



National Plant Monitoring Scheme

Online Training Materials: Introduction to Fresh water

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UK Centre for
Ecology & Hydrology



Botanical Society
of Britain & Ireland



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National Plant Monitoring Scheme

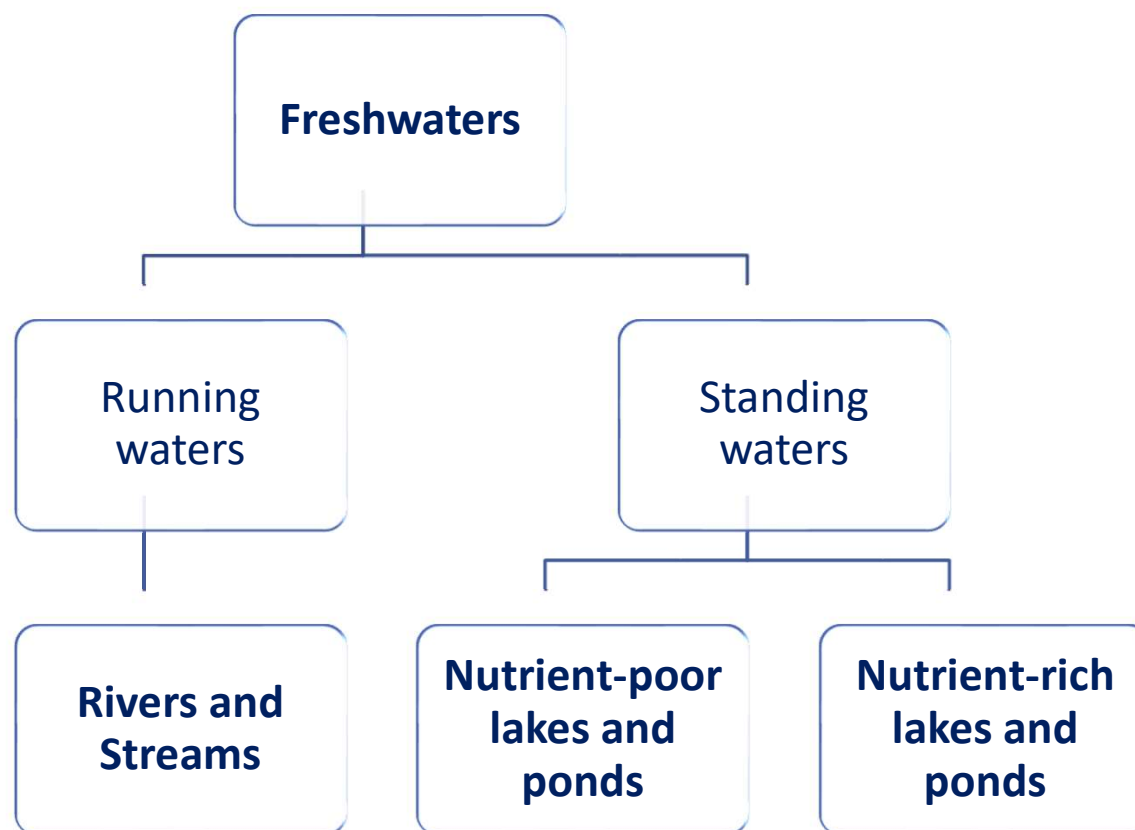
Aims:

- How to identify the different types of freshwater
- How to identify different habitat zones associated with freshwaters
- Understanding of what factors influence what species will be found
- Confidence and ability to identify some of the WF species
- Understanding of where there may be difficulties or confusion between similar species





Freshwater Habitats





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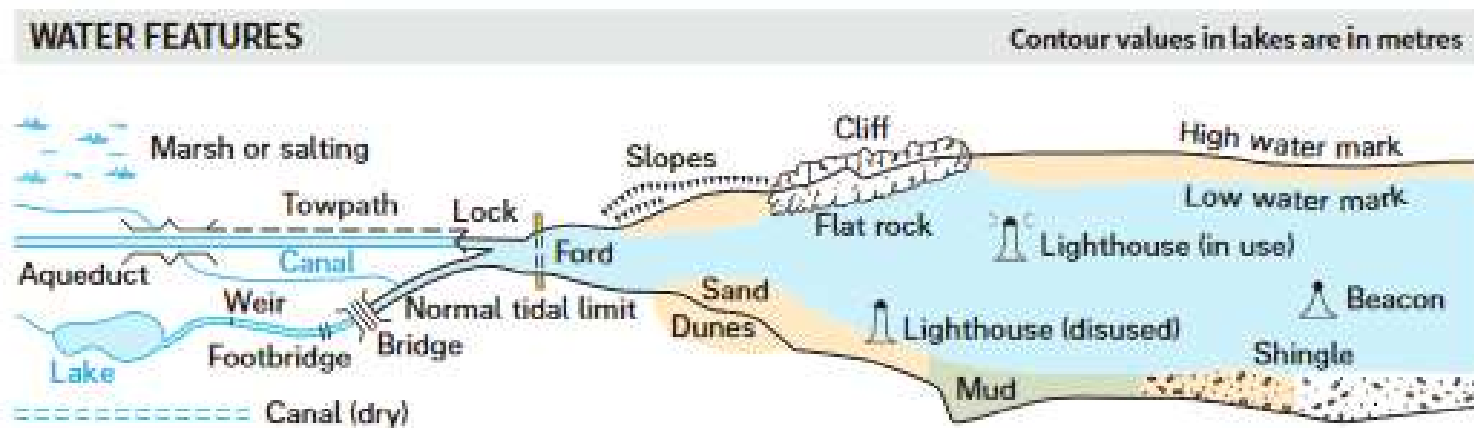
Freshwater Habitats





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Freshwater or saline?



OS 1:50,000 Map Legend





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Freshwater or saline?





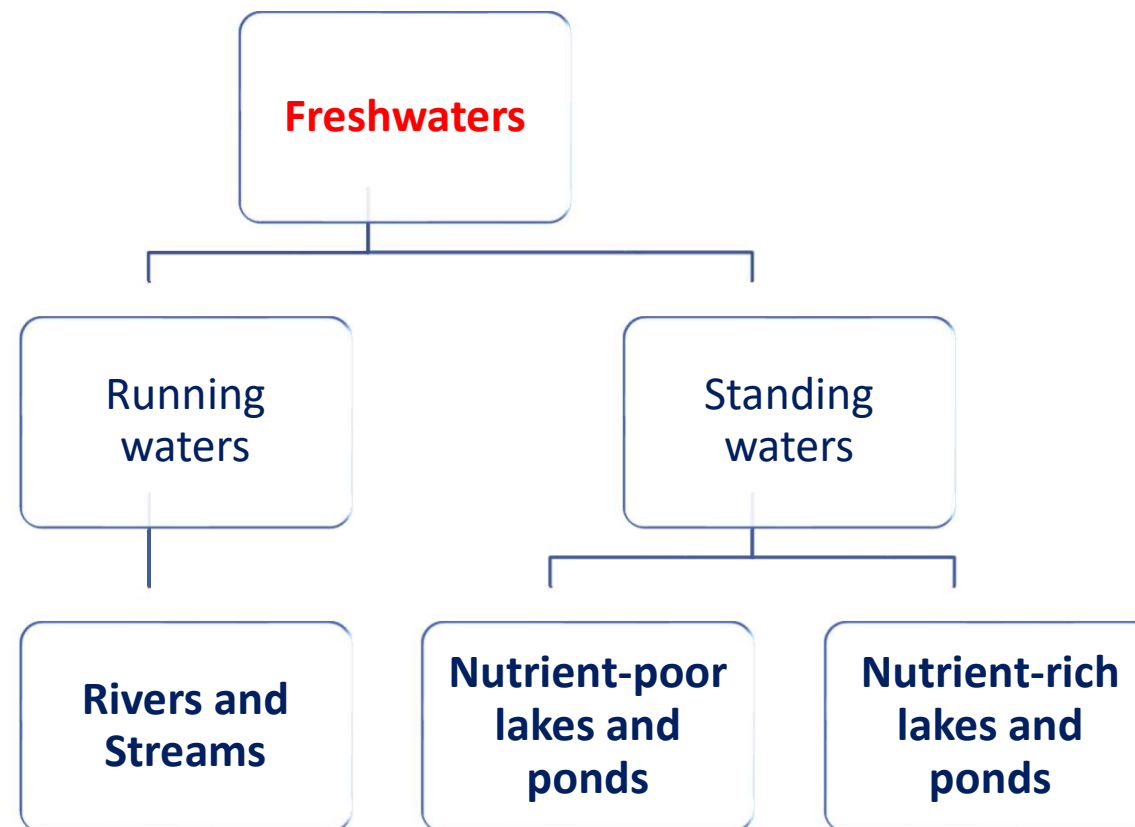
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Freshwater or saline? – Saline influence – look for seaweeds, signs of fluctuating water levels – e.g. green algae on walls.



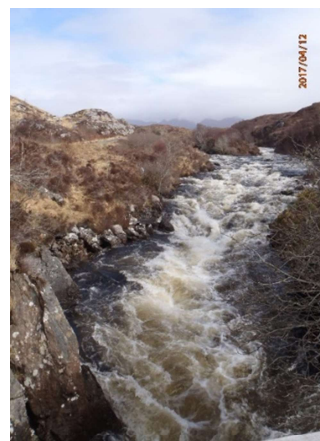
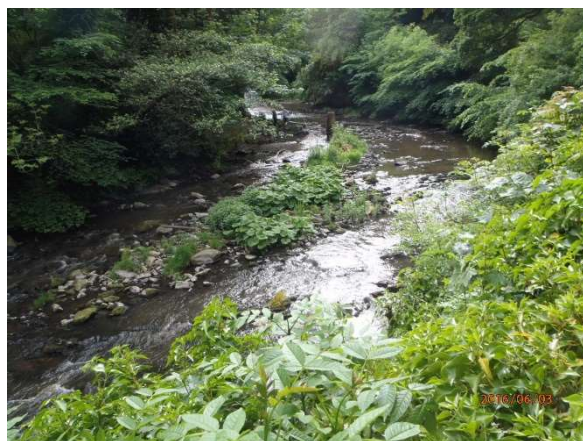


Freshwater Habitats





Running Waters (Rivers & Streams)





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Standing Waters





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Nutrient-poor or nutrient-rich lake/pond?

Dystrophic/ oligotrophic / mesotrophic / eutrophic / hypertrophic

Nutrients



Abundance/
Density of plants





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Nutrient-poor (Dystrophic/ oligotrophic)



Water Colour: peaty/
brown/ clear

Water Clarity: clear

pH: acid – neutral (usually
< pH 7)

Substrate: Peaty / lots of
bare rocks/ sand



Vegetation: sparse or
abundant; rarely lush

Typical species: bogbean,
Bog pondweed, Quillwort,
Water Lobelia,
bladderworts



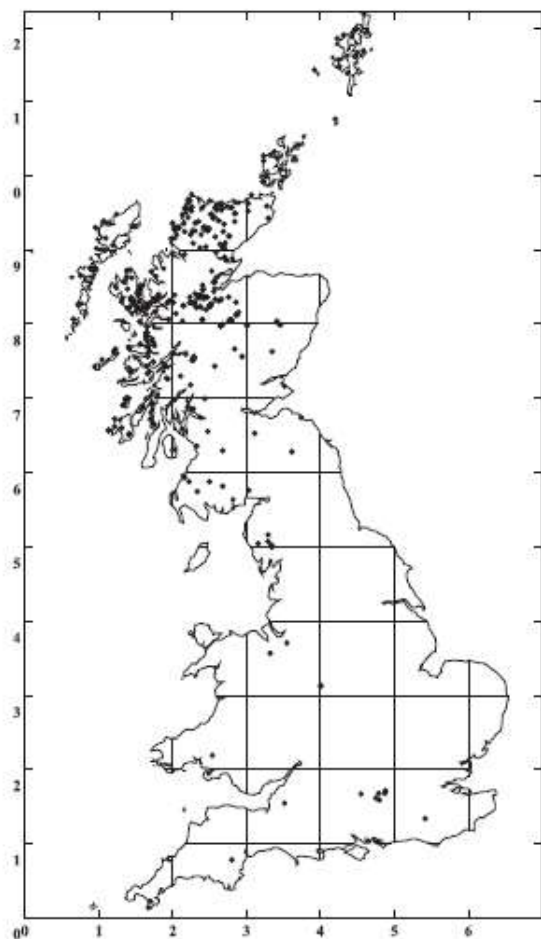
Beware marl sites!



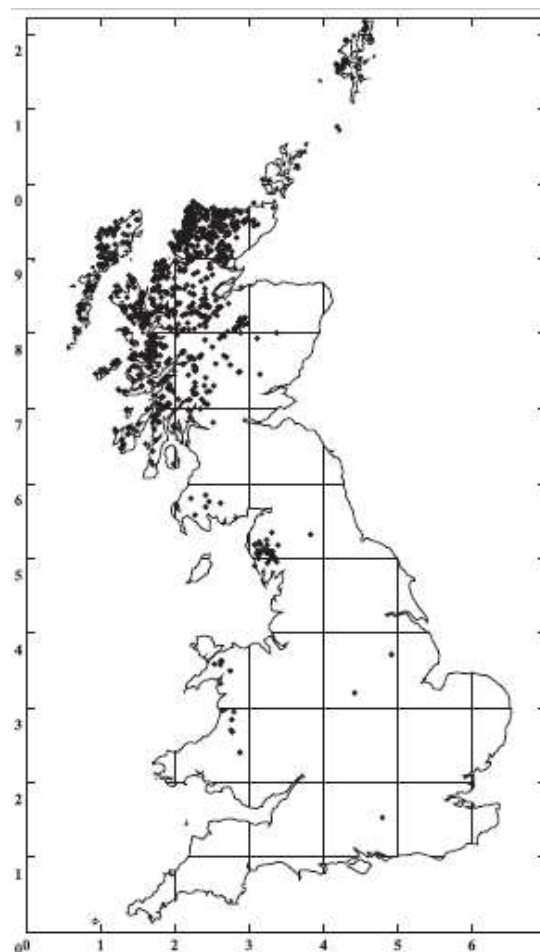


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Nutrient-poor



Distribution of Group B Lakes.
Taken from Duigan *et al*



Distribution of Group D Lakes.
Taken from Duigan *et al*





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**Nutrient-rich
(mesotrophic/ eutrophic/
hypertrophic)**



Water colour: Green

Water clarity: may be cloudy

pH: Neutral – alkaline (usually \geq
pH 7)

Substrate: silt, mud

Vegetation: may be very lush.
May be lots of algal coverage.

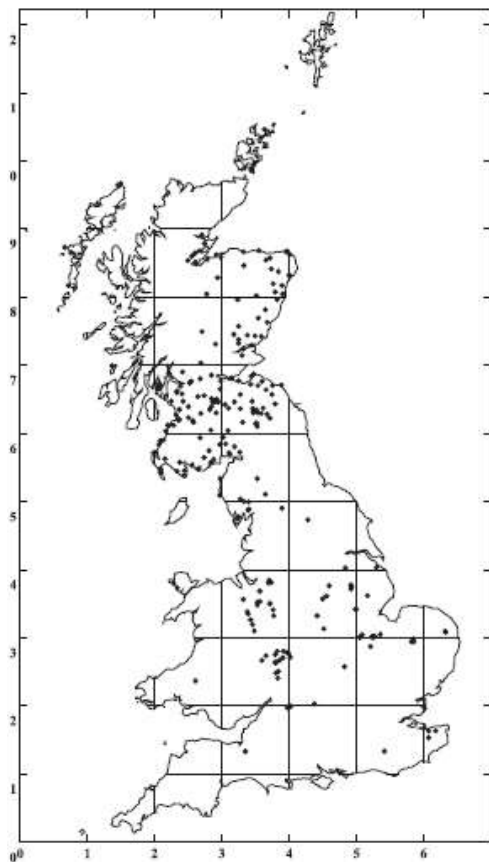
Typical species: pondweeds,
Water-milfoils, Yellow Water-lily



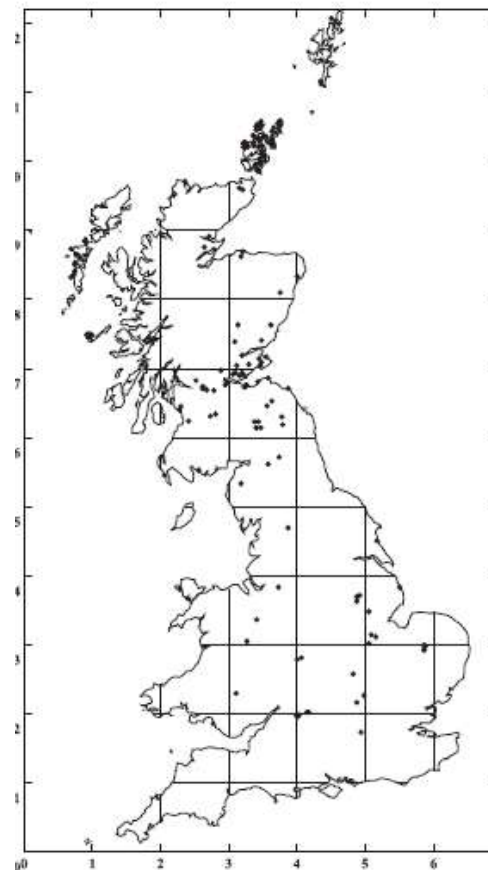


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Nutrient-rich



Group G. Taken from
Duigan et al



Group I. Taken from
Duigan et al





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v.2020

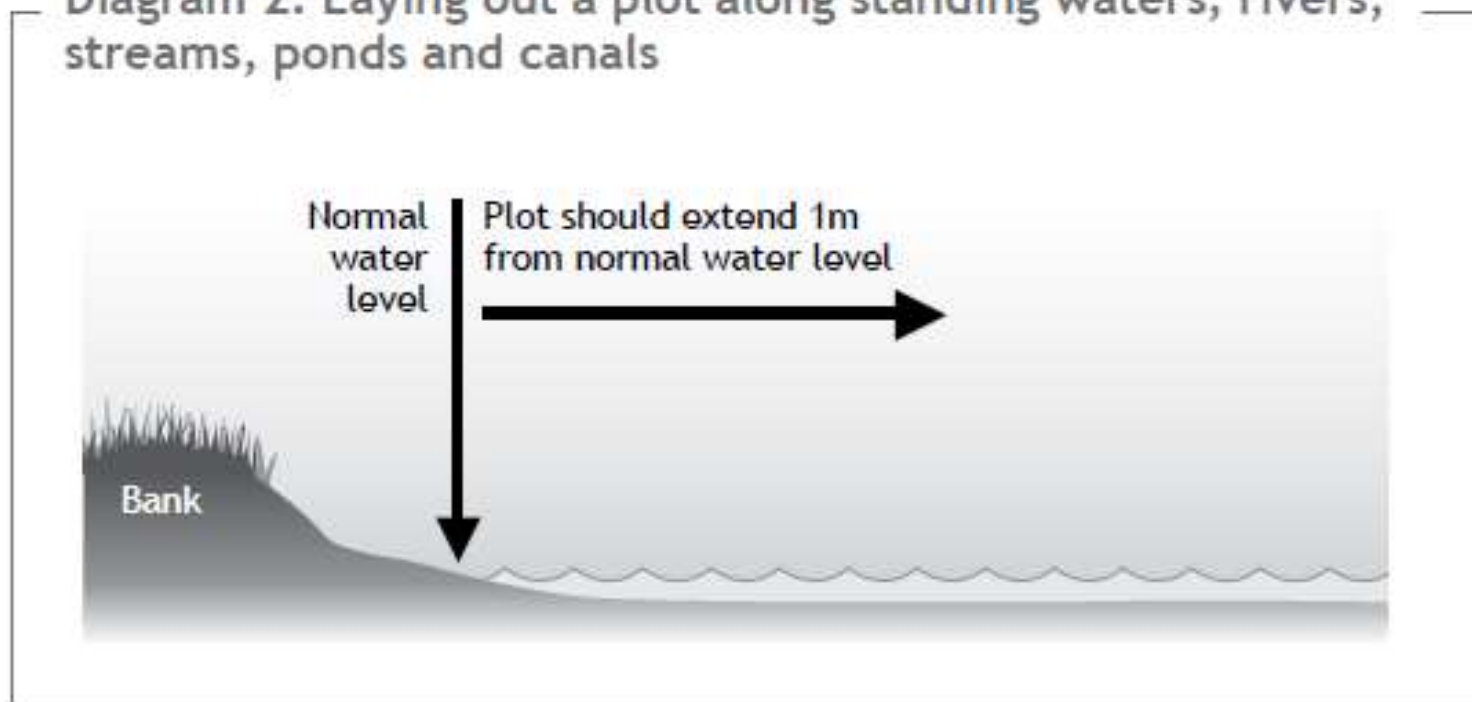
Name(s):		1km square grid ref <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
Date of 1 st survey: <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/>		Date of 2 nd survey: <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/>	
At which level are you surveying?		Plot number: <input type="text"/>	
Wildflower <input type="checkbox"/>		SQUARE plot - OS Grid ref for SW corner <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
Indicator <input type="checkbox"/>		LINEAR/VERTICAL plot - OS Grid refs for plot ends	
Inventory <input type="checkbox"/>		1. <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
Note: In some cases Wildflower or Indicator surveys may find zero species. These surveys are still valid and useful to the NPMS, and can be submitted. Please always send us your "null" samples!		2. <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> - <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	
		Please estimate the 6 figure grid reference. If you have GPS then please enter the 10 figure grid reference.	
Habitat type and description (see guidance notes pp. 27-28 for categories to use):			
Broad habitat:		Fine habitat:	
Please also fill in the following information where possible (see guidance notes pp. 20-23).			





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Diagram 2: Laying out a plot along standing waters, rivers, streams, ponds and canals





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Whenever you leave the water, remember to Check Clean Dry

CHECK

Check your gear after leaving the water for mud, aquatic animals or plant material. Remove anything you find and leave it at the site.

CLEAN

Clean everything thoroughly as soon as you can, paying attention to nets, waders, and areas that are damp and hard to access. Use hot water if possible.

DRY

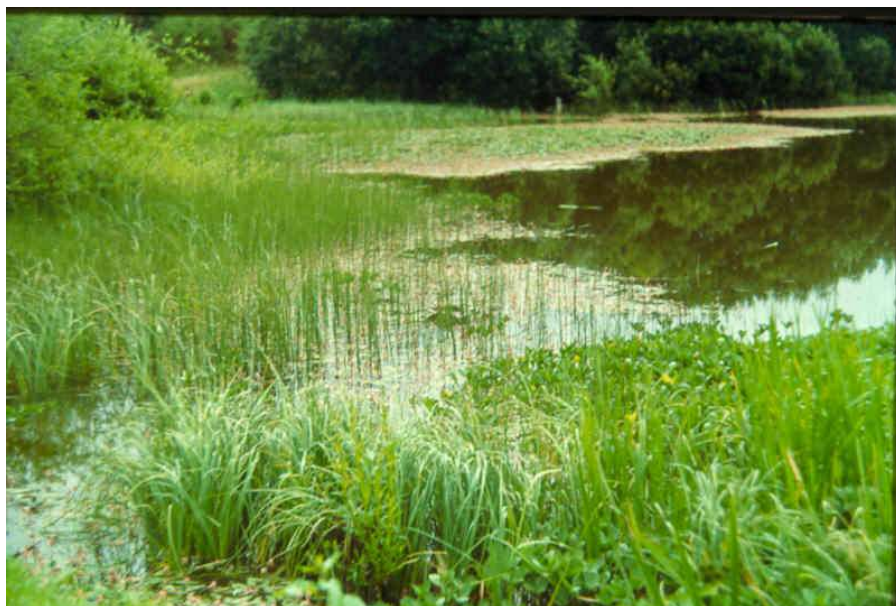
Dry everything for as long as possible before using elsewhere as some invasive plants and animals can survive for two weeks in damp conditions.





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Quiz:



Q: Which fine habitat is this standing water site most likely to be?

- Nutrient-poor lake?
- Nutrient-rich lake?





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Quiz:



A: Nutrient-rich lake

Clues:

- Dense fringing vegetation and emergent growth;
- Lush vegetation;
- Green water colour





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Quiz:



Q. Which fine habitat is this standing water site most likely to be?

- Nutrient-poor lake?
- Nutrient-rich lake?





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Quiz:



A. Nutrient-poor lake

Clues:

- Sparse vegetation
- Clear water
- Set in uplands/ peatland





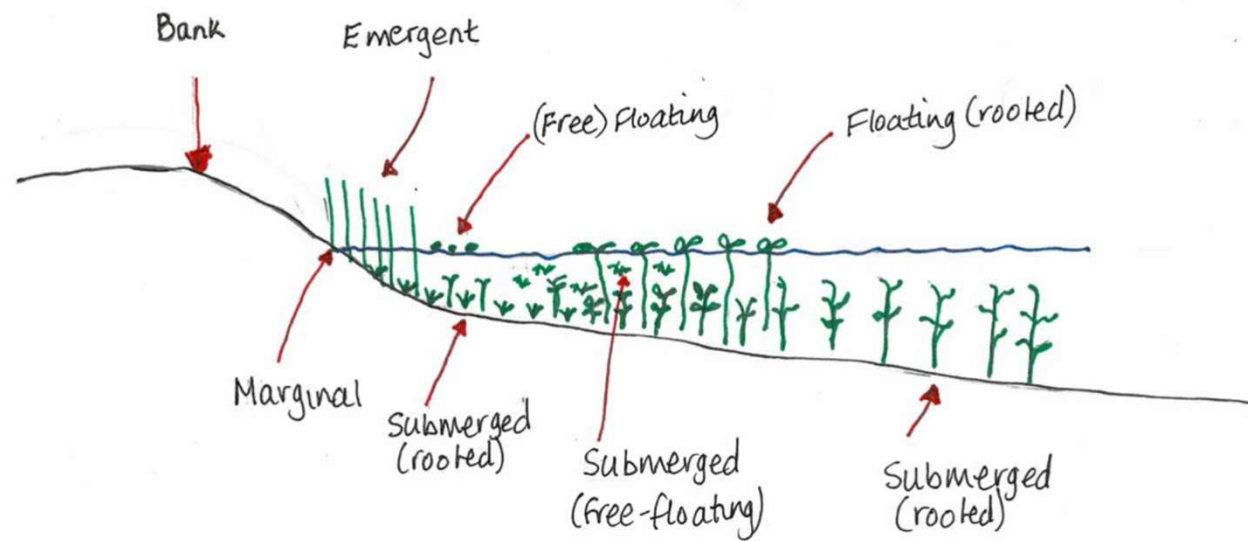
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Habitat Zones/ Growth forms

Marginal / Emergent

Floating

Submerged





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Quiz - Where are the following zones on the photograph? (Tick the correct letter for each zone)



Name the labelled zones:

Emergent

a)

b)

Floating

a)

b)





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Name the labelled
zones:

a) Emergent

b) Floating





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Getting your eye in/ what to look for





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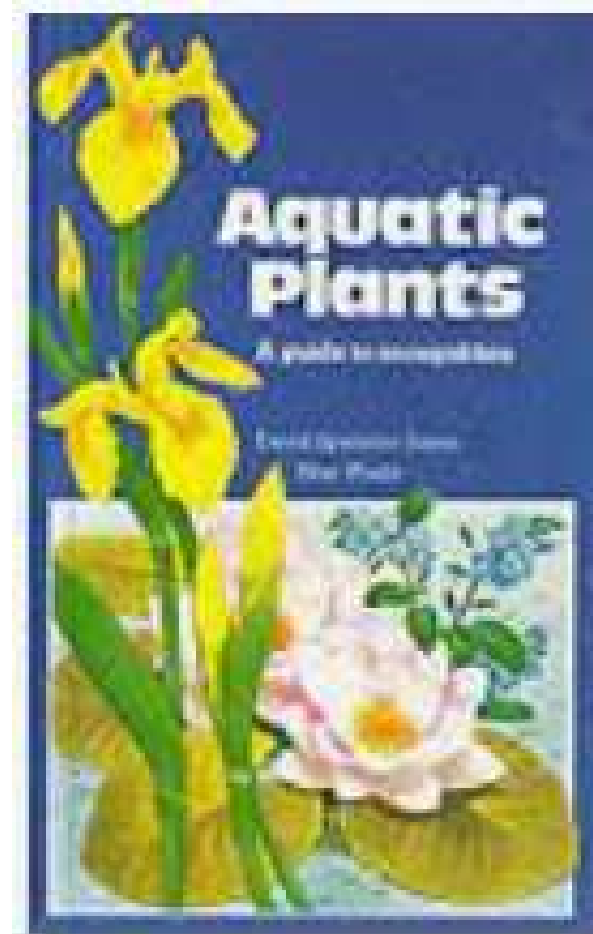
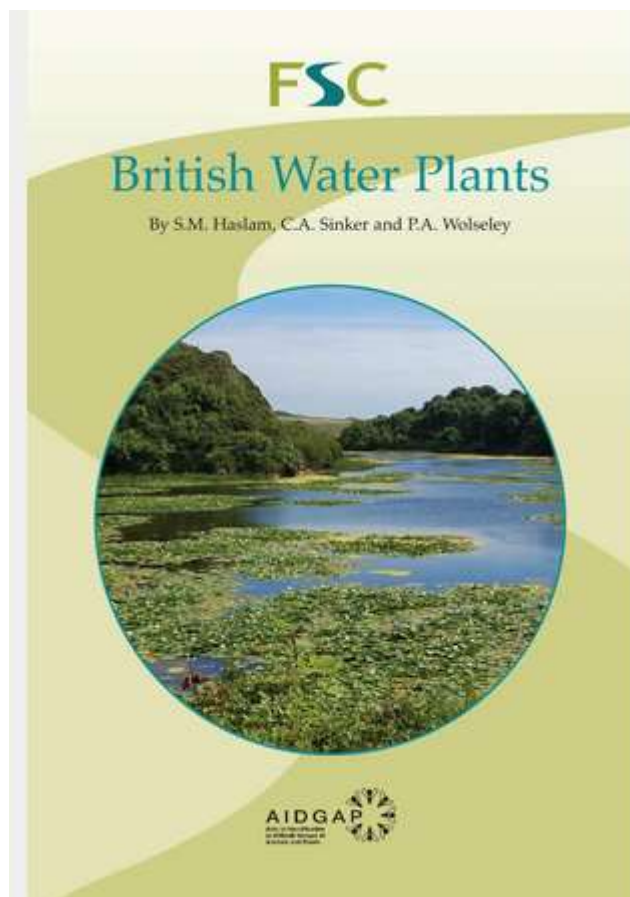
Getting your eye in/ what to look for

Typha latifolia



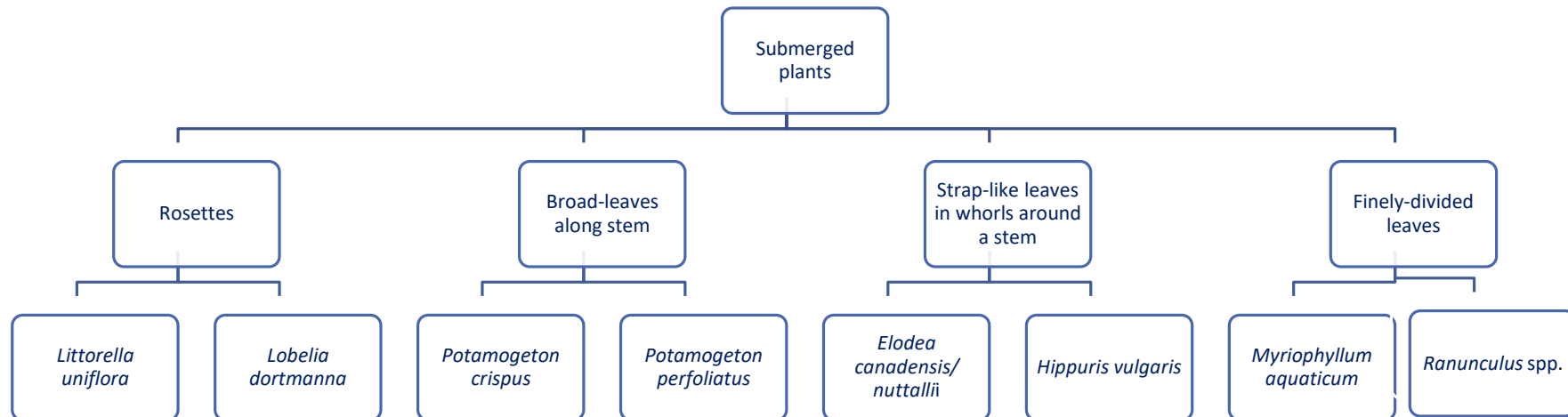


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Rosettes

Littorella uniflora – Shoreweed
(WF/ NRL)



Lobelia dortmanna – Water
Lobelia (NPL)



Not to be mistaken with: *Isoetes* spp., *Subularia aquatica*, *Eriocaulon septangulare*, water plantains





Rosettes

Isoetes lacustris – Quillwort





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Broad-leaves along a stem

Potamogeton crispus – Curled
Pondweed (WF/ NRL/ RS)



Potamogeton pefoliatus – Perfoliate
Pondweed (NPL/ RS)



Not to be mistaken with: other species of *Potamogeton* & *Groenlandia densa*





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Strap-like leaves in whorls

Elodea canadensis – Canadian
Waterweed (WF/ All)



Elodea nuttallii – Nuttall's Waterweed
(WF/ All)



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Not to be confused with: see next slide





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Waterweeds – *Elodea* sp. - not to be confused with:

- *Lagarosiphon major* – Curly Pondweed – leaves in a spiral around the stem



From GBNNSS © RPS Group plc

- Submerged species of *Callitriche* Water Starwort – has leaves in opposite pairs up the stem & notched tips to the leaves
- *Hippuris vulgaris* – Mare's Tail – leaves in whorls of 8 (6 – 12 around stem)

Egeria densa – Large-flowered Pondweed & *Najas flexilis* – Slender Naiad
have very restricted distributions

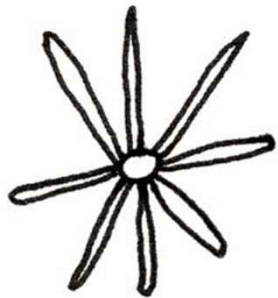




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Strap-like leaves in whorls

Hippuris vulgaris – Mare's Tail (WF/
NPL)





Finely divided leaves

Myriophyllum aquaticum – Parrot's-feather (All)



Native *Myriophyllum*
(*alterniflorum*) – Water Milfoil



Not to be confused with: native species of *Myriophyllum*; *Hippuris vulgaris*;
Hottonia palustris; *Ceratophyllum* spp.



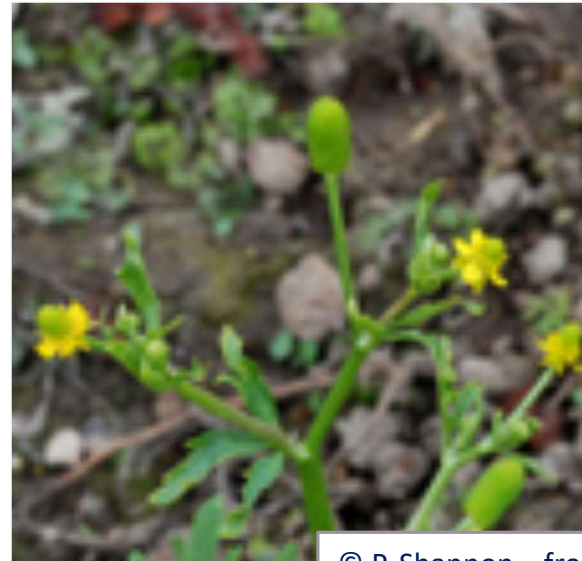


Finely divided leaves

Ranunculus spp. – Water-crowfoot
(NRL/ RS)



Ranunculus sceleratus – Celery-
leaved Buttercup (NPL)



© P. Shannon – from NPMS guide

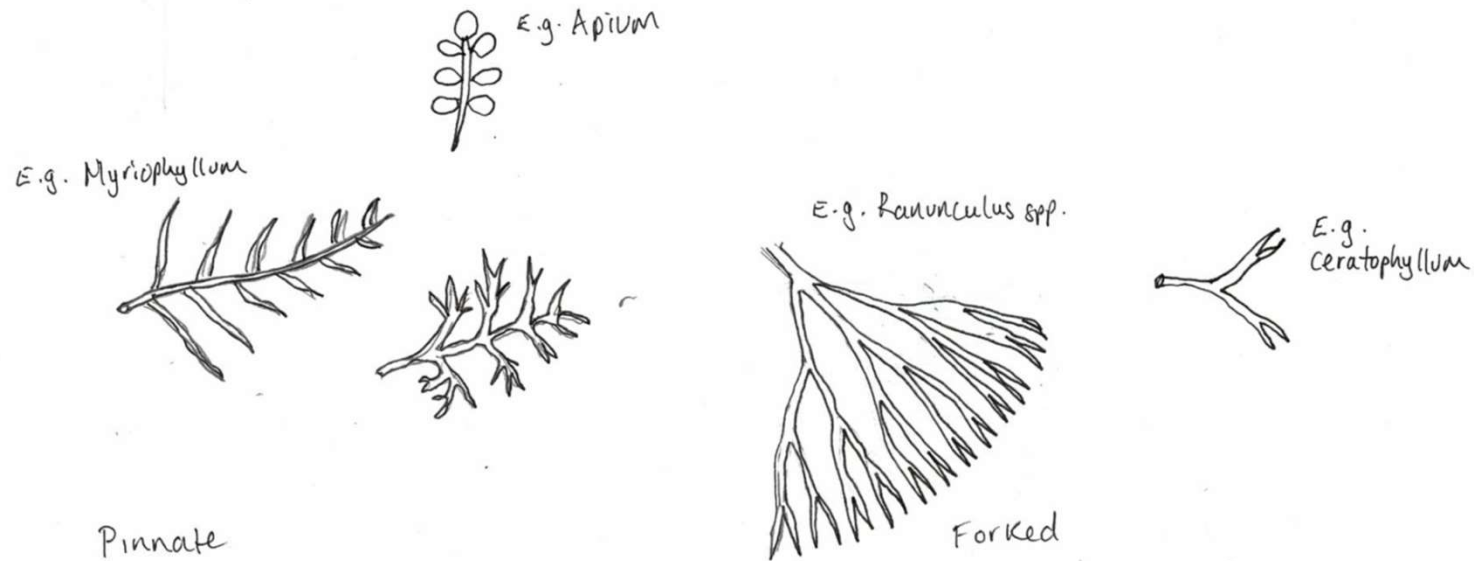
Not to be confused with: *Apium inundatum*, *Ceratophyllum* spp., *Hottonia palustris*, (native) *Myriophyllum* spp., fine-leaved *Potamogeton* spp., *Scirpus fluitans*, *Zannichellia palustris*





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Ranunculus sp. & *Myriophyllum aquaticum* - avoiding confusion





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Quiz:

Name these plants

A:



B:



C:



D:





National Plant Monitoring Scheme

Quiz:

Name these plants

A:



Shoreweed – *Littorella uniflora*

B:



Curled Pondweed – *Potamogeton crispus*

C:



Water Lobelia – *Lobelia dortmanna*

D:

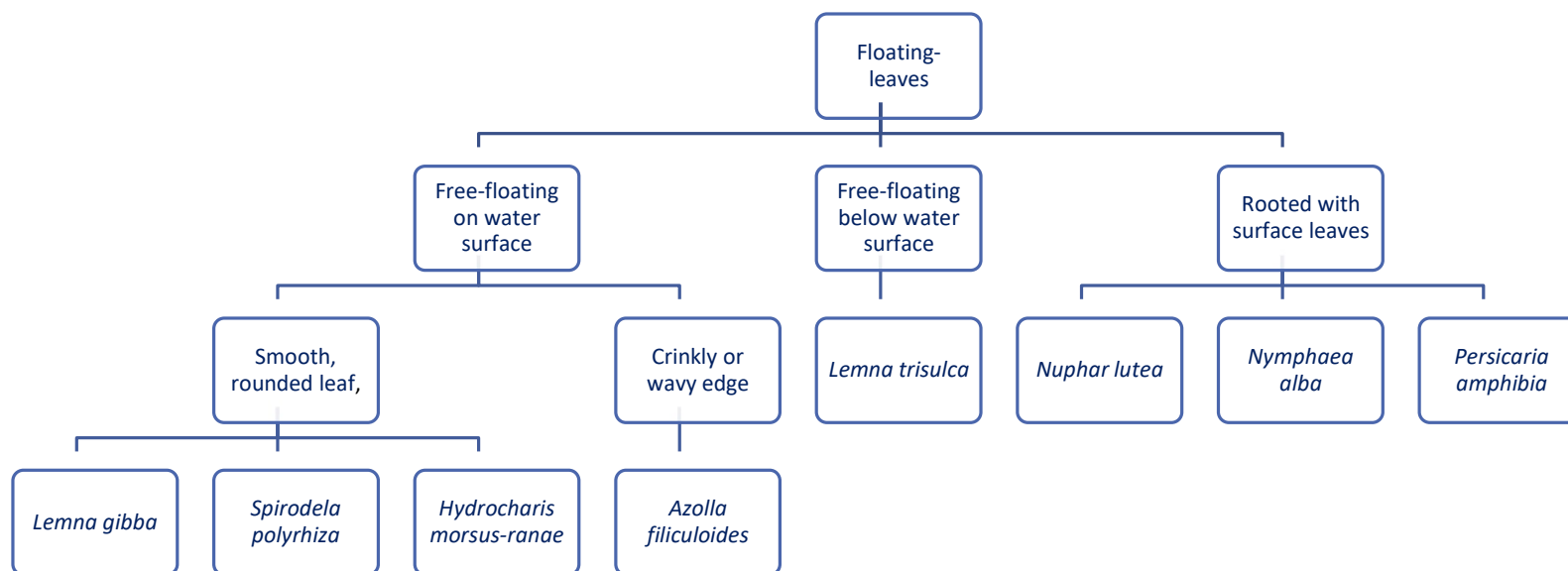


Water-crowfoot – *Ranunculus* sp.





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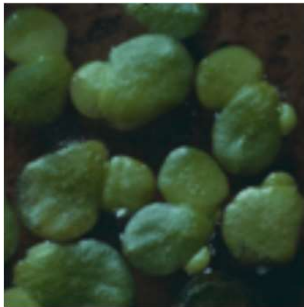




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Free-floating on water surface & rounded leaf

Lemna gibba – Fat Duckweed (All)



© Andrew Gagg from NPMS guide



Spirodela polyrhiza – Greater
Duckweed (All)



© Malcolm Storey 2013

Not to be confused with: other species of duckweed (*L. minor*, *L. minuta*), *Wolffia arrhizal* & *Azolla*





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Free-floating on water surface & rounded leaf

Hydrocharis morsus-ranae –
Frogbit (NRL/ RS)



© Malcolm Storey 2010

Not to be confused with: *Nymphoides peltata*





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Free-floating on water surface & crinkled leaf edge

Azolla filiculoides – Water Fern
(All)

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Not to be confused with: duckweeds (*Lemna* spp)





Free-floating below water surface

Lemna trisulca – Ivy-leaved Duckweed (NPL/ RS)

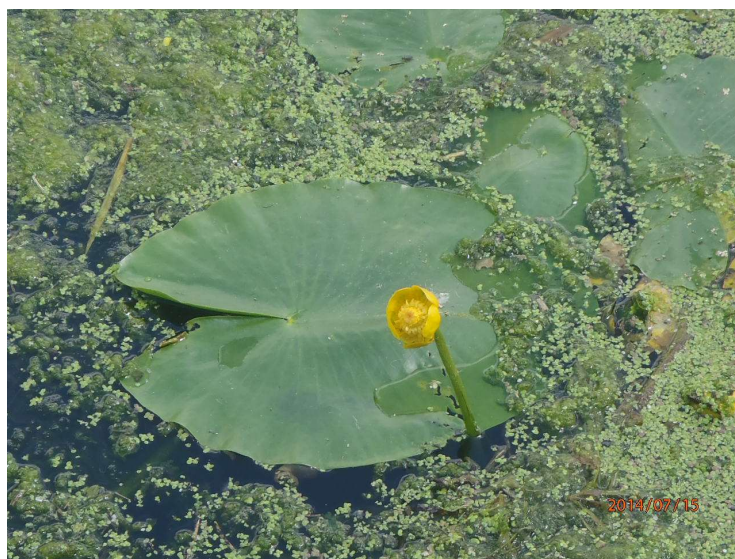




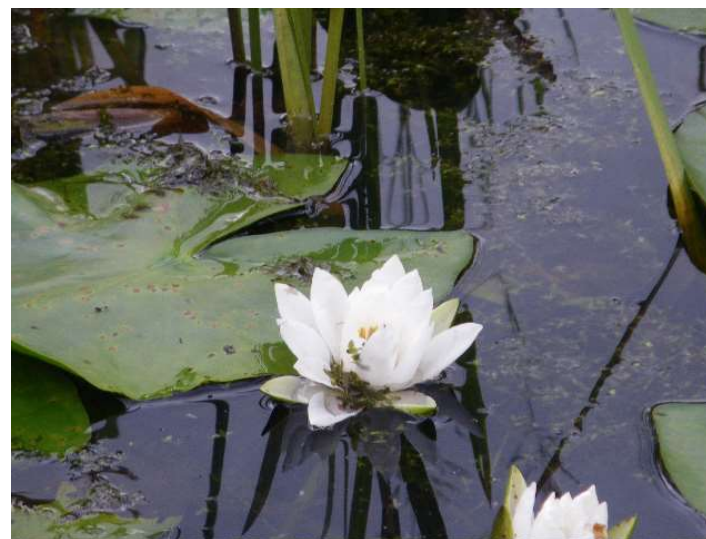
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Rooted with surface leaves

Nuphar lutea – Yellow Water-lily
(All)



Nymphaea alba – White Water-lily
(All)

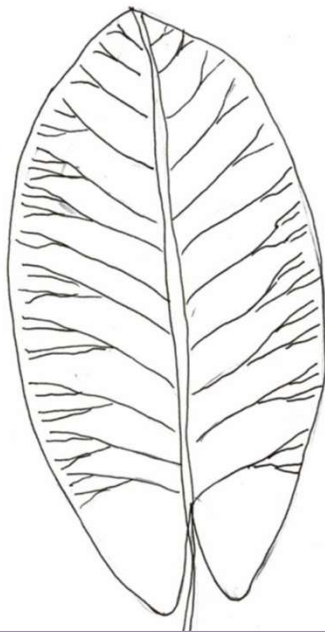


Not to be confused with: other species of water-lily (*N. pumila*, *Nymphoides peltata*,
garden varieties of *N. alba*)

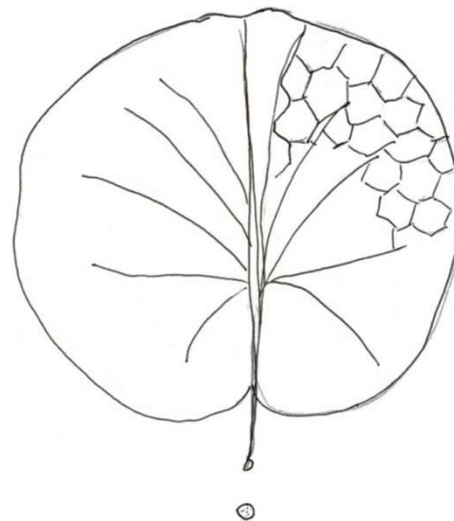




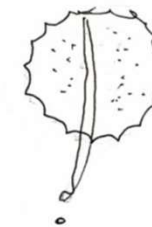
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Nuphar lutea
Oval leaf
Oval/triangular stalk
"tuning fork" veins



Nymphaea alba
Rounded leaf shape
Round, solid stalk
"honeycomb" / crazy paving venation



Nymphoides peltata
Small, rounded, 'wavy' leaves
Round stalk
Spots on underside of leaf





Rooted with surface leaves

Persicaria amphibia – Amphibious
Bistort (NPL/ NRL)



© Malcolm Storey 2000



Not to be confused with: floating leaves of *Potamogeton natans* and other pondweed species





Quiz: Name the species

A:



B:



C:



D:



© Malcolm Storey 2000





Quiz: Name the species

A:

Yellow Water-lily – *Nuphar lutea*



B:

Ivy-leaved Duckweed – *Lemna trisulca*



C:

White Water-lily – *Nymphaea alba*



D:

Amphibious Bistort – *Persicaria amphibia*



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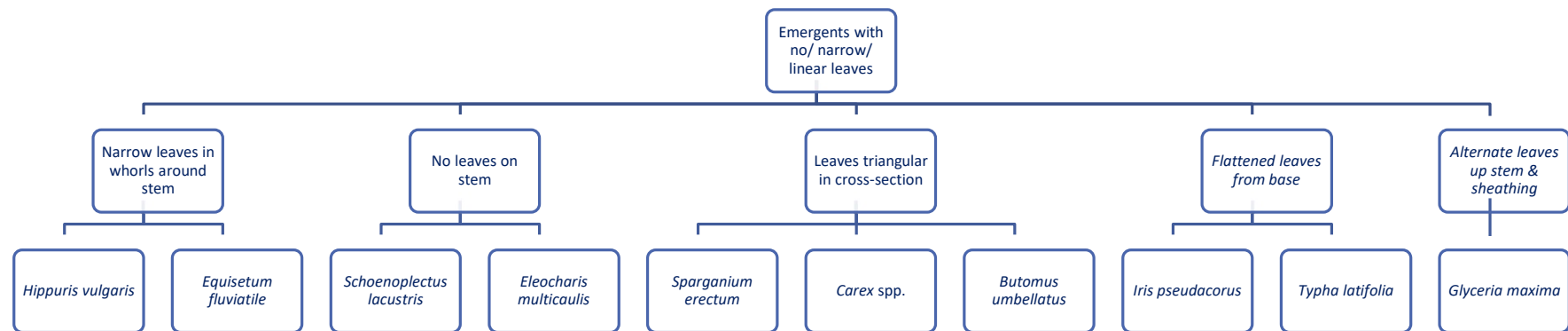


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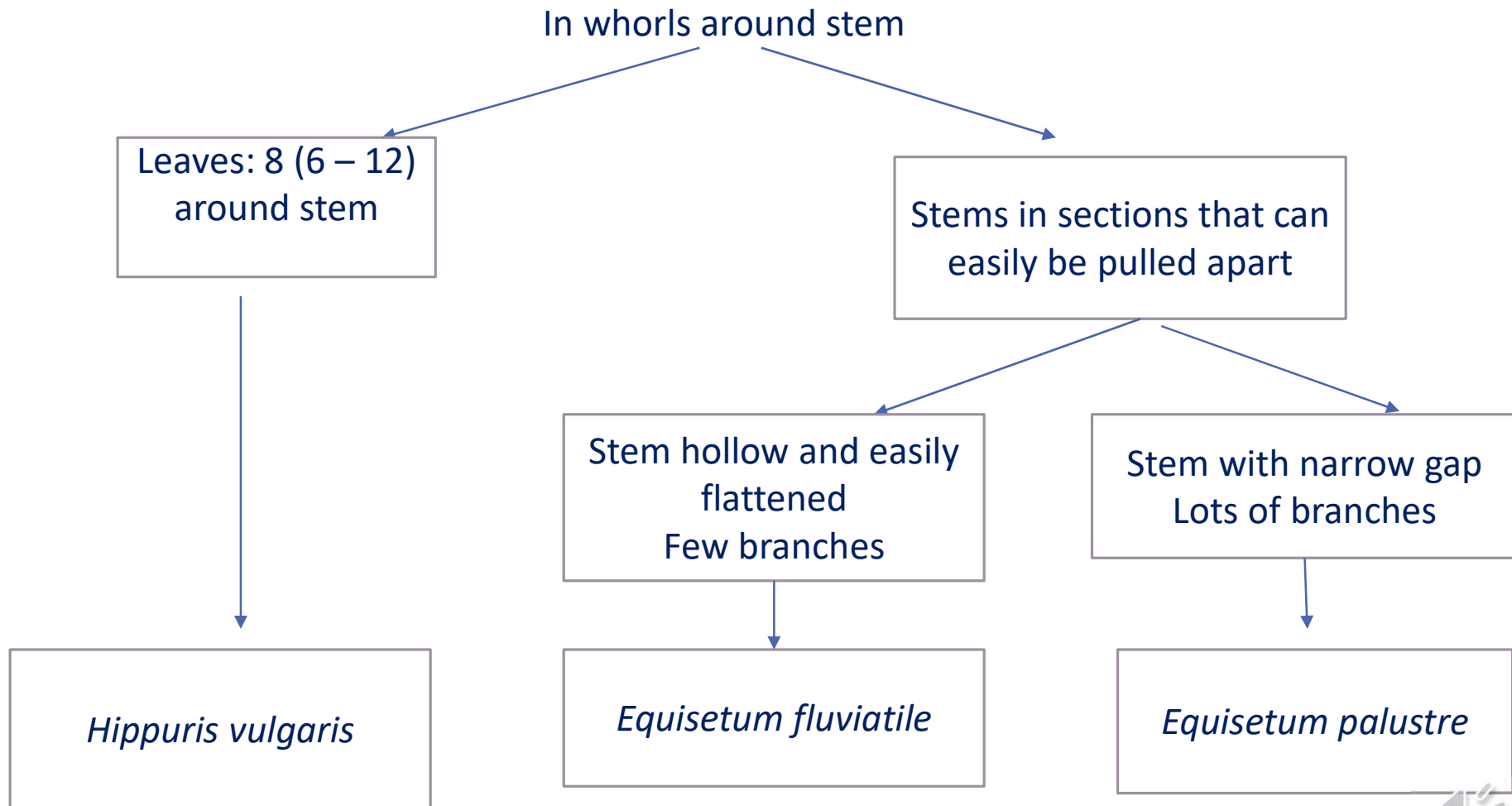
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Emergents with no/ narrow/ linear leaves:





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Emergent: Narrow leaves in whorls around stem

Hippuris vulgaris – Mare's Tail
(NPL)





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Emergent: Narrow leaves in whorls around stem

Equisetum fluviatile – Water
Horsetail (NPL)



Not to be confused with: *Equisetum palustre*

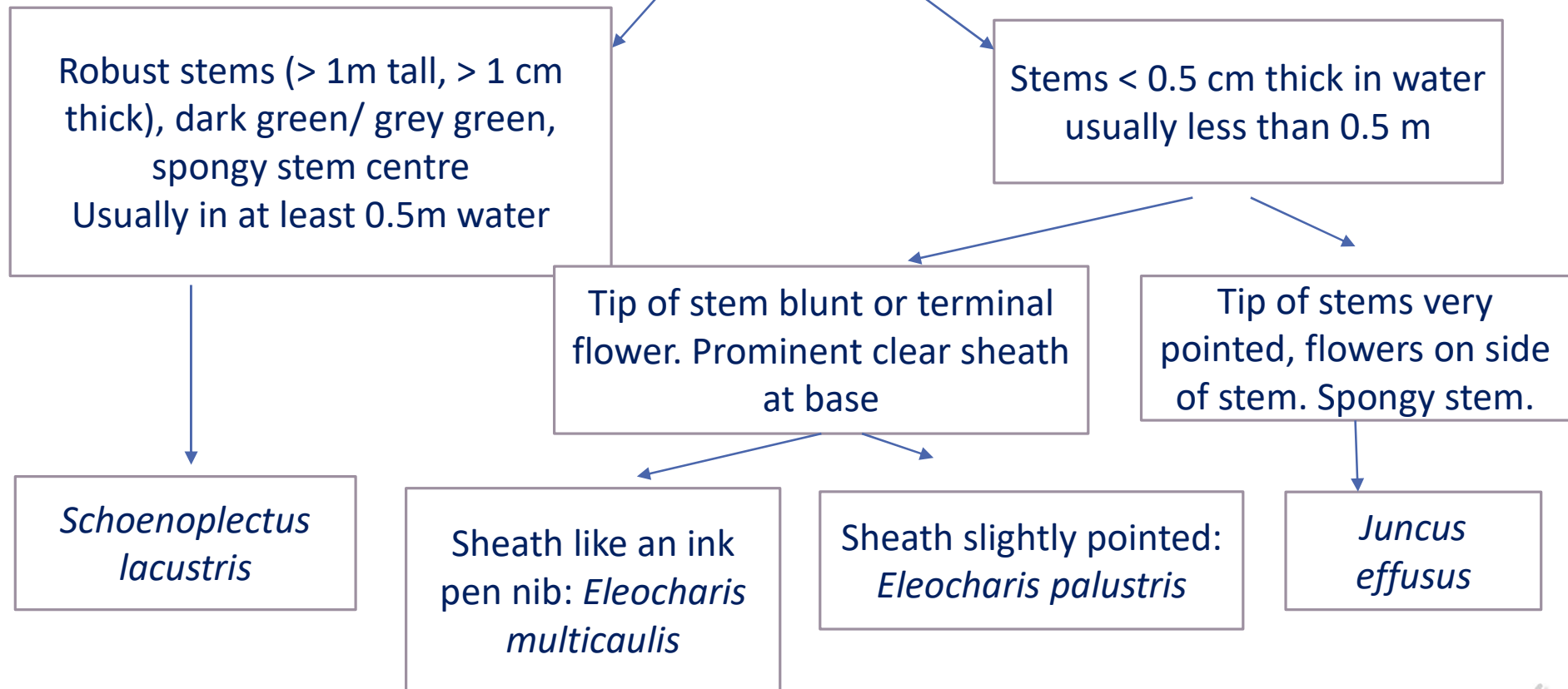




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Emergents with no/ narrow/ linear leaves:

No leaves above water – just an upright green, unbranched stem





Emergent: Bare stem above water

Schoenoplectus lacustris –
Common Club-rush (NPL/ NRL)



Eleocharis multicaulis – Many-
stalked Spike-rush (NPL)



E. palustris



E. multicaulis

Not to be confused with: other species of *Schoenoplectus* and *Eleocharis* (esp. *E. palustris*), *Juncus effusus*

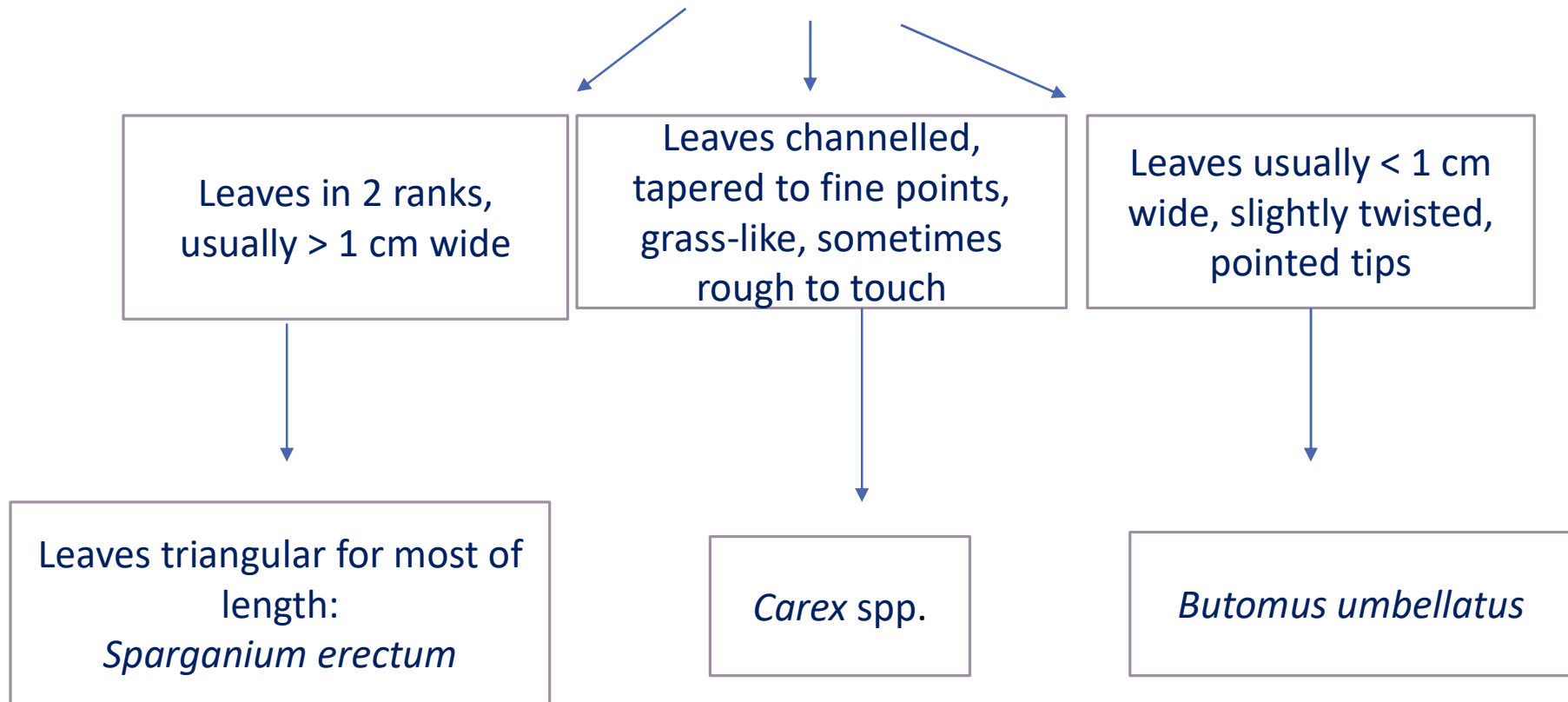




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Emergents with no/ narrow/ linear leaves:

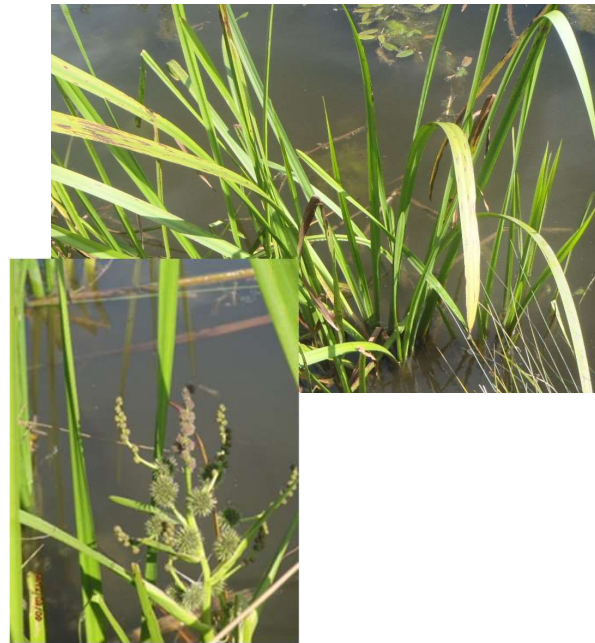
Leaves/ stems triangular in cross section





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Emergent: Leaves/ stems triangular in cross-section



Sparganium erectum –
Branched Bur-reed (NPL/RS)



Carex obtusae - False
Fox-sedge (RS)

Butomus umbellatus –
Flowering Rush (NRL/RS)



Not to be confused with: *Sparganium* can be mistaken for *Typha* or *Glyceria*; *Carex* can be mistaken for grasses – BUT none of these are triangular

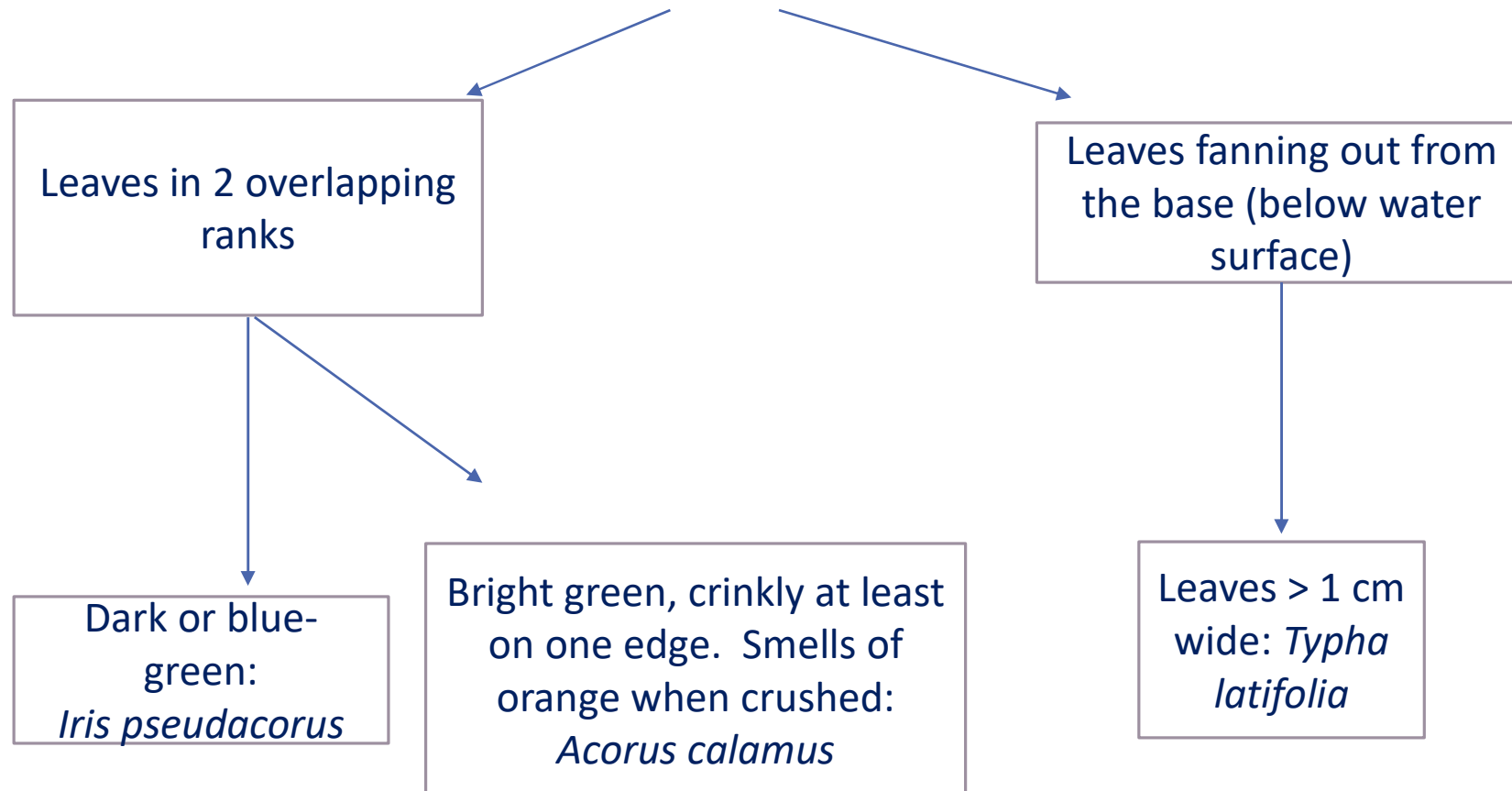




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Emergents with no/ narrow/ linear leaves:

Broad, flattened leaves from base of plant





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Emergent: Flattened leaves from base of stem



Iris pseudacorus - Yellow
Iris (NPL)



Typha latifolia - Bulrush/
Common Reedmace (NRL/
RS)



Not to be confused with: *Iris* can be mistaken for *Acorus* or *Glyceria*; *Typha* can be mistaken for *Sparganium*





Emergent: alternate leaves/ sheathing



Glyceria maxima – Reed Sweet-grass (All)



Not to be mistaken for: *Sparganium*; other grasses esp. *Phragmites australis* & *Phalaris arundinacea*





Emergent: alternate leaves/ sheathing

Phragmites australis - Common reed



Leaves facing same direction

Phalaris arundinacea - Reed canary grass

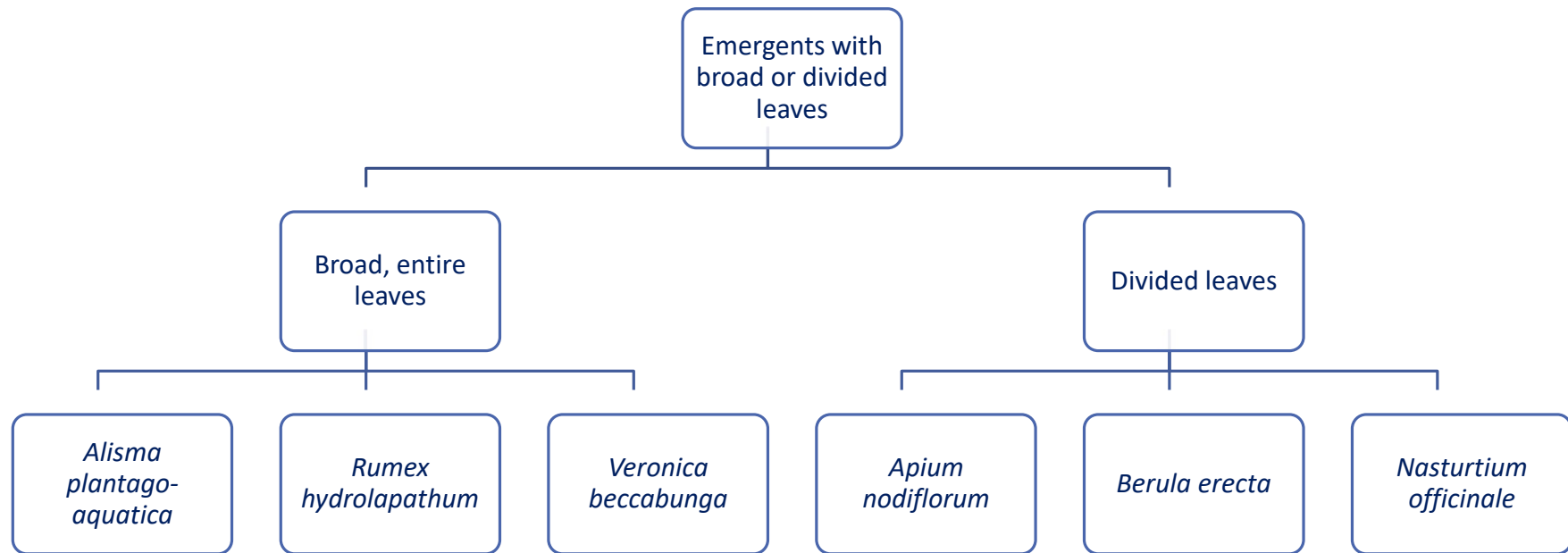


Membranous ligule





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Marginal & Emergent: Broad entire leaves

Alisma plantago-aquatica – Water-plantain (NPL/ NRL)



Rumex hydrolapathum –Water Dock (RS)



Not to be confused with: *Alisma* - there are other species of *Alisma*





Marginal & Emergent: Broad entire leaves

Veronica beccabunga – Brooklime (NRL)



© Malcolm Storey

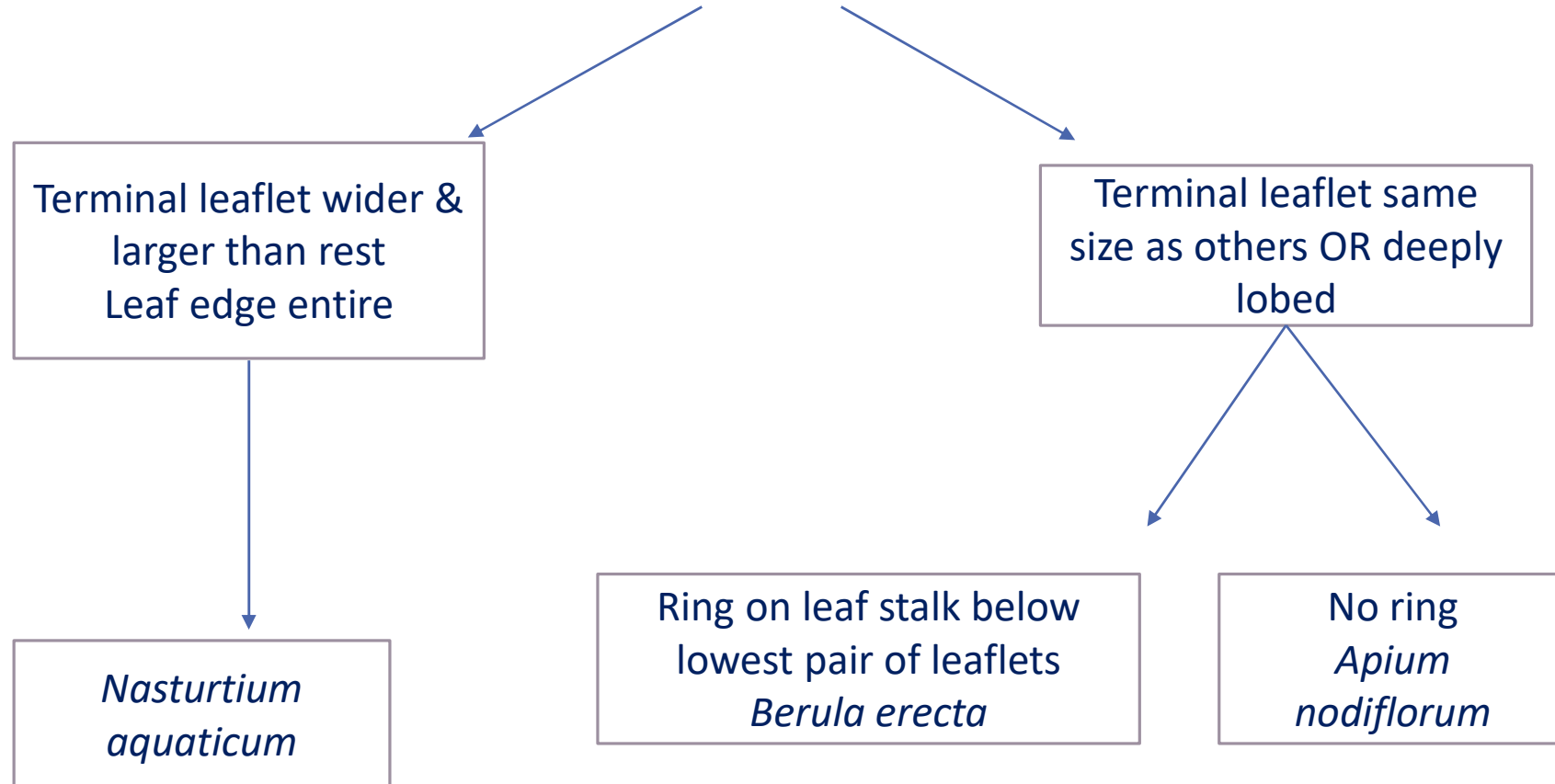




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Emergent Broad or divided leaves:

Leaves divided into sections or lobes





Marginal & Emergent: Divided leaves

Berula erecta – Lesser Water-
parsnip (RS)



Apium nodiflorum – Fool's Water-
cress (RS)



© Malcolm Storey 2008

Not to be confused with: each other; *Oenanthe* spp.





Marginal & Emergent: Divided leaves

Nasturtium officinale – Water-cress (RS)





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Quiz: Name the plants

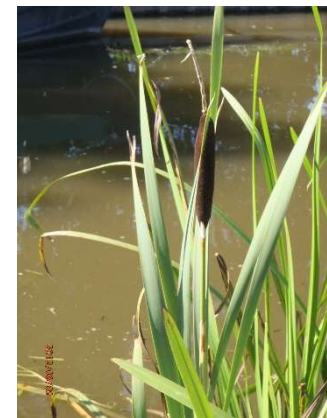
A:



B:



C:



D:



E:



F:





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Quiz: Name the plants

A:

Flowering Rush – *Butomus umbellatus*



B:

Reed Sweet-grass – *Glyceria maxima*



Bulrush – *Typha latifolia*

C:



D:



Water Horsetail – *Equisetum fluviatile*

E:



Mare's Tail – *Hippuris vulgaris*

F:



Branched Bur-reed – *Sparganium erectum*





Negative indicators:



Crassula helmsii – New Zealand
Pygmyweed

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Glyceria maxima –
Reed Sweet-grass



Myriophyllum aquaticum –
Parrot's-feather

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Azolla filiculoides -

Water Fern © Crown
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*Elodea
canadensis/
nuttallii* -
Canadian/
Nuttall's
Waterweed

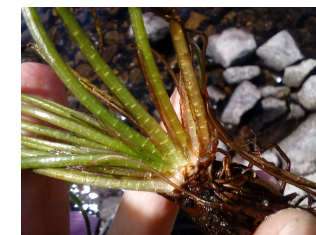
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Quiz: Name the species and likely fine habitat



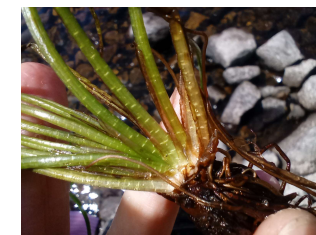
Other typical species: small rosette species including *Isoetes*, *Utricularia* spp.
Menyanthes trifoliata, *Comarum (Potentilla) palustris*





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Nutrient-poor standing water



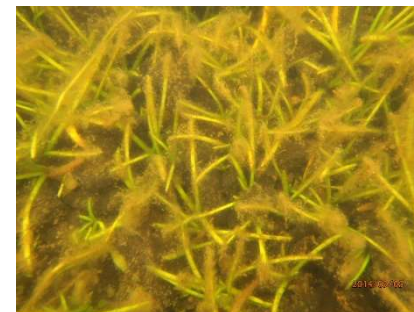
Other typical species: small rosette species including *Isoetes*, *Utricularia* spp.
Menyanthes trifoliata, *Comarum (Potentilla) palustris*





National Plant Monitoring Scheme

Quiz: Name the species and likely fine habitat



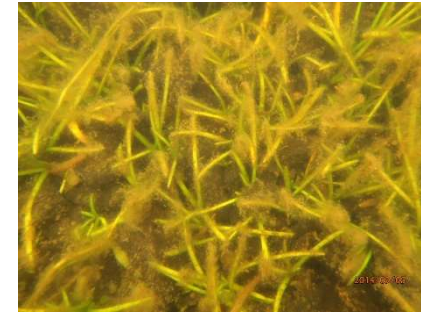
Other typical species: pondweeds, water-milfoils





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Nutrient-rich standing water



Other typical species: pondweeds, water-milfoils





National Plant Monitoring Scheme

Quiz: Name the species and likely fine habitat



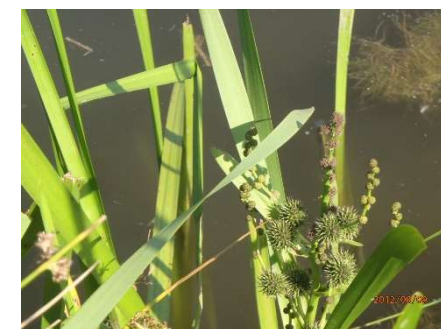
Other typical species: *Persicaria amphibia*, duckweeds, pondweeds, water-cress





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Running water



Other typical species: *Persicaria amphibia*, duckweeds, pondweeds, water-cress



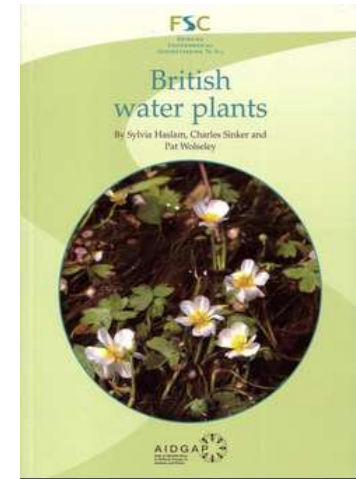


National Plant Monitoring Scheme

Guides and sources of information:

Haslam, S. M., Sinker, C. A. & Wolseley, P. A. 1975. British Water Plants. *Studies* 4 243-351 reprinted 1982 with minor revisions.

<https://www.nhbs.com/british-water-plants-book>



Lake Habitat Survey in the United Kingdom Field Survey Guidance Manual version 3.1 May 2006.

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjD0saqq9jvAhXCnVwKHRjUCNQQFjAAegQIAhAD&url=https%3A%2F%2Farchive.epa.gov%2Fnheerl%2Farm%2Fweb%2Fpdf%2Fwfd42_fieldguide.pdf&usg=AOvVaw2bl1SuykA4YMWsnNhOr3pC





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Guides and sources of information:

A Field Guide to the Riverine Plants of Britain and Ireland – R. V. Lansdown

<https://www.ardeola-environmental.com/macrophyte-other-wetland-dependent-plant-surveys>



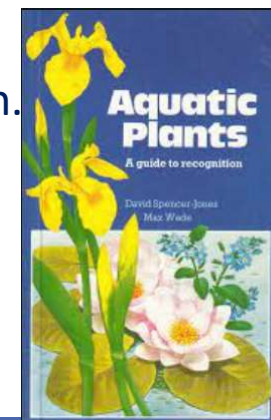


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Guides and sources of information:

Species Action Framework. Invasive non-native plants associated with fresh waters. (Copy and paste the following into your browser to find the document)
<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiq96z5q9jvAhVUVsAKHfLzCKcQFjANegQIDBAD&url=https%3A%2F%2Fwww.nature.scot%2Fsites%2Fdefault%2Ffiles%2F2018-01%2FSpecies%2520Action%2520Framework%2520-%2520Invasive%2520non-native%2520plants%2520associated%2520with%2520fresh%2520waters%2520-%2520A%2520guide%2520to%2520their%2520identification%2520-%2520training%2520manual.pdf&usg=AOvVaw0EyjwlrJTnliQhqM-hEbJy>

Spencer-Jones, D & Wade, M. 1986. Aquatic Plants – A guide to recognition.
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Rich, T. C. G & Rich, M. D. B. 1988. Plant Crib. BSBI

Wigginton, M. J. & Graham, G. G. 1981. Guide to the identification of some of the more difficult vascular plant species. NCC

BSBI handbooks

