Potamogeton Workshop & a Key to the Norfolk Pondweeds & similar species

Bob Leaney Nov. 2008

The species dealt with in this workshop will be mainly the Broad-leaved and Fine-leaved Potamogeton species, or pondweeds. However, in dealing with the pondweeds it is customary to include ~~the endrote~~ the other usually encountered member of the Potamogetonaceae, Groenlandia densa (Oppositi-Leaved Pondweed), and necessary also to consider plants from other families that can be easily confused with the Fine-leaved "Pots" :- the two spp. of Ruppia (Ruppiaceae); Zannichellia palustris (Zannichelliaceae); and Juncus bulbosus (Juncaceae), aquatic forms of which can be remarkably unlike the usual densely tufted terrestrial form. As regards the Norfolk species this amounts to 8 BL Pots, 8 FL Pots and 5 "similar Species", 21 species in all, to be dealt with in the key.

In order to keep the key as simple as possible I have not included the waterweeds with floating leaves similar to Potamogeton (Persicaria amphibia and Aponogeton), nor Eleogiton fluitans. The latter (Floating Club-rush) has a stoloniferous, grass-like appearance and the whole plant floats on (or just below) the water surface. These species will be briefly considered in the section on identification characters.

The key is designed to come to a provisional determination only in some of the scarcer or more difficult Potamogeton species, and voucher specimens should be kept to show RWE, JP or myself if these species are suspected. All the information in this workshop comes from either Norfolk experience & discussions with RWE & JP, or from Chris Preston's excellent BSBI handbook, and a provisional identification should if possible be checked against the descriptions in this handbook, the keys in which allow for determination of both species and hybrids. Anyone wanting to make a special study of pondweeds needs not only some equipment to take samples, but also a copy of the handbook, and a binocular microscope. Using the key presented here, any specimen not keying out with some ease should be suspected as a hybrid, which are of fairly frequent occurrence.

Potamogetonaceae family characters Herbaceous aquatic plants with simple leaves and parallel venation (monocot); leaf edge either entire, (microscopically) denticulate, or (occasionally) serrate; leaves opposite (Groenlandia) or alternate (Potamogeton), not in whorls of 3 or more as in Elodea spp. (Canadian & Nuttall's waterweed) or Lagarosiphon (curly waterweed); all spp. with submerged leaves, some of the BLPs with floating leaves as well, or with submerged leaves reduced to phyllodes (midrib only); Stems terete (○) (BLPs) or compressed to flattened (○ ⬭ ⬭) (FLPs), or 1-2 grooved (◔ ◔) (Pot crispus); Leaves either arising directly from the nodes, or from a sheath like base some mms. above the node, with a ligule at the junction of sheath & lamina (Potamogeton subgenus Coleogeton: P. pectinatus, P. filiformis in the N); flowers and fruits on long stalked inflorescences, either in opposite pairs (Groenlandia), or numerous (Potamogeton); fruits indehiscent, with a beak and a spongy buoyant pericarp (thus floating); single seed with a stony hard endosperm (thus sinking).

Life history The mode of perennation (survival overwinter) shows a clear cut association with the subgenera and sections within Potamogeton. All the "Pots" have fleshy buoyant fruits & seeds that are stony & sink. The BLPs (subgenus Potamogeton, Section Potamogeton) all have rhizomes which survive overwinter, & so are unequivocally perennial; the FLPs (subgenus Potamogeton, section graminifolii), all produce turions and only these survive the winter (plus seeds), so this group is sometimes labelled annual (Preston), sometimes perennial (Stace); Pot. crispus (subgenus Potamogeton section Batrachosperis) is intermediate in having both rhizomes & turions (as it is in leaf shape & width); Pot. pectinatus (subgenus Coleogeton) produces weak rhizomes that sometimes survive over at least one winter, & tubers from the rhizome side branches, rather than leafy turions.

Relations with other organisms The Pondweeds (and Ruppia) are of great importance for waterfowl, which graze on leaves, stems & fruits from spring to autumn, but which may be even more dependent on rhizomes, tubers, turions or seeds in winter. This has been most studied in the USA where 20 waterfowl species were found to rely on Pots for at least 10% of their food, and Coot and Canvasback over 50% (mainly taking tubers of Pot. pectinatus!). The Pochard is thought to be similarly dependent on Pots in the UK, as are Coot & to some extent 8 other duck species. The dabbling ducks sometimes associate with Coot and rely on them to uproot pondweeds so that they float to the surface!

The potential importance of pondweeds for waterfowl is clear from two studies :- one turion of P. crispus planted in Spring produced 23,520 turions by the end of the year ; and one plant of P. pectinatus produced 2,380 tubers !

There are several galls of Potamogeton known - one homopteran bug (the aphid Rhopalosiphum nymphaeae) has as its primary host Prunus domestica or Pr. spinosa, and infolds the leaves of pondweeds & other aquatics ; a smut also enlarges the fruits of Potamogeton by up to 6 x ; the Brown Cluna-mark Moth (Elophila nymphaeata) mines a leaf & then makes a floating case of leaf fragments to complete its development.

Eutrophication and the decline in Pondweeds Since the early 1800s there has been an enormous increase in plant nutrients entering river systems in lowland areas of the U.K., and this process of eutrophication has resulted in a catastrophic decrease in Pondweeds and other aquatic macrophytes ; in our area this has famously involved not just the main rivers, but also the closely connected Broads. The nutrient concerned are (i) from the early 1800s : Sewerage (ii) from the early-mid 1900s : artificial fertilisers (mainly nitrates) (iii) from the mid 1900s : detergents (mainly phosphates). Since around the 2nd WW there has also been much conversion of grazing marsh & pasture to arable land, further increasing nitrate eutrophication.

The loss of aquatic macrophytes due to eutrophication is best known in the Broads area, but has been profound all over lowland UK., affecting the midland canals as well as Rivers and lakes as far north as lowland Scotland - Roscobie Loch in Angus had 14 spp. of Potamogeton in 1908 and only 4 in 1965 (P. crispus, P. pusillus, P. pectinatus, P. filiformis), this decrease being attributed solely to arable conversion of surrounding farmland.

It is important to realise that very nutrient poor (oligotrophic) waters contain few species of Potamogeton or other macrophytes - eg Isoetes, Littorella or Lobelia if acidic, or Charophytes (± Groenlandia & Pot. lucens) if calcareous. Hickling Broad, fed by no nutrient rich water from a major river & surrounded by grazing marsh, is still dominated by charophytes, and cores taken from the major river beds themselves show a white zone at the deepest levels reached (corresponding to around 1850), virtually completely made up of charophytes. Cores from higher up become increasingly brown in colour with the effects of sewage & then artificial fertiliser, due to the remains of pondweeds & other macrophytes. By the 1950s these plants were reported to be incredibly flourishing in crystal clear water, both in the major rivers but also in the Broads fed by them, and at the time this was taken as being the "natural state" of these waters. However, after a brief burgeoning of competitive

plants like Ceratophyllum, Myriophyllum, Stratiotes & Utricularia, the waters of the main rivers & Broads suddenly became turbid and green from around 1960, with no aquatic macrophytes at all, due to a sudden efflorescence of phytoplankton, mainly green algae. For the last 50 years or so the main strongholds for pondweeds & other waterweeds has been the ditches and drainage channels in surrounding pasture and grazing marsh.

The best ditches to find pondweeds are therefore those that are mesotrophic to eutrophic, with clear water and scattered emergents such as Sparganium, Alisma, or Sagittaria. In more eutrophic conditions competitive waterweeds such as Ceratophyllum, Myriophyllum, Stratiotes or Utricularia build up, or emergents like Sparganium, Glyceria maxima or Phragmites take over – in both scenarios pondweeds become very scarce. Dominance by tall emergents from the edge of the ditch, and by competitive waterweeds, is a feature of ditches nearing the end of the ditching cycle. After the ditch has been cleared out pondweeds often flourish for a few years, regenerating quickly from rhizomes, tubers or seeds lying dormant in the silty substratum.

Conversion to arable is the most deleterious factor for macrophytes, increasing eutrophication and also leading to deepening of ditches so that waterlevels become too fluctuating – such ditches are nearly always dominated by Phragmites. The introduction of underground pipe drainage to grazing marsh similarly lowers water tables and increasing Phragmites dominance, but also entails cessation of ditch management – Neglected ditches dry out and "fill up" within a decade or two.

Habitat preferences of Norfolk Pondweeds – what is basic for particular species –

Apart from nutrients status (or degree of eutrophication) 5 other factors are mainly involved in determining pondweed distribution: (i) Nature of the bed substrate; (ii) Rapidity of flow; (iii) Depth (iv) Shape of the waterbody edge (v) Exposure (large waterbodies) All pondweeds grow best in silt, which will not collect if water flow is too rapid, or the edge too steeply shaping. Most BLPs with floating leaves (P. natans, P. polygon., P. coloratus, P. gramineus) favour shallower water, and those with only submerged leaves (P. perfoliatus, P. praelongus) deeper water – the preferences of P. alpinus & P. lucens lie in between. FLPs can grow in both deep & shallow water, but, since most spp lack rhizomes, they tend to be confined to sheltered bays, being uprooted by turbulence on more exposed shores. (P. pectinatus less so because it has short rhizomes). This is one reason why large rafts of FLPs seem frustratingly confined to the centres of large lakes!

Due to interaction between these factors, the expected sites for Norfolk Pondweeds are as follows:

(1) Fast flowing stony or chalk bottomed streams, where silt cannot collect, are little colonised by pondweeds: Groenlandia densa occasionally occurs; more usually though the dominant waterweeds are Zannichellia, Water Crowfoot spp and Callitriche fluviatile. Look for bays or sheltered areas behind meanders, where silt may collect, for Pots.

(2) Fairly shallow mid zones of rivers: P. alpinus (eg between Aylsham & Burgh next Aylsham on the R. Bure) NB. may produce a few "giveaway" floating leaves.

(3) Slow flowing, deep lower stretches of Rivers:- P. perfoliatus (commonest); P. praelongus; P. lucens in shallower water; in sheltered side waters occasionally P friesii or P. pusillus, (and P. natans)

(4) Small field or village ponds: P. natans virtually the only species.

(5) Lakes: P. perfoliatus (if deep); P lucens, P. friesii, P. pusillus; P berchtoldii, P. pectinatus. P natans (shallow edges).

(6) Gravel Pits: Mainly P. crispus, P. pusillus & especially P pectinatus; P lucens & perfoliatus if deep; P. natans if shallow edges.

(7) Calcareous Brecklands meres: mainly P. lucens, P. gramineus (& P x zizii).

(8) Fens: P. coloratus is very characteristic of shallow fen pools, often associated with mosses and charophytes (& fen ditches). A species of E. Anglian fens, & Central Ireland.

(9) Acid ("poor") fen, bogs, or wet heath: P. polygonifolius, in shallow pools and flushes, associated often with Sphagnum & "Bog Moss" communities, or terrestrial

(10) Drainage ditches: FLPs much more frequent than BLPs (apart from P natans):- P crispus infrequent; main spp are P. pectinatus, P. pusillus, P friesii; P. trichoides more less frequent, as are Groenlandia; P. compressus & P acutifolius (very rare, but P obtusifolius P. berchtoldii nationally important)

(11) Major drains in Fenland: Some of same species, + P. lucens and P perfoliatus.

(12) Saline drainage marsh ditches, or pools, near coasts & estuaries:- P. pectinatus (& P. filiformis in the N of the UK) is usually the only pondweed in brackish waters, though P. pusillus is somewhat saline tolerant; Ruppia cirrhosa & maritima should be looked out for at such sites (R. maritima the most salt tolerant sp.).

P. pectinatus with its tolerance of highly eutrophic, brackish or polluted water is the most ubiquitous species, along with P. natans. Terrestrial forms of P polygon; P. coloratus & P natans,

all occur & can be difficult or impossible to separate, especially if not fruiting.

Equipment & collection of material One needs a "pond dipping pole" of some sort to sample narrow ditches & small ponds, and some type of grapnel for broad ditches, lakes, gravel pits etc. BLPs should be put into large sealable polythene bags, and FLPs into small bags, or (better) watertight screw-topped bottles or jars – the delicate stipules are less likely to be spoilt by rubbing between the two sides of the polythene bag. The bags or bottles should have only one specimen in each, & be labelled with an 8 figure grid ref., parish, date & provisional identification. When at home they should be transferred immediately to a large white photographic tray (or tupperware with white paper beneath) for storage & initial examination. Kept in a cool place with indirect sunlight they will not deteriorate for many days, & can be suspended in tap water. The sticky label on the collecting bag or bottle should be transferred to the tray, again one specimen per tray. For confirmation the specimen can be transferred back into a sealed bag.

When collecting BLPs with floating leaves it is important to obtain an inflorescence with fruits if possible, but more importantly a long section of stem to include submerged mid-stem leaves, because these are much more useful for identification. With FLPs a length of the terminal shoot c 10 cms long should suffice.

Blind dipping with a pole in green or bladder-wrack ditches is not worthwhile, but can be productive in deep drainage channels, rivers or lakes – better still with a grapnel. Examining footrams at the edge of large waterbodies can also very rewarding. (Beware misleading fragments of Najas marina for P. crispus in the Thame catchment area – the leaves of Najas are narrower (< 8 mm) and conspicuously spinose-dentate rather than minutely serrate-undulate.

Identification characters of pondweeds are predominantly vegetative. Fruit length is occasionally crucial (mainly P. colaratus vs. P. polygoniformis); the inflorescence structure & peduncle length is also useful in deciding between P. friesii and P. obtusifolius.

Floating leaves The presence of FLs may be more diagnostic than their characters – in P. colaratus the floating leaves differ little from the submerged leaves & don't really float ("drowned" form). They are however conventionally regarded as "floating". The presence of FLs is more significant than their absence for spp capable of producing FLs may not do so (ie. in very deep water!) – alternatively submerged leaves may be FLs recently inundated by rising water levels.

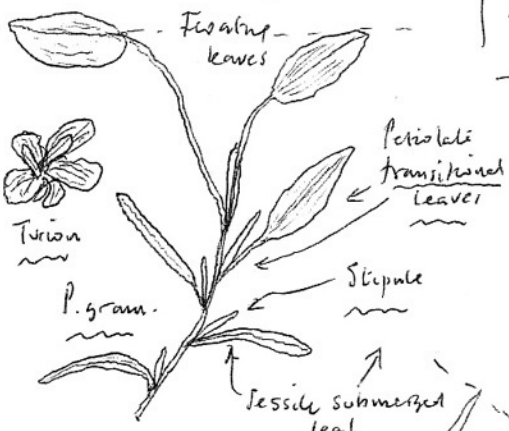
Submerged leaves from the mid-stem are the most diagnostic; in species where sessile leaves

are diagnostic, these may only be found on the main stem ~ transitional leaves just below the surface will have petioles often very long (eg P. gramineus) even in "sessile leaved spp".

Broad leaved pondweeds

Leaf shape

Narrowly oblong-elliptic to lanceolate to broadly ovate-elliptic



Stipules

V. short (P col; P alp.)

V. long (P natans)

P lucens, P gram. (P x zizii)

Phyllodes & partial phyllodes

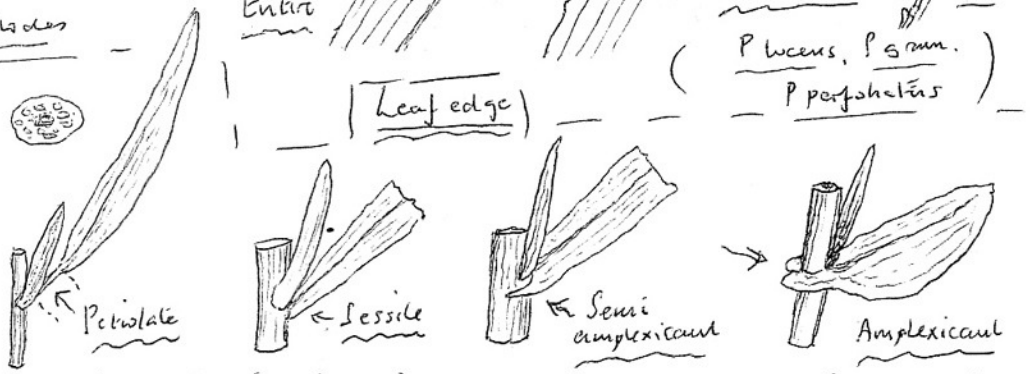
Leaf tip

All stems terete

Leaf insertion →

(On mid stem leaves)

Leaf edge



Leaf "hinge" in P. natans The discoloured, narrowed & flexible section between the petiole & lamina in P. natans will not be present in terrestrial forms, and is not even always visible on floating leaves (Preston) ~ it is partly a herbarium character. The translucent lateral veins are a better distinction from P coloratus & P polygoniformis, but are only present in the living plant; & disappear in terrestrial plants

Terrestrial forms of P. coloratus P. polyg & P. natans can be very difficult to separate ~ fruit length may be crucial *

Lagarosiphon major (Curly pondweed) — in whorls of 3+ — Spirals. Leaves much longer than Elodeas (6-30 mm)

Elodea can. Canadian pondweed

Elodea nut. Nuttall's Pondweed

Persicaria amphibia Aponogeton (see below)

Hydrocharis morsus-ranae (Frogbit)

Groenlandia densa — Always in pairs

Look-alikes for BLP floating leaves

Fine leaved pondweeds — All have linear or very narrowly oblong linear leaves with parallel sides.

Terminal shoots to examine Stipule

Alternate sessile leaves

Stipule

Stipule transected @ base

Splitting

Neither indicates open stipule

P. pusillus

Green zones (≠ ribs)

P. friesii

Green-brown ribs

Other spp

Apparently open Stipule

Nodal glands — Absent / Well developed / Poorly developed — Leaf base

Closed or tubular Stipules

Open or Split Stipules

Stem transection

Terete — Compressed — Strongly Compressed — Flattened

Leaf tip shape:

Acute — Venation obscure — **P. pect.**

Acute — 1 lat. vein each side

Subacute mucronate — 1 lat. vein each side

Rounded - oblique obscurely mucronate — **Pobl.** — 2 lat veins each side

Leaves linear oblong to oblong serrate, undulate

Slightly compressed — 1-2 grooves

P. crispus

Leaf transection (at ½ way point)

Leaf midrib — **Pot. trichoides** — 30-70% ± prominent

The others — Leaf margins 10-35%: not prominent

Leaf width & transection at ½ way

Key to Norfolk Potamogetons and similar plants

Bob Leaney Nov. 2018

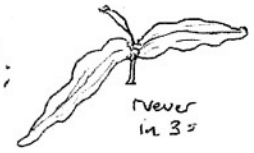
All leaf characters, including presence or absence of petioles and leaf arrangement (alternate or opposite), apply to mid stem leaves on main fertile shoots – the normal alternate leaf arrangement in Pots does not apply to the crowded leaves just below the inflorescence, which will usually be petiolate even in "sessile leaved" species.

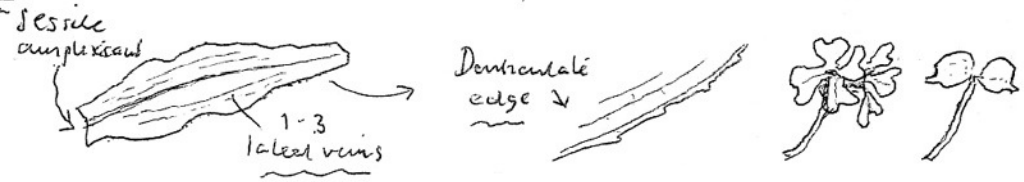
"Spec" indicates that a specimen should be retained for confirmation (difficult or scarce species)

1 | Leaves in opposite pairs, 3s, or in clusters at the nodes . . . 2

1 | Leaves alternate (except sometimes just below the inflorescence) . . . 4

2 | Leaves all in opposite pairs | lanceolate (-ovate), sessile-amplexicaul, translucent bright green with denticulate-undulate edge; 6–42 mm long (usually much longer than wide & never in 3s); Only 2 flowers or fruits per inflorescence, in opposite pairs . . Scarce Spec

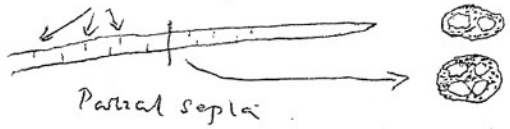


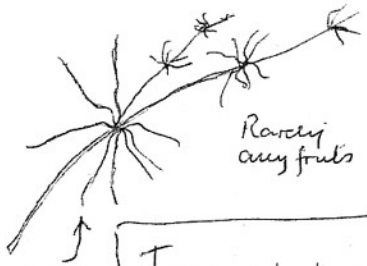


Groenlandia densa
(Opposite leaved pondweed)

2 | Leaves in opposite pairs, 3s, or in clusters from the nodes, | linear filiform or grass like | 3

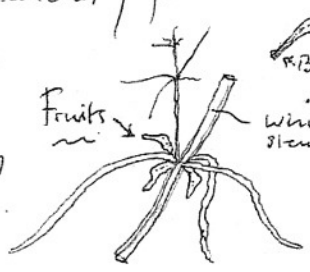
3 (i) Leaves in clusters of up to c20, giving untidy habit ± cylindrical in cross section (usually showing 2-4 tubes); partial transverse septa visible with a microscope (at X40), and through light (Juncus subgenus Septati)

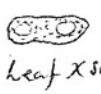




Juncus bulbosus
(Bulbous rush)

3 (ii) Leaves in 2s or 3s (+ frequent branches) from nodes, slightly flattened with 2 lobes in cross section, acute to obtuse at tip, stems white, usually Curved fruits arising from nodes.



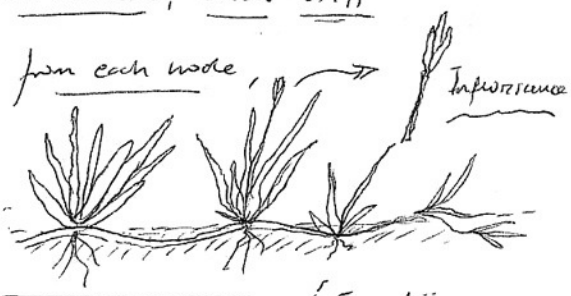


Zannichellia palustris
(Horned Pondweed)

(3 (iii)) Stems floating on surface (or just below), horizontal, with stiff yellow green grass like leaves arising in tufts from each node, together with roots below; leaf cross section Triangular at base, Keeled higher up.

Scarce | Spec | *

NB Stoloniferous perennial arising from base. or sometimes more or less creeping.

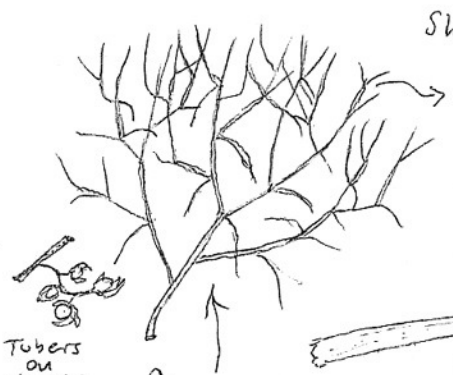


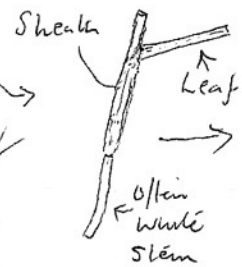
| Eleogiton fluitans | (Fluating Club-rush)

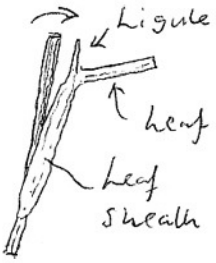
(4) | Leaves alternate with sheaths, so appearing to arising well above nodes ... 5

(4) | Leaves alternate, without sheaths, so arising direct from nodes ... 6

(5) | Leaf with ligule | at junction of sheath & lamina; leaf tip very gradually attenuated to ± acute tip | not | denticulate at tip | ; (double barrelled in X section)







Leaf tip subacute to * acute, not denticulate

" double barrelled

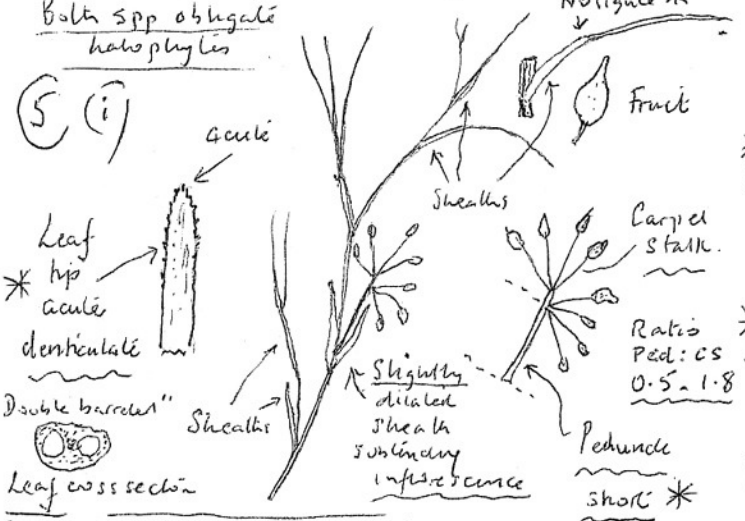
Usually stiff with Calcium deposition (rough brittle texture)

| Pot. pectinatus | (Fennel Pondweed)

(5) | Leaf without ligule at junction of sheath and lamina (sheaths sub tending inflorescence ± dilated), double barrelled in cross section | denticulate at tip | * ... | Ruppias | (Preston: NB only separable * with mature fruits)

Both spp obligate halophytes

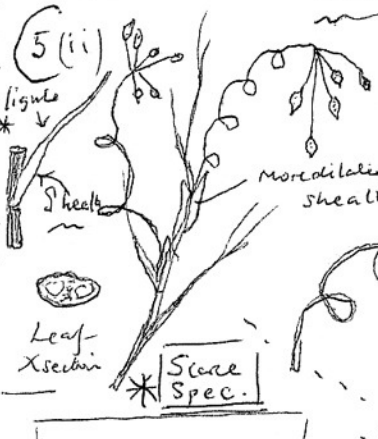
(5 (i))

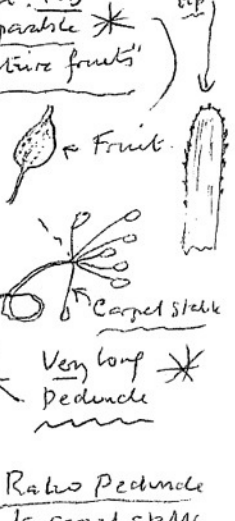


| Scarce Spec | * | Ruppia maritima | (Beaked Tasselweed, Widgeongrass)

Most saline tolerant sp | Ruppia cirrhosa | (Spiral Tasselweed)

(5 (ii))





" Double barrelled" leaf transection

(6) Leaves without sheaths arising direct from the nodes; oblong to linear oblong margins macroscopically toothed (serrate), and undulate; stems slightly compressed shallowly grooved on one or both sides:—

Pot crispus (Curled Pondweed)

(6) Leaves without sheaths, arising direct from the nodes, not serrate edged; stems terete to flattened, not grooved 7

(7) Leaves linear-oblong, linear or filiform, parallel sided, ... 8
(Fine leaved Potamogetons) all leaves submerged

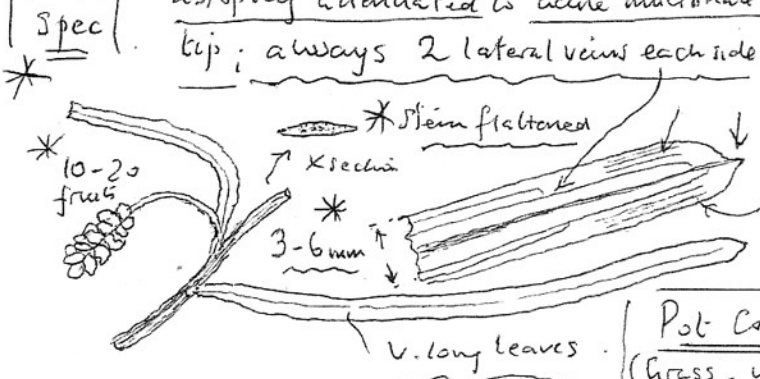
(7) Leaves lanceolate, lanceolate-elliptic to broadly ovate-elliptic with convex sides sometimes with floating leaves . . . 13
(Broad leaved Potamogetons)

(8) At least some leaves 4 - 6 mm. wide
Sclerenchymatous strands (grass-like parallel ridges) on upper surface . . 9

(8) All leaves below 4 mm wide, no sclerenchymatous strands . . 10

(9(i)) - Leaves very broad (3-6 mm);
- Leaves very long (85-270 mm),
strong sclerenchymatous strands abruptly attenuated to acute mucronate tip; always 2 lateral veins each side:

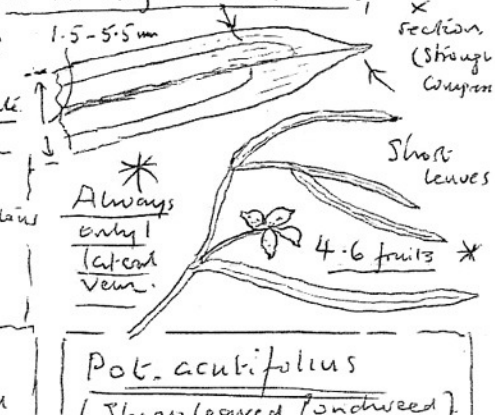
Rare Spec



Pot Compressus (Grass-wrack Pondweed)

Leaves broad (1.5 - 5.5 mm) and quite short (35 - 135 mm); weak sclerenchymatous strands.

V. rare Spec

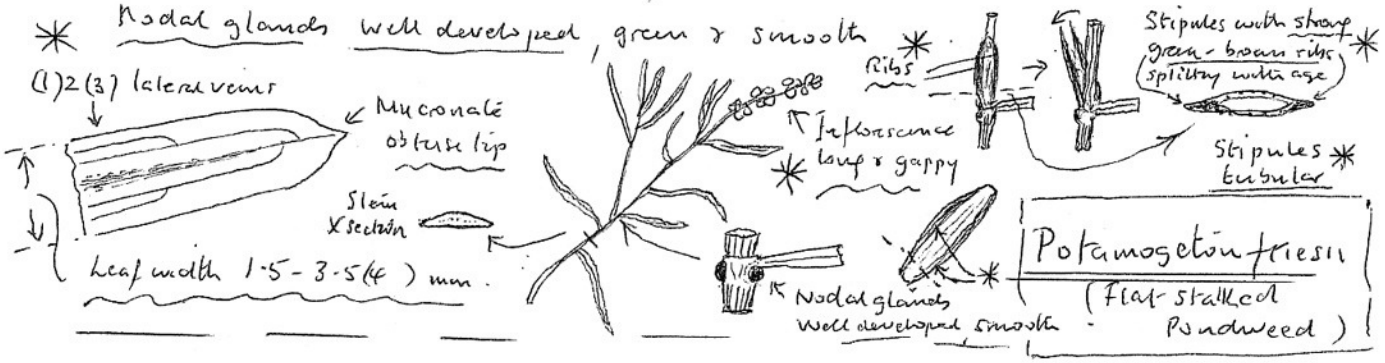


Pot. acutifolius (Sharp leaved Pondweed)

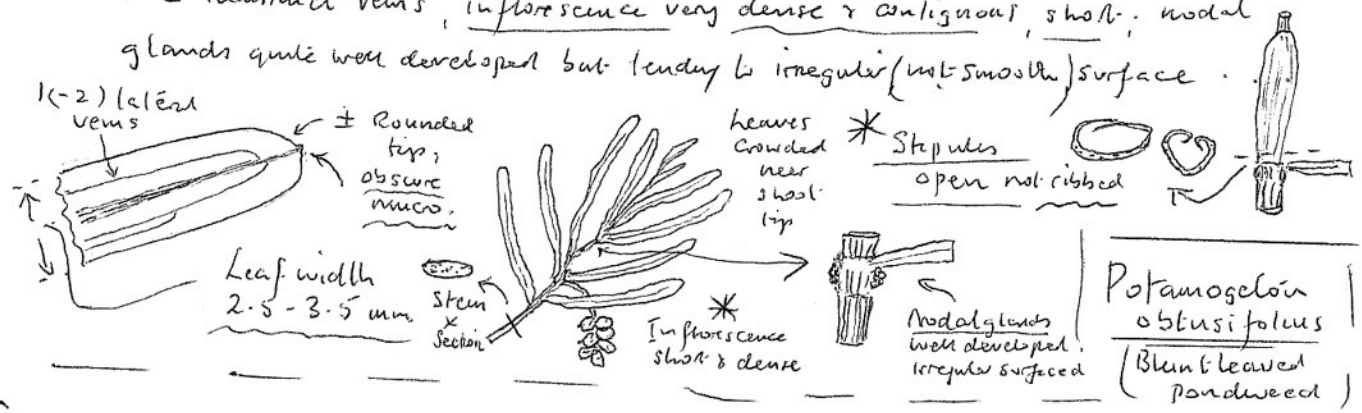
(10) At least some leaves 2·3 – 4 mm wide 11

(10) All leaves below 2·3 mm wide . . . 12

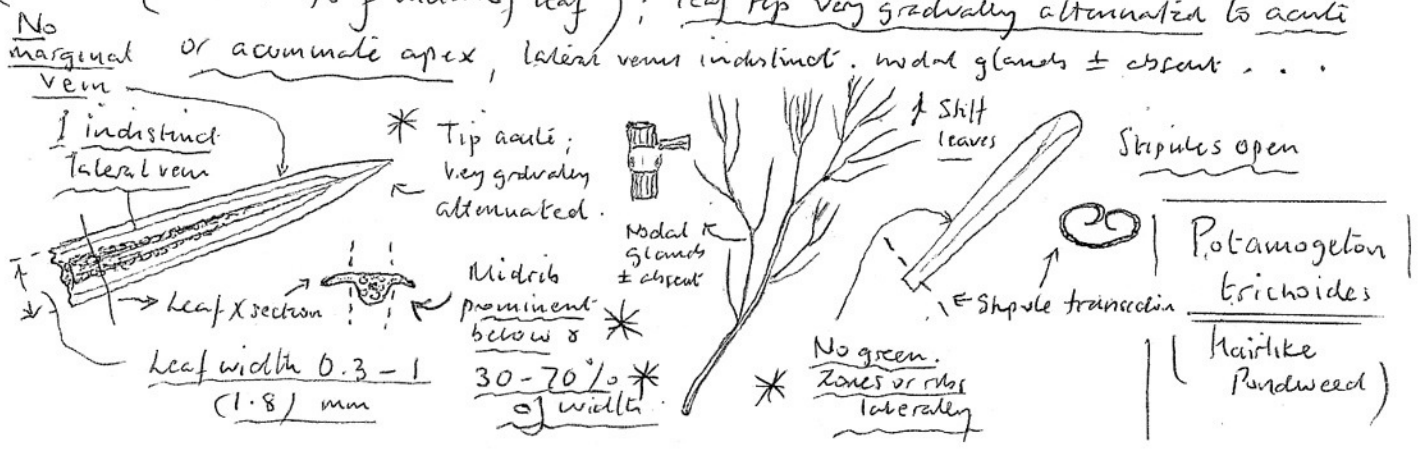
(11)(i) Stems strongly compressed (flattened to the feel); leaves green to green-brown, 1·5 – 4 mm wide, with obtuse to subacute mucronate tip; (1-) 2 (-3) lateral veins; inflorescence diffuse and gappy, long; nodal glands well developed, green & smooth



(11)(ii) Stems compressed but not flattened to feel, leaves usually pink or red brown crowded near tips of shoot, obtuse to rounded at tip with obscure mucro 1 – 2 indistinct veins; inflorescence very dense & contiguous, short; nodal glands quite well developed but tending to irregular (not smooth) surface.



(12) Plant shift out of water, leaves extremely narrow, 0·3 – 1 (1·8) mm wide (most < 1 mm wide); leaf transection with prominent broad midrib (30 – 70% of width of leaf); leaf tip very gradually attenuated to acute or acuminate apex, lateral veins indistinct. nodal glands ± absent . . .



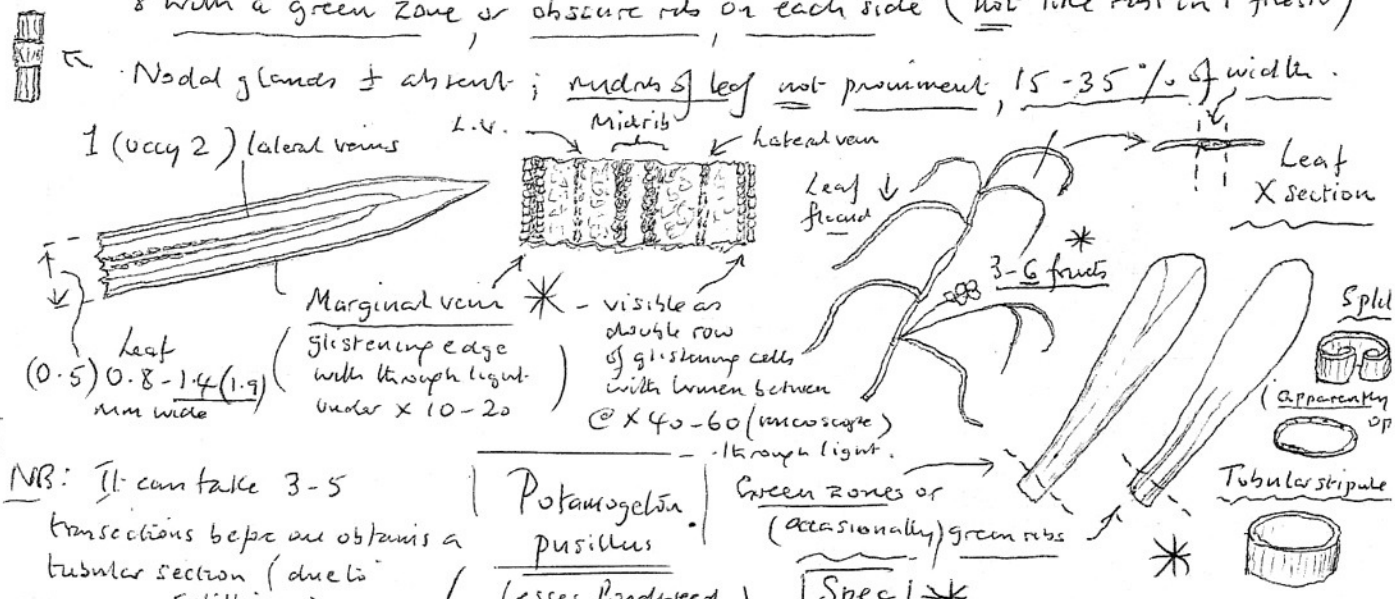
(12) Plant flaccid out of water, leaves 0·5 – 2·3 mm wide, (mostly > 1 mm.), midrib not prominent below & only 10-35% of leaf width, leaf tip more abruptly attenuated to acute, subacute or obtuse tip . . . . . 13 (P. pusillus or P berchtoldii)

* Take Specimen for RNE JP or RMC

NB * These two species are called "pusilloids" by Chris Preston, who always takes suspected specimens home for microscopy & stipule transection ~ whether the stipules are tubular or open is the only reliable separating character.

(12)(i) Leaf tip usually fairly gradually attenuated to an acute tip; leaves (0.5) 0.8 – 1.4 (1.9) mm wide (mostly below 1·5 mm wide), bordered by a marginal vein; stipules closed or tubular on transection, & with a green zone, or obscure ribs on each side (not like ribs in P fresii)

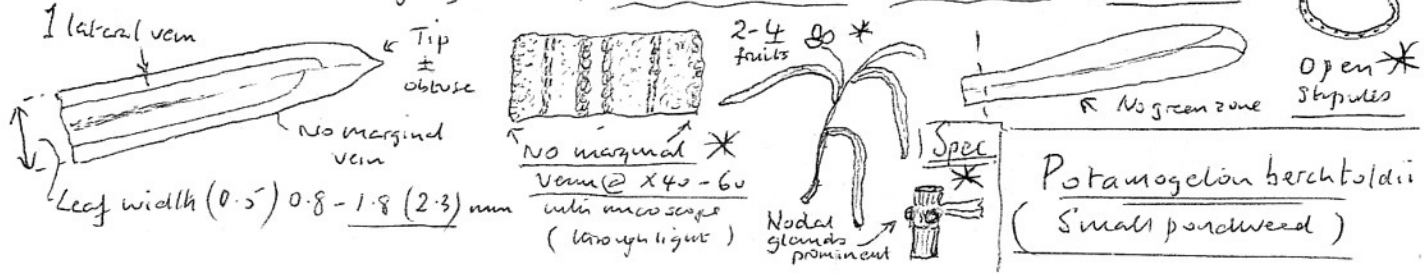
← Nodal glands ± absent; midrib of leaf not prominent, 15-35% of width.



NB: It can take 3-5 transections before one obtains a tubular section (due to splitting)

Potamogeton pusillus (Lesser Pondweed) | Spec | *

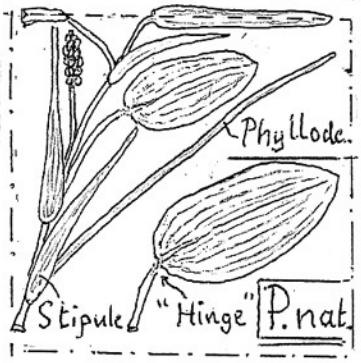
(12)(ii) Leaf usually more abruptly attenuated to a subacute or obtuse tip; leaves (0.5) 0.8 – 1.8 (2·3) mm wide (some above 1·5 mm), no marginal vein, midrib 10-20% of leaf width; stipules without green zones/ribs, open.

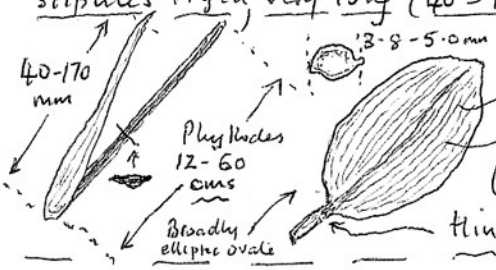


Potamogeton berchtoldii (Small pondweed)

(13) Leaves lanceolate, lanceolate-elliptic to broadly ovate-elliptic with convex sides, sometimes with floating leaves (Broad leaved Potamogetons)
- Submerged leaves all reduced to phyllodes (mid rib only) 14
- Submerged leaves with laminae, (Sometimes with phyllodes as well) . . . 15

(14)





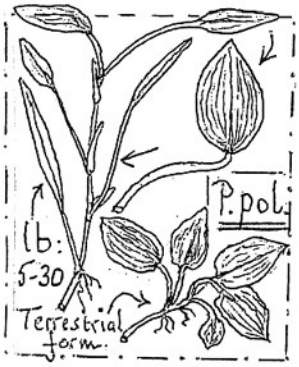
Floating leaves ± with discoloured "hinge" at junction between petiole & lamina; lateral veins translucent in living plant; * stipules rigid very long (40-170 mm); Phyllodes only beneath water
Lateral veins (6) 8-12 (16) each side
Lateral veins translucent (fresh) (but not in terrestrial forms)
Hinge not always present *

(15) Mid stem submerged leaves petiolate (stalked) (16)

(15) Mid stem submerged leaves sessile, amplexicaul or not . . . 17

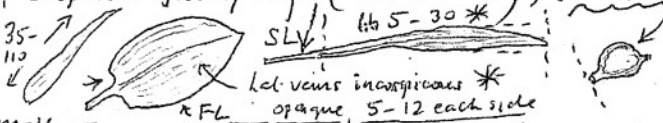
Calcifuge

(16)(i)

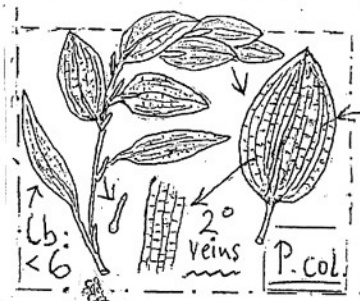


Floating leaves with no discoloured "hinge"; coriaceous, lateral veins opaque not translucent; Submerged leaves clearly differentiated from FLs, and often very narrow (l:b ratio 5-30); never * any phyllodes; stipules fairly long (35-110 mm); fruits 1.9-2.6 mm

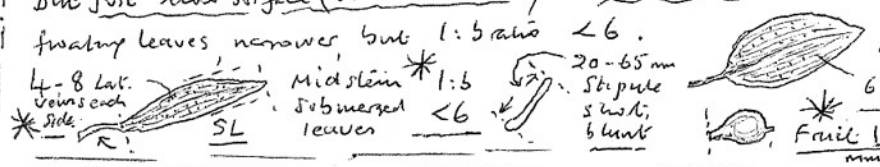
NB Terrestrial forms common & can be very small — may only be separable from TFs of P. nat. & P. pol. by fruit length *



(16)(ii) Spec *

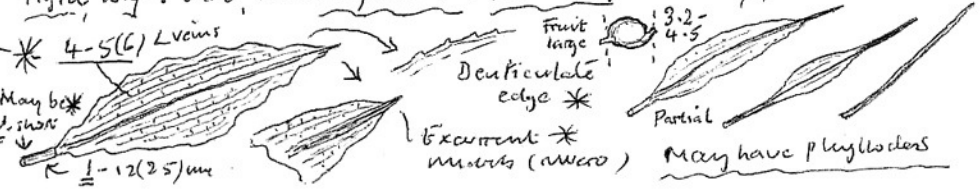


Floating leaves with no "hinge", translucent with conspicuous secondary (transverse) veins giving reticulate appearance; not truly floating but just below surface ("drowned" look); Submerged leaves more like floating leaves narrower but l:b ratio <6.



(16)(iii) Calcicole

No floating leaves; submerged leaves strikingly large & uniform in size usually, translucent, shiny yellowish green, with prominent 2° veins (reticulate); leaf tip mucronate with long exserted midrib; leaf edge denticulate; stipules rigid long & wide, with 2 prominent green wings extending for at least ½ length

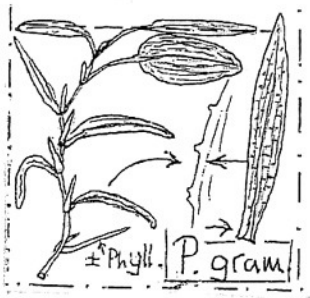


(17) Mid stem leaves sessile, not amplexicaul : 18

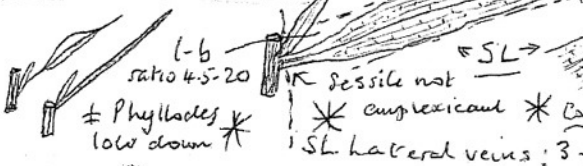
(17) Mid stem leaves sessile and amplexicaul 19

Caricole

(18(i)) Rare Spec *



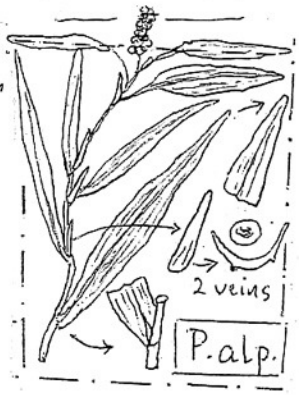
Floating leaves opaque & coriaceous, narrowly to broadly elliptic oblong-elliptic or obovate; | Submerged leaves |: noticeably * small, very narrowly * elliptic or oblong-elliptic, translucent with conspicuous secondary veins, lb ratio 4·5 – 20, mucronate tip but without excurved midrib, * denticulate edge, phyllodes often low down *.



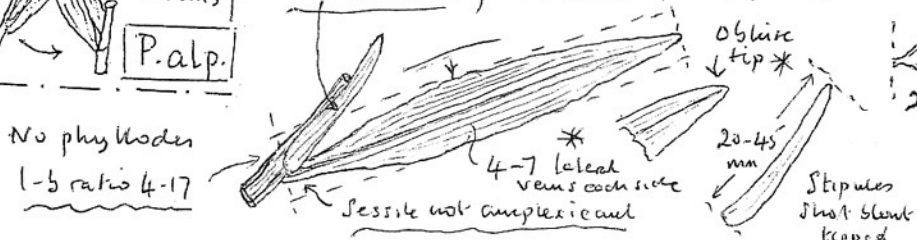
Pot. gramineus (Various-leaved pondweed)

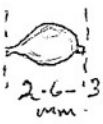
Upper/mid reaches of rivers

(18(ii)) Rare * Spec *



Floating leaves very narrowly elliptic to oblong elliptic; tapering to base, subcoriaceous, usually pinkish; | Submerged leaves: translucent, secondary veins not conspicuous, again * narrowly elliptic to oblong elliptic & tapering to base; leaf tip: obtuse; stipules short, blunt tipped & inconspicuous; lb ratio 4 - 17; edge entire.





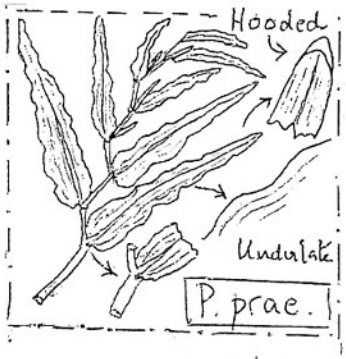
Usually mid depth & mid zones of rivers

Potamogeton alpinus (Red Pondweed)

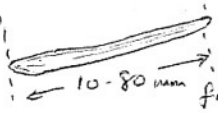
(19) Mid stem leaves sessile and amplexicaul . . . . . *

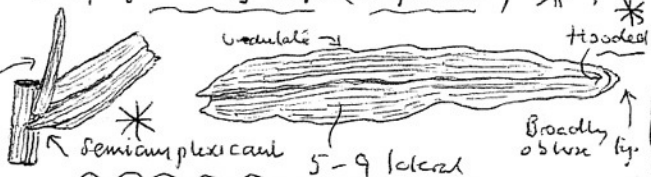
Deep water

(19(i)) Very rare Spec *



Floating leaves absent; | Submerged leaves: narrowly lanceolate to oblong-lanceolate *, base semi-amplexicaul * (embracing c ½ the stem circumference), tip broadly obtuse and widely hooded *; stipules quite long, blunt tipped; lateral veins 5-9 each side; leaf margin undulate entire; fruit very large (diagnostic) *.





Potamogeton praelongus (Long stalked Pondweed)

Deep water

(19(ii))

Floating leaves absent; | Submerged leaves: narrowly lanceolate to broadly ovate, base amplexicaul * (embracing nearly whole stem circumference), tip broadly obtuse to rounded (sometimes slightly hooded); leaf margin * denticulate.

Potamogeton perfoliatus (Perfoliate Pondweed)

Some pondweed "lookalikes" not dealt with in key :-

NB Persicaria amphibia was formerly "Potamogeton amphibius" (mid 1500s)

Fine leaved Pot. lookalike

Batrachium Ranunculus sp (Water crowfoots)

Has filiform leaf segments when like FLS but clearly bifurcately divided leaves on closer examination.

Broad leaved Pot lookalikes

Mimicking floating leaves of P. natans etc

Persicaria amphibia
Much narrower lanceolate or oblong lanceolate

Aponogeton distachyos (Cape Pondweed)
FLS much longer (Potamogetons etc < 14 cms only *)

Some Norfolk Potamogeton hybrids

Potamogeton x fluitans (P. lucens x natans) :- More like P lucens with floating leaves.
Limpenhoe VC 27

Potamogeton x zizii (P gramineus x lucens) : Like rather small leaved lucens with some mid stem leaves sessile some petiolate, + floating leaves
- Broadland meres VC 28 (Still at Langmere 2018)
Three broads in past (before 1970)

Potamogeton x salicifolius (P lucens x perfoliatus) - West Somerton Staithe VC 27 (Still present c2008)
- Fenland drains for SW VC 28 (post 1970)

Potamogeton x cooperi (P crispus x perfoliatus)
One pre 1970 record V27 (North mid Norfolk)

Further reading :-

Martin George (1992). The land use, Ecology and Conservation of Broadland. Chichester: Packard Publishing.

Brian Moss (2001). The Broads. New Naturalists Series. Collins

Owen Mountford (1994). Floristic change in English grazing marshes: the impact of 150 years of drainage & land use change. Watsonia, 20: 3-24

Chris Preston (1995). Pondweed of Great Britain & Ireland BSBI Handbook No 8, London