



## **Springs and Seepages of Wessex**

### **Lyme Regis Bryophyte Survey -Charmouth to Eype Undercliffs**



**April 2012**



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## Summary

The coastline of Lyme Bay in Dorset is well known for its extensive undercliff systems. These clay landslips extend many kilometres along the coast and abound with flushes, seepage lines and small streams. Large tracts of coastal habitats lie within the West Dorset Coast SSSI which has been notified as an internationally important geological site, especially famous for its fossil reptiles. The undercliffs themselves support populations of a number of rare plants and animals. Part of this coastline, from below Stonebarrow Hill near Charmouth east to Eype Mouth was the focus of the second year of the Springs and Seepages of Wessex project.

The sites varied greatly in bryophyte diversity with some supporting no bryophytes at all and the best one supporting 20 species. The presence of a well-developed bryoflora appeared to be linked to several key physical characteristics of the undercliffs, the most important being the ground stability. The most actively slumping and eroding sites offered very poor habitat for bryophytes, whereas relatively stable sites with complex micro-topography and well-established vegetation cover were far more diverse.

The undercliffs west of Eype Mouth were particularly interesting for populations of bryophytes, given the presence of a series of prominent flush systems and tufa formations on the undercliffs and groundwaters probably arising through a range of rock strata. A significant number of species were recorded from the Eype undercliffs but not at any of the sites further west.

## 1. Introduction

The coastline of Lyme Bay in Dorset is well known for its extensive undercliff systems. These clay landslips extend many kilometres along the coast and abound with flushes, seepage lines and small streams. Large tracts of coastal habitats lie within the West Dorset Coast SSSI which has been notified as an internationally important geological site, especially famous for its fossil reptiles. The undercliffs themselves support populations of a number of rare plants and animals.

Part of this coastline, from below Stonebarrow Hill near Charmouth east to Eype Mouth was the focus of the second year of the Springs and Seepages of Wessex project. The survey encompassed habitats at thirteen undercliff sites chosen by Andy Godfrey for invertebrate sampling. Each site, from damp seepage lines and small flushes to small streams, perched marshes and pools, was surveyed in March 2012 to evaluate the nature of its bryophyte community.

## 2. Methodology

All of the sites were surveyed between 6<sup>th</sup> and 20<sup>th</sup> March 2012 by Sharon Pilkington CEnv MIEEM. The survey effort was targeted at the specific sampling locations recorded by Andy Godfrey in the course of his invertebrate sampling in 2011 and the GPS waypoint numbering system adopted by him to identify each of his survey locations has been continued here. A hand-held GPS receiver<sup>1</sup> was used to navigate to the waypoints, guided by his descriptions of the habitat.

At each waypoint all species of moss, liverwort and hornwort present within the spring or seepage were recorded together with an estimate of local abundance using the DAFOR<sup>2</sup> scale. Because the sites were so varied in extent and scale, this involved sampling all representative wet microhabitats within a 5-10m radius of the waypoint, including;

- Damp or wet clay in or around flushes and streams;
- Small rivulets and pools;
- Livestock- and deer-poached ground;
- Stress fractures in landslips;
- Stones and boulders;
- Ant-hills and hummocks;

Most species of moss and liverwort and hornwort found in the course of the survey could be identified with confidence in the field. However, in some instances, subsequent microscopic examination was required to confirm identity to species level. A full list of species found in the survey, together with their national or local conservation status is given in Appendix 1.

## 3. Results

Descriptions of the general nature and bryological composition of each sampling location are laid out in this section, with locations shown and listed in order from west to east. Bryological nomenclature follows Hill *et al* (2008) whilst that for vascular plants follows Stace (2010). Please note that many vascular plants are not visible or readily identifiable in early spring so descriptions of vegetation communities are likely to be incomplete.

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<sup>1</sup> Garmin model Vista HCX

<sup>2</sup> Dominant; Abundant; Frequent; Occasional; Rare

### 3.1 Site Descriptions

#### 3.1.1 Undercliffs east of Westhay Farm

These locations were all surveyed on 16<sup>th</sup> March.

##### Waypoint 799: SY38802.92581

This site lay on a major slumped undercliff. From a small spring rising on the landslip a small rivulet flowed seaward through a well-developed series of stress fractures. Livestock poaching had been significant in the area, creating areas of bare wet clay around the rivulet. Despite the ground cracks, this part of the landslip appeared to be relatively stable and had developed perched marsh vegetation with a few ant-hills which was dominated by the likes of Soft-rush *Juncus effusus*, Hard Rush *J. inflexus*, Great Willowherb *Epilobium hirsutum*, Marsh Thistle *Cirsium palustre* and Tall Fescue *Schedonorus arundinaceus* (Plate 1).

Bryophytes were an integral part of the vegetation community, growing mainly within the shaded confines of the ground cracks and on wet ground between the rushes. Seventeen mosses and three liverworts were identified and several large pleurocarps (perennial mosses) dominated well-lit ground, including *Calliergonella cuspidata*, *Brachythecium rivulare* and *Kindbergia praelonga*. Smaller opportunists were dominant in the cracks where vascular plants were absent. The most abundant of these were the mosses *Dicranella varia* and *Pohlia melanodon*, together with the thalloid liverwort *Riccardia chamaedryfolia*.

Of note were small populations of *Fissidens crispus* and *Brachythecium mildeanum*. The former is genuinely rare in Dorset whilst the latter is scarce but almost certainly under-recorded.



Plate 1. Rushes obscure much of the soft ground at this site

Species	Abundance
<i>Aloina aloides</i>	O
<i>Barbula convoluta</i>	R
<i>Barbula unguiculata</i>	R
<i>Brachythecium mildeanum</i>	R
<i>Brachythecium rivulare</i>	F

Species	Abundance
<i>Brachythecium rutabulum</i>	O
<i>Bryum dichotomum</i>	R
<i>Calliergonella cuspidata</i>	LA
<i>Cratoneuron filicinum</i>	O
<i>Dicranella varia</i>	A
<i>Didymodon luridus</i>	R
<i>Didymodon tophaceus</i>	O
<i>Fissidens crispus</i>	R
<i>Fissidens taxifolius</i>	R
<i>Kindbergia praelonga</i>	F
<i>Lophocolea bidentata</i>	O
<i>Oxyrrhynchium pumilum</i>	R
<i>Pellia endiviifolia</i>	F
<i>Pohlia melanodon</i>	A
<i>Riccardia chamedryfolia</i>	A

### Waypoint 707: SY38795.92520

This site occupied part of a more active landslip and was characterised by wet clay around a seepage fissured by many stress cracks (Plate 2). It was sparsely vegetated by perennial species including Tall Fescue, Creeping Bent *Agrostis stolonifera*, Colt's-foot *Tussilago farfara* and Hard Rush with maximum cover of 15-20%.

Small mosses had colonised much of the damp ground, establishing a sheet of *Dicranella varia*, *Pohlia melanodon* and *Didymodon tophaceus*. Larger bryophytes were absent, probably as a consequence of the inherent instability of the ground and the lack of shelter from prevailing winds.



Plate 2. Location 2 looking downhill to the west

Species	Abundance
<i>Barbula unguiculata</i>	R
<i>Bryum dichotomum</i>	R
<i>Dicranella varia</i>	A
<i>Didymodon tophaceus</i>	F
<i>Pellia endiviifolia</i>	O
<i>Pohlia melanodon</i>	A
<i>Riccardia chamedryfolia</i>	O

### Waypoint 708: SY38917.92477

This site was in fact two sampling points in a small stream cutting down southwards to the sea through a slumped undercliff. The upper sampling point (Plate 3) lay just above a waterfall falling about six metres to the beach below, where the stream belled out slightly. The sides of the stream channel were steep and formed of flaking clay which was clearly actively eroding. In the stream channel and on the wet and damp clay of its lower banks there were few vascular plants and no bryophytes. Higher up, drier clay supported patchy Creeping Bent, Colt's-foot and Buck's-horn Plantain *Plantago coronopus*. Apart from a small population of the moss *Aloina aloides*, this ground was also devoid of bryophytes.



Plate 3. Stream at mouth of waterfall

The lower sampling point lay in the water sinking into the beach below the waterfall and where it ran down over the rocks above (Plate 4). This area supported no bryophytes, though some colonies of filamentous green algae were present within the cascade.



Plate 4. Lower part of Waypoint 708

### 3.1.2 *St Gabriel's Mouth area*

The sites at Waypoints 800 and 709 were surveyed on 16<sup>th</sup> March whilst those at Waypoints 710 and 711 were surveyed on 6<sup>th</sup> March.

#### **Waypoint 800: SY39100.92415**

This sampling location lay in an area of highly unstable undercliffs. A recent major landslip above the slumped clay platform on the beach (Plate 5) appeared to have obscured the sampling point and no bryophyte survey was therefore undertaken there.



Plate 5. Small rivulet just above beach. Note the recent landslip above.

## Waypoint 709: SY39188.92416

At this location a small rivulet tumbled down through a relatively stable and well-vegetated part of the undercliff, with meanders, boulders and some scrub offering shelter and habitat diversity to a range of different bryophytes (Plate 6). Tussocky streamside vegetation supported Creeping Bent, Tall Fescue, Hard Rush, Colt's-foot, Great Willowherb and Fool's Water-cress *Apium nodiflorum*.

These sheltered micro-habitats provided a home for a sheet of low-growing species, most prominently *Dicranella varia*, *Didymodon tophaceus* and *Pohlia melanodon*. The stream bed and its immediate environs also supported good populations of the thalloid liverworts *Pellia endiviifolia* and *Riccardia chamaedryfolia*. No notable bryophytes were found.



Plate 6. Small rivulet with varied micro-habitats

Species	Abundance
<i>Barbula unguiculata</i>	R
<i>Bryum dichotomum</i>	O
<i>Dicranella varia</i>	A
<i>Didymodon tophaceus</i>	A
<i>Kindbergia praelonga</i>	R
<i>Pellia endiviifolia</i>	F
<i>Pohlia melanodon</i>	A
<i>Riccardia chamaedryfolia</i>	O

### Waypoint 710: SY39637.92244

The sampling point comprised the mouth of a small stream approximately 1m wide and a few centimetres deep which had carved a deep, steep-sided gully through an actively eroding undercliff (Plate 7) before sinking into a pebble beach. The banks of the stream at this location comprised flaky clay, damp for about half a metre above the stream but dry above. The sides of the stream were unstable and supported few plants apart from a scattering of Common Reed *Phragmites australis* and some low Grey Willow *Salix cinerea* scrub. Only three species of bryophyte were seen, all in very small quantity.



Plate 7. Actively eroding stream gully near Waypoint 710

Species	Abundance
<i>Didymodon tophaceus</i>	R
<i>Kindbergia praelonga</i>	R
<i>Pellia endiviifolia</i>	R

### Waypoint 711: SY39709.92214

This location lay on a prominent slumped clay platform lying over the beach. A small muddy channel with shallow pools surrounded by wet clay formed the sampling point (Plate 8). The whole site appeared to be rather unstable and cover of higher plants was low. Together, Creeping Bent, Tall Fescue, Common Reed, Colt'-foot, Buck's-horn Plantain and sow-thistles *Sonchus* sp(p) reached only about 10% cover. No bryophytes were found at this location; it may simply be too unstable or too exposed to salty winds.



Plate 8. Waypoint 711

### 3.1.3 Undercliffs west of Eype Mouth

All of these locations were surveyed on 20<sup>th</sup> March.

### Waypoint 798: SY43939.91298

This sampling point lay within a relatively stable, extensively flushed undercliff slump supporting a perched marsh dominated by Common Reed (Plate 9). Other plants in the marsh included Hard Rush, Common Fleabane *Pulicaria dysenterica*, Glaucous Sedge *Carex flacca*, Velvet Bent *Agrostis canina* and Brookweed *Samolus valerandi*.

Although the marsh was extensively vegetated, actual aerial cover was quite low, and bare wet clay between the plant stems and tussocks was covered by a sheet of small mosses and liverworts. The most abundant of these were *Didymodon tophaceus*, *Dicranella varia*, *Pohlia melanodon* and *Pellia endiviifolia*. No notable bryophytes were found.



Plate 9. Perched marsh dominated by Common Reed

Species	Abundance
<i>Aneura pinguis</i>	O
<i>Bryum pseudotriquetrum</i>	O
<i>Calliergonella cuspidata</i>	O
<i>Dicranella varia</i>	F
<i>Didymodon tophaceus</i>	A
<i>Leiocolea turbinata</i>	R
<i>Pellia endiviifolia</i>	A
<i>Pohlia melanodon</i>	F
<i>Riccardia chamedryfolia</i>	O

### Waypoint 672: SY44159.91257

The sampling location lay around a small rivulet and perched marsh on a slumped undercliff below heavily flushed cliffs with occasional prominent vertical tufa flows. Stress fractures at the leading edge of the landslip were occupied by small pooled sections of the rivulet (Plate 10). Overall, both habitat and topography were complex, and provided considerable shelter to some strong populations of bryophytes. Common Reed dominated the marsh, together with Great Horsetail *Equisetum telmateia* and some low willow scrub.

Much of the ground was carpeted by the usual three low-growing mosses: *Didymodon tophaceus*, *Dicranella varia* and *Pohlia melanodon*. The thalloid liverwort *Pellia endiviifolia* was abundant in and around the stream.

Of note was a strong population of *Oxyrrhynchium speciosum* growing in the marsh. This moss appears to be a rare species in Dorset, with only two tetrad records. One of these, and the first vice-county record, was made at Eype Mouth in 1969. There was also a small population of *Bryum gemmiferum*. This is also a rare species in Dorset, but was also first recorded in the county (in 1952) near Eype Mouth.



Plate 10. Perched marsh and rivulet near front of landslide

Species	Abundance
<i>Brachythecium rivulare</i>	O
<i>Brachythecium rutabulum</i>	O
<i>Bryum gemmiferum</i>	R
<i>Bryum pseudotriquetrum</i>	O
<i>Dicranella varia</i>	F
<i>Didymodon luridus</i>	R
<i>Didymodon tophaceus</i>	A
<i>Leiocolea turbinata</i>	O
<i>Oxyrrhynchium speciosum</i>	R
<i>Pellia endiviifolia</i>	F
<i>Pohlia melanodon</i>	A
<i>Riccardia chamedryfolia</i>	O

### Waypoint 671: SY44352.91178

It is possible this site has suffered erosion since the invertebrate sampling as it did not really fit the description of it. There was evidence of some recent small slippages on the undercliffs in the nearby area. The location was centred on a small rivulet and seepage line on a very steep face of a landslide to the beach (Plate 11).

Much of the face comprised wet flaking clay and appeared to be very unstable. Apart from a population of Common Reed, higher plant cover was sparse and restricted mainly to a handful of rhizomatous or stoloniferous species i.e. Creeping Bent and Colt's-foot. The habitat was too friable and exposed to provide good habitat for bryophytes and only small patches of the mosses *Dicranella varia* and *Didymodon tophaceus* were found.



Plate 11. Unstable seepage line

Species	Abundance
<i>Dicranella varia</i>	R
<i>Didymodon tophaceus</i>	R

### Waypoint 670: SY44564.91104

This sampling location lay in a reed-dominated perched marsh on a landslip, just below a seepage line at the base of a clay bluff (Plate 12). Below this was a series of low marshy undercliff terraces falling away to the beach. Tall Fescue, Creeping Bent, Common Fleabane and Cat's-ear *Hypochaeris radicata* were prominent elements of the vegetation and the whole site appeared to be relatively stable.

The large perennial moss *Brachythecium rivulare* was patchily abundant, sharing the wetter ground with *Pellia endiviifolia*. Small areas of bare wet clay were dominated by *Pohlia melanodon* and a suite of less frequent species and no notable bryophytes were seen.



Plate 12. *Brachythecium rivulare* is common in this location

Species	Abundance
<i>Barbula unguiculata</i>	R
<i>Brachythecium rivulare</i>	F
<i>Brachythecium rutabulum</i>	R
<i>Dicranella varia</i>	O
<i>Didymodon tophaceus</i>	O
<i>Kindbergia praelonga</i>	O
<i>Pellia endiviifolia</i>	A
<i>Pohlia melanodon</i>	A
<i>Riccardia chamedryfolia</i>	O

### Waypoint 669: SY44611.91090

The sampling location was centred on a minor seepage line with a little surface water lying between a relatively stable-looking perched marsh and an actively eroding undercliff face (Plate 13). Common Reed was abundant and associated species included Tall Fescue, Yorkshire-fog *Holcus lanatus*, Cat's-ear and Brookweed.

The location supported very low numbers of bryophytes, the most common being *Didymodon tophaceus* in the seepage line. Another small population of the notable *Bryum gemmiferum* was found here.



Plate 13. Small seepage line at Waypoint 669

<b>Species</b>	<b>Abundance</b>
<i>Barbula convoluta</i>	R
<i>Bryum gemmiferum</i>	R
<i>Dicranella varia</i>	R
<i>Didymodon tophaceus</i>	O
<i>Pellia endiviifolia</i>	O
<i>Pohlia melanodon</i>	O
<i>Riccardia chamedryfolia</i>	R

#### 4. Discussion

The undercliffs that dominate the part of Lyme Bay visited in the current survey are derived from Jurassic clays which are mostly neutral or base-rich (Hill and Edwards 2003). The clay valleys alternate with greensand hilltops, such as Golden Cap, just east of St Gabriel's Mouth. In the Lower Eype area soft sandstones are also present, which increase the geological diversity of the undercliffs and provide variety in the physical properties of the rising groundwaters.

On the whole, the sampled sites supported ground-dwelling mosses and liverworts with a preference for more or less permanently damp places with a pH of about 6.5 or more. The three commonest mosses encountered, *Dicranella varia*, *Didymodon tophaceus* and *Pohlia melanodon*, are all typical of such habitats. However, the notable moss *Bryum gemmiferum* (Plate 14) is an indicator of moderately acid soils (Hill et al 2007), so its presence on undercliffs west of Eype Mouth indicate that in places, more acid conditions are present.



Plate 14. *Bryum gemmiferum* (pale plants)

The results of the survey suggest that the interplay of certain environmental factors is determining which of the sample locations support diverse suites of mosses and liverworts. These are, in descending order of importance:

- Ground stability;
- Shelter from sea spray and wind;
- Small-scale terrain and habitat complexity

Table 1 summarises the perceived physical characteristics of each site (grouped from west to east).

**Table 1. Characteristics of sites**

General location	Waypoint no.	Ground stability	Shelter	Terrain and habitat complexity	Relative bryophyte diversity
Undercliffs east of Westhay Farm	799	Good	Moderately Good	High	High
	707	Moderate	Poor	Moderate	Low-moderate
	708	Very poor	Poor	Low-moderate	No bryophytes
St Gabriel's Mouth area	800	Not sampled			
	709	Moderate	Moderate	High	Moderate
	710	Very poor	Poor	Low	Very low
	711	Poor	Very poor	Low	No bryophytes
Undercliffs west of Lower Eype	798	Good	Good	Moderate	Moderate
	672	Good	Good	Very high	High
	671	Poor	Poor	Low	Very low
	670	Good	Good	Low	Moderate
	669	Poor	Poor	Low-moderate	Very low

Only two sites supported more than 10 different bryophyte species (672 = 12 and 799 = 20) and it is no coincidence that both were situated in stable parts of the undercliff with a well-established perennial plant cover and complex micro-topography provided by gradual soil fissuring and slumping.

More than a third of the sites sampled were found to either support very few bryophytes or lack them altogether. All of these sites were located in actively eroding undercliffs where the continual erosion of the clay substrate would serve to prevent establishment of even opportunistic species e.g. *Dicranella varia* and *Pohlia melanodon*. Because bryophytes lack morphological adaptations such as rhizomes or stolons that would enable them to survive continual surface erosion, they are unable to thrive in such situations.

Sites with at least moderately good ground stability had been colonised by a thin cover of tall wetland plants including Common Reed and Hard Rush, which would create a humid and sheltered microhabitat around them on the ground, making it suitable for more bryophytes. Typically, the trio of *Dicranella varia*, *Didymodon tophaceus* and *Pohlia melanodon* dominated open ground in such places, together with, or replaced by, carpets of large perennial species such as *Calliergonella cuspidata*, *Brachythecium rivulare* and *Pellia endiviifolia* where the seepages were large and the ground stable for long periods.

## 5. References

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Preston C.D. 2006. **A Revised List of Nationally Scarce Bryophytes**. In *Field Bryology* **90**: 22-31. British Bryological Society.

Stace C.A. 2010. **New Flora of the British Isles** (3<sup>rd</sup> edition). Cambridge University Press.

## Appendix I: Species List and Status

Species	Type of lower plant	Status <sup>i</sup>
<i>Aloina aloides</i>	Moss	Common
<i>Aneura pinguis</i>	Liverwort	Common
<i>Barbula convoluta</i>	Moss	Common
<i>Barbula unguiculata</i>	Moss	Common
<i>Brachythecium mildeanum</i>	Moss	Locally scarce but under-recorded
<i>Brachythecium rivulare</i>	Moss	Common
<i>Brachythecium rutabulum</i>	Moss	Common
<i>Bryum dichotomum</i>	Moss	Common
<i>Bryum gemmiferum</i>	Moss	Locally rare
<i>Bryum pseudotriquetrum</i>	Moss	Common
<i>Bryum</i> sp.	Moss	-
<i>Calliergonella cuspidata</i>	Moss	Common
<i>Cratoneuron filicinum</i>	Moss	Common
<i>Dicranella varia</i>	Moss	Common
<i>Didymodon luridus</i>	Moss	Common
<i>Didymodon tophaceus</i>	Moss	Common
<i>Fissidens crispus</i>	Moss	Nationally Scarce
<i>Fissidens taxifolius</i>	Moss	Common
<i>Kindbergia praelonga</i>	Moss	Common
<i>Leiocolea turbinata</i>	Liverwort	Common
<i>Lophocolea bidentata</i>	Liverwort	Common
<i>Oxyrrhynchium pumilum</i>	Moss	Common
<i>Oxyrrhynchium speciosum</i>	Moss	Locally rare
<i>Pellia endiviifolia</i>	Liverwort	Common
<i>Pohlia melanodon</i>	Moss	Common
<i>Riccardia chamedryfolia</i>	Liverwort	Common

<sup>i</sup> Local status of species (in Dorset) is taken from Hill and Edwards (2003). National status is derived from Preston (2006)