

Ecological distribution of the water grimmia (*Schistidium agassizii* Sull. & Lesq.), a nationally scarce semi-aquatic moss in the U.K., with a new record from an upland tributary of the River Dee, N.E. Scotland

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Bryophytes comprise a highly successful group of plants that have managed to exploit environmental conditions generally unsuitable for sustaining vascular plant growth (Stream Bryophyte Group, 1999; Lang, 2010). For example, in fast flowing and boulder-strewn upland headwater streams, bryophytes are often the dominant form of plant life, tolerating being pummeled by harsh current velocities and dislodged or rolling substratum (Lang, 2010; Lang & Murphy, 2012). These stream bryophytes encompass a relatively small proportion of the moss and liverwort flora capable of occupying habitats frequently inundated with water (Stream Bryophyte Group, 1999). Recent work has placed emphasis on the potential value of bryophyte communities for making integrated bioassessments of water quality, and through their prevailing life strategies, also reveal important information concerning the physical character of rivers (Lang & Murphy, 2012; Vieira *et al.*, 2012).

The water grimmia, *Schistidium agassizii* Sull. & Lesq. [= *Grimmia agassizii* (Sull. & Lesq.) Jaeg.] is a semi-aquatic moss species belonging to the family Grimmiaceae, characterised by predominantly dark green-brown to blackish foliage (Birks & Birks, 1967; Smith, 2004). Tending to form discrete clumps, the moss can be found pressed against the surfaces and crevices of partially submersed rocks in rivers (Holmes, 1976; Lang, 2010), though little is understood about its habitat ecology

(http://www.bbsfieldguide.org.uk/sites/default/files/pdfs/mosses/Schistidium_agassizii.pdf).

Schistidium agassizii is designated as nationally scarce (Averis *et al.*, 2012), occurring in only thirteen myriads (U.K. Ordnance Survey grid unit areas of 100 x 100 km², designated by a two letter code) across Great Britain (<https://data.nbn.org.uk/Taxa/NHMSYS0000310590>). In Scotland, it is considered a species of principal importance for biodiversity conservation (<http://www.scotland.gov.uk/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL>).

A northerly distribution of *S. agassizii* is somewhat apparent (Hill *et al.*, 1992; Fig. 1), with the majority of the U.K. records derived from Scottish sites (Table 1), mostly located in the Highlands.

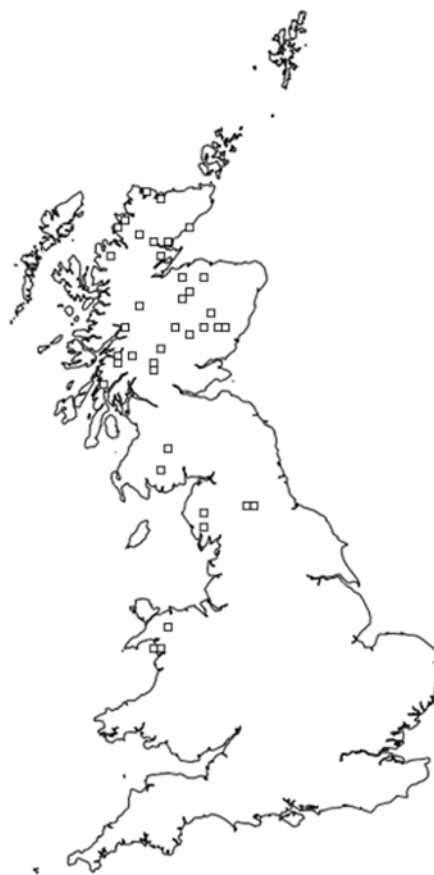


Fig. 1. Grid map of distribution records of the water grimmia, *Schistidium agassizii* in the U.K. (reproduced with permission from https://data.nbn.org.uk/Taxa/NHMSYS0000310590/Grid_Map). © Crown copyright and database rights 2011 Ordnance Survey [100017955].

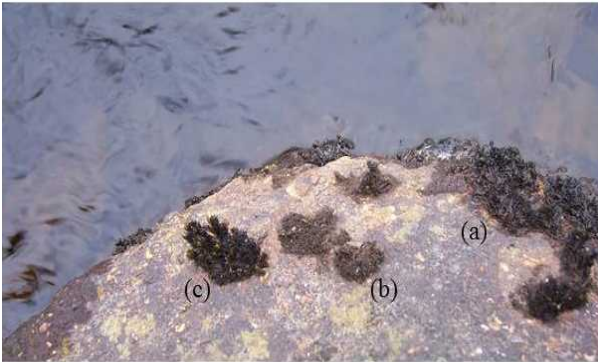


Fig. 2. Photograph of *Schistidium agassizii* (a) co-occurring with *Blindia acuta* (b) and *Racomitrium aciculare* (c) on a partially submerged rock in the Girnock Burn, Royal Deeside.

Table 1. Verified U.K. records of *Schistidium agassizii* (<https://data.nbn.org.uk/Taxa/NHMSYS0000310590>); OS myriad pre-fixed with superscript letter 'S', 'E' or 'W' denoting whether moss populations were derived from Scotland, England or Wales, respectively.

Of the 120 verified records of *Schistidium agassizii* held by the NBN database, to January 2014 for the U.K.

(<https://data.nbn.org.uk/Taxa/NHMSYS0000310590>), nearly all are from riverine locations (with the species hitherto being recorded from 24 Scottish rivers and streams, together with two lochside locations, as well as records from Ben Lawers (e.g., Birks & Birks, 1967), and Polgown Craigs on the north bank of the Scaur Water, in the upper catchment of the R. Nith). Within the R. Dee catchment in Aberdeenshire, there are two existing records from a single site on the river, approximately 2.5 km downstream of Ballater. During botanical surveys conducted in 2005 and 2006, undertaken as part of a larger research project (Lang, 2010), we additionally observed this moss species on repeated occasions, usually limited to sizeable substratum within the stream channel at Hampshires' Bridge (NO 312 912), on the Girnock Burn, a small tributary of the River Dee (joining the river about 5 km upstream of Ballater). The underlying catchment geology of the Girnock Burn is chiefly granitic, interspersed with base-rich rocks that includes a small proportion of limestone (Soulsby *et al.*, 2007; Tetzlaff *et al.*, 2007; Lang & Murphy, 2012), producing a streambed morphology characterised by a high abundance of cobbles and the presence of some larger boulders (Lang, 2010). Its water physico-chemistry is principally oligotrophic (phosphate concentration usually < 0.003 mg L⁻¹), circumneutral (mean pH 7.10) and reasonably well-buffered (mean alkalinity 23.08 mg L⁻¹ as CaCO₃) against acid-induced spate events (Lang, 2010). We found that *Schistidium agassizii* typically co-occurred with *Blindia acuta* (Hedw.) Bruch & Schimp. and *Racomitrium aciculare* (Hedw.) Brid. (Fig. 2),

together forming a small biomass, low diversity species assemblage displaying stress/disturbance resistant traits (e.g., small leaves, wiry stems, streamlined morphology), indicative of intensely scoured and unstable habitat conditions (Lang & Murphy, 2012). This association has been noted to occur elsewhere in Scotland (e.g., the Bruar Water: http://www.sepa.org.uk/water/water_regulation/advertised_applications/idoc.ashx?docid=51ea134b-77c7-4b14-8e16-432c997a4e53&version=-1), and northern England (e.g., upper stretches of the River Tees: Holmes, 1976). Furthermore, the inferences drawn by Lang & Murphy (2012) regarding the adaptiveness of turf mosses such as *Schistidium agassizii*, *Blindia acuta* and *Racomitrium aciculare* for enduring frequently disturbed conditions in high latitude upland streams, generally agree with wider research findings (e.g., Muotka & Virtanen, 1995; Virtanen *et al.*, 2001).

We report a newly confirmed record of the nationally scarce water grimmia, *Schistidium agassizii*, the ecological distribution of which fits in with previous occurrences documented by the NBN Gateway.

U.K. NGR myriad (100 x 100 km ² resolution)	Number of U.K. hectads containing records of <i>S. agassizii</i> (10 x 10 km ² resolution)	Number of individual U.K. records of <i>S. agassizii</i> per myriad held by NBN database, to January 2014
^s NN	8	23
^s NH	6	14
^s NC	5	21
^s NO	5	10
^s NJ	2	6
^s ND	1	2
^s NG	1	2
^s NR	1	2
^s NS	1	3
^s NX	1	1
^e NY	3	28
^e SD	1	1
^w SH	3	7
Total	38	120

Although the moss may be genuinely rare, perhaps it is simply under-recorded or mistaken for *Schistidium rivulare* (Brid.) Podp., which is similar. Therefore, further work on the habitat ecology of *S. agassizii* would certainly benefit conservation knowledge concerning this particular species.

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ELECTRONIC RESOURCES

- http://www.bbsfieldguide.org.uk/sites/default/files/pdfs/mosses/Schistidium_agassizii.pdf
- <http://www.scotland.gov.uk/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL>
- <https://data.nbn.org.uk/Taxa/NHMSYS0000310590>
- https://data.nbn.org.uk/Taxa/NHMSYS0000310590/Grid_Map
- http://www.sepa.org.uk/water/water_regulation/advertised_applications/idoc.ashx?docid=51ea134b-77c7-4b14-8e16-432c997a4e53&version=-1