SUMMARY OF TYPES OF SUBMERGED AND FLOATING WATER PLANTS

SPIKY ROSSETTES - Bottom growing rosettes of stiff, linear or narrowly lanceolate leaves

Leaves long-tapered to acute tip
Isoetes - Quillworts
Eriocaulon aquaticum - Pipewort
Baldelia ranunculoides - Lesser Water Plant'n
Alisma (juvenile) - Water Plantains
Sagitttaria (juvenile) - Arrowheads
Luronium natans - Floating Water Plantain
Subularia aquatica - Awlwort
Limosella - Mudworts
Ranunculus flammula - Lesser Spearwort
Stratiotes aloides - Water Soldier

Leaves ± parallel-sided with rounded or abruptly pointed tips
Littorella uniflora - Shoreweed
Lobelia dortmanna - Water Lobelia

STRAPPY - Leaves linear, over 5 mm wide and more than 10x as long as wide, floating or submerged (not including *Elodea*-types)

Funnel-shaped rosette of stiff, spiny-toothed leaves
Stratiotes aloides - Water Soldier

Leaves alternate
Glyceria - Sweet Grasses
Catabrosa aquatica - Whorl Grass
Potamogeton - Pondweeds

Leaves basal
- leaves flattened triangular or spongy-inflated in section
Sparganium - Bur-reeds
Butomus umbellatus - Flowering Rush
- leaves flat, strap-shaped
Sagittaria - Arrowheads
Sparganium - Bur-reeds
Schoenoplectus - Bulrushes
Luronium natans - Floating Water Plantain
Alisma (juvenile) - Water Plantains

STRINGY - narrow linear leaves

Most leaves densely tufted (some may be alternate)
Juncus bulbosus - Bulbous Rush

Leaves in whorls of more than 5
Charophytes (Stoneworts)
Hippuris vulgaris - Marestail

Leaves alternate
Eleogiton fluitans - Floating Spike Rush
Potamogeton - Pondweeds
Ruppia - Tassel Pondweeds
Pilularia globulifera - Pillwort

Most leaves in groups of 2-3:
- stems horizontal (stolons) with groups of ± vertical upright strands
Pilularia globulifera - Pillwort
Eleocharis acicularis - Needle Spike Rush
- leaves regularly paired
Callitriche - Water Starworts
Crassula helmsii - Swamp Stonecrop
- leaves in irregular groups of (1-)2-3(-4)
Zannichellia palustris – Horned Pondweed
Najas - Naiads
Eleogiton fluitans – Floating Spike Rush

FEATHERY - compound leaves with linear segments

Leaves forked (dichotomously or trichotomously) (cf. tuning forks)
Ranunculus - Crowfoots
Ceratophyllum - Hornworts
Utricularia - Bladderworts

Leaves 1-pinnate (i.e. like feathers)
Myriophyllum - Milfoils
Hottonia palustris – Water Violet

Leaves with primary divisions pinnate but with further divisions which may be pinnate or forked
Apium inundatum - Marshwort
Oenanthe - Water Dropworts
Utricularia - Bladderworts

Expanded translucent leaves (including *Elodea* types)
Leaves large (>5 cm) basal, lettuce-like *Nuphar* - Yellow Water Lilies
Plants less than 2 cm free-floating *Lemna trisulca* - Ivy Duckweed
Leaves alternate (sometimes one opposite pair beneath terminal flower stalks) *Potamogeton* - Pondweeds
Leaves in opposite pairs *Callitriche* - Water Starworts *Groenlandia* - Opposite-leaved Pondweed *Najas* - Naiads
Leaves in whorls of 3-5 *Elodea* - Waterweeds *Egeria densa* - Large-flowered Waterweed *Hydrilla verticillata* - Esthwaite Waterweed *Najas* - Naiads
Leaves spiral but sometimes appearing nearly whorled *Lagarosiphon* - Curly Water Thyme

Expanded opaque leaves, underwater
Elatine - Waterworts *Callitriche* - Water Starworts *Veronica* - Water Speedwells *Ranunculus flammula, R. lingua* - Spearworts *Lythrum portula* - Water Purslane *Myosotis* - Water Forget-me-nots *Hydrocotyle* - Pennyworts *Ludwigia* - Hampshire Purslane Young plants/ drowned plants of emergent or wetland species

FLOATERS - Expanded opaque leaves, floating
Less than 1 cm diameter, free-floating *Lemna* - Duckweeds *Spirodela polyrhiza* - Greater Duckweed *Wolffia arrhiza* - Rootless Duckweed *Ricciocarpos natans* - Floating Liverwort
Less than 3 cm, branched stems of overlapping scales, free-floating *Azolla* - Water Fern
Leaves less than 3 cm, forming floating rosette at tip of stem with leaves in opposite pairs *Callitriche* - Water Starworts
Palmately lobed *Hydrocotyle ranunculoides* - Floating Pennywort *Ranunculus* - Crowfoots
Leaves +/- smooth edges with two basal lobes formed by incision extending to leaf stalk *Hydrocharis morsus-ranae* - Frogbit *Nuphar* - Yellow Water Lilies *Nymphaea* - White Water Lilies *Nymphoides peltata* - Fringed Water Lily *Sagittaria* - Arrowheads
Leaves =/- smooth edges, without basal incision to leaf stalk (rarely slightly cordate): **- primary veins sub-parallel to midrib, extending most of leaf length** *Potamogeton* - Pondweeds *Sagittaria* - Arrowheads *Alisma* (juvenile) - Water Plantains *Luronium* - Floating Water Plantain *Aponogeton* - Cape Pondweed **- primary veins branching at a wide angle from midrib** *Persicaria amphibia* - Amphibious Bistort *Ludwigia* - Water Primroses

N.F.Stewart
Updated May 2020

KEY TO "STRINGY" SUBMERGED AQUATIC PLANTS
(NARROW UNDIVIDED LEAVES LESS THAN 2 MM WIDE)

1a Most leaves in dense tufts, often some with more than 20 leaves per tuft. A few leaves may be alternate. *Juncus bulbosus* (aquatic form)
1b Leaves in groups of five or less or in regular whorls of less than 12 leaves. 2

2a Leaves in regular whorls of 5 or more leaves 3
2b Leaves not in regular whorls although sometimes in groups of up to 3 (-4) 4

3a Leaves flat *Hippuris vulgaris*
3b "Leaves" cylindrical *Stoneworts (Charophytes*)

4a Leaves alternate (i.e. staggered singly up stem) 5
4b Leaves in groups of 2-3 (rarely 4) 9

5a Leaves flat, solid 6
5b Leaves oval to circular in section, solid or formed of 2-4 tubes 7

6a Leaves arising directly from the nodes, with pale/translucent stipule also arising from node and enclosing stem (at least initially) *Potamogeton*
6b Lower part of leaves sheathing, at least when young, separated by kink from upper, blade part *Eleogiton fluitans*

7a Stem a creeping stolon with 1-3 upright (at right angles to stolon) strands arising from nodes 12
7b Stems upright with leaves comprising a sheathing part and a free blade 8

8a Ligule arising at junction of leaf and blade. Leaf tips untoothed *Potamogeton*
8b Ligule absent or sometimes small auricles present at junction of sheath and blade. Tips of leaves toothed *Ruppia*

9a Leaves in regular opposite and equal pairs 10
9b Leaves in irregular groups of (1-) 2-3 (-4) and often unequal in length 11

10a Leaves notched or truncate at tip *Callitriche*
10b Leaves acutely pointed *Crassula helmsii*

11a Leaves flat, toothed, translucent *Najas flexilis*
11b Leaves oval to circular in section, opaque 12
[Note: *Eleogiton fluitans* can appear to have leaves in groups in some contracted forms – see 6]

12a Leaves solid or spongy with central column, 1-2 together rising at right angles from creeping stolon. Youngest leaves at shoot tip curled at tip into tiny coil *Pilularia globulifera*
12b Leaves formed of 2-4 tubes 13

13a Leaves of 2 tubes, spreading. Up to 4 crescent-shaped seeds often present at stem nodes *Zannichellia palustris*
13b Leaves of 3-4 tubes, vertical, pale at base, sometimes with creeping stolons between groups of leaves *Eleocharis acicularis*

Nick Stewart Updated July 2009

KEY TO ROSETTE SPECIES OF AQUATIC PLANT
(SPECIES WITH ROSETTES OF LINEAR, SUBULATE OR NARROWLY LANCEOLATE LEAVES)

1a Leaves linear or subulate (= tapered from near base) 2
1b Some leaves expanded with a narrowly lanceolate blade 8

2a Leaves ± parallel-sided in lower half with acute to rounded tips 3
2b Leaves long-tapered from near base to finely acute tips 5

3a Leaves large, more than 10 x 1 cm, spiny-toothed on edges *Stratiotes aloides*
3b Leaves smaller, less than 0.5 cm wide, edges untoothed 4

4a Leaves cylindrical, spongy in cross-section. Stolons sometimes produced *Littorella uniflora*
4b Leaves flattened, formed of two tubes. Stolons absent *Lobelia dortmanna*

5a Leaves circular in cross-section, made up of four tubes, widening at extreme base in mature plants to contain a 2 mm packet of spores *Isoetes*
(Note: *Eleocharis acicularis* might also key out here but is very slender (less than 1 mm diameter) and stoloniferous)
5b Leaves flattened on top surface, solid, spongy or large-celled 6

6a Roots, distinctively worm-like with alternating whitish cross-walls and translucent bands. Leaves usually more than 15, large-celled, in cross-section one cell thick *Eriocaulon aquaticum*
6b Roots uniformly whitish or brownish. Leaves less than 12, solid or finely spongy 7

7a Leaves less than 7 cm long, light green, usually with drawn out fine tips. Flowering underwater with stems to 8 cm tall and up to 8 tiny white flowers and ellipsoid, up to 5 mm long fruits *Subularia aquatica*
7b Leaves usually more than 10 cm, or if less then more or less terrestrial and acute but not with drawn out fine points 8

8a Leaves green, opaque, stiff, less than 10 cm long, more or less terrestrial 9
8b Leaves green or brownish, often somewhat translucent, stiff or flaccid, more than 10 cm long, usually submerged or emergent 10

9a Petiole cylindrical, slightly tapered, cross-section with central column. Flowers minute, whitish, arising singly on short stems *Limosella aquatica*
9b Petiole slightly flattened or grooved on upper surface, not tapered, cross-section uniformly finely spongy (flowers yellow on leafy stems) *Ranunculus flammula*

10a All parts smelling strongly of coriander when crushed. Often some leaves expanded in upper part into narrowly lanceolate blade *Baldelia ranunculoides*
10b All parts odourless or with faint chemical smell when crushed. (Leaves with blades are floating or emergent and beyond the scope of this key) 11

11a Slender stolons often (but not always) present *Luronium natans*
11b Stolons absent *Alisma* (juvenile), *Sagittaria* (juvenile)

Nick Stewart
August 2006

KEY TO FEATHERY-LEAVED AQUATIC PLANTS
(SPECIES WITH SUBMERGED LEAVES WHICH ARE BRANCHED INTO LINEAR SEGMENTS)

1a Leaves in whorls of 3 or more — 2
1b Leaves alternate and arising singly along the stem — 6

2a Leaves branched furcately (like tuning-forks) — 3
2b Leaves branched pinnately (like feathers) — 4

3a 'Leaves' untoothed; stems and 'leaves' semi-translucent (like looking through a glass bottle), each stem internode comprising of a single cell — *Nitella*
3b Leaves with spine-tipped teeth; stem and leaves fairly opaque with multicellular strands running through them — *Ceratophyllum*

4a Leaves with flattened segments (leaves staggered singly up stem but some leaves may appear whorled) — *Hottonia palustris*
4b Leaves with cylindrical/filamentous segments — 5

5a Leaves feather-like, without any fruiting structures — *Myriophyllum*
5b 'Leaves' with very short side-branches, with orange to black, c.0.5 mm fruiting structures at the lower divisions — *Stoneworts*

6a Leaves divided once only, pinnately (like feathers); leaf segments flattened — *Hottonia palustris*
6b Leaves divided more than once; leaves with cylindrical/filamentous segments — 7

7a Leaves with hair-like spines on the tips and usually also with spine-tipped teeth on the sides; bladders (c.0.5 mm insect traps) usually present among the leaves — *Utricularia*
7b Leaves without spines, teeth or bladders — 8

8a Leaves branched furcately (like tuning-forks) at all divisions — *Ranunculus*
8b Leaves branched pinnately (like feathers) at the first division but subsequently pinnately or furcately — 9

9a Leaves much longer than wide, with primary pinnate division and 1(-2) subsequent furcate divisions — *Apium inundatum*
9b Leaves about as long as wide, with primary pinnate division and 2-4 subsequent pinnate or furcate divisions — *Oenanthe*

(Note: the lowest branches in Oenanthe can be as large as the remaining part of the leaf, giving the appearance of separate leaves. The true leaf stalk base can be distinguished by it being flattened and clasping)

Nick Stewart
Update May 2020.

KEY TO STRAPPY AQUATIC PLANTS
(SPECIES WITH SUBMERGED OR FLOATING LEAVES WHICH ARE STRAP-SHAPED AND MORE THAN 2 MM WIDE AND MORE THAN 5 CM LONG)

1a Plants with a distinct stem and alternate leaves staggered singly along the stem 2
1b Leaves all basal (if leaves are >15cm long and no leaf base is available, assume it is this choice) 3

2a Leaves with sheathing lower part (i.e. grass-like) *Glyceria*
2b Leaves arising directly from the stem-nodes *Potamogeton*

3a Leaves fairly stiff, 5-20 cm long with prominently spiny-toothed edges *Stratiotes aloides*
3b Leaves floppy, not toothed or (rarely) minutely toothed at tips 4

4a Leaves long-tapered to acute or ultimately blunt tips 5
4b Leaves abruptly and obtusely pointed or rounded 7

5a Leaves flattened-triangular and spongy in section, at least in the lower part, often with a weak spiral twist towards the tip *Butomus umbellatus*
5b Leaves flat 6

6a Leaves snapping easily when bent double, stolons often present *Luronium natans*
6b Leaves not brittle when bent double, stolons absent *Schoenoplectus lacustris*
(Juvenile *Alisma* may also key out here and may be difficult to separate from *Luronium*. However, more advanced plants are normally also present in the vicinity)

7a Leaves semi-translucent with widely spaced longitudinal veins, usually distinctly wider in the middle part *Sagittaria*
7b Leaves fairly opaque with closely spaced longitudinal veins, evenly wide along the whole length 8

8a Cell structure of leaves obscure. Leaves flat with obtuse and slightly hooded tips *Glyceria*
8b Cell structure of leaves visible and brick-like when held up to the light. Leaves obtuse or rounded but not hooded 9

9a Leaves rounded and untoothed, often triangular or spongy below (*Sparganium*) 10
9b Leaves obtuse and minutely toothed at tips, flat throughout (rare) *Vallisneria spiralis*

10a Leaves triangular or flattened with a distinct keel in the lower part *Sparganium erectum* or *S. emersum*
10b Leaves flattened bi-convex throughout or with rounded, spongy bases 11
(This character is often best looked for around a third of the way up the leaf, above the spongy basal part. All species become flattened bi-convex in the upper part.)
(*S.erectum* and *S.emersum* underwater/floating leaves are very similar and cannot be reliably distinguished.)

11a Leaves >80 cm long, usually dull green, olive-green or brownish green *Sparganium angustifolium*
11b Leaves <30 cm long (rarely to 50 cm), bright green *Sparganium natans* or juvenile growth of all *Sparganium* species

Nick Stewart
Update May 2020

KEY TO "FLOATERS" – AQUATIC PLANTS WITH OPAQUE FLOATING LEAVES

1a Free-floating plants less than 5 cm in diameter 2
1b Free-floating or rooted plants more than 10 cm in length/diameter 8

Duckweeds and other small floaters

2a Plants without stems, made up of 1-5 disc-shaped or spherical leaves clustered together, often with 1-several rootlets hanging from the underside (Duckweeds) 3
2b Plants branched, or made up of a single rounded-triangular "leaf" with or without rootlets/rhizoids hanging from the underside 5

3a Plants with a cluster of up to 12 rootlets hanging below the leaves; underside of leaves strongly coloured purple; largest leaves >0.5cm *Spirodela polyrhiza*
3b Plants without or with single rootlets hanging below the leaves; underside of leaves green to purplish 4

4a Plants minute (<0.5 mm), spherical to ovoid (rolls between fingers like sand grains) *Wolffia arrhiza*
4b Plants 0.5-3mm, disc-shaped to hemispherical *Lemna*

5a Plants made up of a single rounded-triangular "leaf" with many purplish rhizoids hanging from the underside *Ricciocarpos natans*
5b Plants branched or forked 6

6a Plants made up of a chain of stalked lanceolate, semi-translucent leaves each up to 3cm long *Lemna trisulca*
6b Not as above 7

7a Plants made up of branched stems covered by many small (<1 mm) scale-like leaves, with many rhizoids hanging from the underside of the plant *Azolla*
7b Plants made up of a forked strap to 2mm wide; rhizoids absent or minute *Riccia*

Large floaters

8a Leaves in opposite pairs, less than 2 cm long, often forming a rosette of up to 20 leaves on the water surface, with more sparsely-spaced narrower leaves underwater *Callitriche*
8b Leaves larger, >4cm, alternate or arising from the base of the plant 9

9a Leaves palmately lobed 10
9b Leaves with smooth or slightly wavy edges, unlobed or with two large basal lobes formed by an incision extending to the leaf stalk 11

10a Basal lobes of leaf almost touching or with a narrow gap (sinus) between *Hydrocotyle ranunculoides*
10b Leaves with a wide gap (sinus) between the basal lobes (gap >120 degrees) *Ranunculus*

11a Leaves with a prominent basal sinus (incision extending to the leaf stalk) 12
11b Leaves without a basal sinus 16

12a Leaves <5cm, nearly circular with rounded basal lobes; main lateral veins almost parallel to the leaf edge *Hydrocharis morsus-ranae*
12b Leaves variously-sized with acute to obtuse basal lobes; venation various 13

13a Leaves <10 cm, more than twice as long as broad with sharply acute basal lobes *Sagittaria*
13b Leaves 5-35 cm, 1-1.75 times as long as broad; basal lobes subacute to obtuse 14

14a Most leaf veins radiating out from the point of attachment of the petiole branching at a wide angle and meeting near the leaf edge to form a honeycomb pattern; leaf stalk circular in section 15
14b Leaf veins branching off all along midrib, nearly parallel, forking at a narrow angle and not meeting again near the leaf edge; leaf stalk 2-3-angled; flowers yellow *Nuphar*

15a Leaves <10 cm, with a slightly scalloped edge, conspicuously pitted across the underside; flowers golden yellow with 5 petals *Nymphoides*
15b Leaves 8-35 cm, with a smoothly curved edge, not pitted on the underside; flowers with >12 petals, white, pinkish, creamy yellow or sometimes stronger colours *Nymphaea*

16a Major leaf veins branching off at wide angle all along the midrib 17
16b Major leaf veins sub-parallel running up most of leaf length 18

17a Papery stipule (ochra) sheathing around stem at base of leaf stalk; flower a spike of small pink flowers *Persicaria*
17b Stipules absent; flowers yellow like a small *Oenothera* Evening Primrose *Ludwigia*

18a Leaves staggered alternately along stem *Potamogeton*
18b Leaves all arising from base of plant 19

19a Floating leaves < 5cm long; stolons often present *Luronium natans*
19b Floating leaves >5 cm long; stolons absent 20

20a Petioles triangular or semi-circular in cross section *Sagittaria*
20b Petioles circular in cross section 21

21a Flowers white in a forked spike held above the water surface *Aponogeton distachyos*
21b Flowers not present in floating leaved growth forms *Alisma*

Nick Stewart
Update May 2020

KEY TO SUBMERGED AQUATIC PLANTS WITH UNDIVIDED, EXPANDED TRANSLUCENT BLADES (INCLUDING *ELODEA* TYPES)

1a Leaves large (>5cm), lettuce-like, all arising from the plant base — *Nuphar*
1b Leaves <5cm or, if larger, then arranged along well-defined stems — 2

2a Plants less than 2cm long, free-floating, made up of chains of up to 10 lanceolate leaves with the leaf stalk of one leaf attached to the blade of the preceding leaf of the chain — *Lemna trisulca*
2b Plants with well-defined rooted stems — 3

3a Leaves <3cm x <0.5cm (*Elodea*-types) — 4
3b Leaves >3cm long and usually >0.5cm wide — 9

4a Leaves in equal, opposite pairs; leaf tips truncate or slightly notched but otherwise untoothed — *Callitriche*
4b Leaves arranged singly or in whorls of up to 8 leaves, but never in regular pairs; leaf tips rounded or pointed, minutely to strongly toothed — 5

5a Leaves spirally arranged but sometimes appearing nearly whorled towards the stem tips, strongly recurved often back to the stem — *Lagarosiphon major*
5b Leaves in whorls of (2-)3-6(-8) or in unequal groups of (1-)2-3(-4), recurved or not — 6

6a Leaves in unequal groups of (1-)2-3(-4), with a +/- clasping base — *Najas*
6b Leaves in regular whorls of (2-)3-6(-8), parallel sided to base — 7

7a Leaves predominantly in whorls of 3, sometimes a few whorls with 2-4 leaves — *Elodea*
7b Leaves in whorls of 4-6(-8), rarely with a few 3-leaved whorls — 8

8a Leaves 1-4 cm x 2-5 mm, without scales at the base, in whorls of 4-5; petals 9-12 mm long, much longer than the sepals — *Egeria densa*
8b Leaves 0.5-2 cm x 0.7-2 mm, with tiny, brownish, fringed scales at the base, in whorls of (3-)4-6(-8); petals 3-5 mm long, scarcely longer than the sepals — *Hydrilla verticillata*

9a Leaves alternate (sometimes with one opposite pair beneath the terminal flower stalk), with stipules arising from where the leaf meets the stem (but these fall off very early in *Potamogeton perfoliatus*) — *Potamogeton*
9b Leaves in groups of 2 or more — 10

10a Leaves untoothed, >0.5cm wide, in regular equal, opposite pairs — *Groenlandia densa*
10b Leaves toothed, <0.5 cm wide, in irregular groups of 2-3(-4) — *Najas*

N.F.Stewart
Updated May 2020