A17
Ranunculus penicillatus ssp. *pseudofluitans* community

Synonymy
Moderately swift current vegetation Butcher 1933 *p.p.*

Constant species
Ranunculus penicillatus ssp. *pseudofluitans*.

Physiognomy
This community comprises stands of submerged aquatic vegetation dominated by the crowfoot now known as *Ranunculus penicillatus* ssp. *pseudofluitans*, a taxon previously designated as *R. penicillatus* ssp. *calcareus* (Butcher 1960, Cook 1966, Holmes 1980, Webster 1988). It is a perennial plant with shoots up to 3 m long, growing in clumps and trailing downstream in the flowing water that provides the usual habitat. Maximum cover is attained early in the season, with luxuriant growth of the fine tasselled leaves occurring where conditions are congenial, and clumps can be very numerous such that whole streams of considerable size become choked with this vegetation. The var. *vertumnus*, sometimes separated from a var. *pseudofluitans* (Holmes 1980, Webster 1988), was not distinguished in the sampling.

The community is frequently found in close association with other crowfoot vegetation, like that dominated by *R. aquatilis* and *R. peltatus*, and various other aquatic assemblages, but among denser stands associates are usually few and sparse. *Callitriche stagnalis* and *Potamogeton pectinatus* are occasionally seen, and there are sometimes small patches of *Lemna minor* caught among floating shoots where the flow is slacker. Then, there are quite often some trailing or emergent shoots of plants such as *Nasturtium officinale*, *Veronica beccabunga* and *Berula erecta*, all of which tend to become more luxuriant rather later in the season, as the abundance of the crowfoot is fading.

Habitat
The community is confined to base-rich but generally only moderately fertile waters, of moderate to quite fast flow and with sandy to gravelly beds, mostly in limestone catchments in lowland England and Wales, and especially towards the south.

As diagnosed by Holmes (1979, 1980) and Webster (1988), *R. penicillatus* ssp. *pseudofluitans* is centred in southern England, particularly in waters on the Chalk and Oolite, with some occurrences also on London and Oxford Clays. Further west and north, it can be found on Carboniferous Limestone, Devonian and Silurian rocks, which provide most of the substrates in Wales, but it scarcely penetrates into Scotland, being found in just a very few localities on Old Red Sandstone. Such rocks produce the necessary lime-rich drainage waters for this kind of crowfoot, which is usually found where the pH is between 7 and 9 and the alkalinity 100–300 mg l^{-1} calcium carbonate, somewhat lower in less calcareous river systems like the Tweed and the Usk (Webster 1988). In such waters, nutrient status under natural conditions is generally only moderate and the preference of *R. penicillatus* ssp. *pseudofluitans* seems to be for mesotrophic to fairly eutrophic situations (Haslam 1978, Newbold & Palmer 1979). Where there is a switch from limestone to clays in the catchment, for example, this vegetation is usually lost before the latter produce half of the drainage waters (Haslam 1978), and cultural eutrophication is inimical to the vigour of the community.

Sands and gravels are the preferred substrates and, in such coarser material, the plants are quite difficult to erode despite being shallow-rooted. Although occasional in sluggish conditions, even in dykes and pools, *R. penicillatus* ssp. *pseudofluitans* thus often occurs in waters of quite fast flow, extending into the upper reaches of streams provided these are not too prone to very fierce spates or do not dry up in summer. This kind of vegetation is concentrated in depths of less than 1 m, although bigger volumes of water seem to be preferred (Haslam 1978).

Where conditions are favourable, the plants can quickly spread (Holmes & Whitton 1977*a*, *b*) and

become established over extensive stretches of river, when the resistance to flow of luxuriant growth often results in back-up of the waters and flooding. Considerable effort is therefore needed in some drainage systems to control this vegetation by chemical or mechanical means (Dawson 1978, Westlake & Dawson 1982, Webster 1988) and great attention has been given to the impact of abundant stands of the community on nutrient and energy cycling in rivers (Edwards & Owens 1960, Owens & Edwards 1961, 1962, Westlake 1975, Holmes *et al.* 1972, Casey & Downing 1976). Since regrowth after early cutting can be very vigorous, care needs to be taken not to cut unnecessarily at the beginning of summer if this simply provokes a flood hazard later in the season (Haslam 1978).

Zonation and succession

R. penicillatus ssp. *pseudofluitans* vegetation is sometimes found dominating whole stretches of streams and rivers to the virtual exclusion of other aquatics, but often it occurs with other assemblages of submerged and floating-leaved plants in patterns related to the speed of flow and trophic state of the waters. Zonations along and across Chalk streams are especially distinctive with seasonality of flow becoming important in the upper reaches.

Where this kind of vegetation extends into slacker waters it shows some overlap in its occurrence with *Elodea canadensis* stands and the *Ceratophylletum demersi*, the former like the crowfoot tending to be most prominent in early summer, the latter becoming more abundant later in the season. There can also be considerable differences in the proportions of the communities from season to season (Butcher 1933). With increase in the trophic state of the waters and a shift to finer sediments, as happens in moving downstream, it is vegetation of this kind that eventually replaces the *R. penicillatus* ssp. *pseudofluitans*, or there may be a switch to richer *Potamogeton-M. spicatum* vegetation, a pattern well seen with the move to clay substrates in the lower reaches of some Chalk streams. The *Nuphar lutea* community can also become prominent over crowfoot stands as such quieter, richer waters are reached.

Callitriche stagnalis stands are common, too, in shallower or sheltered places in these stretches but it is in the higher, faster reaches that this vegetation becomes really abundant in Chalk streams, forming a zone along the water margins either side of a central strip often dominated by *R. penicillatus* ssp. *pseudofluitans*, but with locally prominent *Ranunculetum aquatilis* and *Ranunculetum peltati*. Patches of herbs like *Berula erecta* and *Apium nodiflorum* can be abundant among the submerged crowfoots, particularly as these lose their vigour later in the season, and they often thicken up in shallower margins, together with *Nasturtium officinale*, to form a semi-emergent band of Glycerio-Sparganion vegetation, with occasional clumps of *Sparganietum erecti* swamp. Higher still, where summer flow becomes sporadic or non-existent, *R. pencillatus* ssp. *pseudofluitans* tends to yield dominance in the central zone to the *Ranunculetum aquatilis* and *Ranunculetum peltati* with patches of *Callitriche* vegetation, and the Glycerio-Sparganion herbs may extend in irregular fashion over much of the stream bed.

R. penicillatus ssp. *pseudofluitans* is only rarely represented in the aquatic assemblages of more base-poor streams and rivers where *Callitriche* and *Myriophyllum alterniflorum* vegetation are the major elements in faster reaches, but ssp. *penicillatus* (Webster 1988) is locally found there, and further sampling is needed through western England and Wales to establish the character of its stands (Newbold & Palmer 1979, Holmes 1983).

Distribution

The community is centred in southern England, extending northwards in more scattered localities into south Scotland and westwards into Wales.

Affinities

The confusing taxonomic history of the various crowfoots makes it difficult to trace the role of *R. penicillatus* ssp. *pseudofluitans* in earlier accounts of river vegetation, but the plant was generally included in broadly defined assemblages of moving water (e.g. Butcher 1933, Tansley 1939). Exactly comparable associations have not been characterised from the Continent, but the community belongs to the Callitricho-Batrachion (or Ranunculion fluitantis in Ellenberg 1978).

Floristic table A17

Ranunculus penicillatus pseudofluitans	V (3–10)
Lemna minor	II (3–7)
Callitriche stagnalis	II (2–6)
Nasturtium officinale	II (3–4)
Veronica beccabunga	II (1–3)
Berula erecta	II (1–4)
Potamogeton pectinatus	I (3)
Polygonum amphibium	I (3)
Potamogeton crispus	I (4)
Polygonum hydropiper	I (2)
Elodea canadensis	I (1)
Number of samples	13
Number of species/sample	2 (1–5)

https://doi.org/10.1017/9781107340817.021 Published online by Cambridge University Press