



An Introduction to the Outer Hebrides

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Introduction

The Outer Hebrides is an archipelago of 15 inhabited islands and over 100 smaller islands and skerries, situated 30-50 km off the west coast of Scotland. From the northern tip of Lewis, it is over 200 km to the island of Mingulay in the south. There are a number of remote outlying North Atlantic islands which are part of the Outer Hebrides, including the archipelago of St. Kilda.



Figure 1. Outer Hebrides archipelago lying to the west of the island of Skye and the Scottish mainland. Contains modified Copernicus Sentinel data 2018, CC BY-SA 3.0 IGO

The islands each have a distinct character. In the north the peaty uplands and blanket bogs of Lewis contrast with the rugged terrain of Harris. The

southern isles, collectively known as *Uist* (North Uist, Benbecula, South Uist and Eriskay) are split topographically west and east (fig. 1). The west has an Atlantic influence and noted for machair, a unique habitat that is one of the rarest in Europe, composed of wind-blown shell-sand, developing mobile and stable dune systems. The east is hilly and acidic with heather moorland and boggy terrain. The land between is termed *blackland*; a range of highly organic, fertile, wet, acidic soils. Beyond Uist are the islands: Barra, Mingulay and Berneray (only Barra is accessible by ferry).

Habitat Type (EC Habitats Directive Annex 1)	Description
H3110: Oligotrophic waters containing very few minerals. Moderately acidic with a characteristic <i>Littorelletalia</i> -type vegetation	Oligotrophic lochs of this type are found on the South Uist machairs in the transition blacklands, between peat and calcareous sands. The catchment area is acid moorland.
H3130: Oligotrophic to mesotrophic waters with vegetation of the <i>Littorelletea uniflorae</i> and/or of the <i>Isoëto-Nanojuncetea</i>	Nutrient-poor lochs and lochans that contain vegetation typical of the oligotrophic conditions including <i>Littorella uniflora</i> , <i>Potamogeton</i> spp. and <i>Juncus bulbosus</i> , typically found in the Lewis peatlands. This category also includes some of the blackland machair lochs with a higher species diversity and ephemeral pools.
H3140: Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	Water with a high base content derived from base-rich substrates (calcium rich shell-sand), from which the dissolved minerals are derived. On the machair they are found in an intermediate zone between the oligotrophic inland lochs and the eutrophic lochs found nearer the coast.
H3150: Natural eutrophic lakes with <i>Magnopotamion</i> or <i>Hydrocharition</i> -type vegetation	Natural eutrophic lakes have high nutrient levels and are species rich. Some of the coastal machair lochs are naturally eutrophic which reflects the maritime influence.
H3160 Natural dystrophic lakes and pond	Typically, highly acidic, very poor in nutrients and supporting abundant bog-mosses <i>Sphagnum</i> spp. Dystrophic systems most often occur as blanket bogs and include isolated seasonal pools, groups of irregularly-shaped more-or-less permanent waters, and ordered linear or concentric arrays of pools and small lochs. Dystrophic pools may also be found on raised bogs situated mainly on plains and valley bottoms. Also included are quaking bogs where bog-mosses are found in association with <i>Eriophorum angustifolium</i> and <i>Nymphaea alba</i> .

Table 1. Freshwater habitats in the Outer Hebrides (JNCC 2022)

Freshwater Habitats and Desmid Sites

There are over 6,000 freshwater and brackish lochs in the archipelago (photo's 1–4) and, although the islands comprise only 1.3% of the UK's landmass, the Outer Hebrides contain 15% of its freshwater surface area. Their water chemistry is influenced by their proximity to the sea and the presence of



calcareous deposits in the machair areas. The prevailing winds are predominantly south-westerly and carry sea-spray from the Atlantic. The underlying rocks are granitic in composition but have very little influence.

The freshwater habitats vary from the highly acidic dystrophic pools and lochs of the blanket bogs and mires to the natural eutrophic lochs of the coastal plains of the machair (table 1). Away from the coasts, the land is a mixture of acid grassland, heather moorland and blanket bog and mire. The freshwater habitats are predominantly nutrient poor and acidic; they are present in a variety of forms from deep water lochs and shallow lochans to drainage channels and flooded abandoned peat-cuttings (Angus 2001). Areas of eroded peat are formed naturally, but also result from commercial and domestic peat-cutting. *Sphagnum* is common in the peatlands and around shallow lochs often near water-courses, the mosses grow over the water to a depth of up to a metre to form quaking bogs (schwingmoor).



Photo 1. Loch Cleit na Stiùire, Harris. Photo © Christine Johnson



Photo 2. Loch an Fheadhain, Harris. Photo © Christine Johnson

Relatively mild and wet winters are characteristic of the Hebridean climate and during the winter large ephemeral pools form on the machair. These,

together with ephemeral pools found in granite rock depressions and wet rock faces with mosses and liverworts, are fascinating atmophytic habitats and have a small, but interesting desmid flora.



Photo 3. One of a series of coastal lochs at Baile nan Cailleach, Benbecula. Photo © Christine Johnson



Photo 4. Shallow boggy pool, by the Committee Road, North Uist. Photo © Christine Johnson

Desmids in the Outer Hebrides

'The most prolific localities in the British Islands, and perhaps in the whole of Europe, for freshwater Algae are the small tarns and peat-bogs which lie in the hollows of the Lewisian gneiss of north-west Scotland. The plankton of the larger lakes of this area is also much richer in the Desmidiaceae than any which has been described from elsewhere.' – G.S. West (1904).

Desmid diversity and abundance is exceptionally high in oligotrophic waters, especially in such lentic



habitats as moorland pools, ponds and shallow lakes. The importantly rich and diverse desmid flora of areas such as north-west Scotland, western Ireland and the Lake District (Cumbria) has long been recognised (Brodie et al 2007, John & Williamson 2009). Following the Wests' visits to the Outer Hebrides in 1903 and 1905, the Outer Hebrides were recognised as significant. Although there were some surveys of the desmid flora in the latter part of the 20th century the records were either scattered through various publications or remained unpublished.

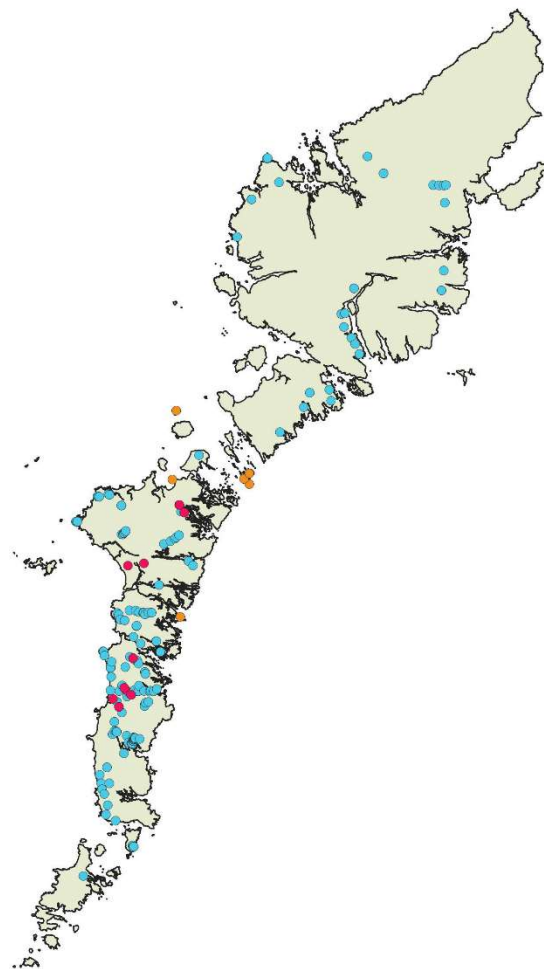


Figure 2. Desmid sample sites 2018–2022 (April)
 ● Sites > 65 taxa ● Sites on off-shore islands

The extensive blanket bogs and raised mires of the islands support an abundance of freshwater oligotrophic and dystrophic habitats known to support a diverse desmid flora. The lochans and pools found on the machair which tend to be circum-neutral to alkaline are classified as important under the EUNIS Habitat Directive, but their desmid communities have not been well studied.

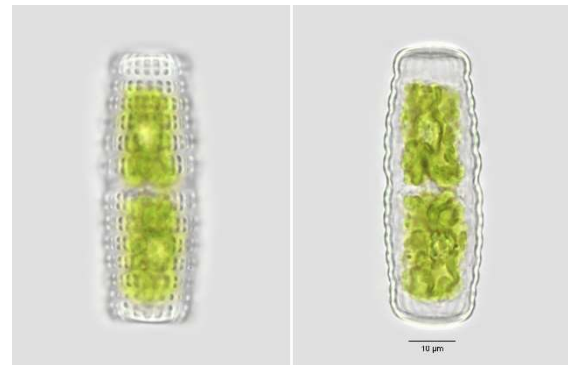


Photo 5. *Cosmarium annulatum* var. *elegans*. Nordstedt. Photo © Chris Johnson

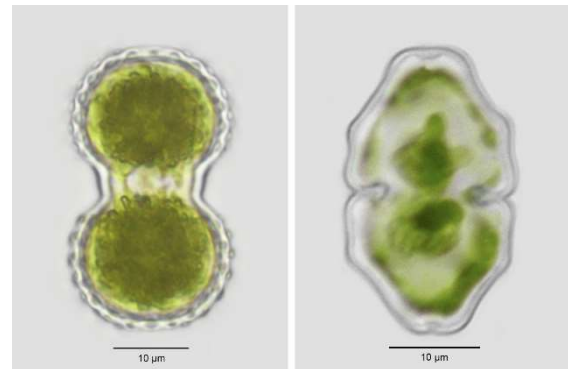


Photo 6. *Cosmarium horizontale* (left). *Cosmarium pokornyanum* (right). Photo © Chris Johnson

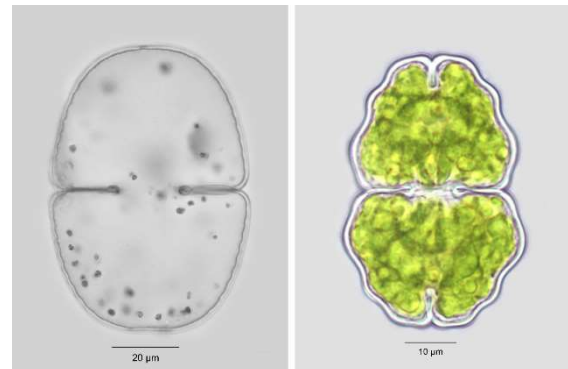


Photo 7. *Cosmarium tyrolicum* var. *beanlandii* (left). *Euastrum inerme* (right). Photo © Chris Johnson

Our current survey was encouraged by Koos Meesters who visited *Uist* in 2018. We have now collected samples from over 170 sites (fig. 2) from a range of habitats and identified over 510 taxa (species and varieties). If we add the taxa from earlier surveys which we have not yet located, the total rises to over 660. It is difficult to make comparisons as our knowledge of the desmid flora of north-west Scotland and the islands is incomplete, however it appears that the diversity of the desmid flora of the Outer Hebrides is particularly rich.



Our original intention was to compile a biodiversity baseline for desmids of the Outer Hebrides, and we therefore sampled a very wide range of habitat-types throughout the islands and the seasons. Our analysis of the taxa associated with the various habitat-types is at a very early stage. However, circumneutral coastal lochs and lochans with a high diversity of plant species generally support the highest number of desmid taxa. These are spread over a number of EUNIS habitat categories (H3130, H3140 and H3150). Species richness and diversity are important criteria, but we suspect that some of the other habitat types e.g., ephemeral pools, may prove to support unusual desmid assemblages.

A few samples

Given our geographic position, we experience many arctic/alpine species which are not common on mainland Europe. There is an irony here as we are neither arctic nor alpine. We have illustrated some (photo 5–10) to give an idea of the Outer Hebrides' potential. Additional information and images are available on our website:

<https://www.outerhebridesalgae.uk/desmids.php>



Photo 8. *Staurastrum pelagicum*. Photo © Chris Johnson

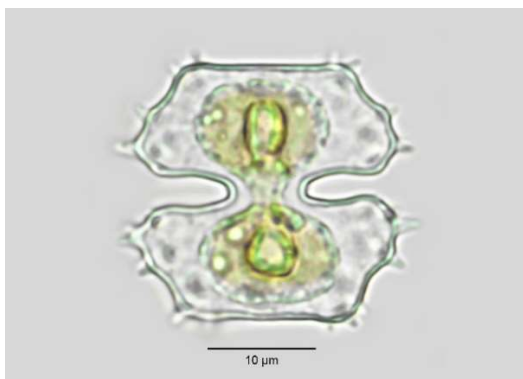


Photo 9. *Xanthidium robinsonianum*. Photo © Chris Johnson

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Photo 10. *Docidium undulatum* (left). *Tortitaenia bahusiensis* (right). Photo © Chris Johnson