotriquetrum	10a
Calliergonella cuspidata	10a
Ceratodon purpureus	10a
Climacium dendroides	10a
Dicranum scoparium	10a
Didymodon fallax	10a
Fissidens adianthoides	10a
Homalothecium lutescens	10a
Hylocomium splendens	10a
Hypnum cupressiforme var. lacunosum	10a
Pseudocalliergon lycopodioides	10a
Pseudoscleropodium purum	10a
Calliergonella cuspidata	10c
Climacium dendroides	10c
Dicranum scoparium	10c
Hylocomium splendens	10c
Rhytidiadelphus triquetrus	10c
Bryum cf. archangelicum	10d
Pseudoscleropodium purum	10d
Calliergonella cuspidata	10e
Hylocomium splendens	10e
Pseudoscleropodium purum	10e
Rhytidiadelphus triquetrus	10e
Bryum dichotomum	11a
Bryum pseudotriquetrum	11a
Bryum rubens	11a
Calliergonella cuspidata	11a
Campylium stellatum	11a
Dicranum scoparium	11a
Homalothecium lutescens	11a
Hylocomium splendens	11a
Pseudocalliergon lycopodioides	11a
Pseudoscleropodium purum	11a
Rhytidiadelphus squarrosus	11a
Rhytidiadelphus triquetrus	11a

Taxon	Location
<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	11a
<i>Thuidium tamariscinum</i>	11a
<i>Calliergonella cuspidata</i>	11b
<i>Climacium dendroides</i>	11b
<i>Pseudoscleropodium purum</i>	11b
<i>Calliergonella cuspidata</i>	12
<i>Brachythecium mildeanum</i>	13
<i>Bryum algovicum</i>	13
<i>Bryum pseudotriquetrum</i>	13
<i>Calliergonella cuspidata</i>	13
<i>Campyliadelphus elodes</i>	13
<i>Climacium dendroides</i>	13
<i>Dicranum scoparium</i>	13
<i>Ditrichum gracile</i>	13
<i>Drepanocladus polygamus</i>	13
<i>Leiocolea badensis</i>	13
<i>Pseudocalliergon lycopodioides</i>	13
<i>Pseudoscleropodium purum</i>	13
<i>Rhytidiadelphus triquetrus</i>	13
<i>Amblystegium serpens</i> var. <i>serpens</i>	14
<i>Aneura pinguis</i>	14
<i>Brachythecium mildeanum</i>	14
<i>Bryum pseudotriquetrum</i>	14
<i>Calliergonella cuspidata</i>	14
<i>Campyliadelphus elodes</i>	14
<i>Campylium stellatum</i>	14
<i>Didymodon tophaceus</i>	14
<i>Drepanocladus polygamus</i>	14
<i>Hylocomium splendens</i>	14
<i>Leiocolea badensis</i>	14
<i>Pseudocalliergon lycopodioides</i>	14
<i>Pseudoscleropodium purum</i>	14
<i>Rhytidiadelphus triquetrus</i>	14
<i>Trichostomum crispulum</i>	14
<i>Aneura pinguis</i>	15
<i>Brachythecium mildeanum</i>	15
<i>Calliergonella cuspidata</i>	15
<i>Campyliadelphus elodes</i>	15
<i>Campylium stellatum</i>	15
<i>Ceratodon purpureus</i>	15
<i>Climacium dendroides</i>	15
<i>Drepanocladus polygamus</i>	15
<i>Fissidens adianthoides</i>	15
<i>Pseudocalliergon lycopodioides</i>	15
<i>Rhytidiadelphus triquetrus</i>	15
<i>Scorpidium cossonii</i>	15
<i>Brachythecium albicans</i>	16
<i>Brachythecium mildeanum</i>	16
<i>Calliergonella cuspidata</i>	16
<i>Climacium dendroides</i>	16
<i>Hylocomium splendens</i>	16
<i>Pseudoscleropodium purum</i>	16
<i>Rhytidiadelphus squarrosus</i>	16
<i>Rhytidiadelphus triquetrus</i>	16
<i>Aneura pinguis</i>	17

Taxon	Location
<i>Brachythecium mildeanum</i>	17
<i>Brachythecium rivulare</i>	17
<i>Calliergonella cuspidata</i>	17
<i>Campyliadelphus chrysophyllus</i>	17
<i>Campyliadelphus elodes</i>	17
<i>Dicranum scoparium</i>	17
<i>Drepanocladus polygamus</i>	17
<i>Fissidens adianthoides</i>	17
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	17
<i>Leiocolea badensis</i>	17
<i>Pseudocalliergon lycopodioides</i>	17
<i>Pseudoscleropodium purum</i>	17
<i>Rhytidiadelphus squarrosus</i>	17
<i>Trichostomum crispulum</i>	17
<i>Aneura pinguis</i>	18a
<i>Brachythecium mildeanum</i>	18a
<i>Bryum algovicum</i>	18a
<i>Bryum pseudotriquetrum</i>	18a
<i>Calliergonella cuspidata</i>	18a
<i>Campyliadelphus elodes</i>	18a
<i>Campylium stellatum</i>	18a
<i>Drepanocladus polygamus</i>	18a
<i>Fissidens adianthoides</i>	18a
<i>Pseudoscleropodium purum</i>	18a
<i>Pseudocalliergon lycopodioides</i>	18a
<i>Brachythecium mildeanum</i>	18b
<i>Brachythecium rivulare</i>	18b
<i>Calliergonella cuspidata</i>	18b
<i>Plagiomnium elatum</i>	18b
<i>Pseudoscleropodium purum</i>	18b
<i>Rhytidiadelphus squarrosus</i>	18b
<i>Rhytidiadelphus triquetrus</i>	18b
<i>Amblystegium serpens</i> var. <i>serpens</i>	19a
<i>Aneura pinguis</i>	19a
<i>Barbula convoluta</i> var. <i>convoluta</i>	19a
<i>Barbula unguiculata</i>	19a
<i>Brachythecium albicans</i>	19a
<i>Brachythecium mildeanum</i>	19a
<i>Brachythecium rivulare</i>	19a
<i>Brachythecium rutabulum</i>	19a
<i>Bryoerythrophyllum recurvirostrum</i>	19a
<i>Bryum algovicum</i>	19a
<i>Bryum capillare</i>	19a
<i>Bryum dichotomum</i>	19a
<i>Bryum pallens</i>	19a
<i>Bryum pseudotriquetrum</i>	19a
<i>Calliergonella cuspidata</i>	19a
<i>Campyliadelphus chrysophyllus</i>	19a
<i>Campyliadelphus elodes</i>	19a
<i>Campylium stellatum</i>	19a
<i>Cephaloziella hampeana</i>	19a
<i>Ceratodon purpureus</i>	19a
<i>Climacium dendroides</i>	19a
<i>Ctenidium molluscum</i> var. <i>molluscum</i>	19a
<i>Dicranella varia</i>	19a

Taxon	Location
Dicranum scoparium	19a
Didymodon tophaceus	19a
Drepanocladus polygamus	19a
Fissidens adianthoides	19a
Funaria hygrometrica	19a
Homalothecium lutescens	19a
Hylocomium splendens	19a
Hypnum cupressiforme var. cupressiforme	19a
Hypnum cupressiforme var. lacunosum	19a
Leiocolea badensis	19a
Lophocolea bidentata	19a
Moerckia flotoviana	19a
Pellia endiviifolia	19a
Preissia quadrata	19a
Pseudocalliergon lycopodioides	19a
Pseudoscleropodium purum	19a
Rhytidiadelphus squarrosus	19a
Rhytidiadelphus triquetrus	19a
Riccardia incurvata	19a
Scorpidium cossonii	19a
Syntrichia ruralis var. ruraliformis	19a
Tortella inclinata	19a
Tortula subulata s.str.	19a
Trichostomum crispulum	19a
Barbula convoluta var. convoluta	19b
Brachythecium mildeanum	19b
Brachythecium rivulare	19b
Bryum algovicum	19b
Bryum pseudotriquetrum	19b
Calliergonella cuspidata	19b
Drepanocladus polygamus	19b
Fissidens adianthoides	19b
Plagiomnium elatum	19b
Pseudocalliergon lycopodioides	19b
Rhytidiadelphus squarrosus	19b
Rhytidiadelphus triquetrus	19b
Bryum pseudotriquetrum	19c
Calliergonella cuspidata	19c
Campylium stellatum	19c
Pseudocalliergon lycopodioides	19c
Barbula convoluta var. convoluta	20a
Brachythecium mildeanum	20a
Brachythecium rivulare	20a
Bryum algovicum	20a
Bryum pseudotriquetrum	20a
Calliergonella cuspidata	20a
Campyliadelphus chrysophyllus	20a
Dicranella varia	20a
Dicranum scoparium	20a
Didymodon insularis	20a
Fissidens adianthoides	20a
Homalothecium lutescens	20a
Hylocomium splendens	20a
Pseudoscleropodium purum	20a
Rhytidiadelphus triquetrus	20a

Taxon	Location
Thuidium tamariscinum	20a
Trichostomum crispulum	20a
Barbula convoluta var. convoluta	20b
Brachythecium mildeanum	20b
Bryum algovicum	20b
Bryum pallens	20b
Bryum pseudotriquetrum	20b
Calliergonella cuspidata	20b
Campyliadelphus elodes	20b
Campylium stellatum	20b
Didymodon tophaceus	20b
Drepanocladus polygamus	20b
Fissidens adianthoides	20b
Hylocomium splendens	20b
Leiocolea badensis	20b
Pseudocalliergon lycopodioides	20b
Rhytidiadelphus triquetrus	20b
Brachythecium mildeanum	21
Bryum pseudotriquetrum	21
Calliergonella cuspidata	21
Campyliadelphus elodes	21
Campylium stellatum	21
Drepanocladus polygamus	21
Hypnum cupressiforme var. lacunosum	21
Pseudocalliergon lycopodioides	21
Pseudoscleropodium purum	21
Scorpidium cossonii	21
Aneura pinguis	22
Brachythecium albicans	22
Brachythecium mildeanum	22
Brachythecium rivulare	22
Brachythecium rutabulum	22
Bryum algovicum	22
Bryum pallens	22
Bryum pseudotriquetrum	22
Calliergonella cuspidata	22
Campyliadelphus elodes	22
Campylium stellatum	22
Climacium dendroides	22
Cratoneuron filicinum	22
Dicranum scoparium	22
Didymodon fallax	22
Drepanocladus polygamus	22
Fissidens adianthoides	22
Pseudoscleropodium purum	22
Rhytidiadelphus squarrosus	22
Rhytidiadelphus triquetrus	22
Scorpidium cossonii	22
Syntrichia ruralis var. ruraliformis	22
Trichostomum crispulum	22
Brachythecium rivulare	23
Bryum pseudotriquetrum	23
Climacium dendroides	23
Drepanocladus polygamus	23
Fissidens adianthoides	23

Taxon	Location
<i>Pseudocalliergon lycopodioides</i>	23
<i>Pseudoscleropodium purum</i>	23
<i>Rhytidiadelphus triquetrus</i>	23
<i>Brachythecium mildeanum</i>	24
<i>Brachythecium rivulare</i>	24
<i>Bryum pseudotriquetrum</i>	24
<i>Calliergonella cuspidata</i>	24
<i>Campyliadelphus elodes</i>	24
<i>Campylium stellatum</i>	24
<i>Cratoneuron filicinum</i>	24
<i>Ctenidium molluscum</i> var. <i>molluscum</i>	24
<i>Dicranum scoparium</i>	24
<i>Eurhynchium striatum</i>	24
<i>Fissidens adianthoides</i>	24
<i>Hylocomium splendens</i>	24
<i>Pseudocalliergon lycopodioides</i>	24
<i>Pseudoscleropodium purum</i>	24
<i>Rhytidiadelphus triquetrus</i>	24
<i>Scorpidium cossonii</i>	24
<i>Aneura pinguis</i>	25
<i>Brachythecium mildeanum</i>	25
<i>Brachythecium rivulare</i>	25
<i>Bryum pallens</i>	25
<i>Bryum pseudotriquetrum</i>	25
<i>Calliergonella cuspidata</i>	25
<i>Campyliadelphus elodes</i>	25
<i>Campylium stellatum</i>	25
<i>Campylopus introflexus</i>	25
<i>Fissidens adianthoides</i>	25
<i>Homalothecium lutescens</i>	25
<i>Hylocomium splendens</i>	25
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	25
<i>Leiocolea badensis</i>	25
<i>Pseudocalliergon lycopodioides</i>	25
<i>Pseudoscleropodium purum</i>	25
<i>Rhytidiadelphus triquetrus</i>	25
<i>Scorpidium cossonii</i>	25
<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	25
<i>Thuidium tamariscinum</i>	25
<i>Tortella inclinata</i>	25
<i>Trichostomum crispulum</i>	25
<i>Aneura pinguis</i>	26a
<i>Barbula convoluta</i> var. <i>convoluta</i>	26a
<i>Brachythecium mildeanum</i>	26a
<i>Brachythecium rivulare</i>	26a
<i>Bryum pseudotriquetrum</i>	26a
<i>Calliergonella cuspidata</i>	26a
<i>Campylium stellatum</i>	26a
<i>Fissidens adianthoides</i>	26a
<i>Hylocomium splendens</i>	26a
<i>Leiocolea badensis</i>	26a
<i>Preissia quadrata</i>	26a
<i>Pseudocalliergon lycopodioides</i>	26a
<i>Pseudoscleropodium purum</i>	26a
<i>Amblystegium serpens</i> var. <i>serpens</i>	26b

Taxon	Location
<i>Aneura pinguis</i>	26b
<i>Bryum pseudotriquetrum</i>	26b
<i>Calliergonella cuspidata</i>	26b
<i>Campylium stellatum</i>	26b
<i>Fissidens adianthoides</i>	26b
<i>Homalothecium lutescens</i>	26b
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	26b
<i>Pellia endiviifolia</i>	26b
<i>Pseudocalliergon lycopodioides</i>	26b
<i>Pseudoscleropodium purum</i>	26b
<i>Scorpidium cossonii</i>	26b
<i>Bryum pseudotriquetrum</i>	26c
<i>Calliergonella cuspidata</i>	26c
<i>Campyliadelphus elodes</i>	26c
<i>Campylium stellatum</i>	26c
<i>Fissidens adianthoides</i>	26c
<i>Pseudoscleropodium purum</i>	26c
<i>Rhytidiadelphus squarrosus</i>	26c
<i>Rhytidiadelphus triquetrus</i>	26c
<i>Aneura pinguis</i>	27
<i>Bryum dichotomum</i>	27
<i>Bryum pseudotriquetrum</i>	27
<i>Calliergonella cuspidata</i>	27
<i>Campyliadelphus elodes</i>	27
<i>Fissidens adianthoides</i>	27
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	27
<i>Preissia quadrata</i>	27
<i>Pseudoscleropodium purum</i>	27
<i>Scorpidium cossonii</i>	27
<i>Aneura pinguis</i>	28
<i>Brachythecium rivulare</i>	28
<i>Bryum algovicum</i>	28
<i>Bryum pseudotriquetrum</i>	28
<i>Calliergonella cuspidata</i>	28
<i>Campylium stellatum</i>	28
<i>Dicranum scoparium</i>	28
<i>Fissidens adianthoides</i>	28
<i>Homalothecium lutescens</i>	28
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	28
<i>Pseudoscleropodium purum</i>	28
<i>Rhytidiadelphus triquetrus</i>	28
<i>Scorpidium cossonii</i>	28
<i>Tortella inclinata</i>	28
<i>Amblyodon dealbatus</i>	29
<i>Aneura pinguis</i>	29
<i>Brachythecium mildeanum</i>	29
<i>Brachythecium rivulare</i>	29
<i>Bryum algovicum</i>	29
<i>Bryum pseudotriquetrum</i>	29
<i>Calliergonella cuspidata</i>	29
<i>Campyliadelphus elodes</i>	29
<i>Campylium stellatum</i>	29
<i>Dicranum scoparium</i>	29
<i>Fissidens adianthoides</i>	29
<i>Homalothecium lutescens</i>	29

Taxon	Location
<i>Hylocomium splendens</i>	29
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	29
<i>Preissia quadrata</i>	29
<i>Pseudoscleropodium purum</i>	29
<i>Rhytidiadelphus triquetrus</i>	29
<i>Riccardia incurvata</i>	29
<i>Scorpidium cossonii</i>	29
<i>Thuidium tamariscinum</i>	29
<i>Tortella inclinata</i>	29
<i>Trichostomum crispulum</i>	29
<i>Pseudocalliergon lycopodioides</i>	29
<i>Brachythecium rivulare</i>	30a
<i>Bryum pseudotriquetrum</i>	30a
<i>Calliergonella cuspidata</i>	30a
<i>Climacium dendroides</i>	30a
<i>Dicranum scoparium</i>	30a
<i>Hylocomium splendens</i>	30a
<i>Pseudocalliergon lycopodioides</i>	30a
<i>Pseudoscleropodium purum</i>	30a
<i>Rhytidiadelphus squarrosus</i>	30a
<i>Rhytidiadelphus triquetrus</i>	30a
<i>Barbula unguiculata</i>	30b
<i>Bryum algovicum</i>	30b
<i>Bryum dichotomum</i>	30b
<i>Bryum pseudotriquetrum</i>	30b
<i>Calliergonella cuspidata</i>	30b
<i>Climacium dendroides</i>	30b
<i>Dicranum scoparium</i>	30b
<i>Hylocomium splendens</i>	30b
<i>Pseudocalliergon lycopodioides</i>	30b
<i>Pseudoscleropodium purum</i>	30b
<i>Rhytidiadelphus squarrosus</i>	30b
<i>Bryum pseudotriquetrum</i>	31
<i>Calliergonella cuspidata</i>	31
<i>Campyliadelphus elodes</i>	31
<i>Didymodon tophaceus</i>	31
<i>Ditrichum gracile</i>	31
<i>Fissidens adianthoides</i>	31
<i>Leiocolea badensis</i>	31
<i>Pseudoscleropodium purum</i>	31
<i>Rhytidiadelphus squarrosus</i>	31
<i>Trichostomum crispulum</i>	31
<i>Barbula unguiculata</i>	32a
<i>Bryum algovicum</i>	32a
<i>Bryum capillare</i>	32a
<i>Bryum pseudotriquetrum</i>	32a
<i>Calliergonella cuspidata</i>	32a
<i>Campyliadelphus elodes</i>	32a
<i>Campylium stellatum</i>	32a
<i>Dicranum scoparium</i>	32a
<i>Didymodon fallax</i>	32a
<i>Ditrichum gracile</i>	32a
<i>Hylocomium splendens</i>	32a
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	32a
<i>Pseudoscleropodium purum</i>	32a

Taxon	Location
<i>Trichostomum crispulum</i>	32a
<i>Pseudoscleropodium purum</i>	32b
<i>Aneura pinguis</i>	33
<i>Barbula convoluta</i> var. <i>convoluta</i>	33
<i>Bryoerythrophyllum recurvirostrum</i>	33
<i>Bryum algovicum</i>	33
<i>Bryum pseudotriquetrum</i>	33
<i>Calliergonella cuspidata</i>	33
<i>Campyliadelphus chrysophyllus</i>	33
<i>Campyliadelphus elodes</i>	33
<i>Campylium stellatum</i>	33
<i>Cephaloziella hampeana</i>	33
<i>Ditrichum gracile</i>	33
<i>Hymenostylium recurvirostrum</i> var. <i>recurvirostrum</i>	33
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	33
<i>Leiocolea badensis</i>	33
<i>Pseudoscleropodium purum</i>	33
<i>Rhytidiadelphus triquetrus</i>	33
<i>Tortella inclinata</i>	33
<i>Trichostomum crispulum</i>	33
<i>Barbula convoluta</i> var. <i>convoluta</i>	34
<i>Bryoerythrophyllum recurvirostrum</i>	34
<i>Bryum algovicum</i>	34
<i>Bryum pseudotriquetrum</i>	34
<i>Calliergonella cuspidata</i>	34
<i>Campyliadelphus chrysophyllus</i>	34
<i>Didymodon tophaceus</i>	34
<i>Homalothecium lutescens</i>	34
<i>Hylocomium splendens</i>	34
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	34
<i>Pseudoscleropodium purum</i>	34
<i>Rhytidiadelphus squarrosus</i>	34
<i>Rhytidiadelphus triquetrus</i>	34
<i>Tortella inclinata</i>	34
<i>Trichostomum crispulum</i>	34
<i>Barbula unguiculata</i>	35a
<i>Brachythecium albicans</i>	35a
<i>Bryum algovicum</i>	35a
<i>Bryum pallens</i>	35a
<i>Calliergonella cuspidata</i>	35a
<i>Pseudoscleropodium purum</i>	35a
<i>Rhytidiadelphus squarrosus</i>	35a
<i>Tortella inclinata</i>	35a
<i>Aneura pinguis</i>	35b
<i>Bryum pallens</i>	35b
<i>Bryum pseudotriquetrum</i>	35b
<i>Calliergonella cuspidata</i>	35b
<i>Campylium stellatum</i>	35b
<i>Cratoneuron filicinum</i>	35b
<i>Dicranella varia</i>	35b
<i>Didymodon tophaceus</i>	35b
<i>Homalothecium lutescens</i>	35b
<i>Leiocolea badensis</i>	35b
<i>Aneura pinguis</i>	36a

Taxon	Location
Brachythecium mildeanum	36a
Brachythecium rivulare	36a
Bryum algovicum	36a
Bryum pseudotriquetrum	36a
Calliergonella cuspidata	36a
Campyliadelphus elodes	36a
Campylium stellatum	36a
Ceratodon purpureus	36a
Dicranella varia	36a
Didymodon tophaceus	36a
Ditrichum gracile	36a
Drepanocladus polygamus	36a
Fissidens adianthoides	36a
Hymenostylium recurvirostrum var. recurvirostrum	36a
Leiocolea badensis	36a
Pseudocalliergon lycopodioides	36a
Pseudoscleropodium purum	36a
Trichostomum crispulum	36a
Bryum pseudotriquetrum	36b
Calliergonella cuspidata	36b
Campyliadelphus chrysophyllus	36b
Drepanocladus polygamus	36b
Fissidens adianthoides	36b
Hylocomium splendens	36b
Pseudoscleropodium purum	36b
Rhytiadelphus triquetrus	36b
Bryum pallens	36c
Bryum pseudotriquetrum	36c
Calliergonella cuspidata	36c
Campyliadelphus chrysophyllus	36c
Pseudoscleropodium purum	36c
Rhytiadelphus triquetrus	36c
Tortella inclinata	36c
Trichostomum crispulum	36c
Amblyodon dealbatus	37
Amblystegium serpens var. serpens	37
Aneura pinguis	37
Barbula convoluta var. convoluta	37
Brachythecium mildeanum	37
Bryoerythrophyllum recurvirostrum	37
Bryum algovicum	37
Bryum pallens	37
Bryum pseudotriquetrum	37
Calliergonella cuspidata	37
Campyliadelphus elodes	37
Campylium stellatum	37
Cephaloziella hampeana	37
Ceratodon purpureus	37
Cratoneuron filicinum	37
Dicranella varia	37
Dicranum scoparium	37
Didymodon fallax	37
Didymodon ferrugineus	37
Didymodon tophaceus	37
Drepanocladus polygamus	37
Encalypta streptocarpa	37
Fissidens adianthoides	37
Funaria hygrometrica	37
Homalothecium lutescens	37
Hylocomium splendens	37
Hypnum cupressiforme var. lacunosum	37
Leiocolea badensis	37
Lophocolea bidentata	37
Moerckia flotoviana	37
Palustriella falcata	37
Petalophyllum ralfsii	37
Plagiomnium elatum	37
Preissia quadrata	37
Pseudocalliergon lycopodioides	37

Taxon	Location
Encalypta streptocarpa	37
Fissidens adianthoides	37
Homalothecium lutescens	37
Hymenostylium recurvirostrum var. recurvirostrum	37
Hypnum cupressiforme var. lacunosum	37
Leiocolea badensis	37
Plagiomnium elatum	37
Pseudocalliergon lycopodioides	37
Pseudoscleropodium purum	37
Riccardia incurvata	37
Scorpidium cossonii	37
Syntrichia ruralis var. ruraliformis	37
Tortella inclinata	37
Trichostomum crispulum	37
Amblystegium serpens var. serpens	38
Aneura pinguis	38
Barbula convoluta var. convoluta	38
Barbula unguiculata	38
Brachythecium albicans	38
Brachythecium mildeanum	38
Brachythecium rivulare	38
Brachythecium rutabulum	38
Bryoerythrophyllum recurvirostrum	38
Bryum algovicum	38
Bryum argenteum	38
Bryum dichotomum	38
Bryum pallens	38
Bryum pseudotriquetrum	38
Calliergonella cuspidata	38
Campyliadelphus chrysophyllus	38
Campyliadelphus elodes	38
Campylium stellatum	38
Cephaloziella hampeana	38
Cratoneuron filicinum	38
Dicranella varia	38
Dicranum scoparium	38
Didymodon fallax	38
Didymodon ferrugineus	38
Didymodon tophaceus	38
Drepanocladus polygamus	38
Encalypta streptocarpa	38
Fissidens adianthoides	38
Funaria hygrometrica	38
Homalothecium lutescens	38
Hylocomium splendens	38
Hypnum cupressiforme var. lacunosum	38
Leiocolea badensis	38
Lophocolea bidentata	38
Moerckia flotoviana	38
Palustriella falcata	38
Petalophyllum ralfsii	38
Plagiomnium elatum	38
Preissia quadrata	38
Pseudocalliergon lycopodioides	38

Taxon	Location
<i>Pseudoscleropodium purum</i>	38
<i>Rhytidiadelphus squarrosus</i>	38
<i>Rhytidiadelphus triquetrus</i>	38
<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	38
<i>Tortella inclinata</i>	38
<i>Trichostomum crispulum</i>	38
<i>Calliergonella cuspidata</i>	39
<i>Climacium dendroides</i>	39
<i>Pseudoscleropodium purum</i>	39
<i>Rhytidiadelphus squarrosus</i>	39
<i>Rhytidiadelphus triquetrus</i>	39
<i>Brachythecium albicans</i>	40
<i>Brachythecium mildeanum</i>	40
<i>Bryum dichotomum</i>	40
<i>Bryum pseudotriquetrum</i>	40
<i>Calliergonella cuspidata</i>	40
<i>Campyliadelphus chrysophyllus</i>	40
<i>Cratoneuron filicinum</i>	40
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	40
<i>Pseudoscleropodium purum</i>	40
<i>Rhytidiadelphus squarrosus</i>	40
<i>Amblystegium serpens</i> var. <i>serpens</i>	41
<i>Barbula convoluta</i> var. <i>convoluta</i>	41
<i>Brachythecium albicans</i>	41
<i>Brachythecium mildeanum</i>	41
<i>Bryoerythrophyllum recurvirostrum</i>	41
<i>Bryum algovicum</i>	41
<i>Bryum dichotomum</i>	41
<i>Bryum pallens</i>	41
<i>Bryum pseudotriquetrum</i>	41
<i>Calliergonella cuspidata</i>	41
<i>Campylium stellatum</i>	41
<i>Cephaloziella hampeana</i>	41
<i>Dicranella varia</i>	41
<i>Dicranum scoparium</i>	41
<i>Drepanocladus polygamus</i>	41
<i>Hylocomium splendens</i>	41
<i>Pseudocalliergon lycopodioides</i>	41
<i>Pseudoscleropodium purum</i>	41
<i>Rhytidiadelphus squarrosus</i>	41
<i>Rhytidiadelphus triquetrus</i>	41
<i>Tortella inclinata</i>	41
<i>Brachythecium albicans</i>	42
<i>Brachythecium mildeanum</i>	42
<i>Brachythecium rivulare</i>	42
<i>Bryum pseudotriquetrum</i>	42
<i>Calliergonella cuspidata</i>	42
<i>Campylium stellatum</i>	42
<i>Climacium dendroides</i>	42
<i>Dicranum scoparium</i>	42
<i>Fissidens adianthoides</i>	42
<i>Pseudoscleropodium purum</i>	42
<i>Rhytidiadelphus squarrosus</i>	42
<i>Rhytidiadelphus triquetrus</i>	42
<i>Thuidium tamariscinum</i>	42

Taxon	Location
<i>Pseudocalliergon lycopodioides</i>	42
<i>Aneura pinguis</i>	43
<i>Brachythecium rutabulum</i>	43
<i>Bryum algovicum</i>	43
<i>Bryum pseudotriquetrum</i>	43
<i>Calliergonella cuspidata</i>	43
<i>Campyliadelphus elodes</i>	43
<i>Campylium stellatum</i>	43
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	43
<i>Pellia endiviifolia</i>	43
<i>Plagiomnium elatum</i>	43
<i>Pleurochaete squarrosa</i>	43
<i>Preissia quadrata</i>	43
<i>Pseudocalliergon lycopodioides</i>	43
<i>Pseudoscleropodium purum</i>	43
<i>Rhytidiadelphus squarrosus</i>	43
<i>Rhytidiadelphus triquetrus</i>	43
<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	43
<i>Tortella inclinata</i>	43
<i>Aneura pinguis</i>	44
<i>Brachythecium mildeanum</i>	44
<i>Brachythecium rivulare</i>	44
<i>Brachythecium rutabulum</i>	44
<i>Bryum algovicum</i>	44
<i>Bryum pallens</i>	44
<i>Bryum pseudotriquetrum</i>	44
<i>Calliergonella cuspidata</i>	44
<i>Campyliadelphus chrysophyllus</i>	44
<i>Campylium stellatum</i>	44
<i>Ctenidium molluscum</i> var. <i>molluscum</i>	44
<i>Fissidens adianthoides</i>	44
<i>Homalothecium lutescens</i>	44
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	44
<i>Plagiomnium elatum</i>	44
<i>Preissia quadrata</i>	44
<i>Pseudocalliergon lycopodioides</i>	44
<i>Pseudoscleropodium purum</i>	44
<i>Rhytidiadelphus squarrosus</i>	44
<i>Rhytidiadelphus triquetrus</i>	44
<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	44
<i>Tortella inclinata</i>	44
<i>Aneura pinguis</i>	45a
<i>Brachythecium mildeanum</i>	45a
<i>Bryum algovicum</i>	45a
<i>Bryum pseudotriquetrum</i>	45a
<i>Calliergonella cuspidata</i>	45a
<i>Campyliadelphus elodes</i>	45a
<i>Didymodon tophaceus</i>	45a
<i>Drepanocladus polygamus</i>	45a
<i>Moerckia flotoviana</i>	45a
<i>Pseudoscleropodium purum</i>	45a
<i>Amblystegium serpens</i> var. <i>serpens</i>	45b
<i>Aneura pinguis</i>	45b
<i>Brachythecium mildeanum</i>	45b
<i>Bryum algovicum</i>	45b



Taxon	Location
Bryum pallens	45b
Bryum pseudotriquetrum	45b
Calliergonella cuspidata	45b
Cratoneuron filicinum	45b
Didymodon tophaceus	45b
Homalothecium lutescens	45b
Petalophyllum ralfsii	45b
Riccardia incurvata	45b
Aneura pinguis	46
Bryum pseudotriquetrum	46
Calliergonella cuspidata	46
Campylium stellatum	46
Fissidens adianthoides	46
Hylocomium splendens	46
Hypnum cupressiforme var. lacunosum	46
Pseudoscleropodium purum	46
Rhytidiadelphus triquetrus	46
Amblystegium serpens var. serpens	47
Aneura pinguis	47
Barbula convoluta var. convoluta	47
Bryum algovicum	47
Bryum pseudotriquetrum	47
Calliergonella cuspidata	47
Campyliadelphus elodes	47
Campylium stellatum	47
Homalothecium lutescens	47
Hylocomium splendens	47
Hypnum cupressiforme var. lacunosum	47
Rhytidiadelphus triquetrus	47
Trichostomum crispulum	47
Homalothecium lutescens	48
Scorpidium cossonii	48
Brachythecium mildeanum	49a
Calliergonella cuspidata	49a
Climacium dendroides	49a
Dicranum scoparium	49a
Brachythecium mildeanum	49b
Bryum dichotomum	49b
Calliergonella cuspidata	49b
Drepanocladus aduncus	49b
Calliergonella cuspidata	50
Cratoneuron filicinum	50
Kindbergia praelonga	50
Pseudoscleropodium purum	50
Calliergonella cuspidata	F01
Calliergonella cuspidata	F02
Dicranum scoparium	F02
Hylocomium splendens	F02
Hypnum cupressiforme var. lacunosum	F02
Hypnum jutlandicum	F02
Polytrichum juniperinum	F02
Pseudoscleropodium purum	F02
Rhytidiadelphus triquetrus	F02
Thuidium tamariscinum	F02
Bryum dichotomum	F03

Taxon	Location
Calliergonella cuspidata	F03
Campylopus introflexus	F03
Dicranum scoparium	F03
Hylocomium splendens	F03
Hypnum jutlandicum	F03
Polytrichastrum formosum	F03
Pseudoscleropodium purum	F03
Tortella inclinata	F03
Calliergonella cuspidata	F04
Cryphaea heteromalla	F04
Dicranum scoparium	F04
Frullania dilatata	F04
Hypnum cupressiforme var. cupressiforme	F04
Metzgeria furcata	F04
Metzgeria violacea	F04
Orthotrichum affine	F04
Radula complanata	F04
Rhytidiadelphus squarrosus	F04
Thuidium tamariscinum	F04
Ulota bruchii	F04
Ulota crispa s.str.	F04
Ulota phyllantha	F04
Calliergonella cuspidata	F05
Hylocomium splendens	F05
Pseudoscleropodium purum	F05
Rhytidiadelphus triquetrus	F05
Rhytidiadelphus triquetrus	F06
Calliergonella cuspidata	F07
Calliergonella cuspidata	F08
Calliergonella cuspidata	F09
Calliergonella cuspidata	F10
Pseudoscleropodium purum	F10
Dicranum scoparium	F11
Eurhynchium striatum	F11
Frullania dilatata	F11
Hypnum jutlandicum	F11
Kindbergia praelonga	F11
Metzgeria furcata	F11
Microlejeunea ulicina	F11
Orthotrichum affine	F11
Thuidium tamariscinum	F11
Ulota crispa s.str.	F11
Ulota phyllantha	F11
Calliergonella cuspidata	F12
Dicranum scoparium	F12
Hypnum cupressiforme var. lacunosum	F12
Pseudoscleropodium purum	F12
Campylopus introflexus	F13
Dicranum scoparium	F13
Hylocomium splendens	F13
Pseudoscleropodium purum	F13
Thuidium tamariscinum	F13
Calliergonella cuspidata	F14
Didymodon insulanus	F15
Fossombronia incurva	F15

Taxon	Location
<i>Homalothecium lutescens</i>	F15
<i>Kindbergia praelonga</i>	F15
<i>Petalophyllum ralfsii</i>	F15
<i>Aneura pinguis</i>	S01
<i>Atrichum undulatum</i> var. <i>undulatum</i>	S01
<i>Aulacomnium palustre</i>	S01
<i>Brachythecium mildeanum</i>	S01
<i>Brachythecium rivulare</i>	S01
<i>Bryoerythrophyllum recurvirostrum</i>	S01
<i>Bryum intermedium</i>	S01
<i>Bryum pseudotriquetrum</i>	S01
<i>Calliergonella cuspidata</i>	S01
<i>Cephaloziella divaricata</i>	S01
<i>Cratoneuron filicinum</i>	S01
<i>Dicranella varia</i>	S01
<i>Didymodon fallax</i>	S01
<i>Funaria hygrometrica</i>	S01
<i>Lophocolea bidentata</i>	S01
<i>Pellia endiviifolia</i>	S01
<i>Philonotis calcarea</i>	S01
<i>Pogonatum urnigerum</i>	S01
<i>Pohlia wahlenbergii</i> var. <i>wahlenbergii</i>	S01
<i>Polytrichum commune</i> var. <i>commune</i>	S01

Taxon	Location
<i>Riccardia multifida</i>	S01
<i>Sphagnum squarrosum</i>	S01
<i>Sphagnum subnitens</i> var. <i>subnitens</i>	S01
<i>Barbula unguiculata</i>	S02
<i>Brachythecium rivulare</i>	S02
<i>Bryum dichotomum</i>	S02
<i>Bryum pseudotriquetrum</i>	S02
<i>Calliergonella cuspidata</i>	S02
<i>Dicranella varia</i>	S02
<i>Funaria hygrometrica</i>	S02
<i>Pellia endiviifolia</i>	S02
<i>Pseudoscleropodium purum</i>	S02
<i>Amblystegium serpens</i> var. <i>serpens</i>	SM01
<i>Bryum</i> cf. <i>archangelicum</i>	SM01
<i>Bryum dichotomum</i>	SM01
<i>Bryum pallens</i>	SM01
<i>Calliergonella cuspidata</i>	SM01
<i>Ceratodon purpureus</i>	SM01
<i>Didymodon tophaceus</i>	SM01
<i>Fossombronia</i> sp.	SM01
<i>Funaria hygrometrica</i>	SM01
<i>Rhytidiadelphus squarrosus</i>	SM01

## APPENDIX 3 – SUMMARY SPECIES INVENTORY

Taxon	N° locations recorded			Total
	Slacks	Saltmarsh	Springs	
<i>Amblyodon dealbatus</i>	2			2
<i>Amblystegium serpens</i> var. <i>serpens</i>	8	1		9
<i>Aneura pinguis</i>	25		1	26
<i>Atrichum undulatum</i> var. <i>undulatum</i>			1	1
<i>Aulacomnium palustre</i>			1	1
<i>Barbula convoluta</i> var. <i>convoluta</i>	14			14
<i>Barbula unguiculata</i>	5		1	6
<i>Brachythecium albicans</i>	8			8
<i>Brachythecium mildeanum</i>	31		1	32
<i>Brachythecium rivulare</i>	26		2	28
<i>Brachythecium rutabulum</i>	6			6
<i>Bryoerythrophyllum recurvirostrum</i>	6		1	7
<i>Bryum algovicum</i>	24			24
<i>Bryum argenteum</i>	2			2
<i>Bryum capillare</i>	4			4
<i>Bryum</i> cf. <i>archangelicum</i>	1	1		2
<i>Bryum dichotomum</i>	12	1	1	14
<i>Bryum intermedium</i>			1	1
<i>Bryum klinggraeffii</i>	1			1
<i>Bryum pallens</i>	12	1		13
<i>Bryum pseudotriquetrum</i>	48		2	50
<i>Bryum rubens</i>	1			1
<i>Calliergonella cuspidata</i>	104	1	2	107
<i>Campyliadelphus chrysophyllus</i>	13			13
<i>Campyliadelphus elodes</i>	24			24
<i>Campylium stellatum</i>	37			37
<i>Campylopus introflexus</i>	3			3
<i>Cephaloziella divaricata</i>			1	1
<i>Cephaloziella hampeana</i>	5			5
<i>Ceratodon purpureus</i>	5	1		6
<i>Climacium dendroides</i>	23			23
<i>Cratoneuron filicinum</i>	8		1	9
<i>Cryphaea heteromalla</i>	1			1
<i>Ctenidium molluscum</i> var. <i>molluscum</i>	4			4
<i>Dicranella varia</i>	7		2	9
<i>Dicranum scoparium</i>	28			28
<i>Didymodon fallax</i>	5		1	6
<i>Didymodon ferrugineus</i>	1			1
<i>Didymodon insulanus</i>	3			3
<i>Didymodon tophaceus</i>	11	1		12
<i>Ditrichum gracile</i>	6			6
<i>Drepanocladus aduncus</i>	1			1
<i>Drepanocladus polygamus</i>	17			17
<i>Drepanocladus sendtneri</i>	2			2
<i>Encalypta streptocarpa</i>	2			2
<i>Eurhynchium striatum</i>	2			2
<i>Fissidens adianthoides</i>	28			28
<i>Fossombronina incurva</i>	1			1
<i>Frullania dilatata</i>	2			2
<i>Funaria hygrometrica</i>	2	1	2	5
<i>Homalothecium lutescens</i>	19			19

Taxon	N° locations recorded			Total
	Slacks	Saltmarsh	Springs	
<i>Hylocomium splendens</i>	38			38
<i>Hymenostylium recurvirostrum</i> var. <i>recurvirostrum</i>	3			3
<i>Hypnum cupressiforme</i> var. <i>cupressiforme</i>	2			2
<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	28			28
<i>Hypnum jutlandicum</i>	3			3
<i>Kindbergia praelonga</i>	3			3
<i>Leiocolea badensis</i>	13			13
<i>Lophocolea bidentata</i>	2		1	3
<i>Metzgeria furcata</i>	2			2
<i>Metzgeria violacea</i>	1			1
<i>Microlejeunea ulicina</i>	1			1
<i>Moerckia flotoviana</i>	3			2
<i>Orthotrichum affine</i>	2			2
<i>Palustriella falcata</i>	1			1
<i>Pellia endiviifolia</i>	3		2	5
<i>Petalophyllum ralfsii</i>	3			3
<i>Philonotis calcarea</i>			1	1
<i>Plagiomnium elatum</i>	7			7
<i>Pleurochaete squarrosa</i>	1			1
<i>Pogonatum urnigerum</i>			1	1
<i>Pohlia wahlenbergii</i> var. <i>wahlenbergii</i>			1	1
<i>Polytrichastrum formosum</i>	1			1
<i>Polytrichum commune</i> var. <i>commune</i>			1	1
<i>Polytrichum juniperinum</i>	1			1
<i>Preissia quadrata</i>	7			7
<i>Pseudocalliergon lycopodioides</i>	37			37
<i>Pseudoscleropodium purum</i>	65		1	66
<i>Radula complanata</i>	1			1
<i>Rhytidiadelphus squarrosus</i>	30	1		31
<i>Rhytidiadelphus triquetrus</i>	51			51
<i>Riccardia incurvata</i>	4			4
<i>Riccardia multifida</i>			1	1
<i>Riccia cavernosa</i>	1			1
<i>Scorpidium cossonii</i>	13			13
<i>Sphagnum squarrosum</i>			1	1
<i>Sphagnum subnitens</i> var. <i>subnitens</i>			1	1
<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	8			8
<i>Thuidium tamariscinum</i>	10			10
<i>Tortella inclinata</i>	16			16
<i>Tortula subulata</i> s.str.	1			1
<i>Trichostomum crispulum</i>	17			17
<i>Ulota bruchii</i>	1			1
<i>Ulota crispa</i> s.str.	2			2
<i>Ulota phyllantha</i>	2			2

## APPENDIX 4 – GPS LOCATIONS OF NOTABLE SPECIES

The below provides the central coordinate of each OS 10 x 10 m grid-cell where each notable species was found during the present survey. Note that only a small sample of the locations for *Campyliadelphus elodes* and *Tortella inclinata* were recorded since both are locally frequent within the site and neither is of high conservation concern. Locations of other species listed below are comprehensive and include all locations where they were found.

Species	GR
Amblyodon dealbatus	SH4319563055
Amblyodon dealbatus	SH4178563185
Amblyodon dealbatus	SH4178563195
Amblyodon dealbatus	SH4178563175
Amblyodon dealbatus	SH4179563185
Amblyodon dealbatus	SH4179563195
Amblyodon dealbatus	SH4178563205
Amblyodon dealbatus	SH4180563215
Amblyodon dealbatus	SH4179563215
Amblyodon dealbatus	SH4178563215
Amblyodon dealbatus	SH4177563205
Amblyodon dealbatus	SH4177563215
Amblyodon dealbatus	SH4179563225
Amblyodon dealbatus	SH4180563235
Amblyodon dealbatus	SH4179563235
Amblyodon dealbatus	SH4180563225
Amblyodon dealbatus	SH4178563235
Amblyodon dealbatus	SH4179563255
Amblyodon dealbatus	SH4178563255
Amblyodon dealbatus	SH4178563265
Amblyodon dealbatus	SH4178563275
Amblyodon dealbatus	SH4179563245
Amblyodon dealbatus	SH4178563245
Amblyodon dealbatus	SH4180563255
Amblyodon dealbatus	SH4180563245
Amblyodon dealbatus	SH4179563265
Amblyodon dealbatus	SH4179563275
Amblyodon dealbatus	SH4179563285
Bryum intermedium	SH3990564835
Bryum intermedium	SH3989564845
Campyliadelphus elodes	SH4226563295
Campyliadelphus elodes	SH4288563555
Campyliadelphus elodes	SH4289563585
Campyliadelphus elodes	SH4296563505
Campyliadelphus elodes	SH4243563965
Campyliadelphus elodes	SH4244563895
Campyliadelphus elodes	SH4241563805
Campyliadelphus elodes	SH4249563755
Campyliadelphus elodes	SH4245563745
Campyliadelphus elodes	SH4242563705
Campyliadelphus elodes	SH4250563595
Campyliadelphus elodes	SH4275563345
Campyliadelphus elodes	SH4306563335

Species	GR
Campyliadelphus elodes	SH4309563215
Campyliadelphus elodes	SH4321563275
Campyliadelphus elodes	SH4330563025
Campyliadelphus elodes	SH4343563225
Campyliadelphus elodes	SH4293562735
Campyliadelphus elodes	SH4274562795
Campyliadelphus elodes	SH4187562855
Campyliadelphus elodes	SH4180563205
Campyliadelphus elodes	SH4137562905
Campyliadelphus elodes	SH4155563425
Campyliadelphus elodes	SH4170563465
Campyliadelphus elodes	SH4145563525
Campyliadelphus elodes	SH4141563695
Campyliadelphus elodes	SH4180563775
Campyliadelphus elodes	SH4195563805
Campyliadelphus elodes	SH4223563795
Campyliadelphus elodes	SH4219563655
Campyliadelphus elodes	SH4244563355
Campyliadelphus elodes	SH4214563905
Campyliadelphus elodes	SH4227564425
Drepanocladus sendtneri	SH4278564475
Drepanocladus sendtneri	SH4274564425
Drepanocladus sendtneri	SH4294564235
Fossombronina incurva	SH4066163413
Hymenostylium recurvirostrum	SH4179563225
Hymenostylium recurvirostrum	SH4178563235
Hymenostylium recurvirostrum	SH4179563245
Hymenostylium recurvirostrum	SH4145563325
Hymenostylium recurvirostrum	SH4162563405
Hymenostylium recurvirostrum	SH4173563455
Moerckia flotoviana	SH4207563285
Moerckia flotoviana	SH4224563245
Moerckia flotoviana	SH4225563245
Moerckia flotoviana	SH4224563255
Moerckia flotoviana	SH4223563245
Moerckia flotoviana	SH4222563235
Moerckia flotoviana	SH4222563225
Moerckia flotoviana	SH4246563645
Moerckia flotoviana	SH4246563635
Moerckia flotoviana	SH4252563615
Moerckia flotoviana	SH4250563585
Moerckia flotoviana	SH4243563615
Moerckia flotoviana	SH4137762906

Species	GR
Moerckia flotoviana	SH4138162910
Petalophyllum ralfsii	SH4207563275
Petalophyllum ralfsii	SH4207563285
Petalophyllum ralfsii	SH4225563325
Petalophyllum ralfsii	SH4225563315
Petalophyllum ralfsii	SH4225563295
Petalophyllum ralfsii	SH4224563265
Petalophyllum ralfsii	SH4224563245
Petalophyllum ralfsii	SH4062163387
Petalophyllum ralfsii	SH4135462962
Pleurochaete squarrosa	SH4275762804
Pseudocalliergon lycopodioides	SH4268564055
Pseudocalliergon lycopodioides	SH4357563385
Pseudocalliergon lycopodioides	SH4357563395
Pseudocalliergon lycopodioides	SH4359563405
Pseudocalliergon lycopodioides	SH4358563405
Pseudocalliergon lycopodioides	SH4357563415
Pseudocalliergon lycopodioides	SH4358563415
Pseudocalliergon lycopodioides	SH4205563255
Pseudocalliergon lycopodioides	SH4206563255
Pseudocalliergon lycopodioides	SH4360563435
Pseudocalliergon lycopodioides	SH4360563455
Pseudocalliergon lycopodioides	SH4322563925
Pseudocalliergon lycopodioides	SH4329563875
Pseudocalliergon lycopodioides	SH4304563845
Pseudocalliergon lycopodioides	SH4301563875
Pseudocalliergon lycopodioides	SH4303563885
Pseudocalliergon lycopodioides	SH4302563885
Pseudocalliergon lycopodioides	SH4301563865
Pseudocalliergon lycopodioides	SH4302563865
Pseudocalliergon lycopodioides	SH4302563875
Pseudocalliergon lycopodioides	SH4303563875
Pseudocalliergon lycopodioides	SH4303563895
Pseudocalliergon lycopodioides	SH4226563285
Pseudocalliergon lycopodioides	SH4281564015
Pseudocalliergon lycopodioides	SH4280564005
Pseudocalliergon lycopodioides	SH4227563285
Pseudocalliergon lycopodioides	SH4269564015
Pseudocalliergon lycopodioides	SH4227563295
Pseudocalliergon lycopodioides	SH4266564015
Pseudocalliergon lycopodioides	SH4267564005
Pseudocalliergon lycopodioides	SH4267564055
Pseudocalliergon lycopodioides	SH4269564075
Pseudocalliergon lycopodioides	SH4272564095
Pseudocalliergon lycopodioides	SH4273564085
Pseudocalliergon lycopodioides	SH4273564075
Pseudocalliergon lycopodioides	SH4275564075
Pseudocalliergon lycopodioides	SH4317564185
Pseudocalliergon lycopodioides	SH4247563575
Pseudocalliergon lycopodioides	SH4248563585
Pseudocalliergon lycopodioides	SH4317564195
Pseudocalliergon lycopodioides	SH4251563615
Pseudocalliergon lycopodioides	SH4280564015
Pseudocalliergon lycopodioides	SH4318564195
Pseudocalliergon lycopodioides	SH4281564005

Species	GR
Pseudocalliergon lycopodioides	SH4255563045
Pseudocalliergon lycopodioides	SH4255563055
Pseudocalliergon lycopodioides	SH4294564245
Pseudocalliergon lycopodioides	SH4293564235
Pseudocalliergon lycopodioides	SH4262563185
Pseudocalliergon lycopodioides	SH4292564245
Pseudocalliergon lycopodioides	SH4261563185
Pseudocalliergon lycopodioides	SH4260563205
Pseudocalliergon lycopodioides	SH4264564295
Pseudocalliergon lycopodioides	SH4257564345
Pseudocalliergon lycopodioides	SH4271563245
Pseudocalliergon lycopodioides	SH4258564245
Pseudocalliergon lycopodioides	SH4258564255
Pseudocalliergon lycopodioides	SH4270563235
Pseudocalliergon lycopodioides	SH4269563225
Pseudocalliergon lycopodioides	SH4279563235
Pseudocalliergon lycopodioides	SH4278563245
Pseudocalliergon lycopodioides	SH4280563235
Pseudocalliergon lycopodioides	SH4300563365
Pseudocalliergon lycopodioides	SH4299563365
Pseudocalliergon lycopodioides	SH4299563375
Pseudocalliergon lycopodioides	SH4299563385
Pseudocalliergon lycopodioides	SH4300563385
Pseudocalliergon lycopodioides	SH4300563395
Pseudocalliergon lycopodioides	SH4299563395
Pseudocalliergon lycopodioides	SH4300563405
Pseudocalliergon lycopodioides	SH4300563415
Pseudocalliergon lycopodioides	SH4301563415
Pseudocalliergon lycopodioides	SH4302563415
Pseudocalliergon lycopodioides	SH4302563435
Pseudocalliergon lycopodioides	SH4301563435
Pseudocalliergon lycopodioides	SH4301563425
Pseudocalliergon lycopodioides	SH4300563425
Pseudocalliergon lycopodioides	SH4299563425
Pseudocalliergon lycopodioides	SH4299563405
Pseudocalliergon lycopodioides	SH4298563395
Pseudocalliergon lycopodioides	SH4298563385
Pseudocalliergon lycopodioides	SH4298563375
Pseudocalliergon lycopodioides	SH4297563365
Pseudocalliergon lycopodioides	SH4297563355
Pseudocalliergon lycopodioides	SH4298563365
Pseudocalliergon lycopodioides	SH4272564085
Pseudocalliergon lycopodioides	SH4243563965
Pseudocalliergon lycopodioides	SH4242563965
Pseudocalliergon lycopodioides	SH4242563975
Pseudocalliergon lycopodioides	SH4241563965
Pseudocalliergon lycopodioides	SH4241563955
Pseudocalliergon lycopodioides	SH4238563875
Pseudocalliergon lycopodioides	SH4238563885
Pseudocalliergon lycopodioides	SH4239563875
Pseudocalliergon lycopodioides	SH4239563885
Pseudocalliergon lycopodioides	SH4240563885
Pseudocalliergon lycopodioides	SH4244563885
Pseudocalliergon lycopodioides	SH4244563895
Pseudocalliergon lycopodioides	SH4245563895













Species	GR
Pseudocalliergon lycopodioides	SH4217564005
Pseudocalliergon lycopodioides	SH4213564025
Pseudocalliergon lycopodioides	SH4213564015
Pseudocalliergon lycopodioides	SH4212564015
Pseudocalliergon lycopodioides	SH4212564005
Pseudocalliergon lycopodioides	SH4212563995
Pseudocalliergon lycopodioides	SH4211564015
Pseudocalliergon lycopodioides	SH4211564005
Pseudocalliergon lycopodioides	SH4210564005
Pseudocalliergon lycopodioides	SH4209564005
Pseudocalliergon lycopodioides	SH4208564005
Pseudocalliergon lycopodioides	SH4208564015
Pseudocalliergon lycopodioides	SH4208564025
Pseudocalliergon lycopodioides	SH4209564025
Pseudocalliergon lycopodioides	SH4208564035
Pseudocalliergon lycopodioides	SH4208564045
Pseudocalliergon lycopodioides	SH4209564045
Pseudocalliergon lycopodioides	SH4209564035
Pseudocalliergon lycopodioides	SH4208564055
Pseudocalliergon lycopodioides	SH4209564055
Pseudocalliergon lycopodioides	SH4210564055
Pseudocalliergon lycopodioides	SH4210564065
Pseudocalliergon lycopodioides	SH4211564065
Pseudocalliergon lycopodioides	SH4211564075
Pseudocalliergon lycopodioides	SH4211564085
Pseudocalliergon lycopodioides	SH4212564095
Pseudocalliergon lycopodioides	SH4211564095
Pseudocalliergon lycopodioides	SH4212564105
Pseudocalliergon lycopodioides	SH4211564105
Pseudocalliergon lycopodioides	SH4212564115
Pseudocalliergon lycopodioides	SH4213564105
Pseudocalliergon lycopodioides	SH4213564115
Pseudocalliergon lycopodioides	SH4213564125
Pseudocalliergon lycopodioides	SH4214564125
Pseudocalliergon lycopodioides	SH4214564115
Pseudocalliergon lycopodioides	SH4214564105
Pseudocalliergon lycopodioides	SH4213564095
Pseudocalliergon lycopodioides	SH4214564095
Pseudocalliergon lycopodioides	SH4214564085
Pseudocalliergon lycopodioides	SH4214564075
Pseudocalliergon lycopodioides	SH4215564085
Pseudocalliergon lycopodioides	SH4215564095
Pseudocalliergon lycopodioides	SH4215564075
Pseudocalliergon lycopodioides	SH4215564065
Pseudocalliergon lycopodioides	SH4214564065
Pseudocalliergon lycopodioides	SH4214564055
Pseudocalliergon lycopodioides	SH4214564045
Pseudocalliergon lycopodioides	SH4214564035
Pseudocalliergon lycopodioides	SH4213564035
Pseudocalliergon lycopodioides	SH4210564015
Pseudocalliergon lycopodioides	SH4210564025
Pseudocalliergon lycopodioides	SH4209564015
Pseudocalliergon lycopodioides	SH4211564025
Pseudocalliergon lycopodioides	SH4212564025
Pseudocalliergon lycopodioides	SH4210564035

Species	GR
Pseudocalliergon lycopodioides	SH4211564035
Pseudocalliergon lycopodioides	SH4212564035
Pseudocalliergon lycopodioides	SH4210564045
Pseudocalliergon lycopodioides	SH4211564045
Pseudocalliergon lycopodioides	SH4213564045
Pseudocalliergon lycopodioides	SH4212564045
Pseudocalliergon lycopodioides	SH4211564055
Pseudocalliergon lycopodioides	SH4212564055
Pseudocalliergon lycopodioides	SH4213564055
Pseudocalliergon lycopodioides	SH4212564065
Pseudocalliergon lycopodioides	SH4210564075
Pseudocalliergon lycopodioides	SH4213564065
Pseudocalliergon lycopodioides	SH4213564075
Pseudocalliergon lycopodioides	SH4212564075
Pseudocalliergon lycopodioides	SH4213564085
Pseudocalliergon lycopodioides	SH4228564435
Pseudocalliergon lycopodioides	SH4227564435
Riccardia incurvata	SH4243563685
Riccardia incurvata	SH4247563635
Riccardia incurvata	SH4240563895
Riccardia incurvata	SH4240563825
Riccardia incurvata	SH4243563785
Riccardia incurvata	SH4252563545
Riccardia incurvata	SH4256563545
Riccardia incurvata	SH4256563505
Riccardia incurvata	SH4277563615
Riccardia incurvata	SH4276563595
Riccardia incurvata	SH4178563185
Riccardia incurvata	SH4177563315
Riccardia incurvata	SH4135562975
Riccardia incurvata	SH4319563055
Riccardia incurvata	SH4135662967
Riccia cavernosa	SH4320564205
Tortella inclinata	SH4207563255
Tortella inclinata	SH4304563855
Tortella inclinata	SH4203563105
Tortella inclinata	SH4226563295
Tortella inclinata	SH4007565565
Tortella inclinata	SH4236563695
Tortella inclinata	SH4251563215
Tortella inclinata	SH4310563235
Tortella inclinata	SH4318562985
Tortella inclinata	SH4324562935
Tortella inclinata	SH4295562695
Tortella inclinata	SH4275562795
Tortella inclinata	SH4178562955
Tortella inclinata	SH4115563175
Tortella inclinata	SH4129563225
Tortella inclinata	SH4136563295
Tortella inclinata	SH4140563275
Tortella inclinata	SH4163563305
Tortella inclinata	SH4235564255



## APPENDIX 5 – PHOTOGRAPHIC LOCATIONS OF NOTABLE SPECIES

---



Photograph 5.1. SH4319563055. Slack 29. *Amblyodon dealbatus*. 10 x 20 cm patch with about 20 sporophytes. *Riccardia incurvata* is also present in this area.



Photograph 5.2. SH4178463187. Slack 37. *Amblyodon dealbatus*. Scattered through the thin, damp turf in the foreground. This is part of the area occupied by a much more extensive population in this slack, distributed across 22 10 x 10 m OS grid cells.



Photograph 5.3. SH3989564841. *Bryum intermedium*. Thinly scattered over 1 m length of stream bank (upper arrow) and one small patch (10 x 10 cm) further down stream (lower arrow).





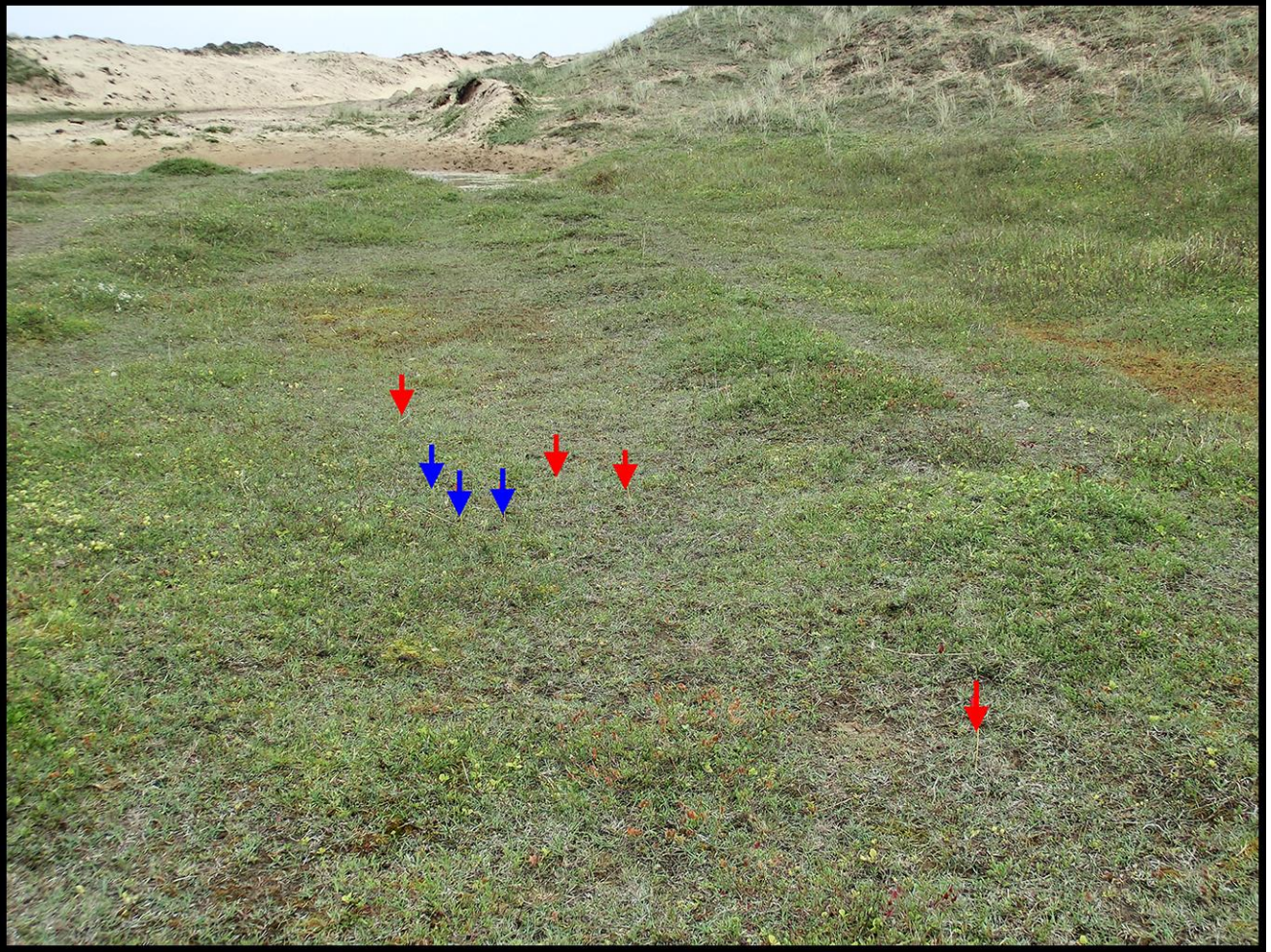
Photograph 5.4. SH4288363551. Slack 19a. *Campyliadelphus elodes*. Frequent amongst the short-grazed, damp turf in the foreground, as it is in many similar slacks across the site.



Photograph 5.5. SH4278764478. Slack 7g. *Drepanocladus sendtneri*. Scattered in small amounts over an area of about 2 x 2 m around the location indicated.



Photograph 5.6. SH4247063640. *Moerckia flotoviana*. About 20 thalli on the edge of a grazed anthill within the extensive Slack 19a.



Photograph 5.7. SH4207463275. Slack 38. *Moerckia flotoviana* (blue arrows) and a total of seven thalli of *Petalophyllum ralfsii* (red arrows).



Photograph 5.8. SH4225663326. *Petalophyllum ralfsii*. Slack 38. Total of five thalli.



Photograph 5.9. SH4225163298. *Petalophyllum ralfsii*. Slack 38. Total of four thalli.



Photograph 5.10. SH4224963274. *Petalophyllum ralfsii*. Slack 38. Total of ten thalli.



Photograph 5.11. SH4135462962. *Petalophyllum ralfsii*. Slack 45b. Total of one thallus.



Photograph 5.12. SH4062163387. *Petalophyllum ralfsii*. Slack F15. Total of about ten thalli.





Photograph 5.13. SH4244563539. *Pseudocalliergon lycopodioides*. An extensive yellowish carpet of *P. lycopodioides* at Slack 19a.



Photograph 5.14. SH4244563539. *Riccia cavernosa*. Slack 8r. A tiny number of scattered thalli, about five in total, on bare moist mud in an old poached wheel-rut, with *Bryum klinggraeffii*.

## **APPENDIX 6 – GRID-MAPS OF NOTABLE SPECIES**

---

The following provides OS 10 m and 100 m grid-maps for some of the more notable species found during the present survey.



