

Introduction to aquatic plant identification



Nick Stewart

- Why study aquatic plants?
- Challenges
- Tools and books
- How to go about identifying aquatic plants
- Leaf form groups
- Some of the key characters in these groups

Why study aquatic plants?

- Fewer people looking at them, so under-recorded
- Many are very sensitive to their environment
- Many are declining



Reasons for decline - Enrichment pollution



Reasons for decline - Succession



Reasons for decline - Introduced plants



Parrot's Feather *Myriophyllum aquaticum*



Which bog is in good condition?



One lake has lots of aquatic vegetation and the other very little.
Which one?



A few have showy flowers



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Most do not



Many aquatic plants have their own families which will be unfamiliar to terrestrial botanists – some examples



Duckweeds
Lemnaceae



Pondweeds
Potamogeton-
aceae



Water Starworts
Callitrichaceae



Water Milfoils
Myriophyllaceae

Similar appearance in vastly different families

Plantain



Fern

Water-plantain

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Cabbage



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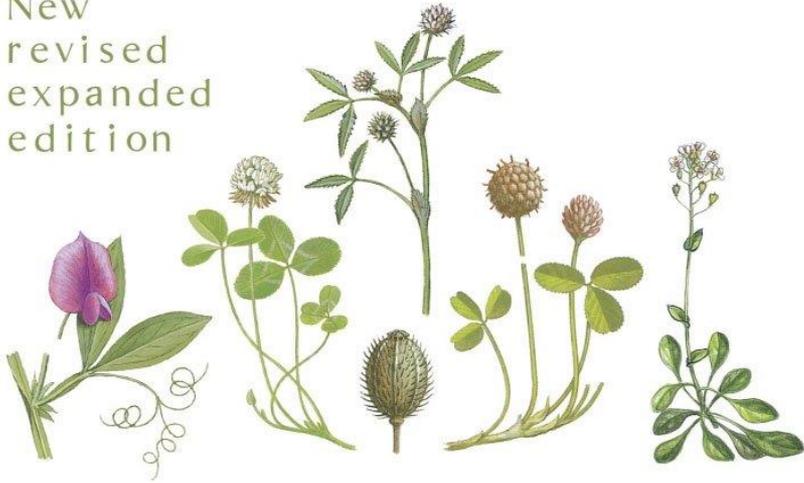
Lobelia



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Books and keys

New
revised
expanded
edition



The WILD FLOWER Key

How to identify wild flowers
trees and shrubs
in Britain and Ireland

Francis Rose
Revised and
updated by
Clare O'Reilly

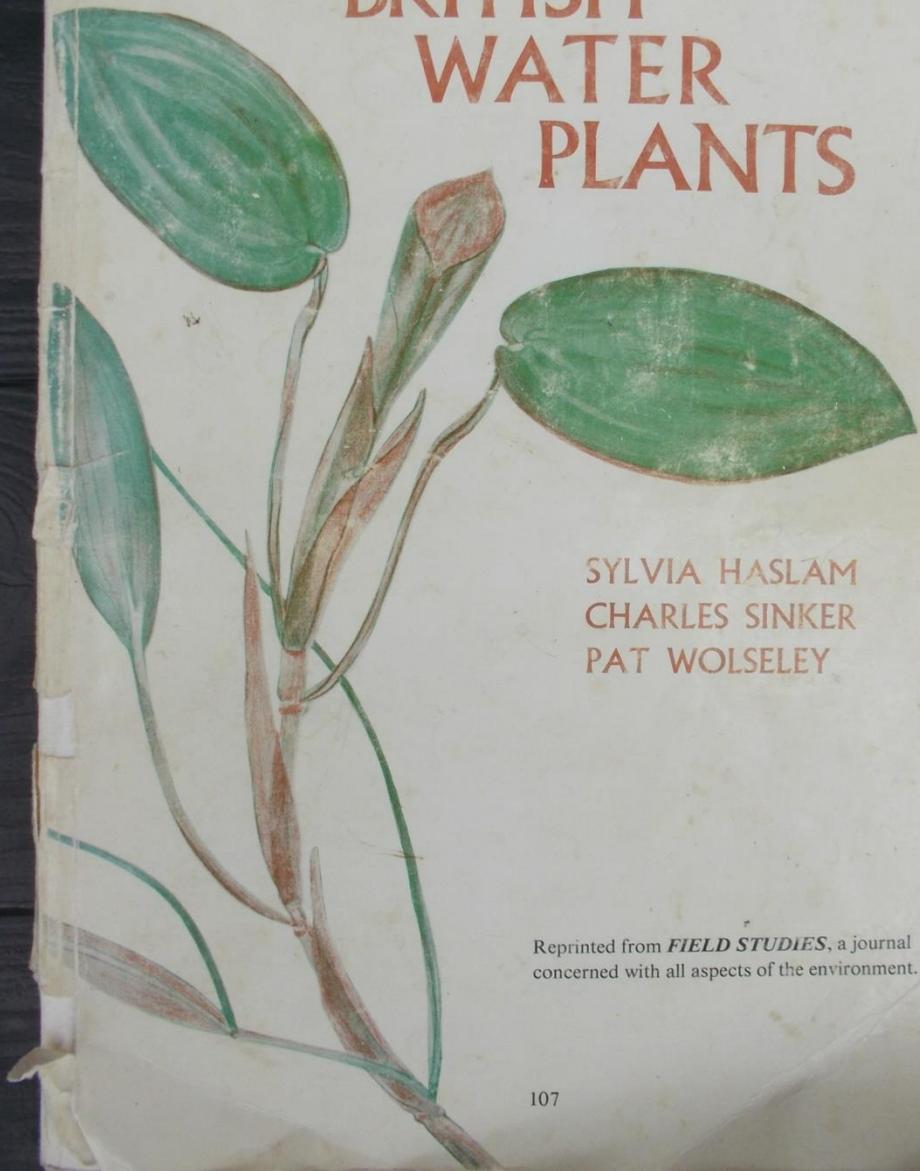


COLLINS



BRITISH
WILD FLOWER
GUIDE

BRITISH WATER PLANTS



SYLVIA HASLAM
CHARLES SINKER
PAT WOLSELEY

Reprinted from *FIELD STUDIES*, a journal
concerned with all aspects of the environment.

Panel 1



Panel 2



Panel 3



ZONATION SUCCESSION → encrusting algae submerged plants FSC

Guide to commoner water plants



What else lives at the pond?
Guide to duckweeds



Duckweeds are plants on a miniature scale; they have leaves, roots and flowers – just very small ones! Duckweeds float on the surface of ponds. Where there is a lot of duckweed it can block out sunlight, which affects other pond life. This chart shows six duckweeds that you might see when you're spending time around the pond taking part in the OPAL Water Survey.

HINT The pond may contain more than one species of duckweed. This guide groups duckweeds by how many roots they have, so look for that first. Then use the size, shape and colour of the leaves to decide which species you have. Using the OPAL magnifier will help you.

Tell us what you see! Duckweeds are useful indicators of water quality and a pond's condition. Invasive duckweeds (introduced from other countries) can negatively affect our native duckweeds. Help us track their spread by completing the OPAL Water Survey. www.OPALexplornature.org

Key

- Invasive species
- Native species

Duckweeds with no roots

Rootless Duckweed

Wolffia arrhiza
Never has roots.
Leaves are 0.5-2 mm long, oval-shaped and fat. They look like tiny bright green grapes.
Flare.



floating-leaf plants

WATER-STARWORTS
CALLITRICHE
of
EUROPE



R. V. LANSDOWN

BSBI HANDBOOK

PONDWEEDS
of
GREAT BRITAIN
AND IRELAND

C. D. PRESTON

CHAROPHYTES
of GREAT BRITAIN
AND IRELAND



J. A. MOORE

HANDBOOK No 8

PLANT CRIB 1998

T. C. G. RICH & A. C. JERMY



BOTANICAL SOCIETY OF THE BRITISH ISLES

**A FIELD GUIDE TO THE RIVERINE PLANTS
OF BRITAIN AND IRELAND**
Including selected vascular plants, bryophytes, lichens and algae

R.V. Lansdown



Ardeola Environmental Services
45 The Bridle, Stroud
Glos. GL5 4SQ
Phone: 01453 763348

- 11* Blütenboden deutlich behaart, Schwimmblätter vorhanden oder fehlend, Unterwasserblätter 10-25(38) cm lang, länger als Internodien, mit zahlreichen (> 200) Endsegmenen (Abb. 15-9), Kelchblätter 3-7 mm lang, Kronblätter (5-)10-15(-22) mm lang, Staubblätter (8-)20-40, Fruchtblätter (15-)30-40, Fruchtsiel 50-100 mm lang.....12



Abb. 15-8 (kw)



(kw)



Fachbeiträge des LfU
Heft Nr. 120

Bestimmungsschlüssel für die
aquatischen Makrophyten
(Gefäßpflanzen, Armleuchteralgen und
Moose) in Deutschland

Band 2: Abbildungen

Schwimmblätter u. Überwasserblätter im mittleren Teil der Pflanze feine und pinselartige, immer birnenförmig.
Ranunculus penicillatus

Unterwasserblätter 8-15 cm lang, parallel bis konisch, bis 10 mm, Nektarium
Ranunculus pseudofluitans
subsp. *pseudofluitans*
[BUTCHER] C. D. K.

vertumnus C. D. K. Cook
und haben birnenförmige

in Wirteln.....14
.....19

Helosciadium inundatum
(f.) (Untergetauchter

n x H. nodiflorum) ähnelt
der bandförmig und nicht
in Helosciadium xmoorei

.....15
.....16

Hottonia palustris

.....16

Oenanthe fistulosa

.....17

- 17 Stängel meist deutlich kantig gefurcht (Abb. 15-10), Überwasserblätter einfach gefiedert.....*Sium latifolium* L. (Breitblättriger Merk)
17* Stängel nicht deutlich gefurcht, Überwasserblätter zwei- bis dreifach gefiedert.....13
18 Unterwasserblätter zweifach fiederteilig, kräftig (Abb. 15-11), deren Basis keilförmig, Früchte > 5 mm lang.....*Oenanthe fluviatilis* (BAB.) COLEMAN (Flutender Wasserfenchel)
18* Unterwasserblätter 3-4fach fiederteilig, fein (Abb. 15-12), deren Basis nicht keilförmig, Früchte 3,5-4,5 (5) mm lang.....*Oenanthe aquatica* (L.) POIR. (Großer Wasserfenchel)

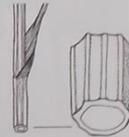


Abb. 15-10



Abb. 15-11 (kw)



Abb. 15-12

- 19 Zipfel der Unterwasserblätter (0,3) 0,8-1,2 (1,5) mm breit.....20
19* Zipfel der Unterwasserblätter weniger als 0,8 mm breit.....21
20 Zumindest einige Unterwasserblätter nicht im Quirl, nur grundständige Rosette mit wechselständigen Blättern am Spross (Abb. 15-15).....*Hottonia palustris* L. (Wasserfeder)
20* Alle Unterwasserblätter im Quirl.....*Myriophyllum aquaticum* (VELL.) VERDC. (= *Myriophyllum brasiliense* CAMBESS.) (Brasilianisches Tausendblatt)
21 Blattquirle meist 4 (Abb. 15-13).....22
21* Blattquirle meist 5-6 (Abb. 15-14) oder Blattquirle 4 mit einigen wechselständigen Blättern (Abb. 15-21).....23

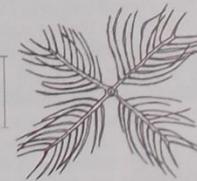


Abb. 15-13

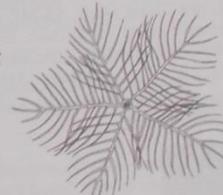


Abb. 15-14



Abb. 15-15

- 22 Blatt mit maximal 18, meist wechselständigen Fiederblättchen, Stängel ohne deutliche Rottfärbung, Drüsen ausschließlich am Ende der Blattfiedern und am Blattgrund, Spreiten der Fiederblättchen ohne Drüsen, Blüten wechselständig, zierliche Pflanzen, beim Trocknen oft schwarz werdend.....*Myriophyllum alterniflorum* DC. (Wechselblütiges Tausendblatt)

SUMMARY OF TYPES OF SUBMERGED AND FLOATING WATER PLANTS

SPIKY ROSETTES - 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 Plantain
Alisma (juvenile) - Water Plantains
Sagittaria (juvenile) - Arrowheads
Luronium natans - Floating Water Plantain
Subularia aquatica - Axlwort
Limnolia - Mudworts
Ranunculus flammula - Lesser Spearwort
Stratiotes aloides - Water Soldier
 Leaves \pm parallel-sided with rounded or abruptly pointed tips
Littorella uniflora - Shoreweed
Lobelia dortmanna - Water Lobelia

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 - Marestalk
 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 \pm 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

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

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

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

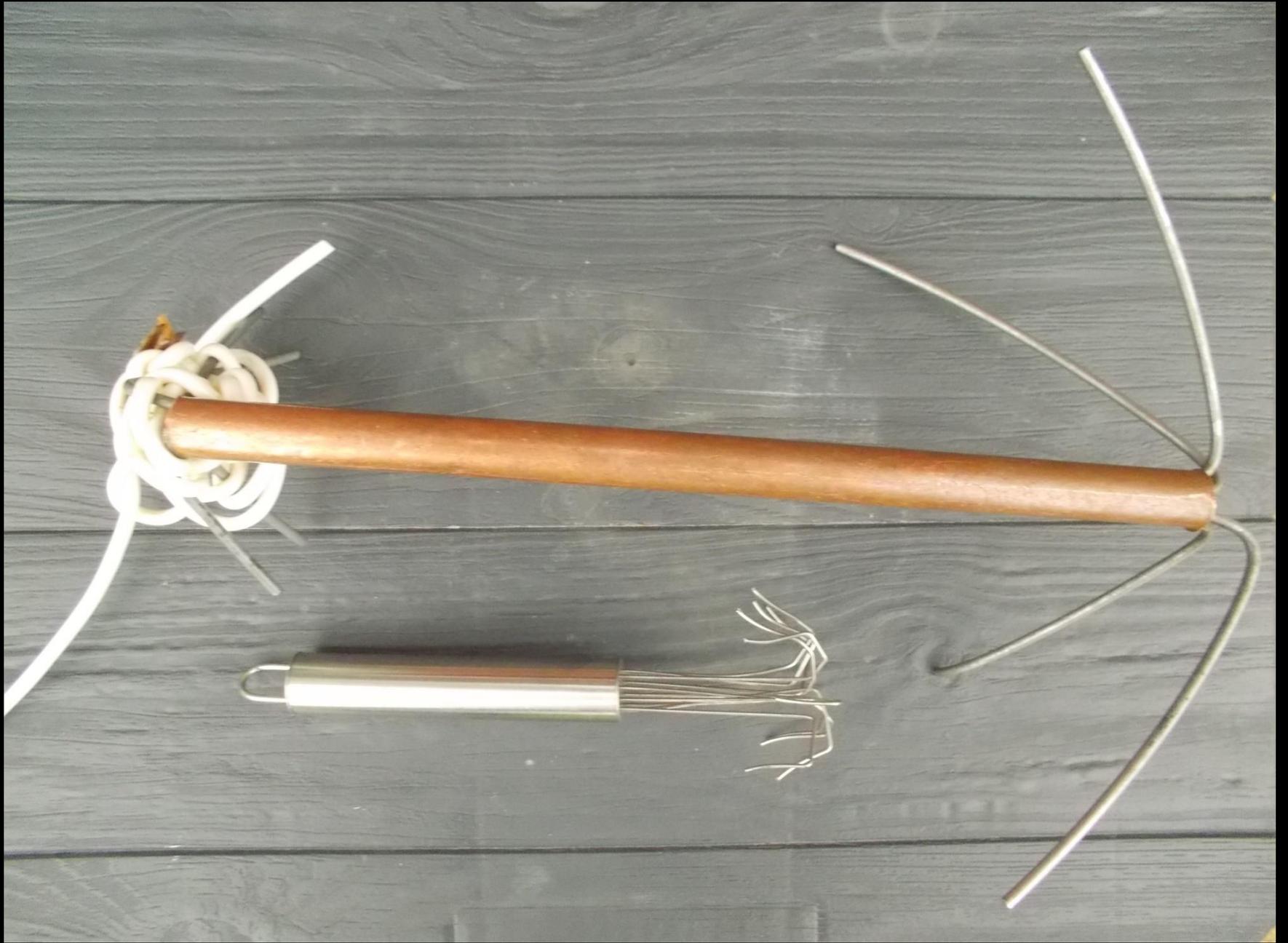
- 1a Leaves linear or subulate (= tapered from near base) 2
 1b Some leaves expanded with a narrowly lanceolate blade 8
- 2a Leaves \pm parallel-sided in lower half with acute to rounded tips 3
 2b Leaves long-tapered from near base to finely acute tips 5
- 3a Leaves large, more than 10 x 1 cm, spiny-toothed 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 *Limnolia 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)

Survey aids





Photo: Sarah Pierce







Easiest approach is to divide aquatic
plant into leaf-form types

Reduces the possibilities to 8-20
species/genera per group



Claudia Ferguson-Smyth

Aquatic plant types

Spiky rosettes

Stringy

Feathery

Strappy

Floaters

Expanded translucent

Submerged expanded opaque

**Spiky rosettes –
Bottom growing rosettes of stiff, linear
or narrowly lanceolate leaves**



Isoetes - Quillworts

Littorella uniflora - Shoreweed

Lobelia dortmanna - Water Lobelia

Eriocaulon aquaticum - Pipewort

Baldelia ranunculoides - Lesser Water Plantain

Alisma (juvenile) - Water Plantains

Sagittaria (juvenile) - Arrowheads

Luronium natans - Floating Water Plantain

Subularia aquatica - Awlwort

Limosella - Mudworts

Ranunculus flammula - Lesser Spearwort

Stratiotes aloides - Water Soldier

Stringy - Narrow linear leaves



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Feathery – Compound leaves with linear segments



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**Strappy –
Linear leaves >5 mm wide and over 20cm
long**



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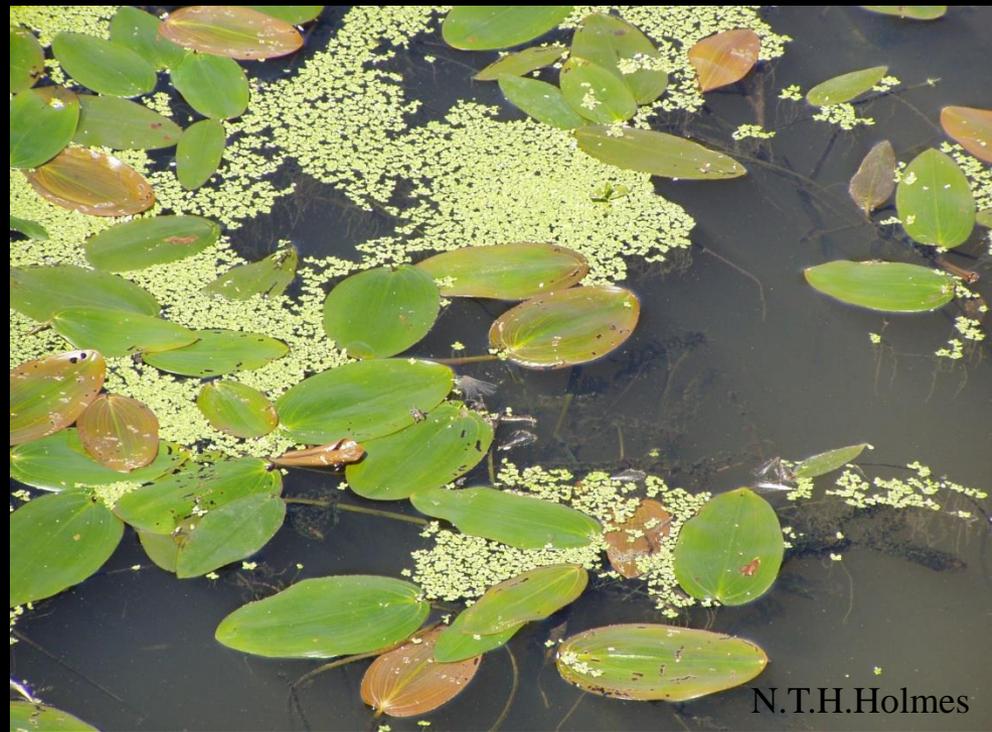
Floaters – Expanded, opaque, floating leaves



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Expanded translucent leaves



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Expanded submerged opaque leaves



Combinations



Stream Water Crowfoot – *Ranunculus penicillatus*



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Arrowhead
Sagittaria sagittifolia



Water Starworts
Callitriche

Multiple
classifications

Some of the key characters
in each group

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

- Leaf shape
- Cross section
- Root colour
- Subulate/ Presence of blade



Awlwort – *Subularia aquatica*

Leaf shape

Water Lobelia
Lobelia dortmanna



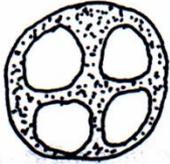
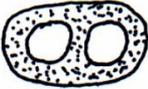
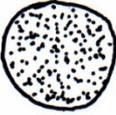
Shoreweed
Littorella uniflora



LAKE-BOTTOM 'ISOETIDS' WITH TERETE LEAVES: *ERIOCAULON* / *ISOETES* / *LITTORELLA* / *LOBELIA* / *SUBULARIA*, VEGETATIVE

The latter four of these taxa with terete leaves are widespread and relatively frequent in clear lakes, lochs, etc. They look superficially similar vegetatively, but can easily be distinguished even from solitary leaves washed up on the shore. Note the characters given below are diagnostic only for these taxa. With practice, growth, form, colour etc. are also useful. For *Luronium* and *Baldellia* which have flat leaves, see page 313.

The Red Data Book species *Eriocaulon aquaticum* is easily distinguished from all by the segmented roots, which are very obvious. Under water, its narrowly triangular rosettes are also distinctive. *Isoetes* roots are brownish, the other species are white.

	<i>Isoetes</i> spp.	<i>Lobelia dortmanna</i>	<i>Littorella uniflora</i>	<i>Subularia aquatica</i>
Cross section at middle of leaf	 <p>± Round with 4 hollow tubes</p>	 <p>Compressed with 2 hollow tubes</p>	 <p>± Round, spongy inside</p>	 <p>± Round to triangular, solid</p>
Leaves	Flattened and expanded at base, generally tapering gradually to point or terete and tapering in upper ¼ only	Strap-shaped, apex blunt and curving out; small quantity of milky latex exudes when leaves broken off	Cylindrical, narrowing suddenly at apex, variable in length	Expanded at base, tapering gradually to a fine point
Habit	Solitary	Solitary	Stoloniferous	Solitary

Cross section



Quillwort – *Isoetes lacustris*

Root colour



Water Lobelia - *Lobelia dortmanna*



Shoreweed *Littorella uniflora*



Presence of a blade

Lesser Spearwort
Ranunculus flammula

Lesser Water plantain
Baldellia ranunculioides





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Water Soldier *Stratiotes aloides*

STRINGY - narrow linear leaves

- Leaf arrangement – tufted, whorls, small groups, alternate
- Solid/translucent tissue



Alternate leaves
- Potamogeton



Grouped leaves -
Zannichellia

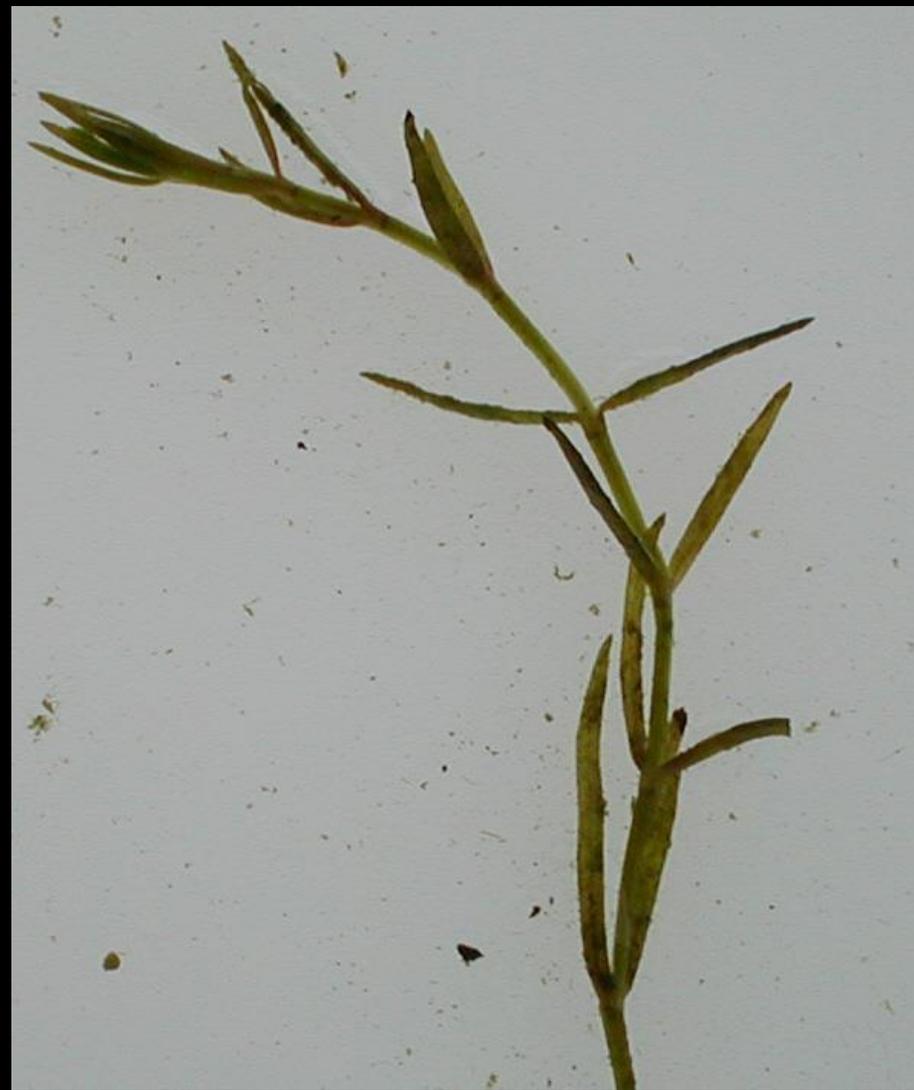


Densely tufted leaves
-Juncus bulbosus



Callitriche brutia

Equal and opposite pairs



Swamp Stonecrop – *Crassula helmsii*



Translucent leaved –
Potamogeton pusillus



Solid leaf, 2 tubes
Potamogeton pectinatus

Solid leaf,
flat
Eleogiton
fluitans



FEATHERY - compound leaves with linear segments

- Whorled or staggered (alternate) leaves
- Forked divisions or feather-like divisions
- Leaves divided once or multiple times

Leaf arrangement

Whorled -
Myriophyllum



Alternate - Ranunculus

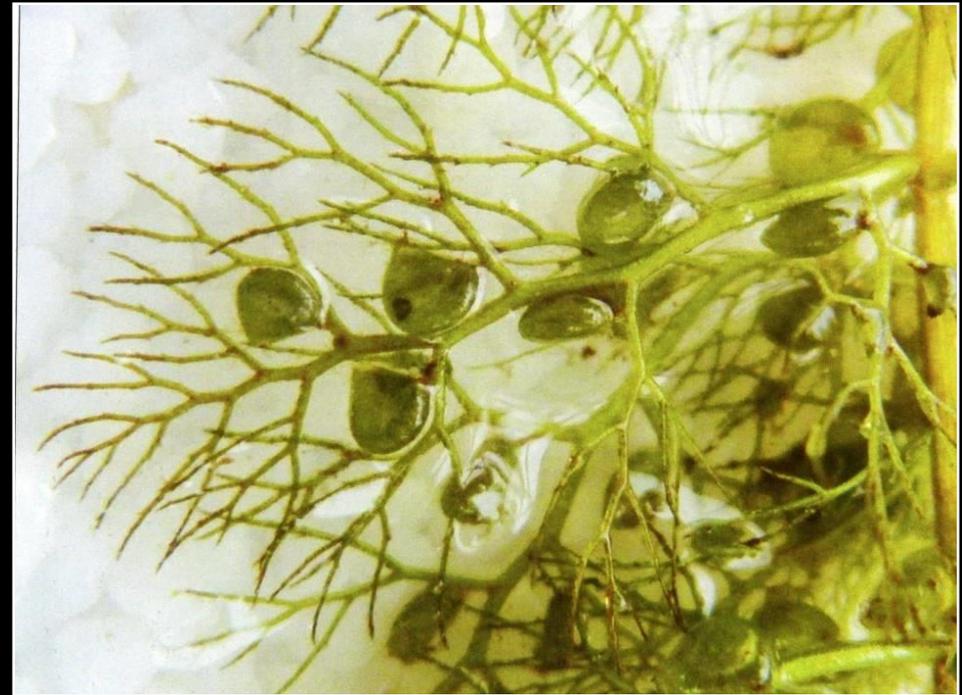


Staggered but sometimes
appears whorled – *Hottonia
palustris*



Leaf divisions

Forked - Ceratophyllum



More complex - Utricularia

Feather-like - Myriophyllum



Leaf divisions

2-3 times divided – *Apium inundatum*



3-4 times divided – *Oenanthe aquatica*



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

- Obvious stem
- Leaf venation
- Pointed/blunt
- Flat/spongy

With obvious stems

Solid leaf with sheath and ligules – Grasses e.g Glyceria, Catabrosa



Translucent with stipules - Potamogeton





Butomus

Sparganium

Schoenoplectus

Sagittaria

FLOATERS - Expanded opaque leaves, floating

- Small free floating to large floaters
- Leaf lobes
- Leaf venation





Ivy Duckweed
Lemna trisulca

Common Duckweed
Lemna minor

Great Duckweed
Spirodela polyrrhiza

Least Duckweed *Wolffia arhiza*



Water Fern *Azolla filiculoides*





Multi-lobed
Ranunculus

Leaf lobing

Basal lobes – *Nuphar lutea*



Unlobed – *Potamogeton natans*





Circular venation
*Hydrocharis
morsus-ranae*

Leaf venation

Longitudinal veins
Potamogeton natans

Herring-bone – *Persicaria amphibia*





White Water Lily
Nymphaea alba

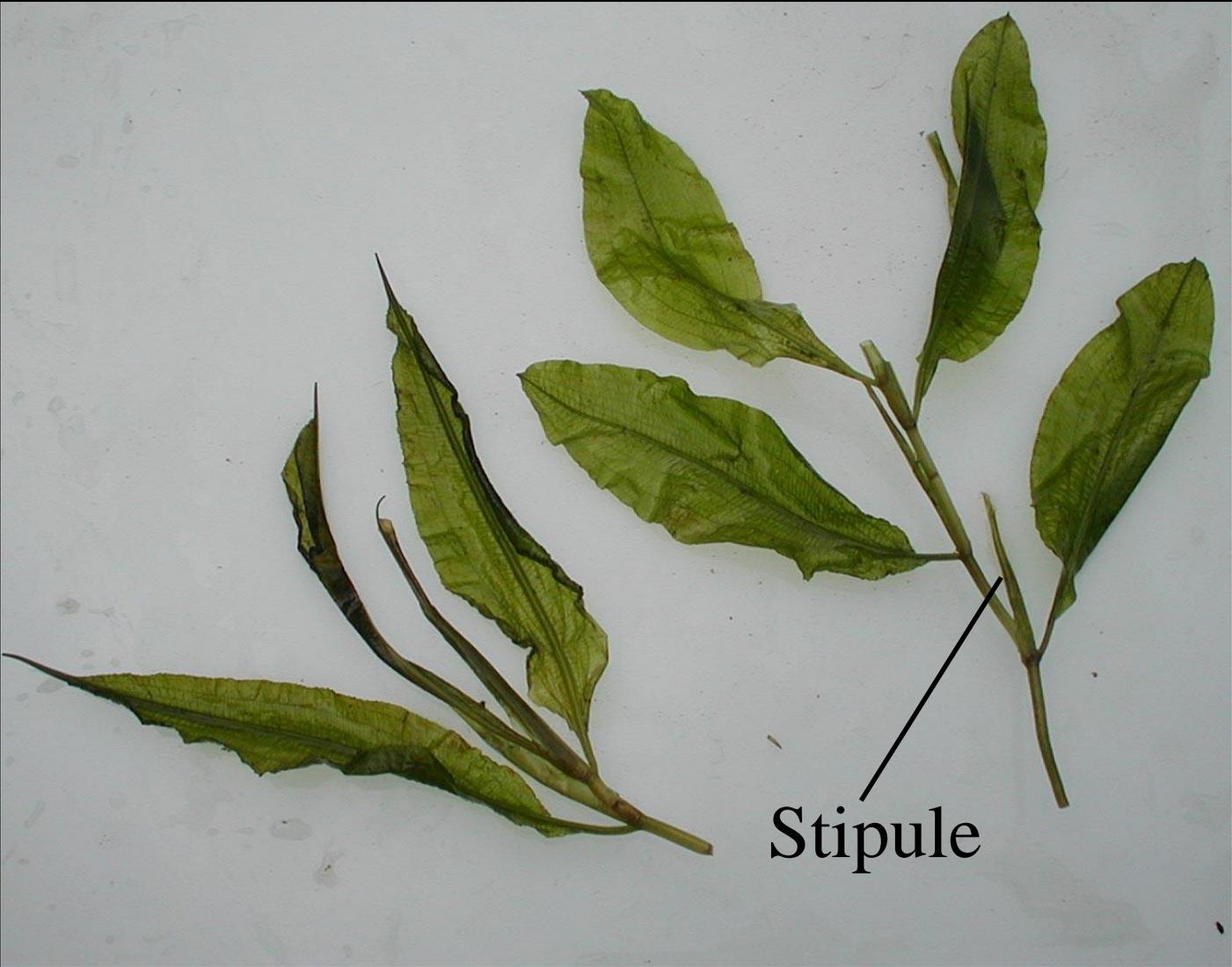


Yellow Water Lily
Nuphar lutea



Expanded translucent leaves (including Elodea types)

- Leaf arrangement - alternate/paired/whorled
- Presence of stipules



Stipule

All Pondweeds Potamogeton have alternate leaves and stipules



Canadian Pondweed
Elodea canadensis



Nuttall's Pondweed
Elodea nuttallii

Yellow Water Lily has underwater leaves



Expanded submerged opaque leaves

- Miscellaneous group including drowned terrestrial plants

Expanded submerged opaque leaves



Six-stamened Waterwort
Elatine hexandra



Water Purslane – *Lythrum portula*



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Hampshire Purslane – *Ludwigia palustris*



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Water Starworts - Callitriche



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Blinks – *Montia fontana*



Marsh Pennywort –
Hydrocotyle vulgaris

THANKS!



An Roinn Cultúir,
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Heritage and the Gaeltacht



National Parks & Wildlife Service

Nigel Holmes who provided many of the pictures



Claudia Ferguson-Smyth