
A1

Lemna gibba community

Lemnetum gibbae Miyawaki & J.Tx. 1960

Synonymy

Wolffio-Lemnetum gibbae Bennema (1943) 1946.

Constant species

Lemna gibba.

Rare species

Wolffia arrhiza.

Physiognomy

The *Lemnetum gibbae* comprises floating mats of the small thalli of *Lemna gibba*, often very numerous and densely crowded, sometimes forming a virtually continuous cover over many square metres, though generally disposed just one layer thick, except where the wind pushes up the thalli one upon another. No other species is constant, but *L. minor* is fairly common, occasionally occurring in some abundance, and there can be great difficulty in distinguishing this from non-gibbous forms of *L. gibba* which are found quite widely. *Spirodela polyrrhiza* also occurs with locally high frequency and extensive cover and, where such mixtures have a little *Hydrocharis morsus-ranae*, the vegetation begins to grade to the more species-rich kind of duckweed mat. The tiny rootless thalli of *Wolffia arrhiza* are very occasionally found, but this plant is much scarcer with us than in some other parts of Europe, where it can be a constant in the *Lemnetum gibbae*, as in The Netherlands (Westhoff & den Held 1969).

Beneath the mat, submerged aquatics are generally few, but free-floating *Lemna triscula* and *Elodea canadensis*, and rooted shoots of *Callitriche stagnalis*, *C. obtusangula*, *Potamogeton pectinatus* and *Zannichellia palustris* have been recorded in the samples. And the *Lemnetum gibbae* often occurs sheltered among the shoots of emergents, a variety of which can be recorded among the mats: *Nasturtium officinale* and *Apium nodiflorum* were the commonest here, but the community is frequently found in close association with vegetation dominated by *Glyceria fluitans*, *G. maxima*, *Sparganium*

erectum, *Typha latifolia* and, in more brackish situations, *Scirpus maritimus* (Charman 1981, Wolseley *et al.* 1984).

Habitat

The *Lemnetum gibbae* is typical of standing or sluggish, eutrophic and base-rich waters throughout south-east Britain, often in situations which are too recently disturbed or unstable to support much other aquatic vegetation. It occurs widely in sheltered stretches of pond and lake margins, and along the edges of very slow-moving lowland streams, but is especially common in canals and ditches, where it can make a quick recovery from cleaning and dredging.

In common with other free-floating aquatics, all duckweeds are warmth-requiring to some degree, preferring waters that remain ice-free in winter (Ellenberg 1978) but, compared with *L. minor*, *L. gibba* is more strictly confined to the warmer lowlands of Britain (Perring & Walters 1962). Apart from major outliers in the plains of Lancashire and Cheshire, it occurs mostly to the south-east of a line from Somerset to the Humber, and virtually all stands experience a mean annual maximum air temperature of 28 °C or more (Conolly & Dahl 1970). Moreover, it seems to have somewhat higher base and nutrient requirements than *L. minor*. It is possible, though, that its success in dominating duckweed mats is also due in part to the competitive ability of the swollen thalli to ride up over the flat ones of *L. minor* and *S. polyrrhiza* and shade them out. Both these species when grown alone are more productive than *L. gibba*, but each succumbs to it in mixed cultures (Harper 1961, Clatworthy & Harper 1962). In the light of this, the rarity of the diminutive *W. arrhiza* in this vegetation is hardly surprising: it is even more warmth-demanding, recently discovered on the Gwent Levels (Margaret Palmer, personal communication) but otherwise occurring only to the south of a line from the Severn to the Thames (Perring & Walters 1962), and is the most weakly competitive of all the species (Wotek 1974).

None of the floating duckweeds will persist on moving or very wind-blown open waters, but they can reproduce rapidly after disturbance and are unaffected by the turbidity and oxygen depletion that can preclude the rapid regrowth of many submerged aquatics. The aggressive behaviour of *L. gibba* may give it an important edge in this recovery phase, particularly in more eutrophic waters: in The Netherlands, the *Lemnetum gibbae* becomes dominant after weedkiller treatment when the herbage has been left to rot in the water (de Lange 1972), and Weber-Oldecop (1970) has shown that vegetation of this kind has spread rapidly in parts of Germany where agricultural and effluent pollution has affected ponds and ditches.

Zonation and succession

The *Lemnetum gibbae* is typically found as floating mats adjacent to or among emergents of eutrophic and more shallow open waters. In the early stages of recovery after disturbance, it may be the only kind of truly aquatic vegetation, but it can occur with other duckweed communities and, as succession resumes in the clearing waters, submerged plants can develop beneath it and floating or floating-leaved macrophytes among it, these latter able to replace it in time. With the increasing eutrophication and pollution of lowland water bodies, the *Lemnetum gibbae* may become a more extensive permanent feature.

Very commonly around the fringes of ditches and ponds with fine mineral substrates, the community occurs among semi-submerged mats and emergent shoots of such water-margin vegetation as the *Glycerietum fluitantis* or other Glycerio-Sparganion assemblages dominated locally by plants like *Nasturtium officinale*, *Apium nodiflorum*, *Berula erecta*, *Veronica beccabunga* or *Callitriche stagnalis*, themselves well suited to the periodic instability of such habitats. In other cases, the *Lemnetum gibbae* can be found among emergent stands of the *Sparganietum erecti*, the *Glycerietum maximae*, the *Typhetum latifoliae*, the *Phragmitetum* or, in brackish ditches, the *Scirpetum maritimae*, and these may provide shelter for the duckweed mats out into deeper water.

Where the water is standing or sluggish and relatively unaffected by wind, the *Lemnetum* can extend out as a surface mat beyond the zone of swamp vegetation and is sometimes the only kind of floating aquatic community. In other places, though, it can be found with the *Lemnetum minoris*, grading to it with a switch in dominance from *L. gibba* to *L. minor*, or with the richer *Spirodela-Hydrocharis* community, both of which it can probably replace. Where there has been regrowth of floating-leaved aquatics, the *Lemnetum gibbae* can occur as mosaics with the *Potamogeton natans*, *Polygonum amphibium* or *Nuphar lutea* communities, and as a mat

over a variety of submerged aquatic vegetation, especially assemblages typical of more eutrophic or somewhat brackish waters, like the *Ceratophylletum submersi*, the *Ceratophylletum demersi*, the *Elodea canadensis* community and some of the fine-leaved *Potamogeton* communities.

With regular disturbance and increasing enrichment, the *Lemnetum gibbae* may become repeatedly or more or less permanently established as part of a more impoverished suite of aquatic communities.

Distribution

The community occurs widely through south-eastern England and has also been recorded in the Gwent Levels.

Affinities

Mats of *L. gibba* have been recorded from various other parts of Europe, particularly from the more Atlantic regions, and sometimes considered as impoverished versions of a richer duckweed vegetation (Koch 1954). Generally, though, they have been designated a *Lemnetum gibbae* or, where *W. arrhiza* is an important component, a *Wolffio-Lemnetum gibbae* (Bennema (1943) 1945 (Miyawaki & J.Tx. 1960) and placed in the Lemnion minoris (Westhoff & den Held 1969, Oberdorfer 1977) or a separate Lemnion gibbae (de Lange 1972).

Floristic table A1

<i>Lemna gibba</i>	V (3–10)
<i>Lemna minor</i>	II (1–3)
<i>Spirodela polyrhiza</i>	II (4–10)
<i>Nasturtium officinale</i>	II (2–7)
<i>Lemna trisulca</i>	II (4–6)
<i>Callitriche obtusangula</i>	I (2–5)
<i>Ranunculus sceleratus</i>	I (3)
<i>Hydrocharis morsus-ranae</i>	I (5)
<i>Elodea canadensis</i>	I (5)
<i>Callitriche stagnalis</i>	I (4)
<i>Potamogeton pectinatus</i>	I (4)
<i>Apium nodiflorum</i>	I (4)
<i>Ranunculus trichophyllus</i>	I (5)
<i>Potamogeton natans</i>	I (3)
<i>Wolffia arrhiza</i>	I (2)
<i>Drepanocladus fluitans</i>	I (3)
<i>Zannichellia palustris</i>	I (3)
<i>Mentha aquatica</i>	I (2)
Number of samples	17
Number of species/sample	3 (1–7)