A16
Callitriche stagnalis community

Synonymy
Swift-moderate current vegetation Butcher 1933 *p.p.*

Constant species
Callitriche stagnalis.

Physiognomy
All the starwort vegetation sampled has been grouped in this *Callitriche stagnalis* community, usually dominated by *C. stagnalis*, occasionally accompanied or locally replaced by *C. platycarpa* or, in southern Britain, *C. obtusangula*. Sometimes the plants grow fully submerged, though there are usually at least some shoots trailing to the water surface and, where pools or streams periodically dry out, the vegetation may persist for some time on the moist ground. Maximum growth is generally attained early in the season, but total cover is very variable: many stands are small, but dense luxuriant growth can occur in congenial situations, while just sparse shoots remain in unstable habitats. Colonisation of new sites can be very rapid and, once well established, populations can be long-lived but, in temporary water bodies or disturbed situations, like spatey streams or frequently cleared dykes, stands may be ephemeral.

This kind of vegetation is found in close association with a variety of other aquatics, but associates actually growing within thicker stands are few in number and usually of low cover. In some situations, *Potamogeton pectinatus* becomes a constant feature and it may occur abundantly among the *Callitriche* but, otherwise, there are generally just occasional shoots of *Myriophyllum spicatum*, *M. alterniflorum* and *Ceratophyllum demersum*, with a few thalli of *Lemna minor* sometimes caught among the floating shoots.

Sub-communities

***Callitriche* spp. sub-community.** Starworts are the sole dominants here, with *C. stagnalis* constant and occasional *C. platycarpa* or *C. obtusangula* but no *P. pectinatus*.

***Potamogeton pectinatus* sub-community.** *P. pectinatus* becomes constant here and it can have quite high cover, with *C. stagnalis* the only starwort.

Habitat
The *C. stagnalis* community can be found throughout lowland Britain in a variety of more shallow open waters with but sluggish flow or none, as in dykes, canals, ponds and even periodically rain-filled track ruts, and in such habitats conditions can be eutrophic with the substrates often of silt or clay. It is more distinctive, though, in quite fast to very swift, sometimes seasonal or spatey, waters in streams with sandy or gravelly beds, base-rich in those rarer situations where such conditions are met in the south-east of the country, more acidic and impoverished through the upland fringes of the west and north, where they become very common.

More extensive sampling is necessary before it is possible to characterise precisely the environmental preferences of the various British *Callitriche* spp., which can be difficult to separate where fruiting plants are absent and the leaf shape very variable, as it often is (Wiggington & Graham 1981). Over the country as a whole, *C. stagnalis* is certainly the commonest starwort in vegetation of this general kind, but *C. platycarpa* has a similar widespread distribution (Perring & Walters 1962) and is sometimes especially difficult to distinguish from it (Lewis-Jones & Kay 1977), so it should probably figure more frequently than is apparent here, perhaps favouring more sluggish waters among these colonised (Haslam 1978). It has certainly been often recorded in a number of other communities of still and slow-moving waters. *C. obtusangula* has been encountered in a similar range of vegetation, and is occasionally abundant here, but it has an Oceanic Southern distribution through Europe as a whole (Matthews 1955) and has been found only in southern British stands of *Callitriche* (Perring & Walters 1962). The much rarer Oceanic Southern *C. truncata* only just extends into this country and has not been recorded. *C. hamulata* has not been seen in these denser stands either, although it occurs widely through

Britain and has been found occasionally in other aquatic communities, particularly those of more base-poor and often quite fast-moving waters, and it should be looked for in vegetation of this general kind in streams in The Weald, the New Forest and through the west and north of Britain (Perring & Walters 1962, Haslam 1978). *C. hermaphroditica*, another nationally scarce species, but one concentrated in the north of the country, may well also be locally important, perhaps in stiller waters.

For the moment, then, it is possible to make only broad observations about *Callitriche* stands and their habitat. The first is that, because of their ready colonising powers, rapid establishment and growth occurring from seed or just a few centimetres of unrooted stem fragment, starworts can gain a hold in quite unstable and short-lived situations and return quickly after disturbance (Haslam 1978). Remnants can easily exploit temporary banks of sand or silt on the shifting beds of fast or spatey streams, for example, or take advantage of brief surface flooding by rain on open ground, as on tracks or woodland rides, often far from established populations. Recovery after artificial upheavals, like dredging or cutting of the vegetation in dykes, is speedy.

Second, because at least some of the starworts, notably *C. stagnalis*, *C. platycarpa*, *C. obtusangula* and *C. hamulata*, can survive out of water for considerable periods of time, their vegetation can persist where habitats become seasonally or periodically dry. Stands commonly extend up into the summer-dry reaches of Chalk streams, for example, and are frequently found around the edges of fluctuating ponds. A third general feature of *Callitriche* spp., their shade tolerance, enables the plants to persist in such situations among marginal or emergent herbs or beneath overhanging vegetation on the banks.

Fourth, there is the ability of the starworts to grow in turbulent conditions. Certainly, stands are very widespread and common in standing and sluggish waters where these are fairly shallow, and some species, like *C. platycarpa* and *C. hermaphroditica*, probably prefer such conditions, but this kind of vegetation can extend into some of the swiftest and most spate-prone waters able to support vascular plants. In finer substrates, starworts are relatively easily eroded from their beds, being shallow-rooted, and the stems break with only moderate force, but among medium to coarse material the anchoring strength is substantially greater and the shoots, though individually quite delicate, present a streamlined shape when growing bunched (Haslam 1978). Through river systems as a whole, then, *Callitriche* vegetation tends to become increasingly obvious with decrease in drainage order. In the south-east, for example, it is common in the swifter stretches of base-rich streams on the Chalk and Oolite and in some mill races, and here the *Potamogeton* sub-community is particularly characteristic. To the north and west *Callitriche*-dominated stands become much more widespread in the upper reaches of streams through the upland fringes, where shallow and fast-flowing waters drain catchments of acidic and nutrient-poor rocks of various kinds, including arenaceous sedimentaries and lime-free igneous and metamorphic rocks. *C. hamulata* is perhaps especially distinctive of such situations, though no stands dominated by this species have been sampled.

Zonation and succession

The *C. stagnalis* community occurs with a wide range of other submerged, floating-leaved and floating aquatic vegetation in diverse patterns in the different habitats in which it is found. In stiller, shallow waters, especially where these are more eutrophic, invasion by emergents is common and sometimes rapid, but *C. stagnalis* vegetation can persist long on periodically flooded ground among advancing swamps and even reappear in rain-filled pools where climax forest is opened up.

In such habitats as dykes, canals and ponds, the community can be found among other more species-poor assemblages of submerged aquatics like the *Ceratophyllum demersi*, the *Elodea canadensis* vegetation and stands of *Potamogeton pectinatus*, though it is usually more strictly confined than these to shallow waters, and it will not stand as much turbidity as the first, nor as much enrichment and pollution as the last. Cleaner and more base-rich waters, standing or with up to moderately fast flow, may also have the richer and more diverse *Potamogeton-M. spicatum* community, among which various *Callitriche* spp. can remain occasional and locally quite abundant.

On the surface of these kinds of waters, the *Callitriche* stands can sometimes be seen in more open stretches of floating-leaved covers of the *Nuphar lutea*, the *Potamogeton natans* or the *Polygonum amphibium* communities and, where the waters are more sluggish or still, there are very often patches of the *Lemnetum gibbae*, the *Lemnetum minoris* or, more locally, the richer *Spirodela-Hydrocharis* vegetation. In Broadland dykes, stands of *C. platycarpa* occur in some abundance among the *Hydrocharis-Stratiotes* community.

Where the muddy margins of such open waters are periodically exposed, *C. stagnalis* vegetation can persist for some considerable time on the moist ground, often with scattered thalli of the duckweeds, and sparse patches of such mixtures can survive long in the shade of invading emergents. Most commonly, around these stiller, eutrophic waters, it is communities like the *Phragmitetum*, the *Glycerietum maximae*, the *Typhetum latifoliae* and the *Sparganietum erecti* that colonise the transitions, with various kinds of Glycerio-Sparganion vegetation, patchily dominated by such plants as *Nasturtium officinale*, *Apium nodiflorum*, *Veronica becca-*

bunga and smaller *Glyceria* spp., along the disturbed edges of dykes and streams.

It is this latter kind of vegetation that usually provides a marginal fringe to stands of the *C. stagnalis* community in the middle and upper reaches of its Chalk stream habitat. Where there is a perennial water flow, the starworts can be very prominent in a band up to 1 m wide along the edge of a stream, mixed in with floating shoots of the Glycerio-Sparganion herbs. Submerged clumps of the community can extend into the deeper waters of the stream centre, but their cover is usually of minor importance compared with the luxuriant crowfoot vegetation that typically dominates that zone. *Ranunculus penicillatus* ssp. *pseudofluitans* is particularly important in such reaches, but *R. aquatilis* and *R. peltatus* also occur, and indeed it is these latter species which generally extend higher into the summer-dry reaches of the streams where, together with the *C. stagnalis* community, they form the bulk of the cover on the dampest ground of the bed (Haslam 1978).

In the fast-flowing, acidic and impoverished waters of streams in the upland fringes, the vegetation patterns look very different. Here again, the *C. stagnalis* community becomes more obvious in the upper reaches, but its usual companions are assemblages like the *Potamogeton-M. alterniflorum* vegetation or, in swifter streams, the *Myriophyllum* community. Glycerio-Sparganion vegetation can occur, often rather fragmentarily, along the banks or patches of the *Sparganietum erecti* or the *Phalaridetum*, or there can be just slumped slabs of the surrounding pasture, with more moisture tolerant herbs showing locally luxuriant growth. Where peaty waters drain in, or where there is a transition to bog soakways, the *C. stagnalis* community often passes to *Potamogeton-Ranunculus* vegetation in which starworts can retain an occasional presence, though in associated dystrophic pools, there is usually a sharp switch to *Juncus bulbosus* vegetation. In the swiftest reaches of mountain streams, the *C. stagnalis* community maintains only a sparse presence in slacker byways, and is finally replaced entirely by submerged moss-dominated vegetation.

Distribution

Vegetation of this general kind occurs widely throughout lowland Britain and extends to moderately high altitudes in mountain streams. Further sampling could demonstrate distinct regional patterns of prominence of the various *Callitriche* spp.

Affinities

Vegetation of this kind has figured little in the British literature and *Callitriche* spp. have usually been seen as part of other aquatic assemblages (Butcher 1933). With additional sampling, it will perhaps be possible to characterise a number of distinct communities like those recognised by Oberdorfer (1977) in which *C. stagnalis*, *C. hamulata* and *C. obtusangula* are each prominent. Traditionally, such vegetation has been grouped with crowfoot communities in a Callitriche-Batrachion Den Hartog & Segal 1964, more recently a Ranunculion fluitantis (Ellenberg 1978), alliances in the Potametea.

Floristic table A16

	a	b	16
Callitriche stagnalis	V (4–10)	V (3–8)	V (3–10)
Callitriche obtusangula	II (1–6)		I (1–6)
Callitriche platycarpa	II (4–5)		I (4–5)
Potamogeton pectinatus		V (3–5)	II (3–5)
Lemna minor	II (1–4)	II (1–4)	II (1–4)
Ceratophyllum demersum	I (1–2)	I (4–6)	I (1–6)
Myriophyllum spicatum	I (1)	I (4)	I (1–4)
Number of samples	35	11	46
Number of species/sample	1 (1–3)	2 (2–5)	1 (1–5)

a *Callitriche* spp. sub-community
b *Potamogeton pectinatus* sub-community
16 *Callitriche stagnalis* community (total)

https://doi.org/10.1017/9781107340817.020 Published online by Cambridge University Press