

METHOD (complete one survey form per pond)

Aims: To find out if Pennyroyal is i) present in the pond, ii) get an approximate idea of its location and abundance in the pond, iii) collect physical data about the pond that can be used to assess the reasons for any change recorded on future visits, and iv) look in any adjacent ponds to see if Pennyroyal is present or absent.

Pennyroyal is a very rare perennial plant with a native distribution limited to just a handful of sites in Cornwall, the New Forest and a single site in Wales. Other newly established populations are likely to be the hardier cultivar of this species introduced from North America. This methodology has been developed primarily to monitor Pennyroyal populations on Flagship Pond sites <https://freshwaterhabitats.org.uk/projects/flagship>.

- **Equipment:** It's helpful to take a camera to take confirmatory photos of Pennyroyal, to take photos of your survey pond for the record, and to take a photograph of your sketch maps if you don't have access to a scanner – alternatively you can post your survey forms to Freshwater Habitats Trust.
- **Survey timing:** Pennyroyal is best surveyed during July to October when water levels are at their lowest.
- **Where to look:** Pennyroyal grows in shallow water and on bare ground at the edge of temporary pools which dry up in the summer. Pennyroyal prefers areas which are hard grazed by livestock, so any trackway pools or pools within grazed commons could provide suitable habitat. Plant associates include Chamomile *Chamaemelum nobile*, Marsh Cudweed *Gnaphalium uliginosum*, Water-purslane *Lythrum portula* and Lesser Spearwort *Ranunculus flammula*.
- **Survey the pond:** If Pennyroyal plants are found in the pond, count the total number of plants per pond. If there are more than 200+ plants you may want to make an estimate of the number of plants present, and record the results as an abundance category (over page). The best approach is to count the plants in a small area (e.g. 10 cm² or 1 m²), and multiply this by the area in which Pennyroyal plants are found. If Pennyroyal occurs in different densities in different parts of the pond, make separate calculations for each area, and add them to give a total (see table over page). Note: we only need the overall total for the pond.
- **Mark the location of plants:** Print a map to show the location of Pennyroyal plants within the pond. This may help you and others in the future to search the same area. Remember to fill out the pond habitat survey form for each pond surveyed.
- **Record absence:** If Pennyroyal is not found at the pond, please record this, and continue to fill out the environmental sheet. The findings will help identify reasons for the plant's absence from the pond.
- **Check other ponds and pools in the surrounds:** Finding out if Pennyroyal occurs in other nearby ponds helps us to understand the species as part of a larger population. We would like you to visit as many ponds as possible on the site each year to monitor population change.
- **Mark the location of ponds:** It will be helpful to revisit all surveyed ponds in future years. So, to ensure they can be found again by yourself or others please (a) provide an accurate grid reference and/or mark the locations on your PondNet base map, or (b) sketch a map of location of ponds, and (c) take photos.

Enter your results: Once completed, enter your results online: www.freshwaterhabitats.org.uk/projects/waternet, or email your recording forms and maps to Freshwater Habitats Trust and we can enter the data for you: info@freshwaterhabitats.org.uk.



What it looks like: Pennyroyal is one of the smallest members of the mint family, growing to just 30cm in height. The flowering stems grow upright and produce dense whorls of small lilac flowers at each pair of stem leaves (a). Water mint *Mentha aquatica*, which may be found in the same habitat, produces terminal flower heads at the tip of the flower stalk (b).



Pennyroyal spreads via overground runners, and as such, many populations rarely flower. The leaves can be distinguished from other mint species by the absence of marginal teeth (c), whereas the teeth on Water Mint leaves are visible to the naked eye (d).



Pennyroyal: (a) Erect flowering stem of Pennyroyal © [Mark Gurney \(CC BY-NC-SA 2.0\)](#), (b) Terminal flowers of Water Mint © [Jörg Hempel \(CC BY-NC-SA 2.0\)](#), (c) Pennyroyal leaves growing in it's typical environment of damp, short-grazed turf © [Hannah Shaw](#), and (d) Toothed leaves of Water Mint © [Derek Harper \(CC BY-NC-SA 2.0\)](#).

Your name	<input style="width:95%;" type="text"/>	Date	<input style="width:95%;" type="text"/>
Square: 4 figure grid ref e.g. SP1243 (see your map)	<input style="width:95%;" type="text"/>	Pond: 8 figure grid ref e.g. SP 1235 4325 (see your map)	<input style="width:95%;" type="text"/>
Pond name (if known)	<input style="width:95%;" type="text"/>		
Determiner name (<i>optional</i> - if someone confirms the identity of the species you've recorded)	<input style="width:95%;" type="text"/>	Voucher material (<i>optional</i> - comment if you've taken a photo to confirm identification)	<input style="width:95%;" type="text"/>

If you find Pennyroyal please take a confirmatory photo. You can also take a photo of your pond or your maps (or scan them if you have a scanner) and upload them with the record www.freshwaterhabitats.org.uk/projects/waternet.

Number of Pennyroyal in your pond

If there are many plants, count the number in a small area (i.e. 1m²) and multiply up. We've put a table below to help you keep track and make notes, but for the analysis **we only need a total**.

Areas where Pennyroyal was found (list): use this table to help with your number calculations, and so you/others can re-find plants on future visits.	Number of individuals
1.	<input style="width:95%;" type="text"/>
2.	<input style="width:95%;" type="text"/>
3.	<input style="width:95%;" type="text"/>
4.	<input style="width:95%;" type="text"/>
5.	<input style="width:95%;" type="text"/>

Total number of Pennyroyal (total count)

Provide a single total for the whole pond based on an actual or estimated number of plants recorded

Total number of Pennyroyal (abundance category)

Then record the number of Pennyroyal found in the pond using the following abundance categories:
1, 2-5, 6-10, 11-20, 21-50, 51-100, 101-200, 201-500, 501-1000, 1001-5000, 5001-10000, 10001-20000, 20001+

Pennyroyal looked for, but not found

Note: if you don't find evidence of Pennyroyal at the pond, this is an important result so please still enter these findings online (tick box if none found)

Area of bare ground

% of the whole pond where bare ground has been created by disturbance from people/livestock should include both wet and dry areas of the pond

 %

Pond sketch map: Make a sketch map of your pond and draw on the location of Pennyroyal: use shading if they cover a broad area, or 'x' marks the spot if there are just a few plants.

Location map: Use this box to show the location of the pond and surrounding ponds you searched (or mark the information on the base map included in your site information pack).

Please complete a POND HABITAT SURVEY sheet at each pond surveyed.

This is a really important part of the survey at your pond. Please complete this form whether Pennyroyal is present or absent. Each variable provides information known to be linked to pond quality and community type, and can be used to investigate reasons for change in Pennyroyal occurrence. If you are surveying non-pond habitat – complete all variables that apply.

Go to: www.freshwaterhabitats.org.uk/projects/pondnet/survey-options/habitats for survey guides and more information.

Is the pond new? (less than 10 yrs old) yes, no, unknown	<input type="text"/>	Year of creation? date, decade, unknown	<input type="text"/>	Pond Altitude (m)	<input type="text"/>
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Area m² **Note:** This is the *surface area of the pond when the water is at its highest level (usually in early spring)*. It will probably *not* be the current water level of the pond. The high water level line should be evident from wetland vegetation like rushes at the pond's outer edge. Measure by pacing (single pace = 0.8-1m) or use online maps.

Pond dries? **1 = Never dries, 2 = Rarely dries:** no more than two years in any ten year period, or only in drought, **3 = Sometimes dries:** dries between three years in ten to most years, **4 = Dries annually.** Deduce pond permanence from local knowledge (e.g. landowner) and personal judgement e.g. water level at the time of the survey. Ponds that dry out annually usually have a hard base.

1 = never dries
2 = rarely dries
3 = sometimes
4 = annually

Overhanging trees & shrubs % of pond overhung by trees and shrubs
 % pond margin overhung to at least 1m from the pond margin

This is an estimate of how much of the pond is *directly* overhung by trees and shrubs, i.e. that would be shaded if the sun was overhead (use the diagram (below) as a guide).

Waterfowl impact **Major** = severe impact of waterfowl e.g. few or no submerged plants, water turbid, pond banks have patches where vegetation removed, feed put down; **Minor** = waterfowl present, but little impact on pond vegetation, pond still supports submerged plants and banks are not denuded of vegetation; **None** = no evidence of waterfowl impact (moorhens may be present).

1 = major
2 = minor
3 = none

Fish presence **Major** = dense populations of fish known to be present; **Minor** = small numbers of Crucian Carp, goldfish or stickleback known to be present; **Possible** = no evidence of fish, but local conditions suggest that they may be present; **Absent** = no records of fish stocking and no fish revealed during survey.

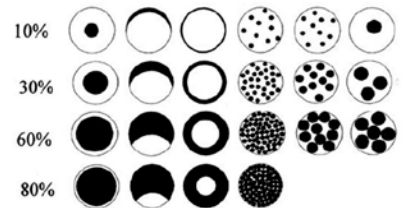
1 = major
2 = minor
3 = possible
4 = absent

Disturbance by dogs **Major** = dogs repeatedly use the pond, compacted edges with little vegetation, water very turbid; **Minor** = dogs use the pond, but little impact on pond vegetation, pond still supports submerged plants and banks are not denuded of vegetation; **None** = no evidence that dogs are using the pond.

1 = major
2 = minor
3 = none

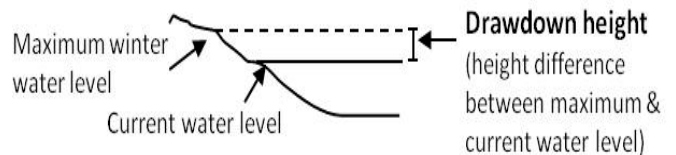
Aquatic vegetation: includes emergent, floating and submerged plants
 % of the whole pond (wet and dry) occupied by emergent vegetation – incl. plants like grasses, water mint and rushes, but not floating (e.g. pondweed) or submerged (e.g. water-crowfoot) species.

% of pond water surface area covered by all vegetation (emergent, floating (excl. duckweed) and submerged).



Water left in the pond % of water area in pond relative to maximum water level. This can be 0% if the pond has dried out.

cm Drawdown. The height drop from the maximum winter water level to current level (see diagram).



Grazing Tick if there is evidence the pond is grazed by livestock. If **yes**, complete the following boxes:
 % % of whole pond grazed (note: stock can wade into shallow ponds to graze).
 % % of pond perimeter grazed (note: stock can wade into shallow ponds to graze otherwise inaccessible edges).
 Grazing intensity: rank 1-5 (1=infrequent or low intensity to 5 = margins heavily poached and almost bare).

Pond management (tick): use tick boxes to list management within the last 12 months. Use 'other' box for any extra info.

<input type="checkbox"/> Fully dredged	<input type="checkbox"/> Partly dredged	<input type="checkbox"/> >5% vegetation removed	<input type="checkbox"/> <5% vegetation removed
<input type="checkbox"/> Trees planted	<input type="checkbox"/> Trees clear-felled	<input type="checkbox"/> Trees cut back / coppiced	<input type="checkbox"/> Pond changed shape / size
<input type="checkbox"/> Plants introduced	<input type="checkbox"/> Bank plants mown	<input type="checkbox"/> Structural work e.g. to dam	<input type="checkbox"/> Straw added

Add other or more detail

Water quality:

Turbidity / water clarity: Estimate turbidity looking down into c.20cm depth of water in the pond.

1 = clear; 2 = moderately clear; 3 = moderately turbid; 4 = turbid

Inflows and outflows: (tick if inflow or outflow present or leave blank)

Inflow present Outflow present

Water chemistry: If suitable kits and meters are available (or leave blank)

pH Conductivity ($\mu\text{S cm}^{-1}$)

Nitrate (NO_3^- -N ppm): PPW kits provided by FHT (tick one from the following range categories)

Phosphate (PO_4^{3-} -P ppm): PPW kits provided by FHT (tick one from the following range categories)

<0.2	0.2-0.5	0.5-1	1-2	2-5	5-10	10 +	<0.02	0.02-0.05	0.05-0.1	0.1-0.2	0.2-0.5	0.5-1	1 +
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Pond base: This refers to the *geology* (i.e. rock-type) that immediately underlies the pond. You may know, or be able to see the underlying geology in the base or banks of the pond, especially in new ponds. If not, check a geology map or leave this section blank. Choose one of the following to categorise the % composition of **each** of pond base: 1= 0-32%, 2= 33-66%, 3= 67-100%

Silt/ clay Sand, gravel, cobbles Hard rock Peat Other (please specify)

Surrounding land use: Estimate the *percentage* of surrounding land-use in distance zones from the pond perimeter (i.e. the maximum winter water level) used to assess pond area. In many ponds the 0-5m zone will include surrounding trees/scrub.

Habitat	0-5m	0-100m	Examples
Trees, woodland & scrub	%	%	Deciduous and coniferous woodland, individual trees, scrub and hedgerows.
Heath & moorland			Lowland and upland heathland, moorland and mountain; includes bracken.
Rank vegetation			Unmanaged grass, neglected and abandoned land, set-aside, verges and buffer strips.
Unimproved grassland			Herb-rich, calcareous and acid grassland (good quality plant indicators usually present). Low percentage of agricultural grasses. Not fertilised, little or no drainage.
Semi-improved grassland			A transition category. Grasslands modified by fertilisers, drainage, herbicides or intensive grazing, but retaining elements of natural grassland types in the area.
Improved grassland			Fertile agricultural grass, often bright green and lush; including parks and golf greens.
Arable			All crops. Includes flower and fruit crops (e.g. strawberries) and ploughed land.
Urban buildings & gardens			Areas in curtilage (associated with buildings); including glass-houses and farm yards.
Roads, tracks & paths			Including car-parks and footpaths.
Rock, stone & gravel			Cliffs, rock-outcrops, gravel-pits, quarries, areas of sand and gravel or stone.
Bog, fen, marsh & flush			Wetland vegetation and blanket bog.
Ponds & lakes			Permanent and seasonal waterbodies; including trackway pools.
Streams & ditches			Rivers, streams, ditches, springs and canals.
Other (state)			E.g. maritime vegetation, saltmarsh, sand-dune, orchards and railways.

Is the pond in a protected area? (e.g. nature reserve, SSSI, etc.) (choose one option - yes, no, unknown)

New Zealand Pigmyweed *Crassula helmsii*: This non-native weed may have an impact on this species.

% of drawdown zone occupied by New Zealand Pigmyweed

Identification of New Zealand Pigmyweed:

- Can be submerged, emergent and terrestrial.
- Forms dense mats below and above the water surface.
- The flowers it has, if any at all, are very small (less than 1cm) whitish-green to slightly pink with 4 petals.
- Leaves are up to 2cm long in opposite pairs - fleshy for emergent plants, but flatter for submerged parts of the plant.
- Similar species (such as the Water-starworts) do not have fleshy leaves. Water-starworts also have a notch at the leaf tip which is absent in New Zealand Pigmyweed.



Other invasive non-native species:

(tick all that apply)

- | | | |
|--|---|---|
| <input type="checkbox"/> Parrot's Feather
<i>Myriophyllum aquaticum</i> | <input type="checkbox"/> Floating Pennywort
<i>Hydrocotyle ranunculoides</i> | <input type="checkbox"/> Non-native Pondweed, e.g.:
Canadian Pondweed <i>Elodea canadensis</i> ,
Nuttall's Pondweed <i>Elodea nutallii</i> ,
Curly Waterweed <i>Lagarosiphon major</i> |
| <input type="checkbox"/> Water Fern
<i>Azolla filiculoides</i> | | |

How much of pond perimeter could be surveyed? Note areas of pond not accessible.

Comments box: e.g. new ownership, changes since previous visit, any other information about the pond or survey species.