

Technical Annex 12A  
Hayle Harbour

Bryophyte Survey at Triangular Spit,

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**BRYOPHYTE SURVEY AT TRIANGULAR SPIT, HAYLE HARBOUR,  
(WITH NOTES ON THE CONSERVATION OF LARGE POPULATIONS OF THE  
LIVERWORT *PETALOPHYLLUM RALFSII*)**

**O.S. Grid Ref:** SW553375

**Survey Date:** 3<sup>rd</sup> February 2005

**Surveyor:** David Holyoak PhD

**Taxonomic group:** Bryophytes

**Report compiled by:** David Holyoak PhD

**Report completed:** 6<sup>th</sup> February 2005

**Report for:** The Environment Practice

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## INTRODUCTION

Land in and around Hayle Harbour (triangular area centred on SW553375; Map 1) with much open ground, scrub and low sand dunes is being considered for development. A survey of bryophytes was carried out as part of a range of ecological, floristic and faunistic surveys in order to inform plans for use of this site.

Information on bryophytes at and near Hayle and Lelant is available from studies by Mrs J.A. Paton in 1963 and by D.T. Holyoak in 1995 but it is unlikely that the areas involved in the present survey were visited by Mrs Paton and they were not examined by DTH in 1995. A search of the database of Cornish bryophyte records held by DTH as County Recorder did not reveal any records of rare or uncommon species at Hayle or Lelant Quay or close by.

A detailed field survey of the triangular area of land near South Quay at Hayle Harbour (Map 1) was carried out by DTH on 3rd February 2005. A total of four hours was spent carrying out the survey, which was made in pleasant dry weather, at a time when most of the bryophytes in exposed places were still moist following rain on preceding days. All potential bryophyte habitats were investigated, with particular efforts made to search damp sandy hollows for populations of the liverwort *Petalophyllum ralfsii* (Petalwort), which surprisingly was found in great abundance as a new record at the site. Small specimens of some of the mosses were collected for microscopical checking where field identification is unreliable, including several small gatherings of *Bryum* and *Didymodon* spp. Locations were marked on a photocopy of the 1:10 000 Ordnance Survey map during the fieldwork, checked and recorded as eight- or ten-figure National Grid references (using a Garmin GPS12, which is accurate to  $\pm 6$  m under the conditions in which it was used).

Since the present survey was carried out under good conditions and all of the better types of bryophyte habitat were investigated, it is likely that few if any mosses and liverworts were overlooked. A visit in summer would be necessary to establish the identity of a *Bryum* recorded as *B. cf. algovicum*, but even if a different species were involved this is unlikely to be a rarity.

Throughout this report the names used for mosses and liverworts follow those of the recent check-list by Blockeel & Long (1998). Some will therefore differ from the familiar names used in the National Atlas (Hill *et al.* 1991-1994). Usage of the name *Barbula commutata* follows Smith (2004).

## RESULTS

The bryophytes recorded are listed in Table 1. Totals of 2 liverwort and 29 moss species were found. This is only a small bryophyte flora for a site in West Cornwall, but there are few habitats present at Hayle Harbour (e.g. no natural rocks, woodland, not even mature trees) and areas heavily disturbed in the past such as this also tend to support few species.

There were no Nationally Rare species found, but the Nationally Scarce liverwort *Petalophyllum ralfsii* was remarkably abundant, as discussed below. There were no other bryophytes of much conservation significance, although the small moss

*Didymodon umbrosus* was found in several places. It has only a few other records on the mainland of West Cornwall (vice-county 1), one of them at Lelant Quay. From the national bryophyte *Atlas* (Hill *et al.* 1992) it might appear that *D. umbrosus* (as *Trichostomopsis umbrosa*) is Nationally Scarce. However, more recent records tend to imply that it is an alien species that is expanding its range. Some forms of *D. umbrosus* are also very difficult to identify so the species is doubtless under-recorded.

Populations of *Petalophyllum ralfsii* were assessed according to criteria agreed by the UK BAP Steering Group for work on this threatened species (see Appendix 1), although more detailed population estimates were made. The detailed records are as follows:

A: centred on SW55518/37533; *ca* 300 thalli; in low moss carpet at edge of gravelly track;

B: centred on SW55480/37522; *ca* 750 thalli; on path edges and open mossy hollow in grassland;

C: SW55406/37491 to SW55348/37452; *ca* 7200 thalli (based on mean of 30 thalli/m<sup>2</sup> over 240 m<sup>2</sup> total area occupied); on path edges and above low cliff;

D: area centred on SW5541/3756 and measuring *ca* 80 x 90 m; estimated *ca* 216,000 thalli (based on mean of 100 thalli/m<sup>2</sup> over 2160 m<sup>2</sup> total area occupied, i.e. 80 x 90 m x 30%); sample areas had densities of 10-2600 thalli/m<sup>2</sup> so that estimate of overall mean of 100 thalli/m<sup>2</sup> is minimal; in areas of short vegetation on thin damp sand over 'car park' area surfaced with old mine-spoil;

E: area centred on SW55480/37583; 17 thalli; in gaps in short grassland along path on slope;

F: area centred on SW55377/37649; *ca* 600 thalli; in hollow at track edge;

G: area centred on SW55346/37655; *ca* 2800 thalli; in sandy hollows in gravelly old mine-spoil near top of low cliff;

H: around SW55575/37283; 276 thalli counted; in hollow beside track.

The overall total of *P. ralfsii* thalli estimated above is 227, 943 and this is undoubtedly an under-estimate because the density assumed for the largest population (D) was minimal. This total exceeds the combined total for all other sites in Cornwall from surveys during the 2004-05 winter and indeed the combined total for all sites in England (Plantlife, unpublished data). Only one population in the U.K. is larger (418,186 thalli estimated in March 2002 at Brownslade Burrows, Pembrokeshire).

## **SIGNIFICANCE OF BRYOFLORA**

Other than Petalwort, the areas surveyed lack Nationally Rare or Nationally Scarce bryophyte species and lack any bryophytes that are rare in Cornwall as a whole or any bryophyte communities of special conservation significance.

However, Petalwort is regarded as a threatened plant species that enjoys considerable statutory protection. It is listed on Schedule 8 of the Wildlife & Countryside Act (1981), placed on Annex II of EC Habitats Directive and listed on Appendix I of the Bern Convention. The European *Bryophyte Red Data Book* lists it as Vulnerable, it is a Priority Species within the U.K. BAP and on English Nature's Species Recovery Programme. The Action Plan for Petalwort within the UK BAP has the following targets subsequent to the 2001 Targets Review: T1 - Maintain the population size at all extant sites; T2 - Maintain the geographical range.

The U.K. government has an obligation to protect sites with Petalwort under the EC Habitats Directive, so that most of the important sites already known for the species are protected as SSSIs and cSAC. The numerical importance of the populations newly discovered at Hayle may well be sufficient to justify SSSI notification for this species alone. At any event, all of the Petalwort plants are protected under Schedule 8 of the Wildlife & Countryside Act (1981) so that nothing should be done that would destroy or harm even small parts of their population, unless this is allowed under License from English Nature.

Plantlife International is Lead Partner for work under the UK BAP on Petalwort, so they and English Nature should be informed of the newly discovered populations.

All work proposed in digging trial pits or making boreholes within the overall area with Petalwort should be postponed so that precise locations for all disturbance involved can be agreed to ensure that no harm is done to Petalwort populations. However, presence here of the largest Cornish population of this protected species is likely to preclude any extensive development of the areas involved.

## REFERENCES

Blockeel, T.L. and Long, D.G. 1998. *A Check-list and Census Catalogue of British and Irish Bryophytes*. Cardiff: British Bryological Society.

Hill, M.O., Preston, C.D. and Smith, A.J.E. 1991. *Atlas of the Bryophytes of Britain and Ireland. Vol. 1. Liverworts (Hepatocae and Anthocerotae)*. Colchester: Harley Books.

Hill, M.O., Preston, C.D. and Smith, A.J.E. 1992. *Atlas of the Bryophytes of Britain and Ireland. Vol. 2. Mosses (except Diplolepideae)*. Colchester: Harley Books.

Hill, M.O., Preston, C.D. and Smith, A.J.E. 1994. *Atlas of the Bryophytes of Britain and Ireland. Vol. 3. Mosses (Diplolepideae)*. Colchester: Harley Books.

Smith, A.J.E. 2004. *The moss flora of Britain and Ireland*. 2nd ed. Cambridge: Cambridge University Press.

**Table 1. Bryophytes recorded at Hayle Harbour, West Cornwall on 3rd February 2005.**

f = sporophytes present.

**Liverworts** (2 species)

*Lunularia cruciata*

*Petalophyllum ralfsii* f

**Mosses** (29 species)

*Barbula commutata*

*Barbula convoluta* f

*Barbula unguiculata* f

*Brachythecium albicans*

*Bryum argenteum*

*Bryum bicolor* f + *B. dunense* [both taxa = *B. dichotomum*]

*Bryum* cf. *algovicum* f

*Bryum capillare*

*Bryum ruderale*

*Cratoneuron filicinum*

*Dicranella varia* f

*Didymodon fallax*

*Didymodon insulanus*

*Didymodon rigidulus*

*Didymodon tophaceus*

*Didymodon umbrosus*

*Didymodon vinealis*

*Eurhynchium praelongum*

*Funaria hygrometrica* f

*Grimmia pulvinata* var. *pulvinata* f

*Homalothecium lutescens*

*Hypnum lacunosum* var. *lacunosum*

*Pseudocrossidium hornschuchianum*

*Rhynchostegium megapolitanum* f

*Rhytidiadelphus squarrosus*

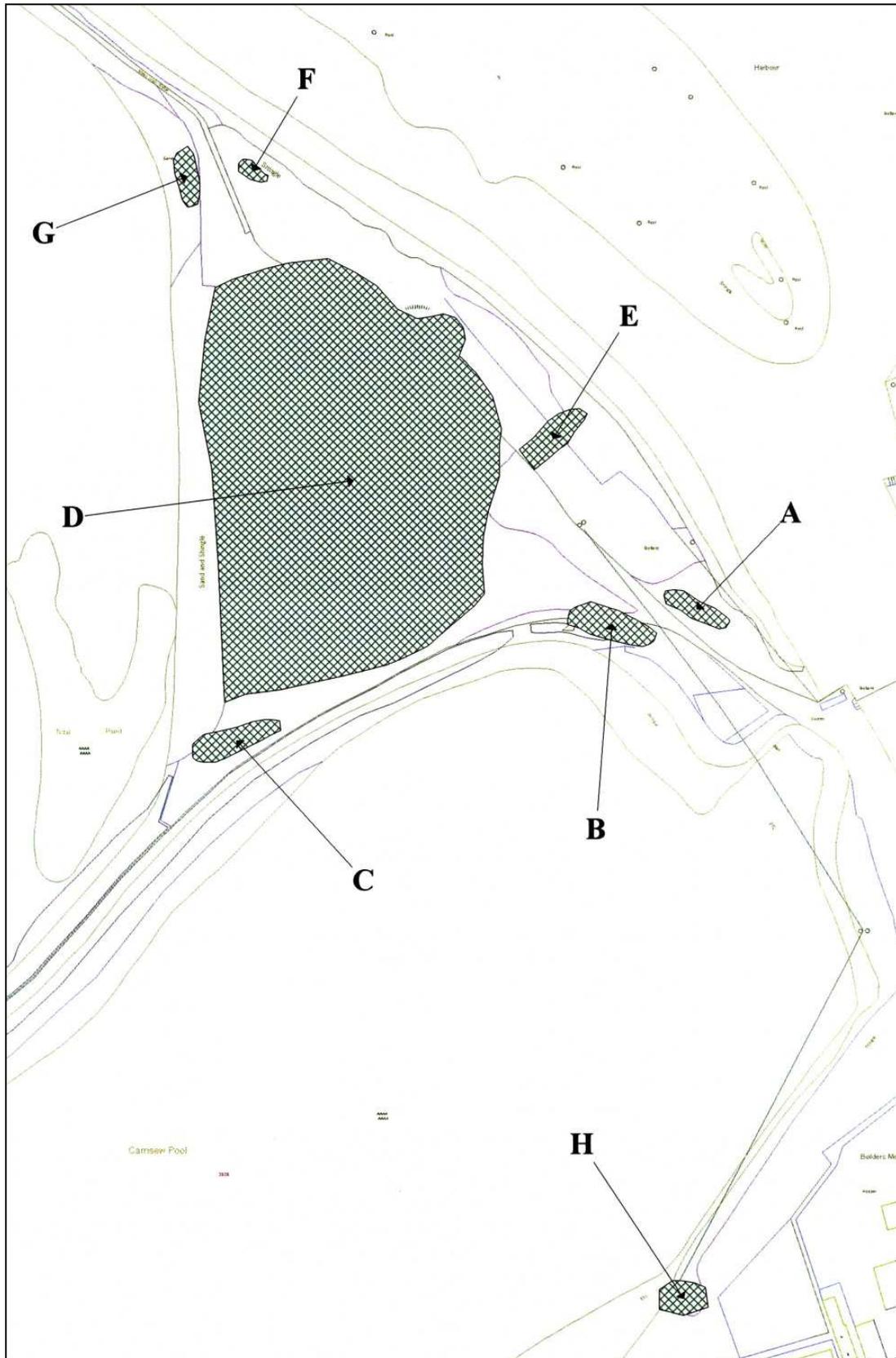
*Scleropodium purum*

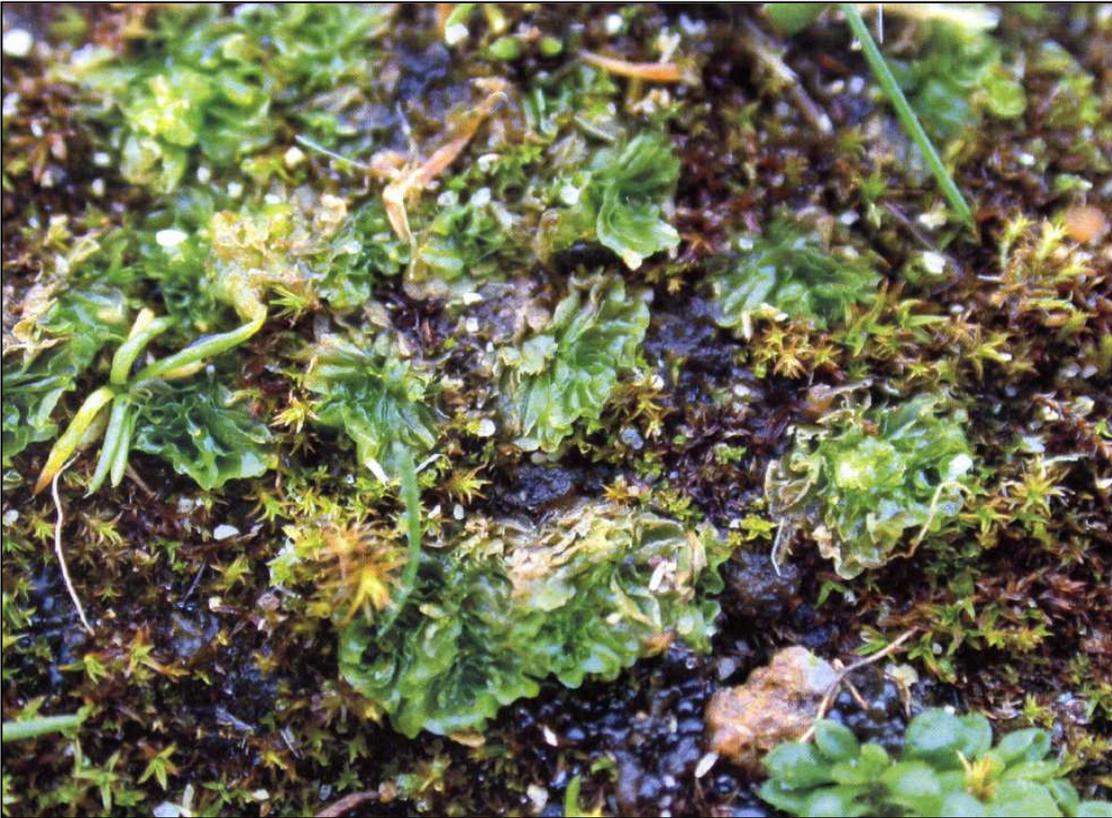
*Scorpiurium circinatum*

*Syntrichia ruraliformis*

*Tortula muralis* var. *muralis* f

**Map 1.** Hayle Harbour, West Cornwall to show triangular area of land investigated in detail for bryophytes on 3rd February 2005 and locations with *Petalophyllum ralfsii* (labelled A-H).





**Petalwort at Hayle Harbour, February 2005**



**Typical Petalwort habitat at Hayle Harbour**



**Typical Petalwort habitat at Hayle Harbour**

## **Appendix 1. Guidelines for *in-situ* monitoring of populations of Petalwort (*Petalophyllum ralfsii*).**

Management of habitat to benefit Petalwort requires knowledge of the locations of its populations and, ideally, estimates of the abundance of the species. These notes consider various difficulties that arise in estimating numbers of Petalwort plants and then suggest appropriate monitoring methods.

**Locating Petalwort** On first acquaintance with Petalwort, most non-bryologists are surprised by its small size and the resulting difficulties in finding it at all, let alone in locating it consistently. Monitoring is therefore unlikely to be effective unless it is carried out by people who have become familiar with the plant and are able to locate it reliably.

**Identification** The structure of Petalwort, comprising a flattened thallus beset with raised lamellae radiating from near the midline, is unique in the British flora. Nonetheless, in the field even experienced bryologists can confuse it with species of *Fossombronia*, despite the fact that the structure of that genus is radically different with leaves arising each side of a flattened stem, not a leafless thallus. The difficulties arise because leaves of *Fossombronia* commonly overlap and have raised, crisped margins giving a very similar impression to the crisped, raised lamellae of Petalwort. Using a good x10 hand-lens, careful probing with a needle or forceps should reveal the separate leaves if *Fossombronia* is involved, whereas it should result in exposure (if not tearing) of the thallus of Petalwort. Other differences that may help are that most *Fossombronia* have violet rhizoids, whereas Petalwort and *Fossombronia husnotii* have colourless rhizoids; most *Fossombronia* have leafy stems narrower than mature Petalwort thalli (not true of *F. angulosa*). Also, many *Fossombronia* are monoicous but Petalwort and some *Fossombronia* are dioicous. Recent fieldwork has emphasised that Petalwort and *Fossombronia* can occur close together and in similar habitats, so that particular care is needed with identification when large counts are made. *Moerckia hibernica* can also be confused with Petalwort, particularly its male plants with many scales on a thallus that can have strongly crisped margins.

**Significance of Counts** Many if not most individual thalli of Petalwort arise from underground branches of other thalli, although the connections decay as the new thalli grow. Hence, groups of Petalwort thalli are mainly clones of identical individuals, more nearly equivalent to branches of a single plant than to groups of different plants.

Three years of monthly recording of individual thalli at a Cornish colony have shown that those parts of thalli exposed above ground die back during dry weather in late spring and reappear at the same places in autumn, the tuberous bases of the thalli having passed the summer underground. Even from October to April the proportion of thalli showing above ground varied from 0% to 85%. The *lowest* values for exposed thalli during the winter occurred (1) early and late in the winter, (2) when mosses grew rapidly or a covering of sand appeared due to flooding, or (3) if the ground surface dried. However, there was no time when *all* the thalli that were known to be present were visible above ground.

**Best months for monitoring** The typical annual cycle of Petalwort involves aestivation underground from about May to September. If ground conditions remain

or become wet, small numbers of thalli may be seen on the surface during the summer months, but they are not consistently present (although some thalli are visible throughout a normal summer at the Scottish colony in Wester Ross and the same is apparently true in western Ireland). In order to obtain the highest counts, monitoring visits should therefore be made between October and April, but even in those months periods should be avoided when the weather is unusually dry, when parts of slacks that normally hold Petalwort populations are flooded or have recently been flooded, or when the ground is frozen. Ideally, counts should be made on several visits between late October and mid April and the highest count regarded as the best estimate.

**Methodology for counting thalli** Prolonged work in some Petalwort colonies can easily damage the habitat, especially when the ground is wet. Such damage can be kept to an absolute minimum by working alone and making counts while kneeling on a folded plastic fertiliser sack or garden 'kneeler'.

With small populations (50 thalli or fewer) there is little difficulty in recording the highest count of thalli seen, although it may be very time consuming to locate small thalli that are partly concealed amongst patchy grasses, herbs and mosses. Where thalli are small and scattered it is often easier to mark them with cocktail sticks after checking each of them with a hand-lens, then to count the cocktail sticks as they are removed.

If accurate counts are required, larger populations need to be counted systematically to avoid missing some thalli and double-counting others. This can be achieved in various ways, e.g. by stretching a surveyor's tape through the colony and then repeatedly counting within 50 x 50 cm quadrats placed along the tape and at measured intervals away from it. This takes a great deal of time. Although counts of thousands seem satisfying at the time, for the reasons outlined above they are probably not closely reproducible on future visits and they are likely to give little real indication of the numbers of genetically distinct plants that are present.

The reproductive status of Petalwort plants is worth recording at each visit, the most important information being the presence of antheridia or archegonia, or stage of development of sporophytes (green capsule, dark capsule, seta elongated, capsule dehiscing).

**Practical monitoring** Many days are needed to locate and count thalli in large populations of Petalwort and the resulting counts are anyway of rather uncertain significance. Hence, where limited time is available it is better to ascertain details of the local distribution of the species and estimate numbers in each *carefully defined* locality, rather than to leave whole areas unexplored while counting hundreds of thalli at a few locations. Where possible, location of populations should be recorded using hand-held GPS equipment or marked carefully on 1:10,000 maps, with accompanying notes on their exact locations (e.g., 'ca 20 thalli along west edge of path, 3 metres north of lone sallow') and on habitat conditions at the sites. Where more time is available but counts are impracticable, rough estimates of population size can be assigned to a scale such as 1-10, 11-50, 51-100, 101-200, 201-500, 501-1000, 1000+.