
A3

Spirodela polyrhiza-*Hydrocharis morsus-ranae* community

Synonymy

Hydrocharitetum morsus-ranae van Langendonck 1935.

Constant species

Berula erecta, *Elodea canadensis*, *Glyceria fluitans*, *Hydrocharis morsus-ranae*, *Lemna gibba*, *L. minor*, *L. trisulca*, *Spirodela polyrhiza*.

Rare species

Azolla filiculoides, *Wolffia arrhiza*.

Physiognomy

The major element of the *Spirodela polyrhiza*-*Hydrocharis morsus-ranae* community consists of a floating mat of various mixtures of the duckweeds *Lemna minor*, *L. gibba* and, particularly distinctive here, *Spirodela polyrhiza*, together with *Hydrocharis morsus-ranae*. The rare *Wolffia arrhiza* is also occasionally found and the alien fern *Azolla filiculoides* sometimes occurs. Beneath this, there is a closely associated layer of submerged plants, with *Elodea canadensis* and *Ceratophyllum demersum* very common and sometimes abundant, and entangled among them the thalli of *L. trisulca*. Other more occasional associates are *Callitriche platycarpa*, *C. obtusangula*, *Ranunculus circinatus*, *Zannichellia palustris*, *Potamogeton crispus*, *P. pectinatus* and *P. berchtoldii*. Then, there are generally some emergents, not taller shading species, but ones with their shoots often semi-submerged among the aquatics or sometimes totally underwater. Most frequent among the available samples were *Berula erecta*, which can grow well even fully submerged, when it produces shorter, stockier plants than in swamps (Haslam 1978), and *Glyceria fluitans*, whose lush masses of shoots trail out into open water, but *Apium nodiflorum* and *Agrostis stolonifera* have also been recorded growing among this kind of vegetation (Wolseley *et al.* 1984).

Habitat

The *Spirodela*-*Hydrocharis* community is confined to unpolluted and unshaded, clear mesotrophic and eutrophic standing waters, sometimes quite calcareous or slightly saline, in the warmer lowlands of southern and eastern Britain. It is especially characteristic of more open dykes and ponds, disused and little-used canals, and can return fairly quickly after physical cleaning but, with widespread pollution and eutrophication, it is becoming increasingly local.

The two most distinctive species of this community, *Spirodela* and *Hydrocharis*, as well as the associated *C. demersum*, *L. gibba* and, to a lesser extent, *L. trisulca*, are largely confined to the English lowlands, south of a line from the Mersey to the Humber, where the mean annual maximum temperature is more than 28 °C (Conolly & Dahl 1970). Within this zone, this kind of vegetation is restricted to more mesotrophic standing waters, often of artificial origin, such as small ponds and dykes, sometimes cut through mineral substrates, sometimes through peat. In certain localities, the waters are fairly calcareous, and the community can also occur in the moderately brackish sections of drainage systems in reclaimed coastal marshes (Charman 1981).

Important considerations, however, are that the waters are free from dense shade, such as that cast by high and closely opposed banks, thick emergent vegetation or overhanging trees, and are not turbid or polluted. Increasingly, then, the *Spirodela*-*Hydrocharis* community has become confined to those places where dykes and pools remain free of agricultural, industrial or domestic effluents and, in its fully developed form, it is now a very local community, found in such widely scattered sites as the Somerset Levels, the North Kent Marshes, the Norfolk Broads and the Fens, and even there is sometimes of sporadic appearance. It will, though, tolerate physical disturbance and can redevelop quite rapidly after dykes are cleaned by hand or mechanically: indeed, regular disruption of this kind is essential

to prevent the successional advance of shading macrophytes or emergents which can easily overwhelm the community (Wolseley *et al.* 1984). Where clearing or dredging leaves the water turbid, or where cut or herbicide-treated herbage is left to rot in the water, the submerged element of the vegetation may be slow to return.

Zonation and succession

The community is usually found on smaller, sheltered stretches of open water fringed by but a short or patchy cover of emergents. Other kinds of submerged aquatic vegetation can occur beneath it, and it may persist in fragmentary form among assemblages of floating-leaved macrophytes, but it is readily shaded out by them, and by encroaching swamp communities, relying on repeated cleaning for its continuing survival. Herbicide treatment or pollution, with increased deoxygenation, turbidity and eutrophication of the waters can lead to the replacement of the *Spirodela-Hydrocharis* vegetation by simpler *Lemna* communities.

In the more open dykes with shelving, stepped or low banks which provide the most typical habitat for the community, and particularly where there is some regular physical cleaning of weed growth, the usual pattern is for the water margins to have a short, though sometimes quite luxurious, cover of *Glycerio-Sparganium* vegetation. Decumbent clumps of *Glyceria fluitans* and *Agrostis stolonifera*, or patches of *Berula erecta* and *Apium nodiflorum*, provide floristic continuity with the *Spirodela-Hydrocharis* community, and there can be scattered plants of *Alisma plantago-aquatica* or *Nasturtium officinale*, many of these able to make rapid regrowth if the disturbance has not been too gross. Then, there can be scattered patches of the *Sparganium erecti* or *Sagittaria sagittifolia* swamp but, where taller emergents are represented, these tend to occur in clumps which alternate with the *Spirodela-Hydrocharis* community in less regularly maintained dykes, or to be set back some way from it on a shelving bank. A variety of swamps can be found in such situations, the *Phragmitetum*, the *Glycerietum maximae*, the *Typhetum latifoliae* and, in brackish waters, the *Scirpetum maritimae*, but, wherever these become densely shading, any duckweed vegetation surviving among the shoots tends to be of the impoverished *Lemnetum minoris* or *Lemnetum gibbae*.

Similarly, where floating-leaved macrophyte vegetation such as the *Polygonum amphibium* or *Nuphar lutea* communities develop, these may shade out the submerged elements of the *Spirodela-Hydrocharis* assemblage and even overwhelm *Hydrocharis* itself, leaving just fragmentary and species-poor duckweed mats. Where the waters remain relatively unshaded, however, other submerged aquatic communities can be found with this kind of vegetation, both *Ceratophyllum demersum* and *Elodea canadensis* being able to thicken up into virtually pure stands without a duckweed mat above them. In other places, the *Spirodela-Hydrocharis* community has been recorded with the *Potamogeton pectinatus-Myriophyllum spicatum* vegetation or, in more brackish habitats, the *Potamogeton pectinatus* community, *Ceratophyllum submersi* or *Ranunculetum baudotii*.

Physical cleaning can readily allow this richer kind of duckweed vegetation to regenerate, but treatments which pollute, dirty or eutrophicate the waters to any degree will tend to eliminate the submerged species and simplify the assemblage to a floating mat of the *Lemnetum minoris* or the *Lemnetum gibbae*, communities which have probably ousted the *Spirodela-Hydrocharis* vegetation in many once suitable sites throughout its range.

Distribution

This is an increasingly local community through the warmer lowlands of southern and eastern Britain. It has also been recorded on the Gwent Levels.

Affinities

Richer assemblages of duckweeds with other floating and submerged aquatics have been placed in associations like the *Lemno-Spirodeletum* (Koch 1954) Müll & Gors 1960 (Westhoff & den Held 1969, Oberdorfer 1977, Ellenberg 1978) or, where *Hydrocharis* occurs among them as here, the *Hydrocharitetum morsus-ranae* van Langendonck 1935 (Oberdorfer 1977, Ellenberg 1978). Our *Spirodela-Hydrocharis* community is closest to stands among the latter association which lack *Stratiotes aloides*, though it grades into the *Hydrocharis-Stratiotes* community of this scheme and further sampling may rationalise the two assemblages into a single diverse unit.

Floristic table A3

<i>Spirodela polyrhiza</i>	V (2–8)
<i>Hydrocharis morsus-ranae</i>	V (3–8)
<i>Lemna minor</i>	V (3–10)
<i>Lemna gibba</i>	V (1–8)
<i>Lemna trisulca</i>	V (2–8)
<i>Berula erecta</i>	IV (2–3)
<i>Glyceria fluitans</i>	IV (1–3)
<i>Elodea canadensis</i>	IV (3–9)
<i>Ceratophyllum demersum</i>	III (3–4)
<i>Wolffia arrhiza</i>	II (4–5)
<i>Ranunculus circinatus</i>	I (3)
<i>Callitriche platycarpa</i>	I (3)
<i>Potamogeton crispus</i>	I (2)
<i>Azolla filiculoides</i>	I (2)
<i>Zannichellia palustris</i>	I (3)
<i>Nasturtium officinale</i>	I (5)
<i>Polygonum amphibium</i>	I (2)
Number of samples	8
Number of species/sample	8 (7–11)