National Trust

Freshwater Habitats Trust

Monitoring Ornamental Lakes with the National Trust

Freshwater Habitats Trust

Our aim: To protect freshwater life.

- We are an evidence-based conservation charity, with a strong science grounding.
- We are highly strategic – we target our work where evidence suggests it will be most effective.
- We are concerned with all freshwaters including those that are small and undervalued like headwater streams, ponds, flushes and ditches.
- We work in partnership with people, communities and organisations to get the best results for freshwater wildlife.

Important Freshwater Areas – Some of the most important areas for freshwater biodiversity in the UK.

Monitoring Freshwater with the National Trust

The Government's 25 Year Environment Plan sets out action to help the natural world regain and retain good health.

- The National Trust's own strategy outlines their ambition to play a part in achieving the plan.
- It's critical to provide evidence so that we can monitor impact.
- Freshwater Habitats Trust have developed a monitoring strategy for NT freshwater habitats:
  - To provide a baseline
  - To identify the best sites
  - To take stock and monitor change

A 25 year plan for Nature

Conservation value of Ornamental Lakes

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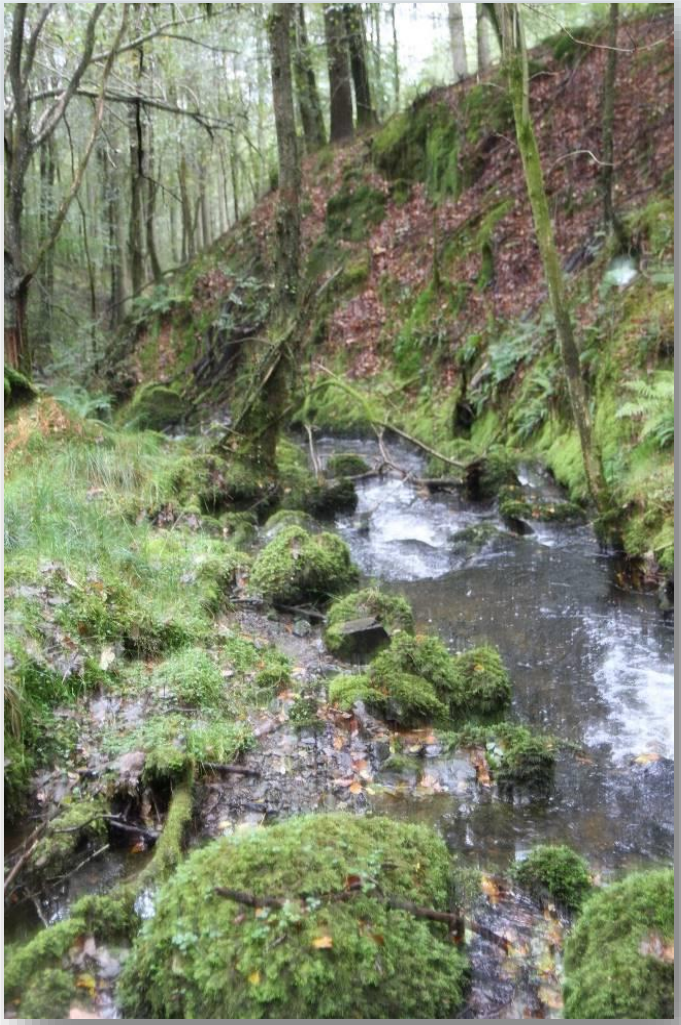
- NT has some 450 lakes, many were created by the great landscape gardeners of the 18th and 19th centuries.
- Our knowledge of the current ecological value of these lakes is poor.
- eDNA offers a quick and easy way to gather some data (fish and amphibians) on species present.
- Aim to combine eDNA data with water chemistry and basic habitat data.

Monitoring Freshwater with the National Trust

Levels of survey:

- **Tier 1**: Existing data from national monitoring programmes.
- **Tier 2**: Professional surveys of 100 ponds and 100 streams (5 year rolling programme).
- **Tier 3**: Citizen science monitoring using new technologies (eDNA, Clean Water for Wildlife), and species specific surveys.
- **Tier 4**: Bespoke monitoring of specific projects (e.g. natural flood management)



Little Langdale, Cumbria.
Rich bryophyte community

Tier 3: Citizen Science Monitoring

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Freshwater habitats and species are in trouble……

…..but, clean water habitats can be identified and species and habitats restored

Our vision for Citizen Science Monitoring

We believe the best way to protect freshwater habitats is to increase people's enjoyment, knowledge and experience of them.

Citizen science approaches are of great interest for their potential to efficiently and sustainably monitor wildlife populations on both public and private lands.

BUT . . . the data people collet MUST be credible, reliable and robust.

Tier 3: Citizen Science Monitoring

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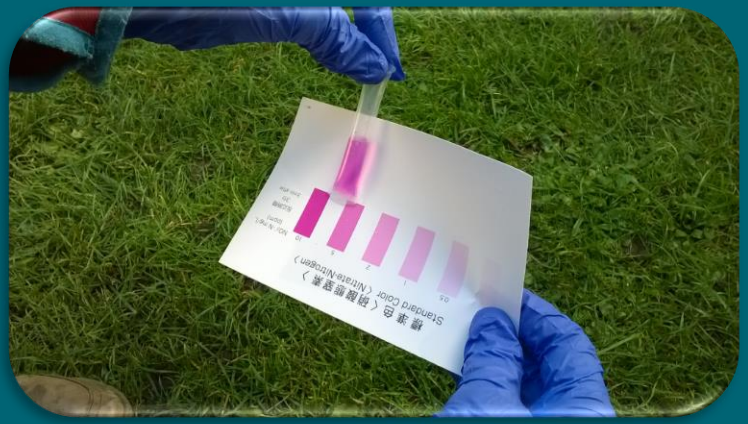
Citizen Science Monitoring using new technologies

Clean Water Kits



eDNA Kits

Tier 3: Citizen Science Monitoring

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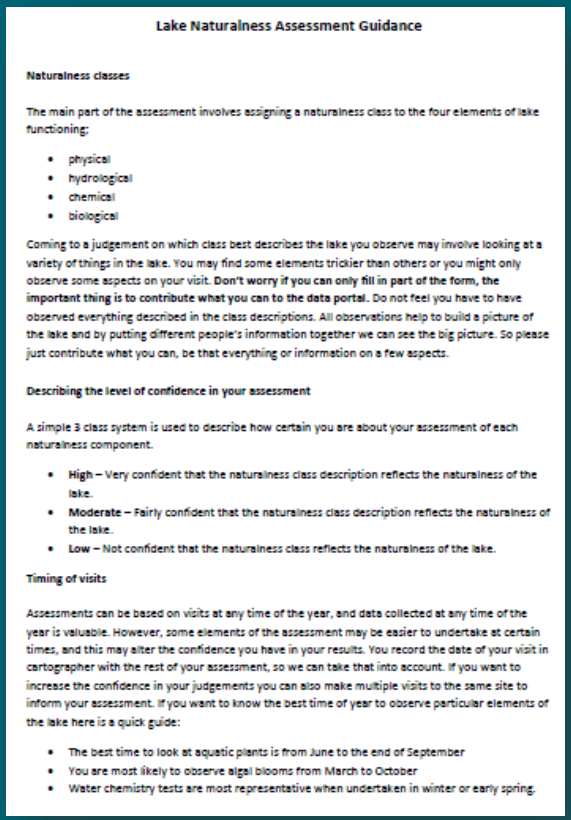
Lake Naturalness Assessment



Lake Naturalness Assessment Guidance

Naturalness classes

The main part of the assessment involves assigning a naturalness class to the four elements of lake functioning:

- physical
- hydrological
- chemical
- biological

Coming to a judgement on which class best describes the lake you observe may involve looking at a variety of things in the lake. You may find some elements trickier than others or you might only observe some aspects on your visit. **Don't worry if you can only fill in part of the form, the important thing is to contribute what you can to the data portal.** Do not feel you have to have observed everything described in the class descriptions. All observations help to build a picture of the lake and by putting different people's information together we can see the big picture. So please just contribute what you can, be that everything or information on a few aspects.

Describing the level of confidence in your assessment

A simple 3 class system is used to describe how certain you are about your assessment of each naturalness component.

- **High** – Very confident that the naturalness class description reflects the naturalness of the lake.
- **Moderate** – Fairly confident that the naturalness class description reflects the naturalness of the lake.
- **Low** – Not confident that the naturalness class reflects the naturalness of the lake.

Timing of visits

Assessments can be based on visits at any time of the year, and data collected at any time of the year is valuable. However, some elements of the assessment may be easier to undertake at certain times, and this may alter the confidence you have in your results. You record the date of your visit in cartographer with the rest of your assessment, so we can take that into account. If you want to increase the confidence in your judgements you can also make multiple visits to the same site to inform your assessment. If you want to know the best time of year to observe particular elements of the lake here is a quick guide:

- The best time to look at aquatic plants is from June to the end of September
- You are most likely to observe algal blooms from March to October
- Water chemistry tests are most representative when undertaken in winter or early spring.

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Clean Water Monitoring : The State of Freshwater

National Trust

What is clean water?








Water without added pollution – pollution includes nutrients like phosphate and nitrate, but also a cocktail of various things in road run off, sediment, pesticides etc.

Just how bad is it?

- **Rivers:** there are no longer any undamaged rivers left in lowland England and Wales.
- **Streams:** 87% of headwater streams are biologically degraded east of a line from the Humber to the Dorset coast.
- **Ponds:** 92% of ponds in England and Wales are biologically degraded; plant richness has declined by 20% in the last decade.
- **Lakes:** there is just a single lake in England and Wales classified as undamaged, Burnmoor Tarn in Cumbria.

The picture given to the public doesn't always reflect how bad things are for freshwater biodiversity.

Assessment under the Water Framework Directive?

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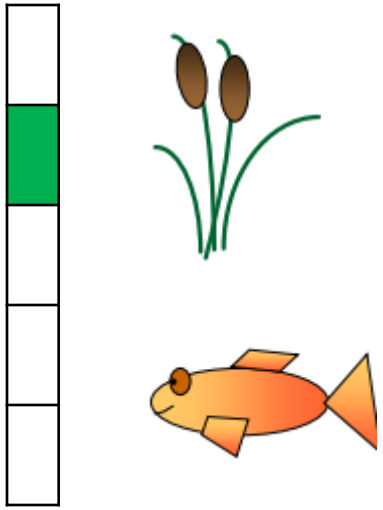
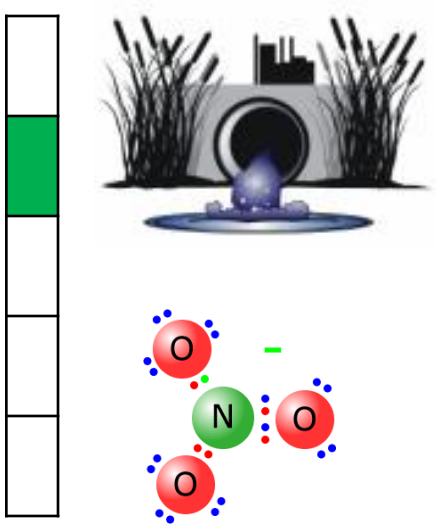
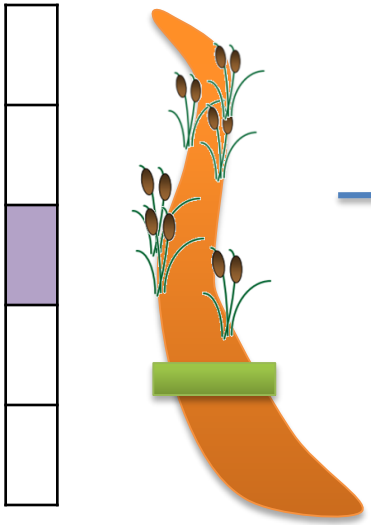
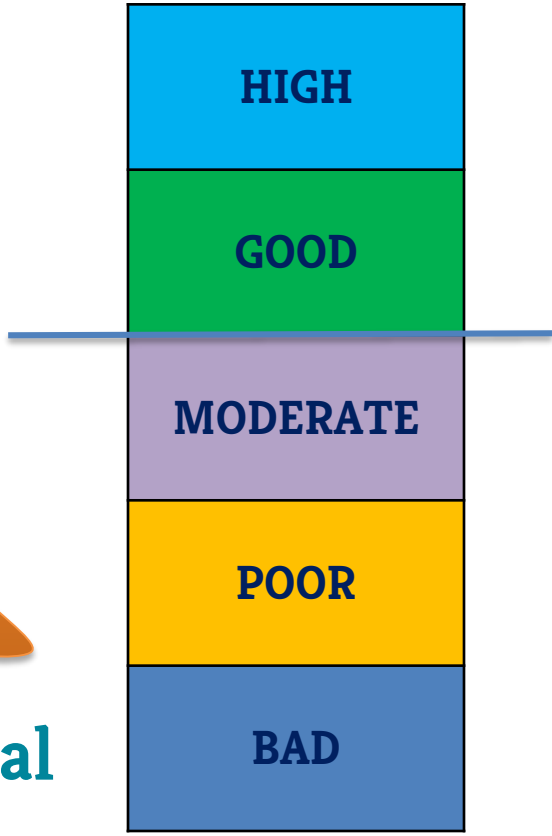
How are rivers and lakes assessed?





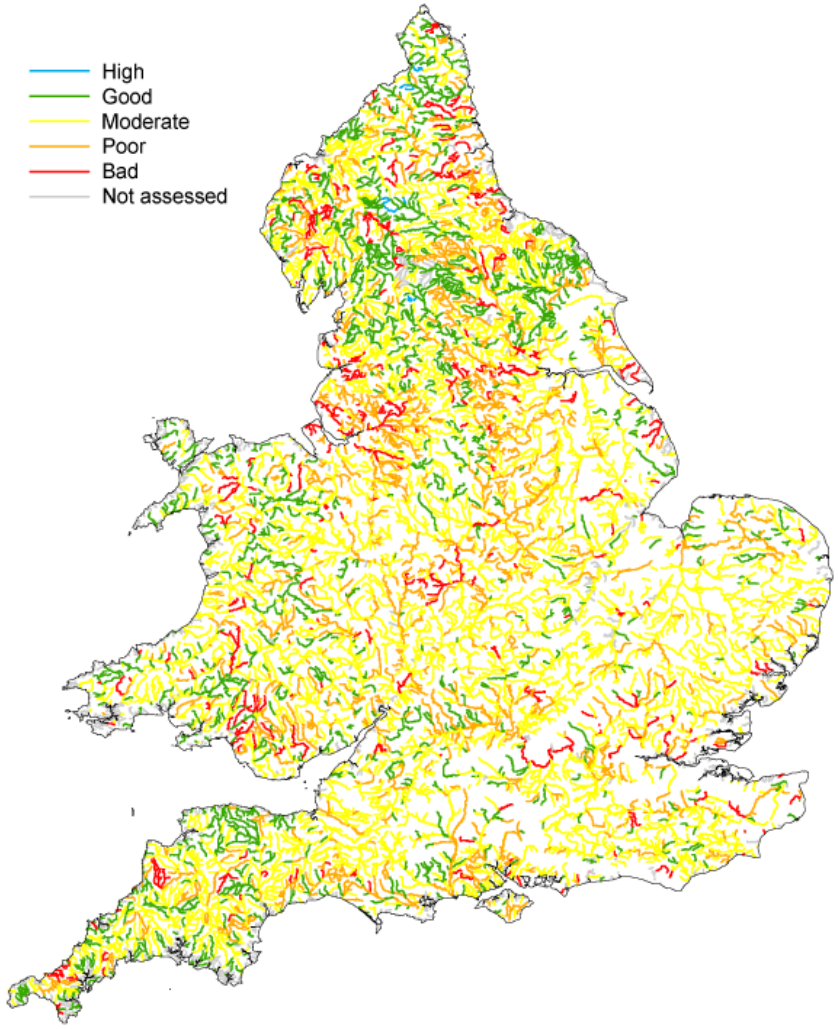


Biological Chemical Morphological



The Water Framework Directive

The state of our monitored freshwaters



- In England and Wales only 1 lake and 4% river sections *undamaged*, reaching 'High' status.
- c.20% of rivers fail minimum legal standard of 'Good' status
- 87% of headwater streams are biologically degraded east of a line from the Humber to the Dorset coast.

And, these data were only collected from a small proportion of the freshwater environment

99% of freshwater habitats fall outside of the statutory monitored network (e.g. 480,000 ponds)

Why is water quality so poor?

- In the UK a large part of the threat to freshwaters is due to pollution especially:

  - Intensive agriculture
  - Urban areas / roads
  - Sewage and other discharges

- Most of England's rivers and lakes are highly polluted – too many nutrients, heavy metals, pathogens, pesticides, sediment

- Waterbodies which drain large catchments, by their very nature will pick up these pollutants

- Extinction rates for freshwater species 4 to 6 times higher than terrestrial and marine

The English countryside on the Oxfordshire / Wiltshire border looks idyllic. Virtually all freshwaters in this landscape are seriously polluted

Public perception …

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theguardian

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Environment › Conservation

Freshwater wildlife thrives in cleanest rivers since Industrial Revolution

Otters, water voles and many species of freshwater fish m… dramatic re…

The Telegraph

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Environment

Sea trout and otters return as British rivers im…

Sea trout, salmon and otters have returned to rivers after what the En… Agency hailed as the best decade for waterways since the industrial re…

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Britain's rivers come back to life

Wildlife flourishing as pollution is reversed, report reveals

By Michael McCarthy, Environment Editor

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31 December 2010 Last updated at 08:05

Water quality in rivers 'good for wildlife'

Cleaner rivers in England and Wales have helped many species of wildlife, the Environment Agency says.

The last decade has been the best for rivers since the industrial revolution, it said.

Record numbers of salmon and sea trout were found in the Mersey, Tyne and Thames, while otters returned to every region in England and Wales.

The decade also saw the return of the water vole after a dramatic decline in the 1990s.

Incidents of serious water pollution have more than halved since 2001.

The River Thames won the International Theiss River Prize for outstanding achievement in river management and restoration earlier this

The water vole has made a recovery after numbers declined in the 1990s

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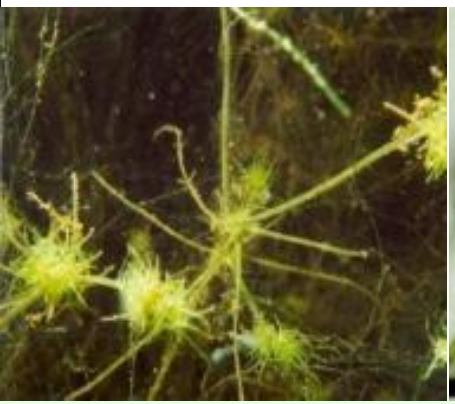
Six wives, 13 kids

How Steve Ginger strives to be a 'good' father

Actual data shows little change in since early 1980s, and the base from which it has changed was very low to start with!

So… what about the ponds?

- Two thirds of all freshwater plants and animals can be found somewhere in ponds
- Ponds support ~100 Priority Species under the England BAP (now S41/S42)
- One in five ponds in semi-natural landscapes support at least one Red Data Book species




We know that ponds are threatened

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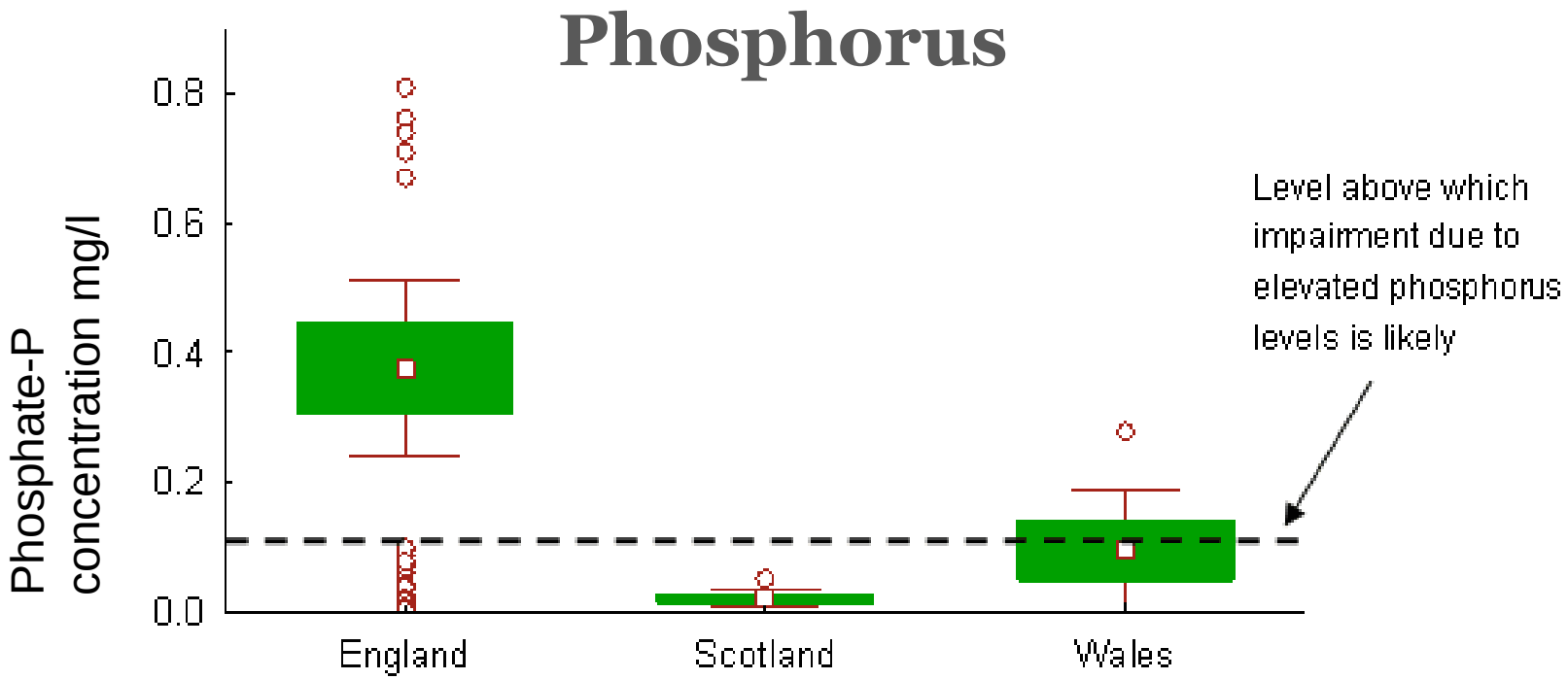
- At GB level two thirds of ponds existing 100 year ago have gone - **currently c.480,000 ponds**
- Probably many millions more seasonal ponds, never recorded, have disappeared
- Better news is Countryside Survey data suggests the number of ponds is now increasing – **up by 12.5%**
- The real problem is pond *quality* …

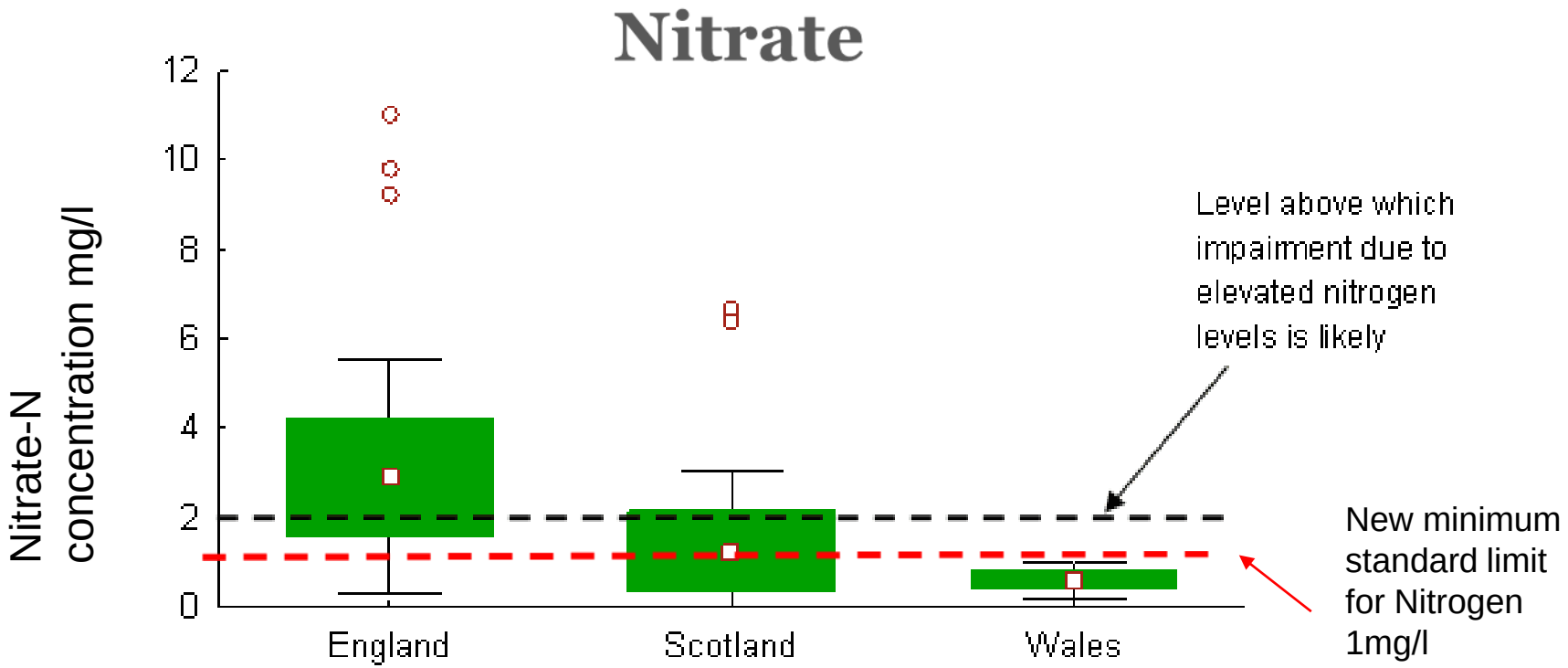
Pond water quality

Data based on Countryside Survey data of c.500 ponds in England, Scotland and Wales.



Pond water quality

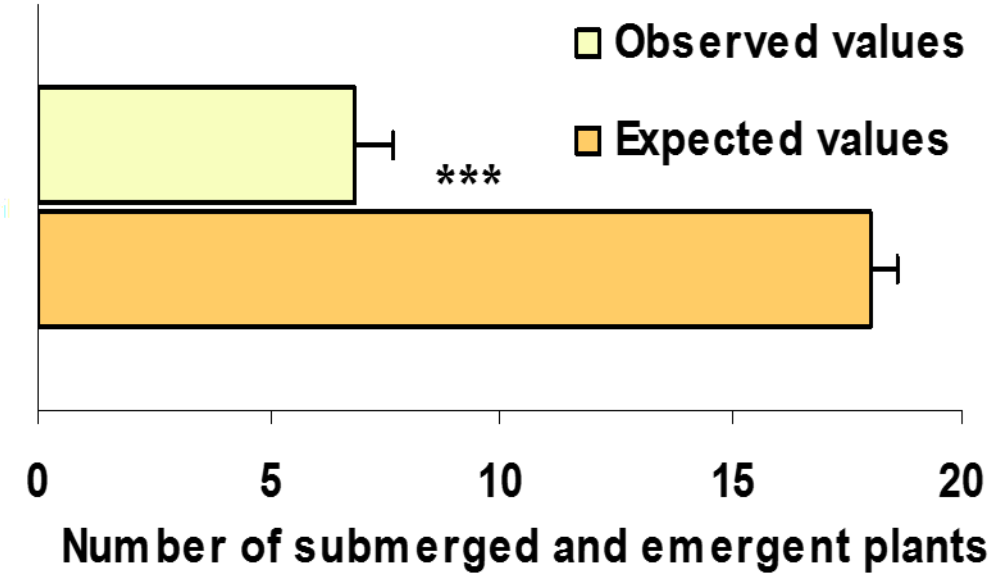
92% of ponds in England and Wales are biologically degraded



What are the effects : Plants

- Plants: submerged species most sensitive
- Very disturbing to see continued retreat under nutrient onslaught
- Marginal plants *also* affected, particularly uncommon species

Countryside Survey 2007 results (published Feb 2010)

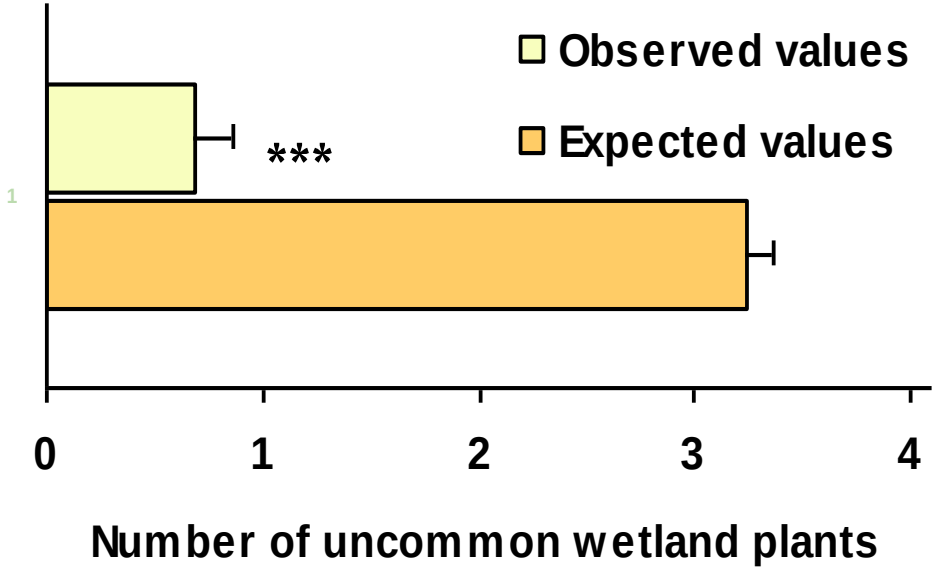


Should be 18 plant species/pond; in fact only 7

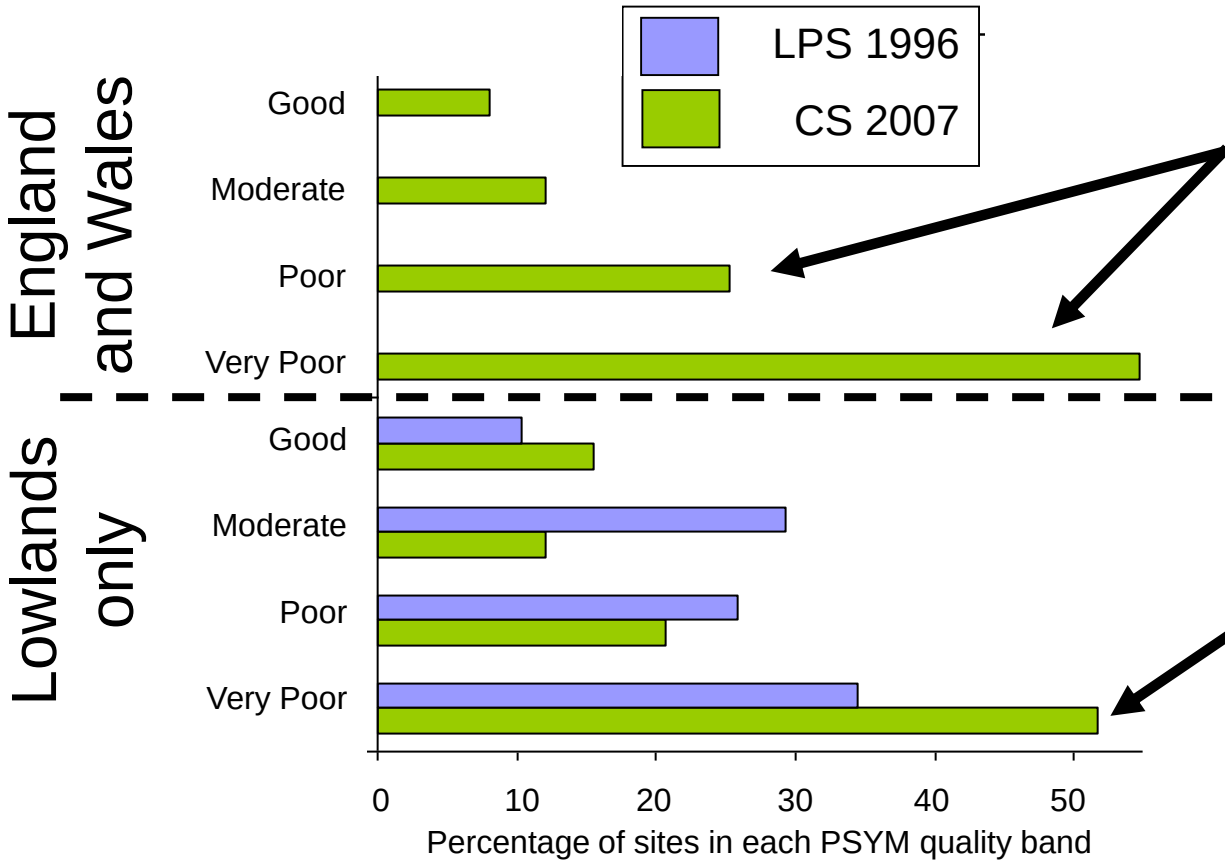
Uncommon Plants

- Uncommon plants: more pronounced effect
- Should be 3 uncommon plant species / pond; in fact only 0.7

Countryside Survey
2007 results
(published Feb 2010)



Changes over time



80% of ponds are in 'Poor' or 'Very Poor' condition

The number of 'Very Poor' ponds has increased by almost 20%

- **Most ponds in the England & Wales are severely degraded, and quality is declining**
- **And behind these data a 20% loss in wetland plant species**

Why are countryside ponds poor and declining?

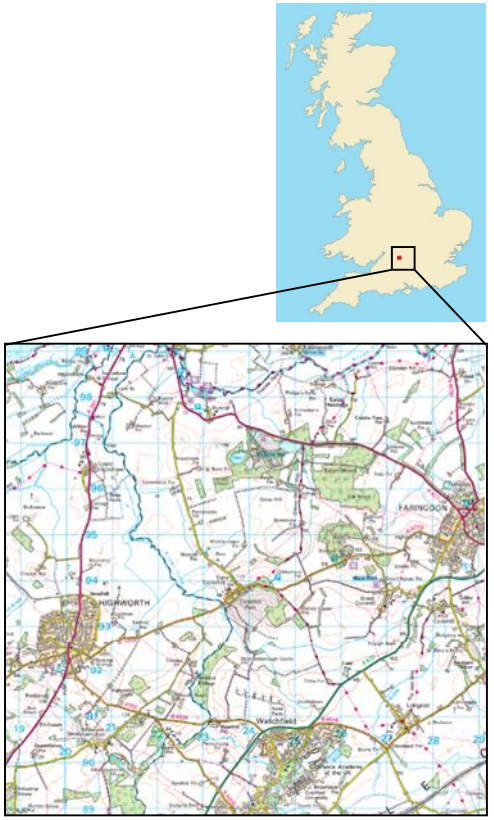
The same as the issues for running waters:

- Intensive agriculture, particularly arable land (nutrients and pesticides)
- High stream inflow volumes (bringing in nutrient rich sediments)
- Presence of road-runoff (nutrients and other pollutants)
- Increasing tree shade

Comparison of ponds with other freshwater habitats

2004: River Cole catchment …

One of first assessments to compare different waterbody types, and showed importance of ponds.



Comparison of (n=80 sites):

- **Rivers**
- **Ponds**
- **Lakes**
- **Streams**
- **Ditches**

Lowland countryside with intensive farming

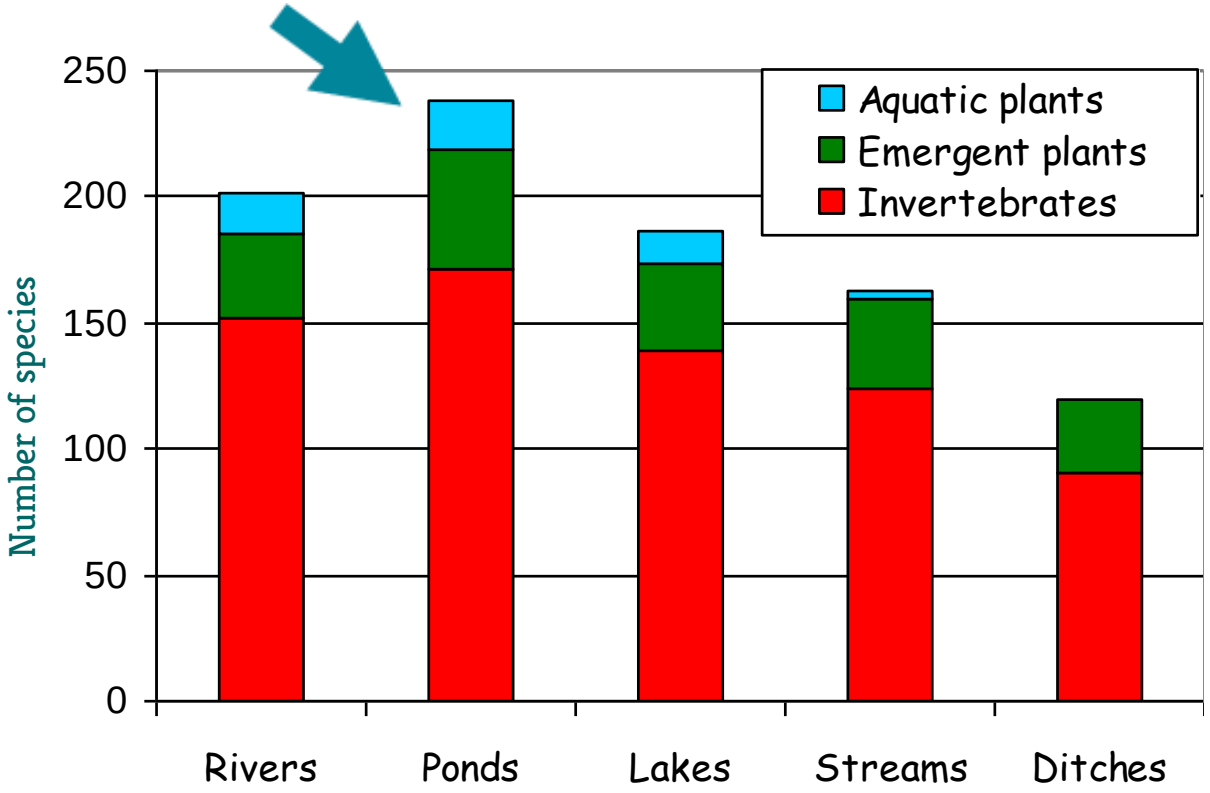
Survey of wetland plants and macroinvertebrates

Williams et al, 2004, Biological Conservation 115: 329-341

Comparison of ponds with other freshwater habitats

2004: River Cole catchment …

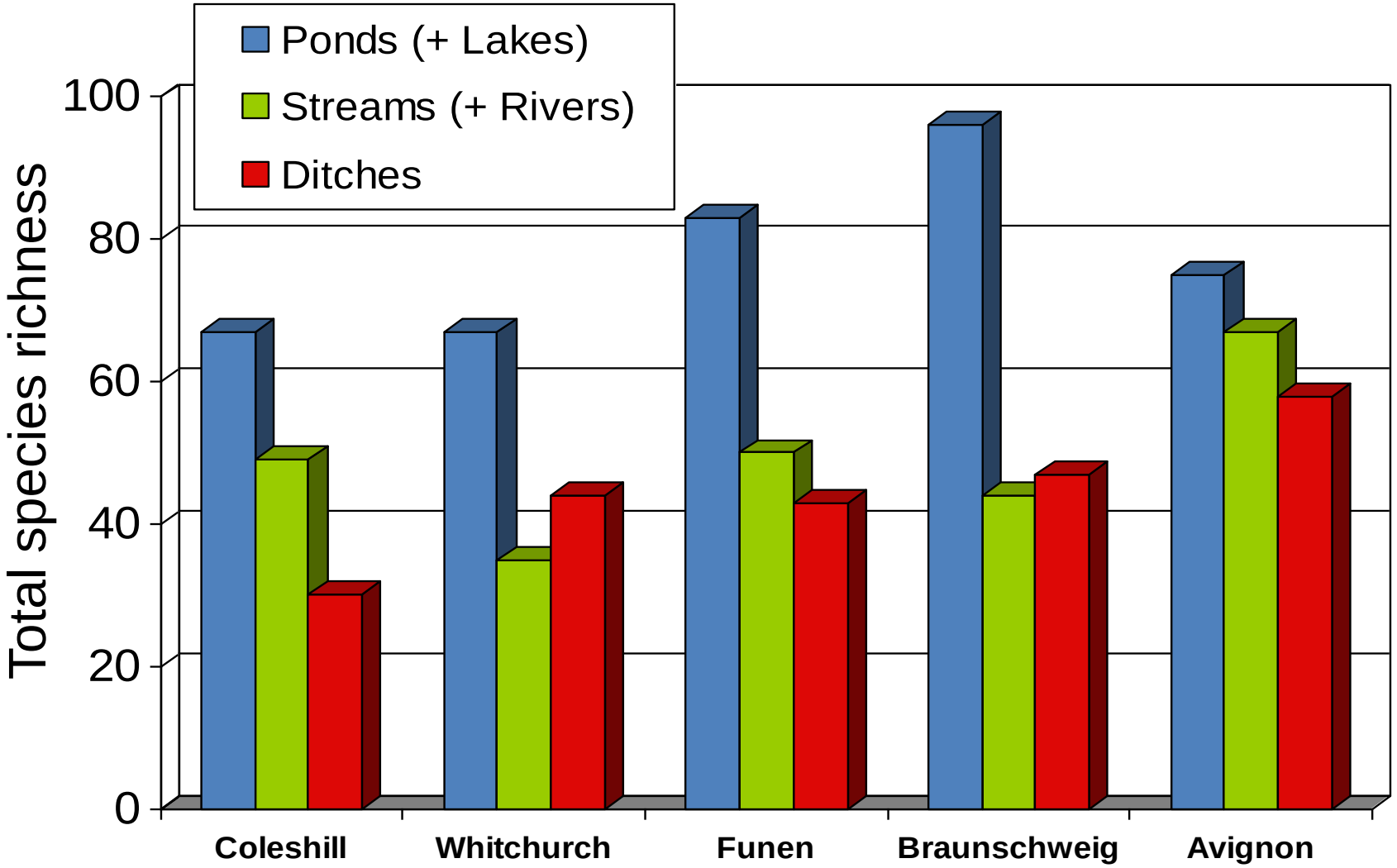
At landscape level, ponds were richest habitat, a result echoed across Europe, and perhaps beyond



Plant and animal species in freshwater habitats in the Coleshill landscape, Oxon/Wilts

Williams et al, 2004, Biological Conservation 115: 329-341

Total plant species richness (gamma diversity)



Williams et al, 2004, Biological Conservation 115: 329-341


clean water

variety

The biotic community will be influenced by……

- Underlying geology (water chemistry)
- Water source
- Hydroperiod
- Pond age
- Surrounding habitat
- Proximity to other wetlands
- Presence and intensity of grazing
- Isolation from sources of anthropogenic impacts

LAKE: Large standing waters bigger than 2 ha in area.

We think of them as natural, but there are now a lot of man-made lakes as well – the result of gravel extraction, and other mineral mining, and the damming up of rivers for water supply, as well as **ornamental lakes.**

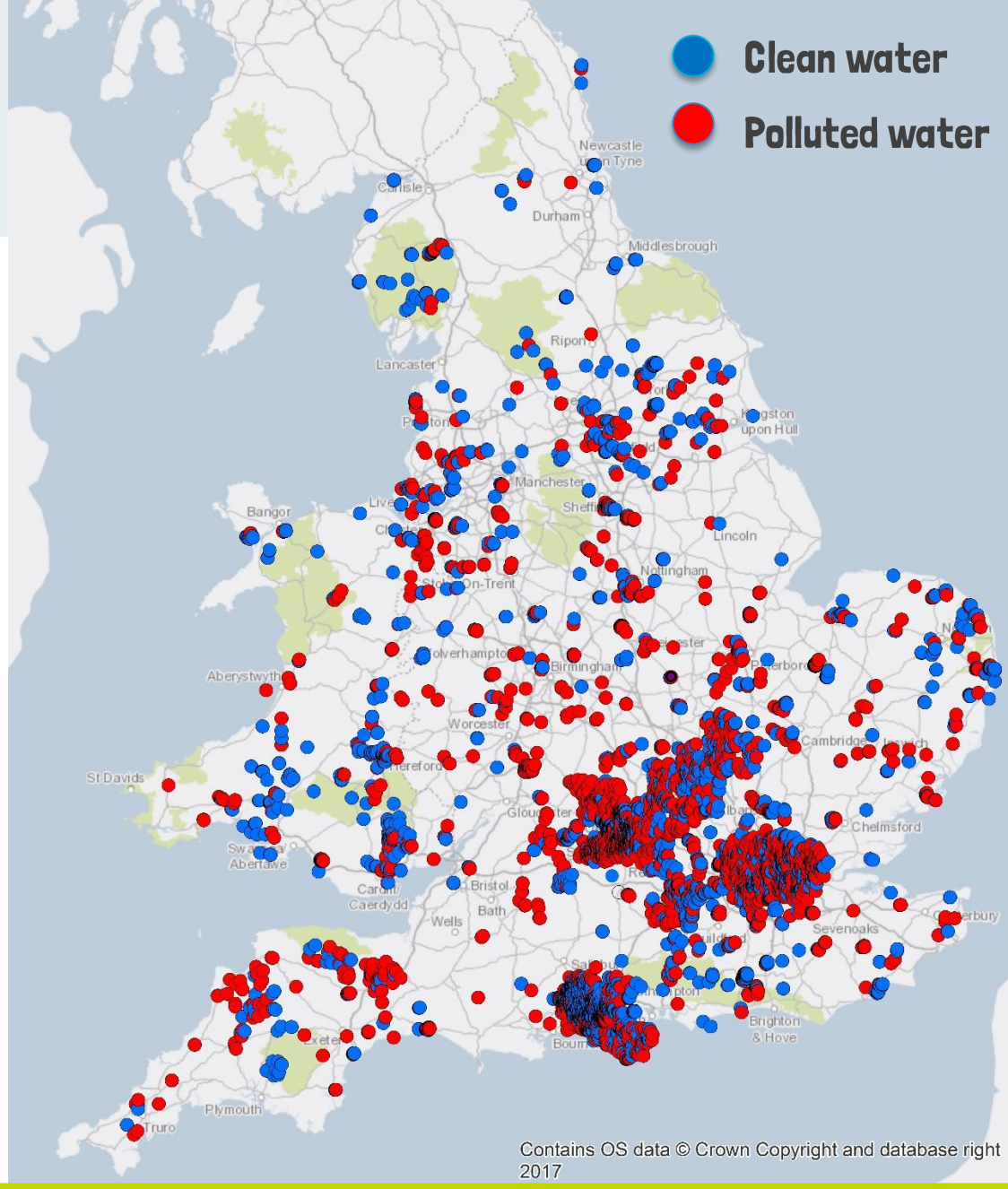
What can you find living in a lake?

The plants and animals of big lakes are the planktonic algae and tiny crustaceans that dominate the open water, and reeds and rushes of the margins, and the fish of deeper open water.

Clean Water Monitoring…..

Clean Water for Wildlife

- **The bad news** - is the extent of nutrient pollution.
- **The good news** - people found clean unpolluted water in all the landscapes they tested.
- **More good news** - the results reveal for the first time the national importance of ponds in the clean water network.



The Ock Catchment

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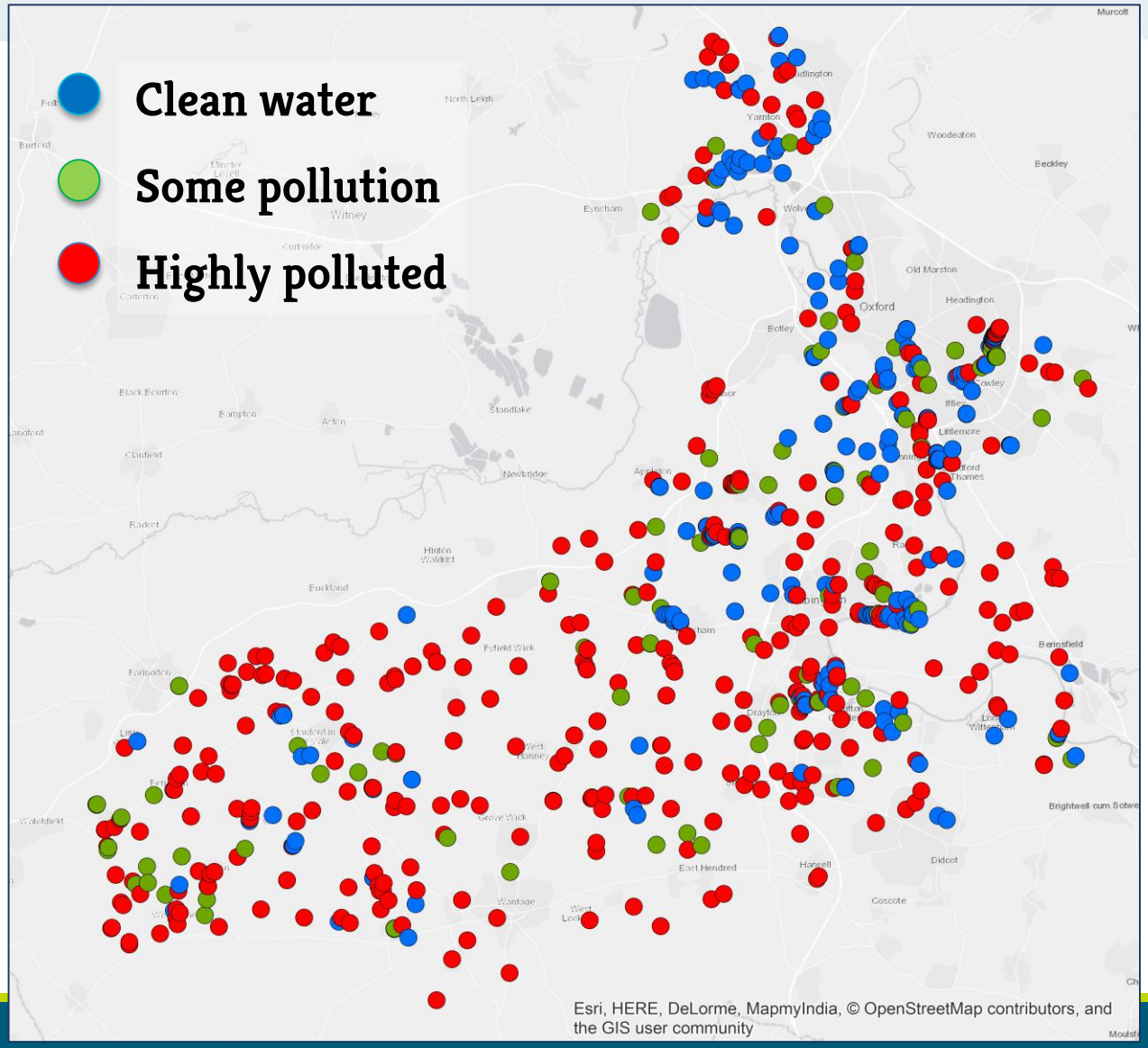

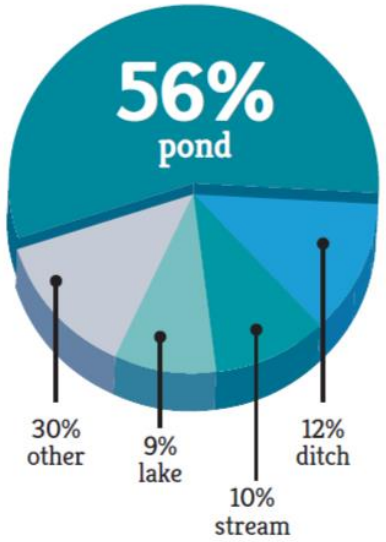

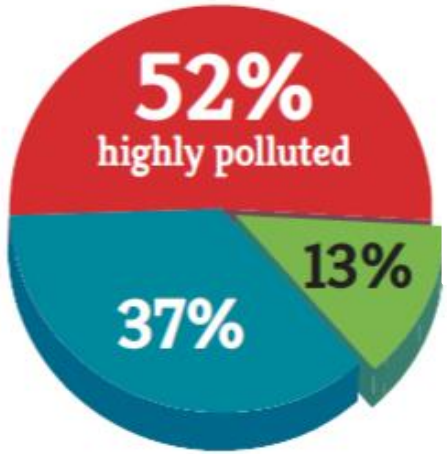

The New Forest

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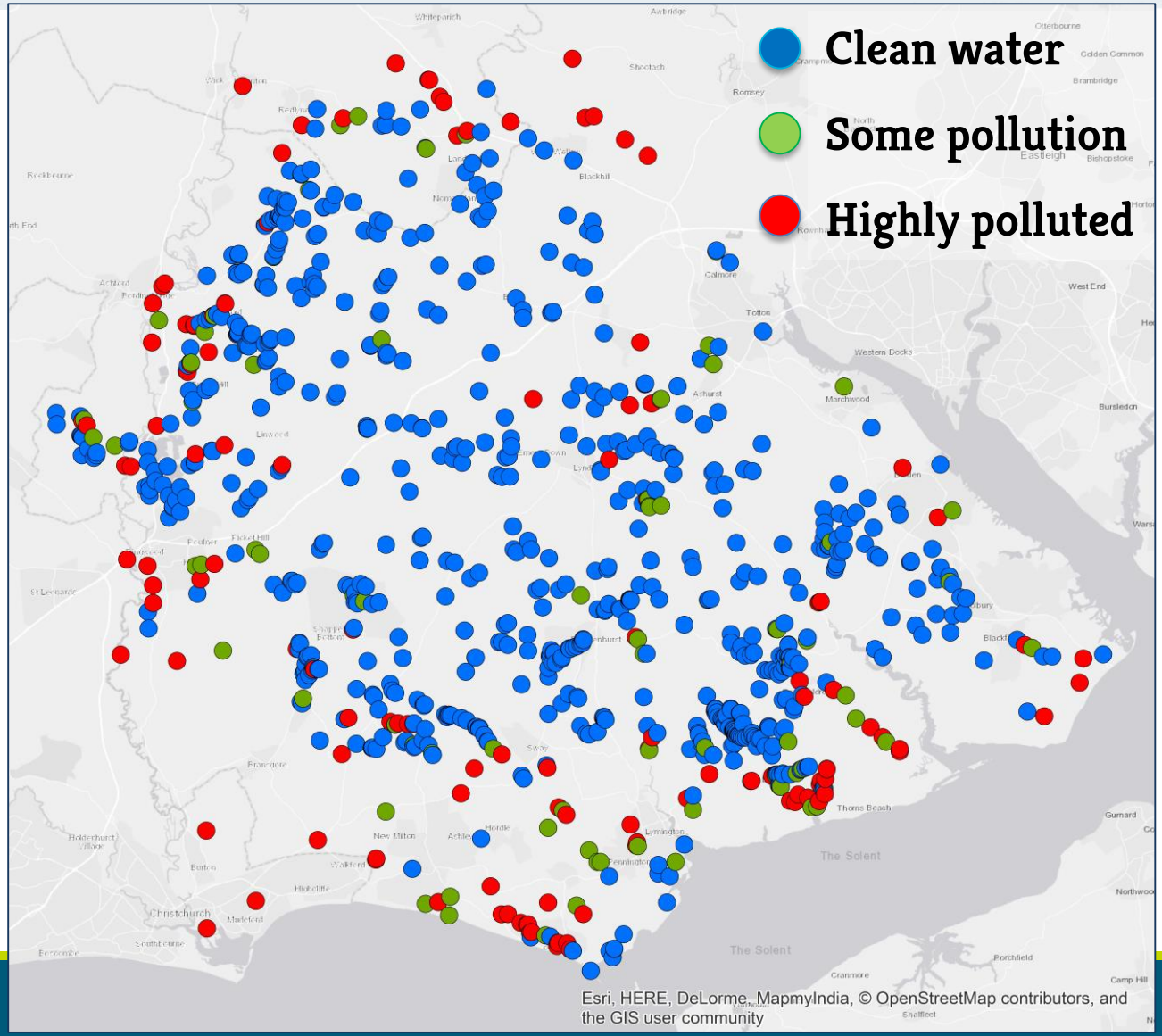

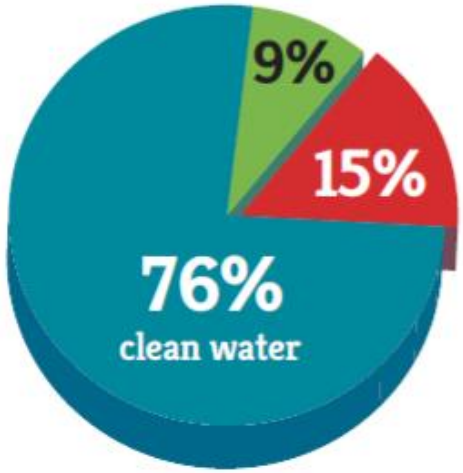

The best sites for freshwater wildlife are free from nutrient pollution

The Lower Windrush Valley

Freshwater Habitats Trust

A outstanding mosaic of wetland habitats of different ages, including lakes, ponds, rivers, ditches, streams and seepages - very rich in plants and animals, of *national* importance for stoneworts

http://www.oxfordshire.gov.uk/lowerwindrushvalleyproject

Level of nutrient pollution in the LWV 2016

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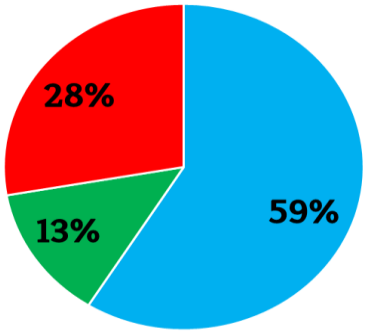

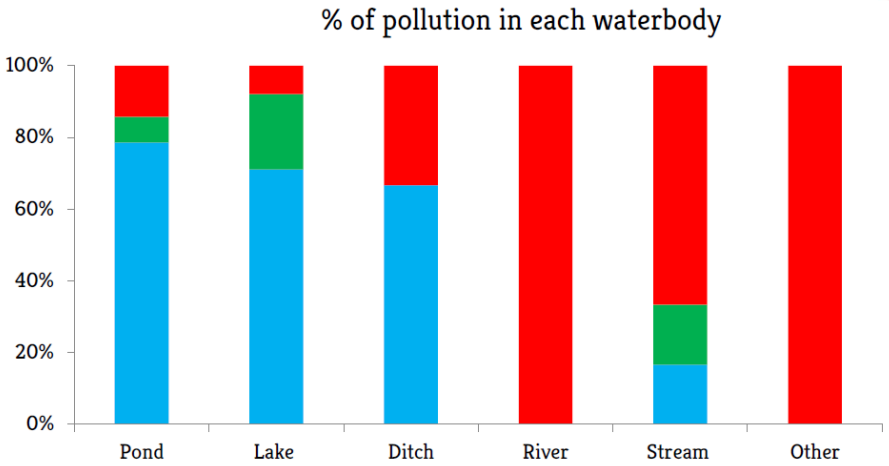

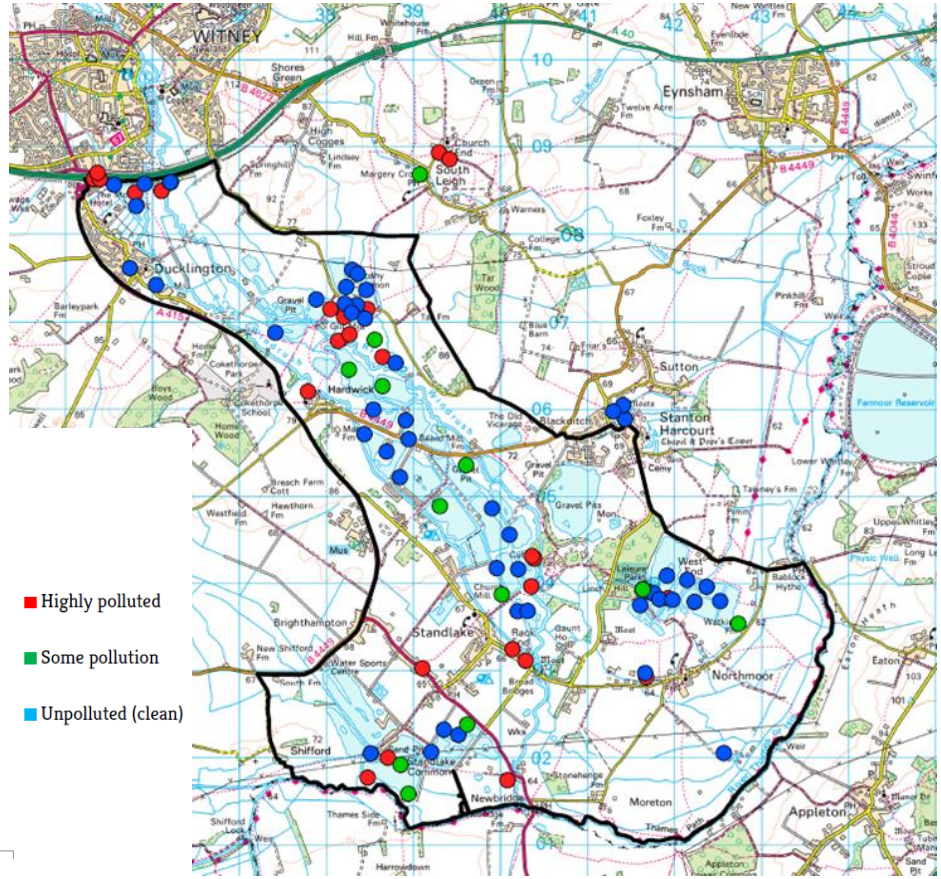

LWV Results 2016

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Table 1: Level of nutrient pollution	Unpolluted (clean)	Some pollution	Highly polluted	Total
Ponds	22	2	4	26
Lake	27	8	3	38
Ditch	2	0	1	3
River	0	0	8	8
Stream	2	2	8	12
Other - well	0	0	1	1
TOTAL	53	12	25	90

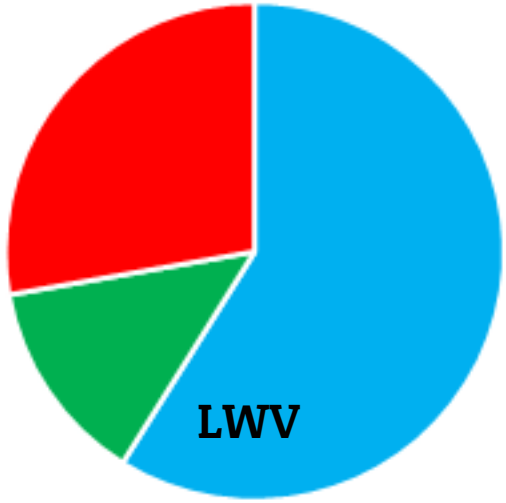
c. 40 volunteers collected 90 samples over 1 month

FHT supplied the nutrient kits, LWV coordinated the volunteers and the collation of results

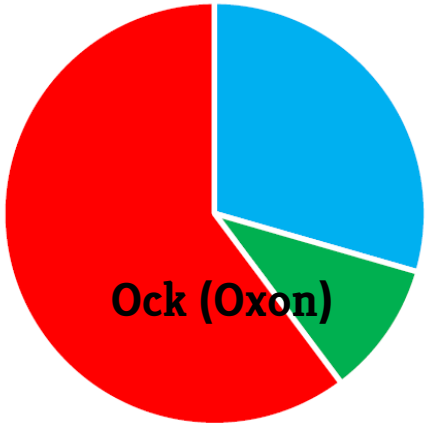
Understanding LWV Results 2016

- **Clean water is concentrated in ponds and lakes.**
- **The majority of streams and all the rivers suffer serious nutrient pollution.**
- This is not surprising because the river networks drain water from large areas of land with multiple sources of pollution from urban and agricultural areas.
- In contrast, many ponds can collect water from locally clean sources and the gravel pit lakes in the LWV also tend to have unpolluted land around them.
- Both lakes and ponds in the LWV are often fed by groundwater flowing very slowly through gravel, which helps keep the water clean and free from nutrient pollution.

How does the LWV compare?



Highly polluted
Some pollution
Unpolluted (clean)



Where is the clean water?

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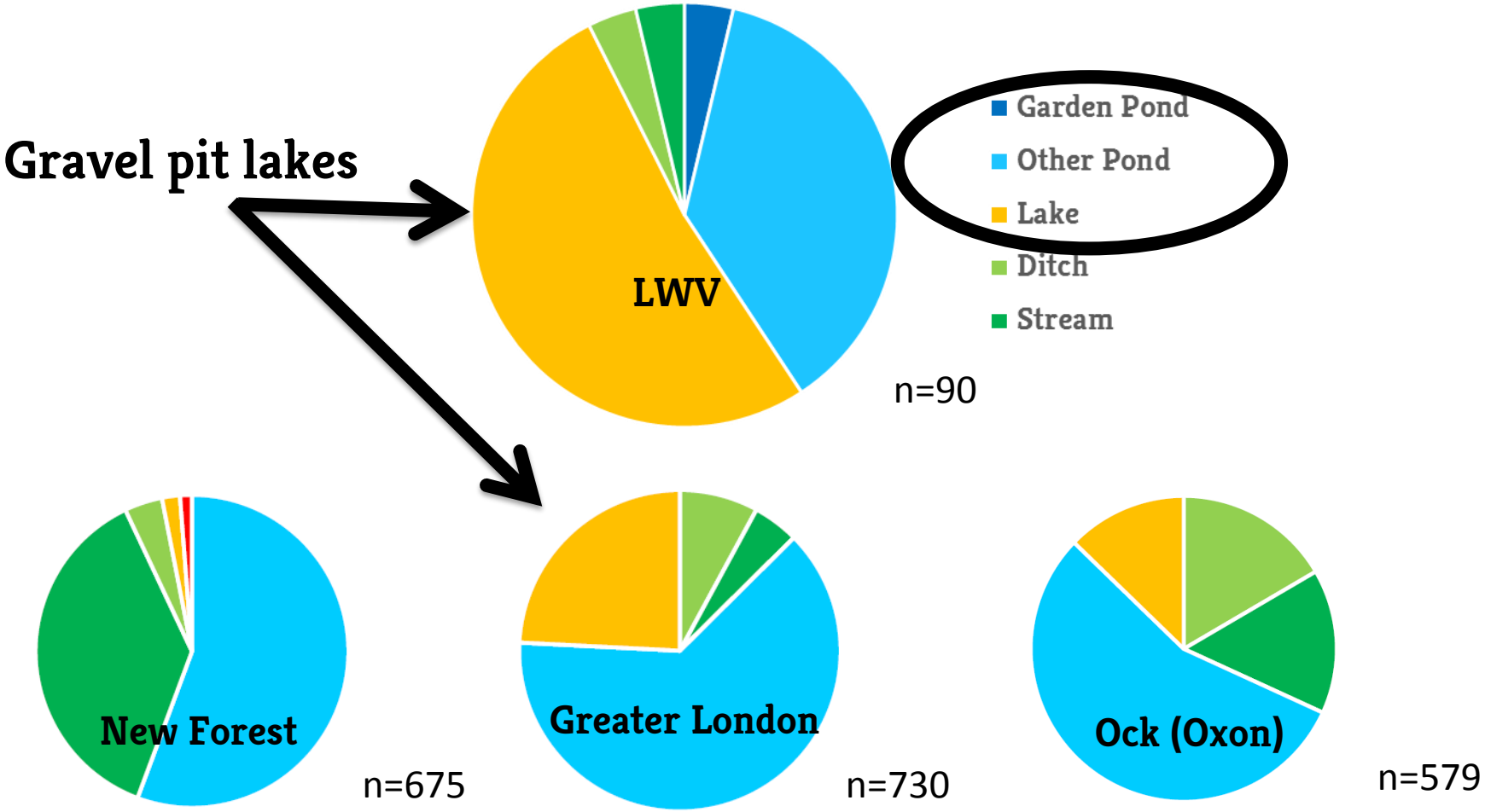
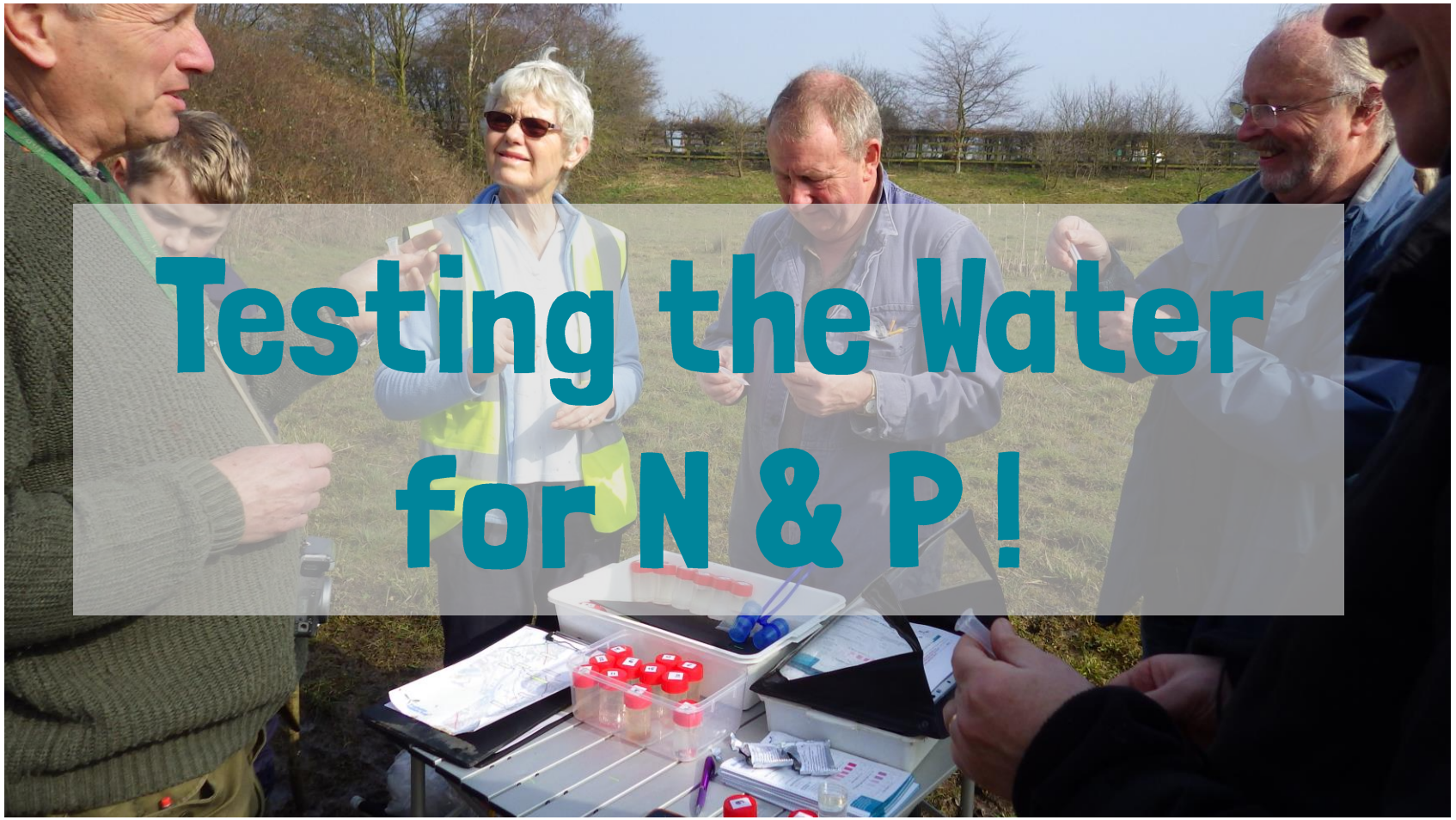
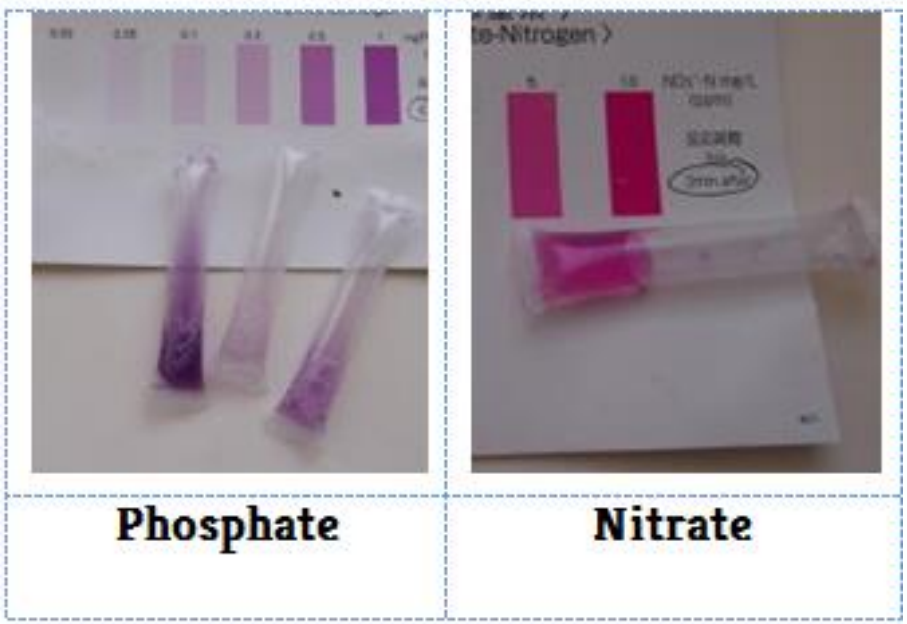


Clean Water Monitoring…..



Clean Water for Wildlife

- Nutrient pollution is invisible so often doesn't seem 'real' to people.
- Quick kits makes it possible for people to easily 'see' pollution for the first time.
- Opportunity to get data from sites which would not otherwise be monitored – cheaply.



Phosphate

Nitrate

Clean Water for Wildlife

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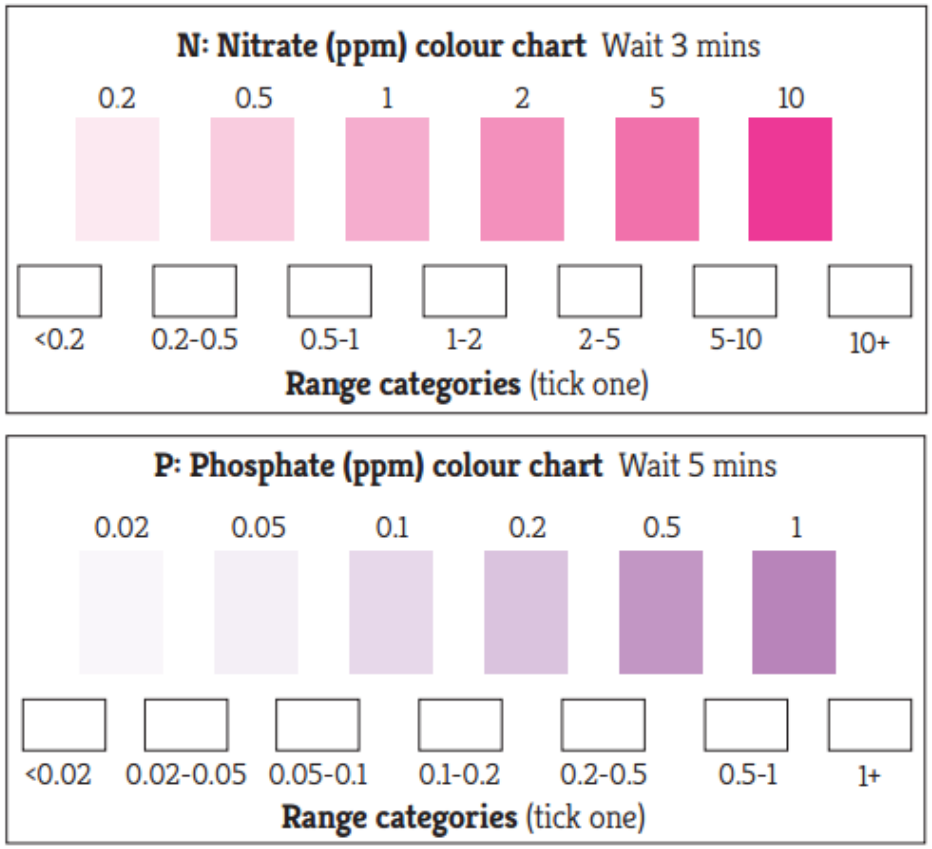
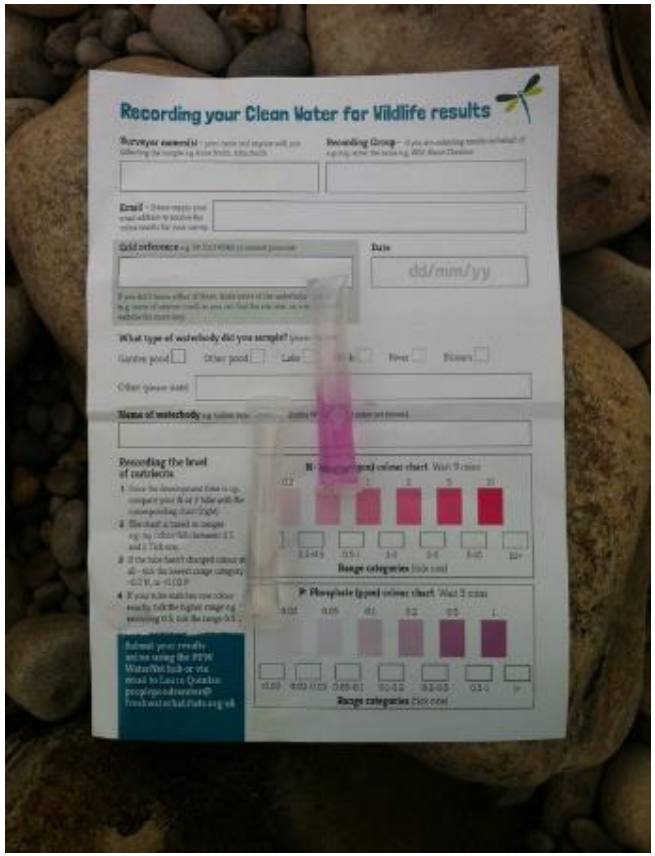
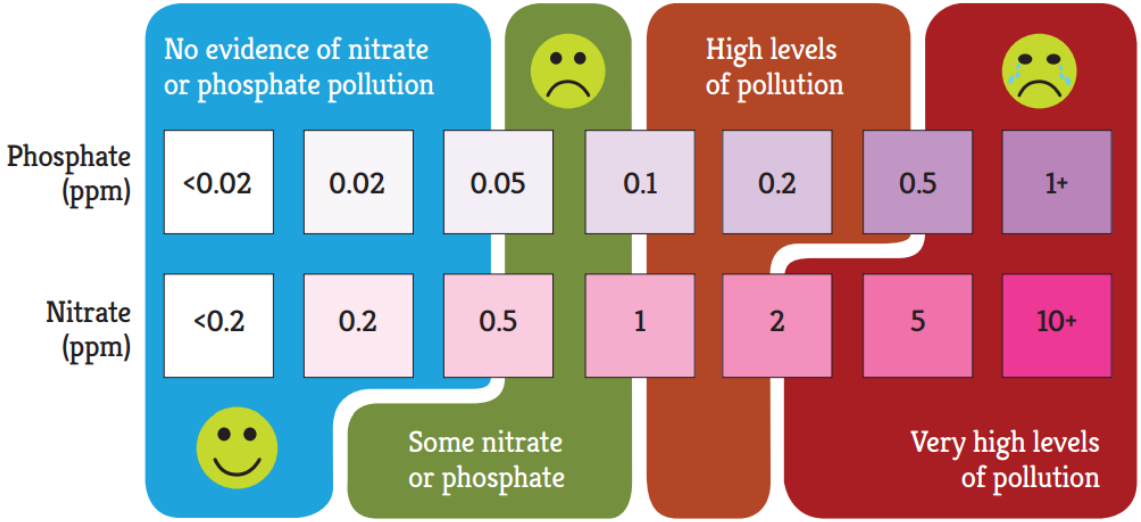




Classifying sites

Three categories:

- No evidence of nitrate or phosphate pollution
- Some nitrate or phosphate pollution
- High or very high level of pollution

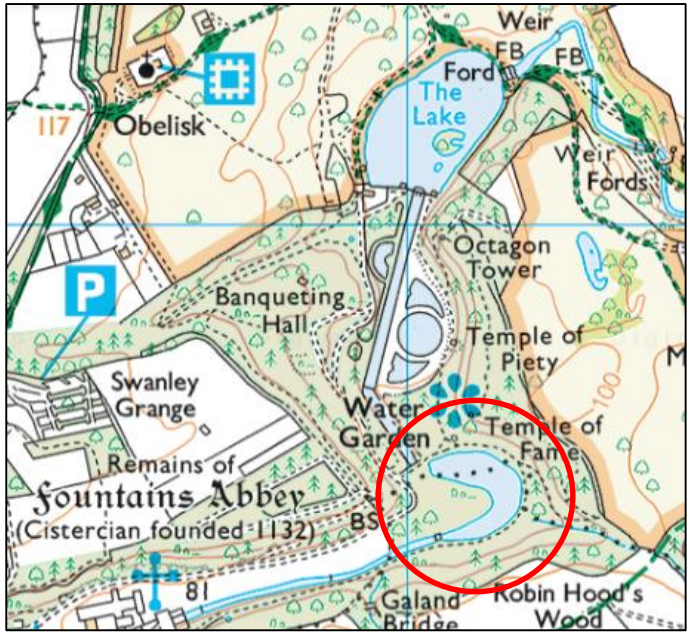


P: Categories intended to match 'High' (blue) and 'Good' (green) Water Framework Directive status

N: categories reflect literature values for High status

Where to take a water sample?

Sample outflow and inflow

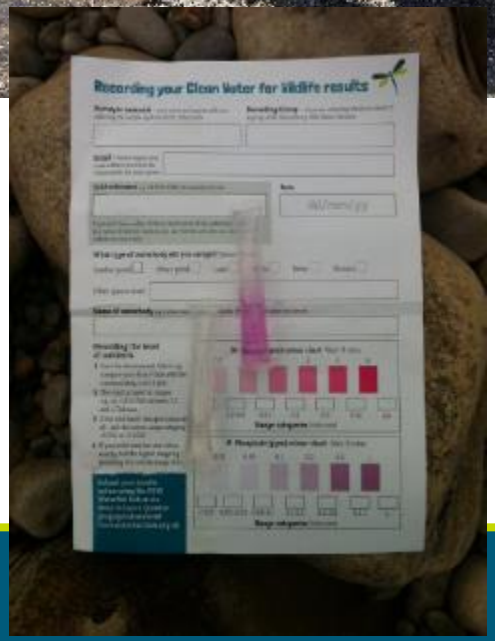


Seven Waterbodies

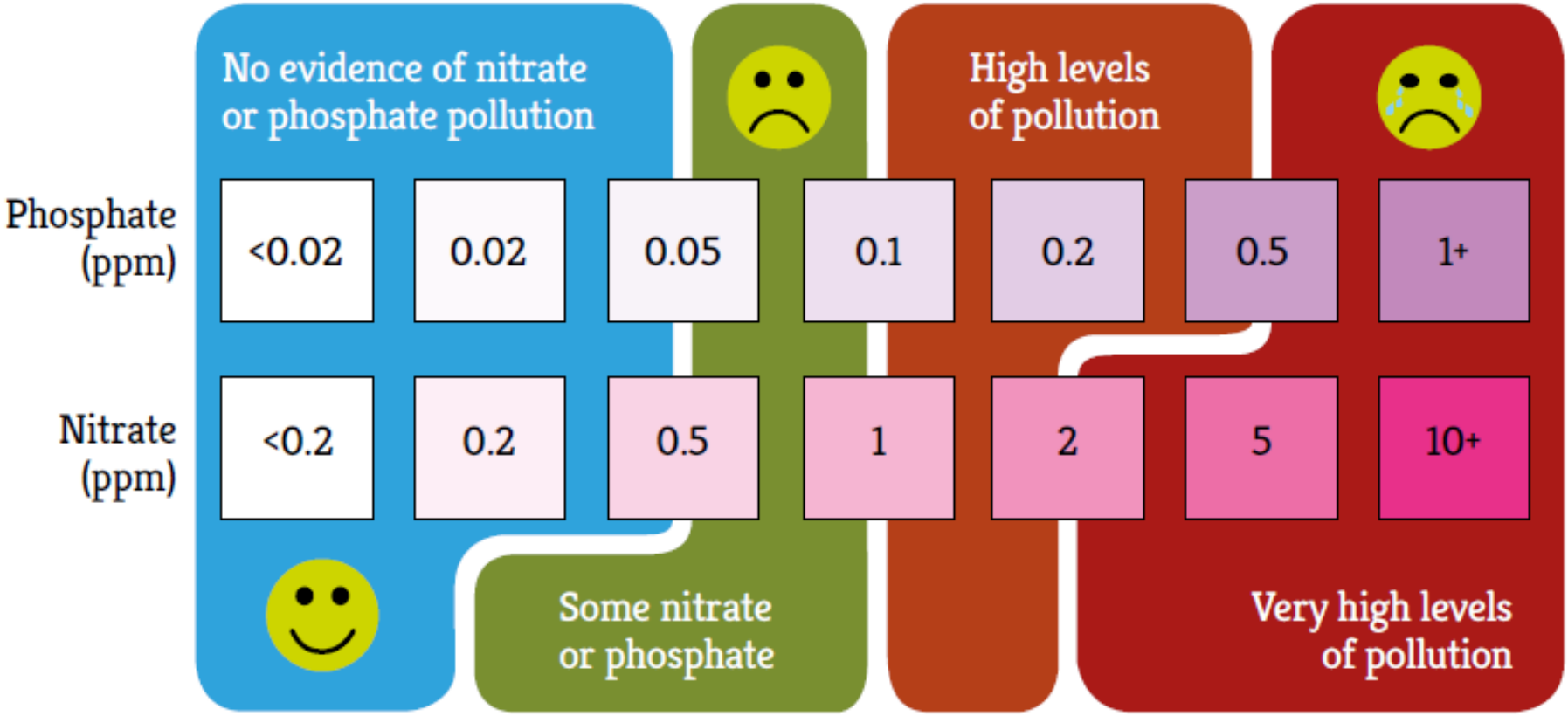
Fountains Abbey and Studley Royal,
North Yorkshire

Demonstration …

Freshwater Habitats Trust



Demonstration …



CWW Demonstration video

https://freshwaterhabitats.org.uk/projects/clean-water/

Freshwater Habitats Trust

eDNA surveys for aquatic wildlife

National Trust

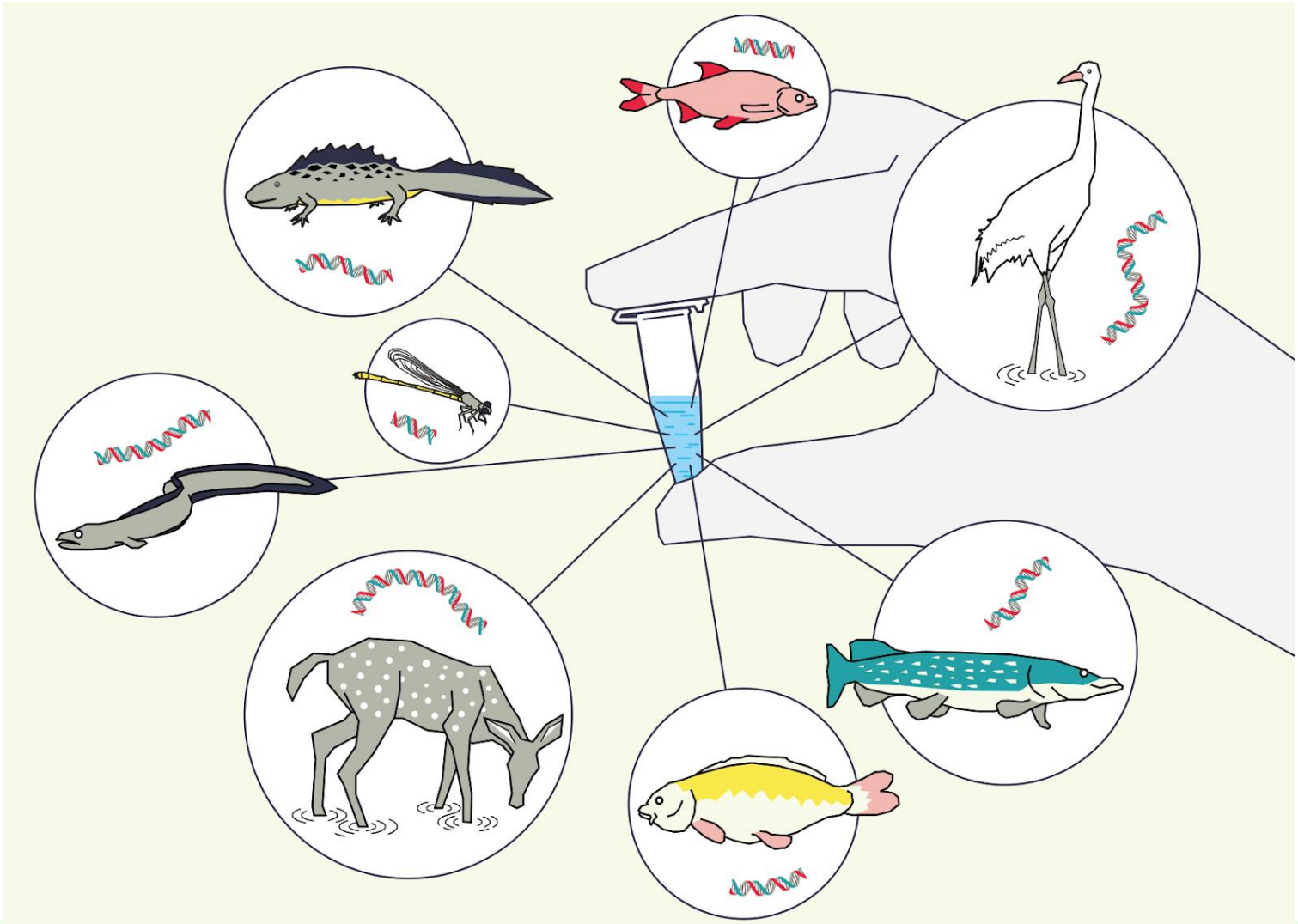
eDNA surveys for aquatic wildlife

Freshwater Habitats Trust

- eDNA is a powerful tool for surveying aquatic vertebrate communities without the need to catch the animals themselves.
- It has been shown to be effective in a wide variety of aquatic ecosystems (ponds, lakes, streams, rivers, estuaries and oceans)
- It can be used either to detect the presence of particular species, or to survey whole communities of organisms.

eDNA surveys for aquatic wildlife

Freshwater Habitats Trust



Animals leave behind their unique DNA code

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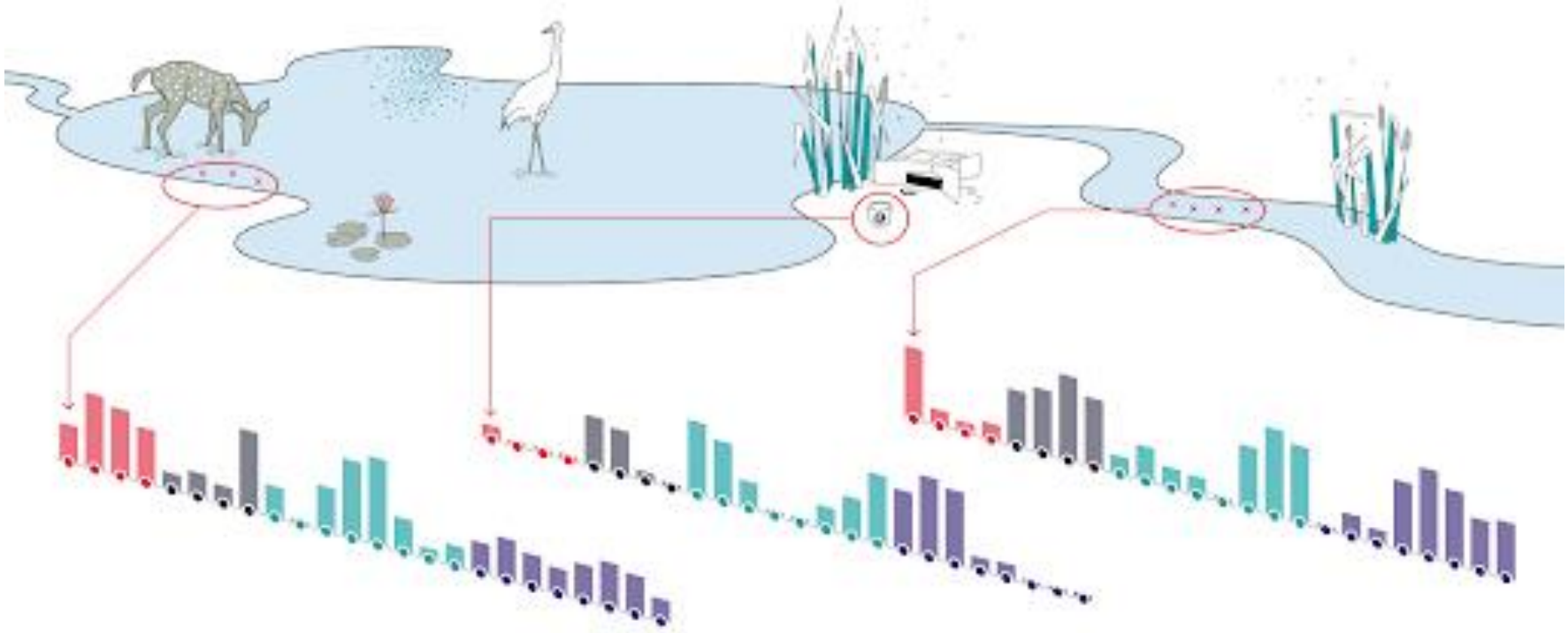
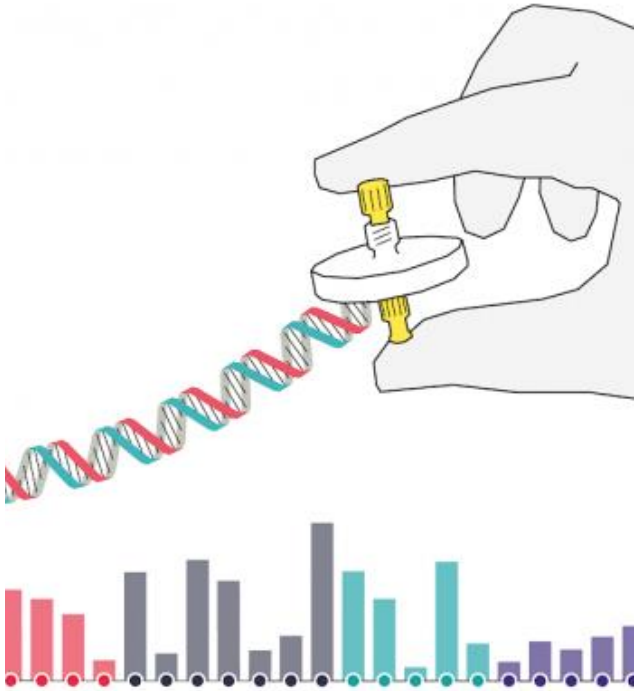


Metabarcoding is a method of sequencing the DNA barcodes of many different organisms in parallel, so that diverse taxa can be identified in a single reaction

Scientists crack the code and tell us what animals have visited the pond

Freshwater Habitats Trust

	Moulsecoomb Primary School	Laurel's Primary School	Coldean Primary School	Sompting School
Rana temporaria (Common Frog)	●	●	●	
Lissotriton vulgaris (Smooth newt)	●	●	●	
Anas platyrhynchos/Tadorna tadorna (Mallard/Common shelduck)				●
Columba sp. (Dove species)	·		·	
Phasianus colchicus (Common pheasant)	·			
Gallinula chloropus (Common moorhen)				·
Corvus corax (Common raven)	·			
Garrulus glandarius (Eurasian jay)			·	
Fringilla coelebs/Fringilla montifringilla (Finch species)		·	·	
Erithacus rubecula (European robin)				
Turdus merula (Blackbird)			·	·
Turdus philomelos (Song thrush)			·	·
Parus major (Great tit)			·	
Sciurus carolinensis (Grey squirrel)		·		·



Great Crested Newts

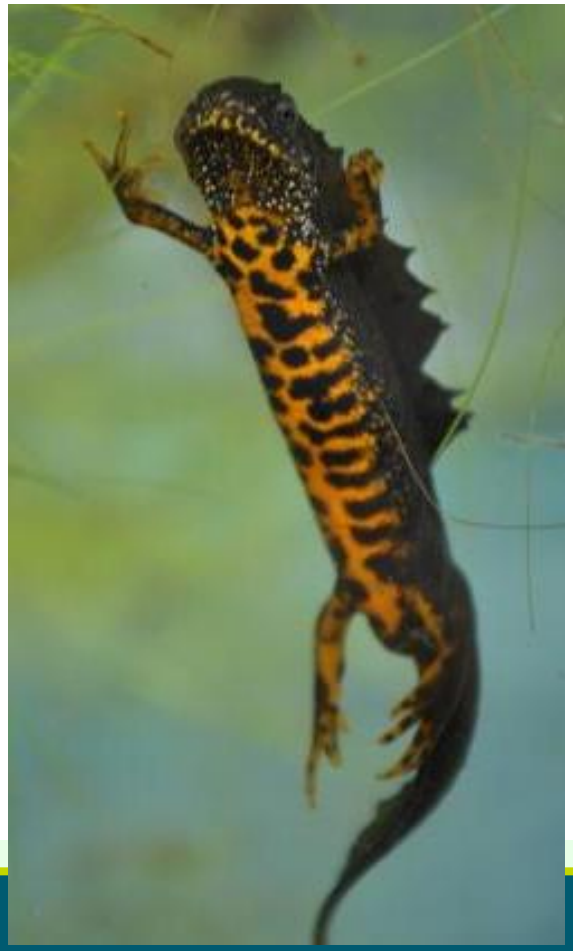
Freshwater Habitats Trust

Evaluation of the use of eDNA to detect the presence and abundance of Great Crested Newts, particularly when used by volunteers (2013).

Professional comparison of eDNA techniques to traditional methods – **99% detection with eDNA** (95% bottle trapping + torch).

Volunteer surveyors assess likelihood of false positives and false negatives - **91% detection with eDNA, no false positives.**

eDNA substantially quicker - 2 person hours, compared to about 48 person hours for a four visit, multiple methods traditional survey.



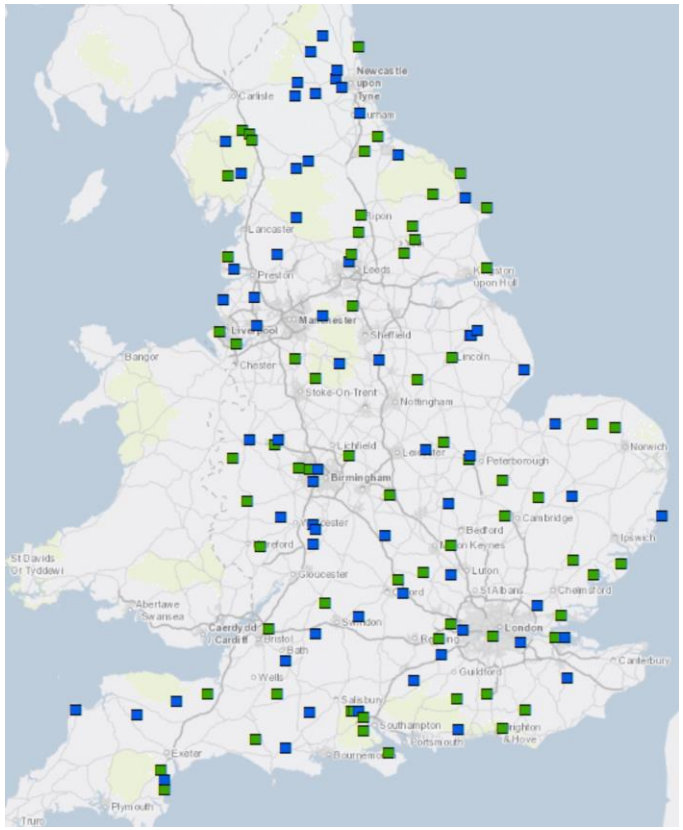
Great Crested Newts

PondNet volunteers undertake annual surveys to monitor Great Crested Newt occupancy trends in England

Over 450 volunteers have helped us to collect eDNA samples from more than 380 ponds across England - 2015-2019.

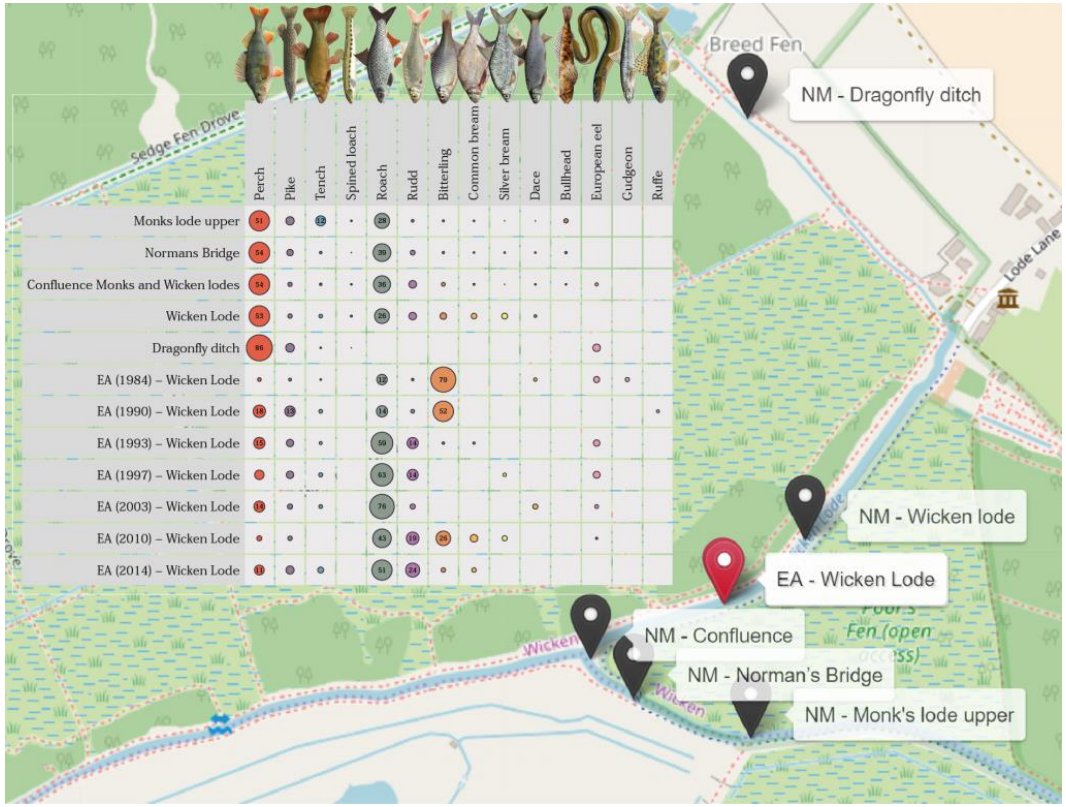
We can now **predict with certainty** that between 11-21% of 1km grid squares (c.21,380 squares) are occupied by Great Crested Newts.

Impossible without eDNA.



Wicken Fen Bioblitz: Fish

Evaluation of the use of eDNA (metabarcoding) to detect the presence and abundance of fish in standing and running waters.



Wicken Fen Bioblitz results

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Results

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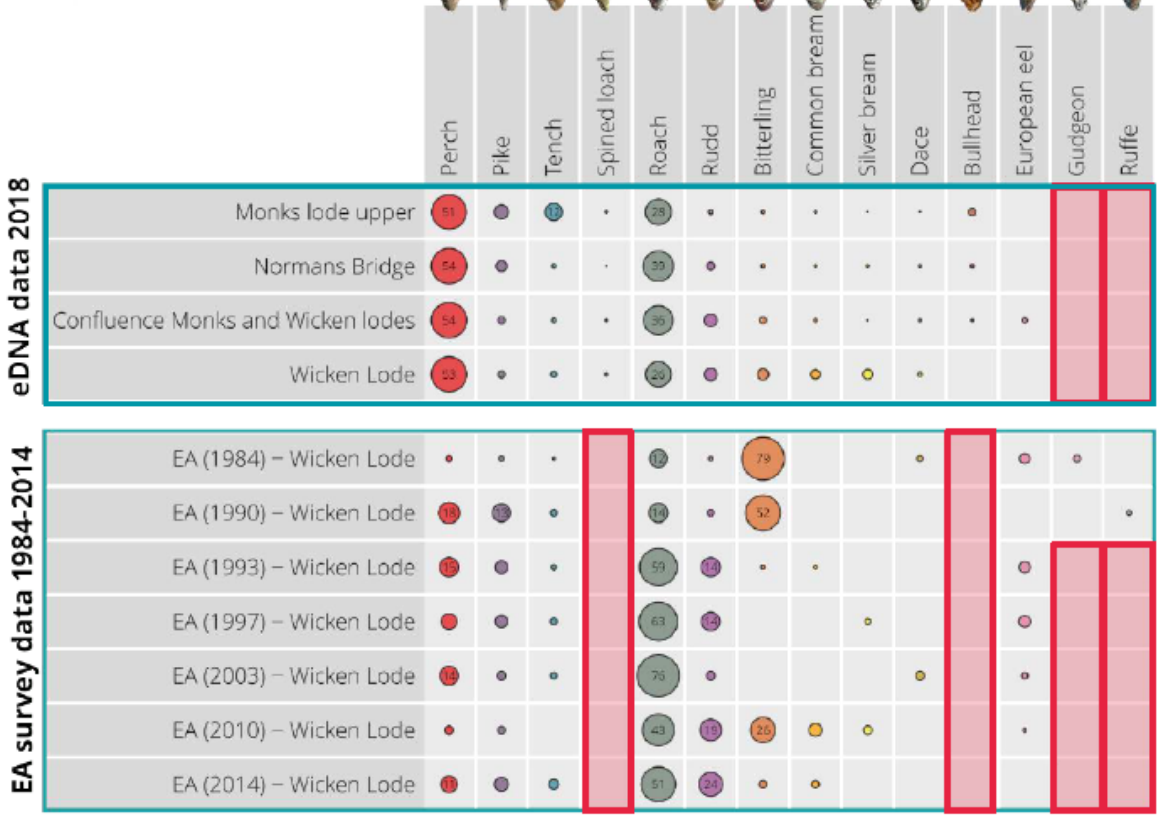
NatureMetrics

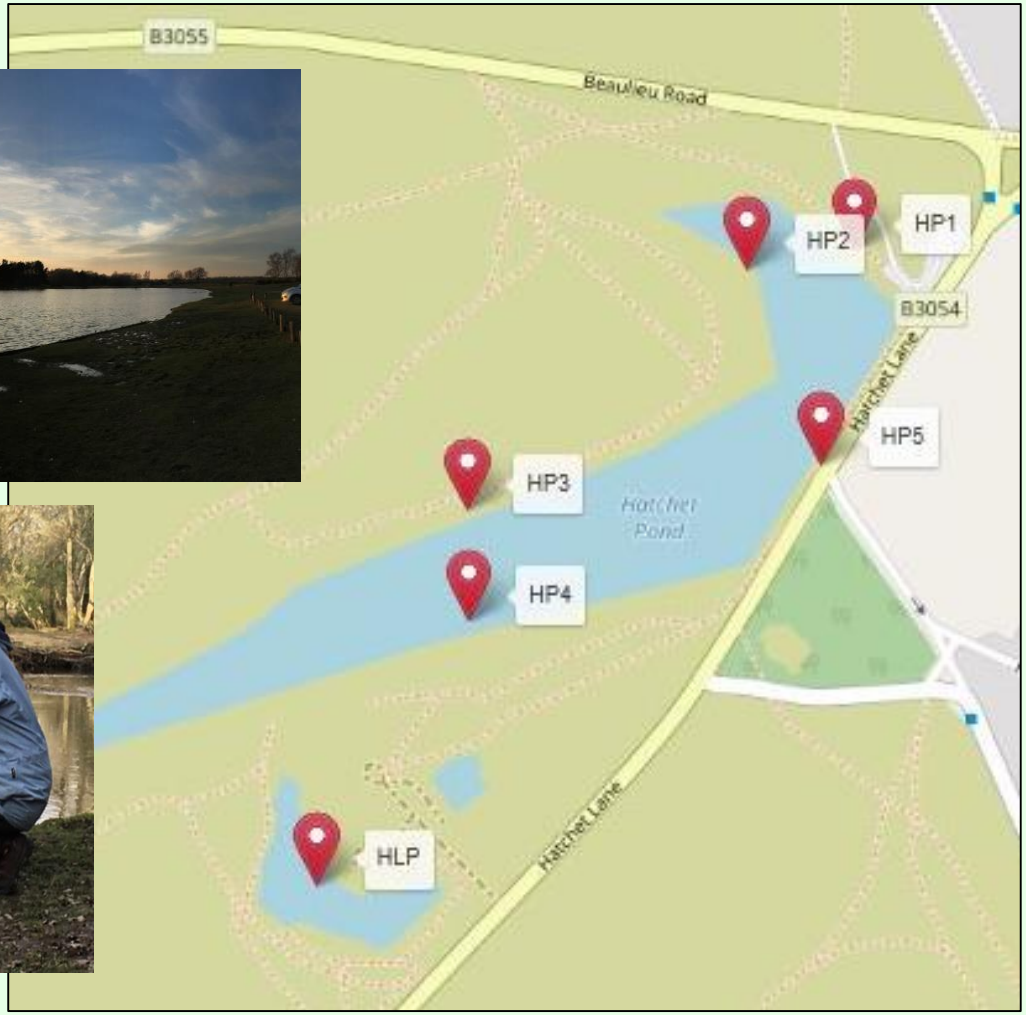


10-12 species per sample (mean 11)

7-9 species per survey (mean 7.6)

Hatchet Pond – fish

Stakeholder engagement and monitoring of Hatchet Pond (SAC/ WFD waterbody).



Hatchet Results

	LHP	HP1	HP2	HP3	HP4	HP5
 Dace						
 Perch						
 Pike						
 Tench						
 Roach						
 Common Bream						
 Ruffe						
 Carp						
 Rudd						
 European Eel						

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NatureMetrics

Forestry Commission England

NATURAL ENGLAND

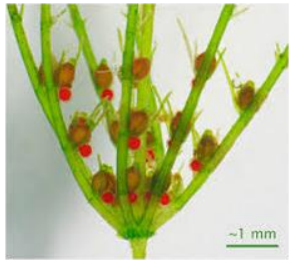
Next steps…..

We aim to test and apply eDNA to a wide range of lesser-known and difficult-to-survey species, and across the full range of freshwater habitats.

This approach has two major benefits for freshwater biodiversity conservation:

(i) It enables many more people to collect reliable data, so a far greater proportion of freshwaters can be reliably surveyed,

(ii) It offers potential for a wide range of species and uncharismatic groups to be recorded consistently for the first time, kick-starting policies and action for their protection.



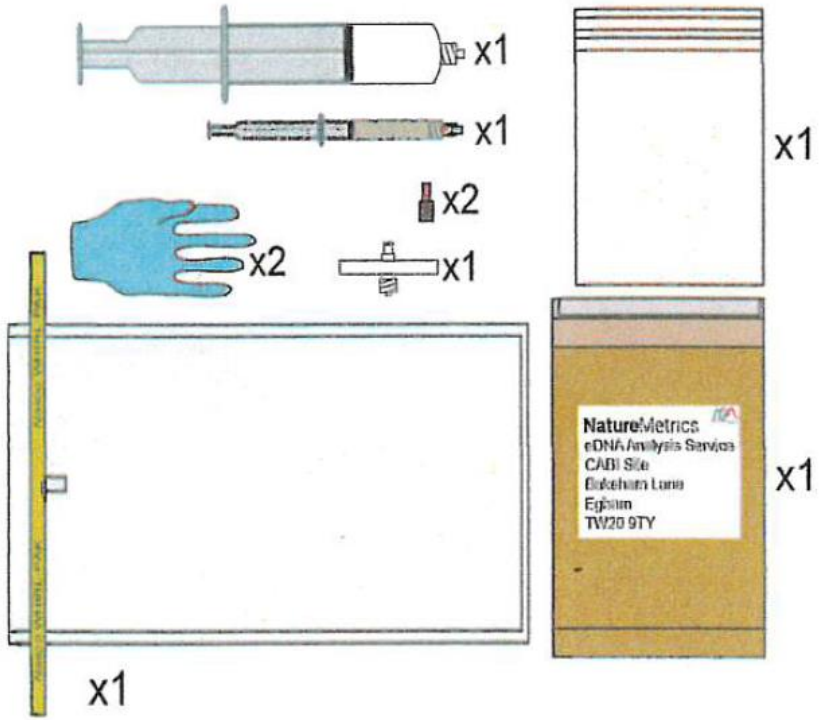
eDNA Monitoring…..

Freshwater Habitats Trust

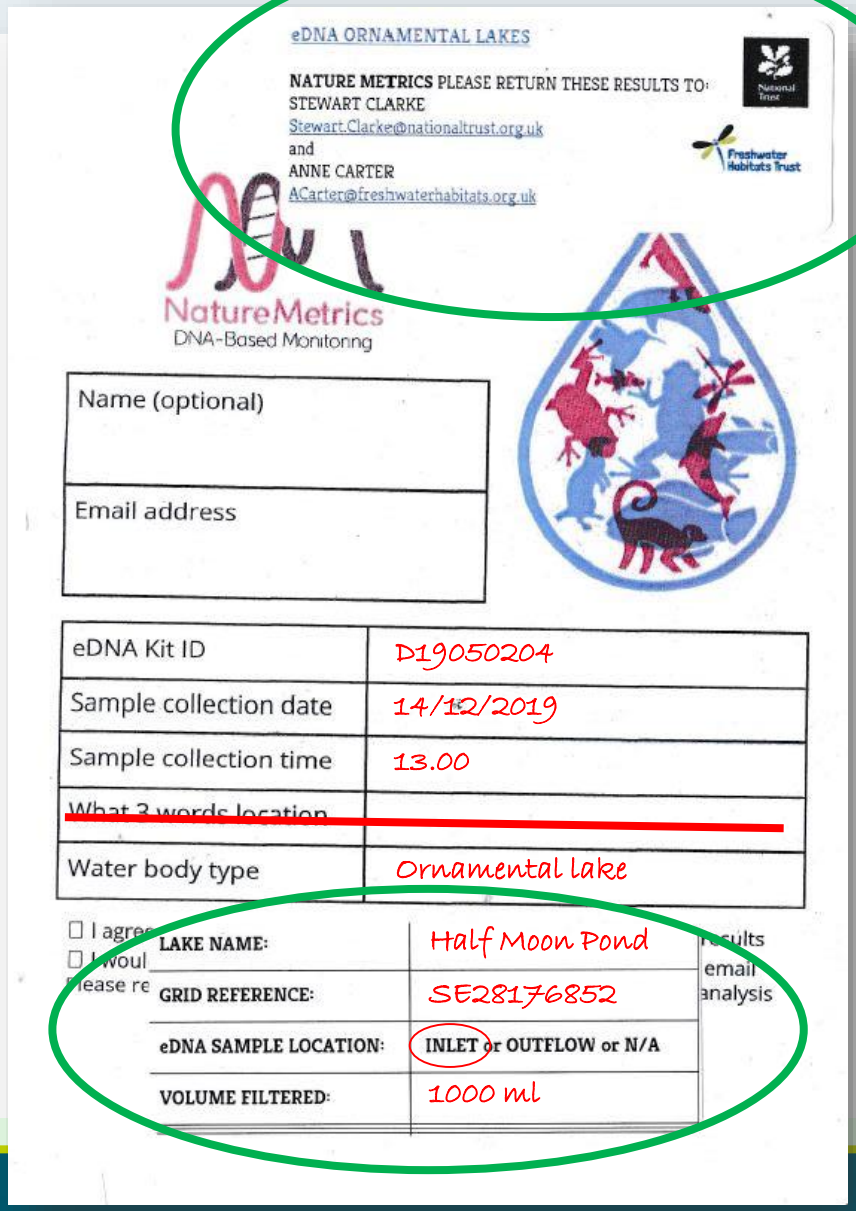
eDNA kits: Multi species

Kit Contents

1x pair nitrile gloves
1x large collection bag
1x 60ml Luer Lock plastic syringe
1x filter
1x small syringe with preservative
2x red resealable zip lock bag
1x NatureMetrics addressed jiffy bag



eDNA kits: Multi species



eDNA ORNAMENTAL LAKES

NATURE METRICS PLEASE RETURN THESE RESULTS TO:
STEWART CLARKE
Stewart.Clarke@nationaltrust.org.uk
and
ANNE CARTER
ACarter@freshwaterhabitats.org.uk

NatureMetrics
DNA-Based Monitoring

Name (optional)	
Email address	

eDNA Kit ID	D19050204
Sample collection date	14/12/2019
Sample collection time	13.00
What 3 words location	
Water body type	Ornamental lake

☐ I agree
☐ I would
Please re
results
email
analysis

LAKE NAME:	Half Moon Pond
GRID REFERENCE:	SE28176852
eDNA SAMPLE LOCATION:	**INLET** or **OUTFLOW** or **N/A**
VOLUME FILTERED:	1000 ml

Clean bamboo cane

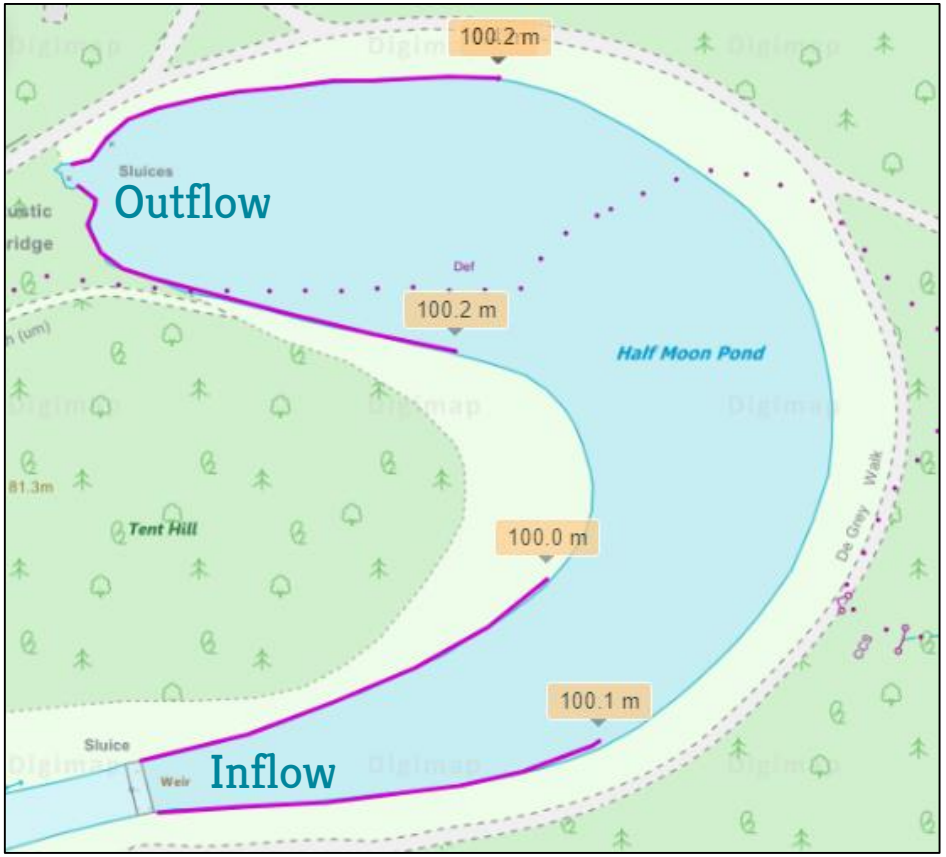
Cable tie

NatureMetrics

Sample pot

eDNA kits: Multi species

- Use graduated sample pot (50ml) to collect 20 samples per kit
- For each lake use a minimum of two kits (the largest lakes may require more)
-
- Kit 1 : Collect samples either side of **outflow** every 10m either side (i.e. 10 each side of outflow)
- Kit 2: pick **inflow** or opposite side (if no inflow) every 10m either side (i.e. 10 each side of inflow)

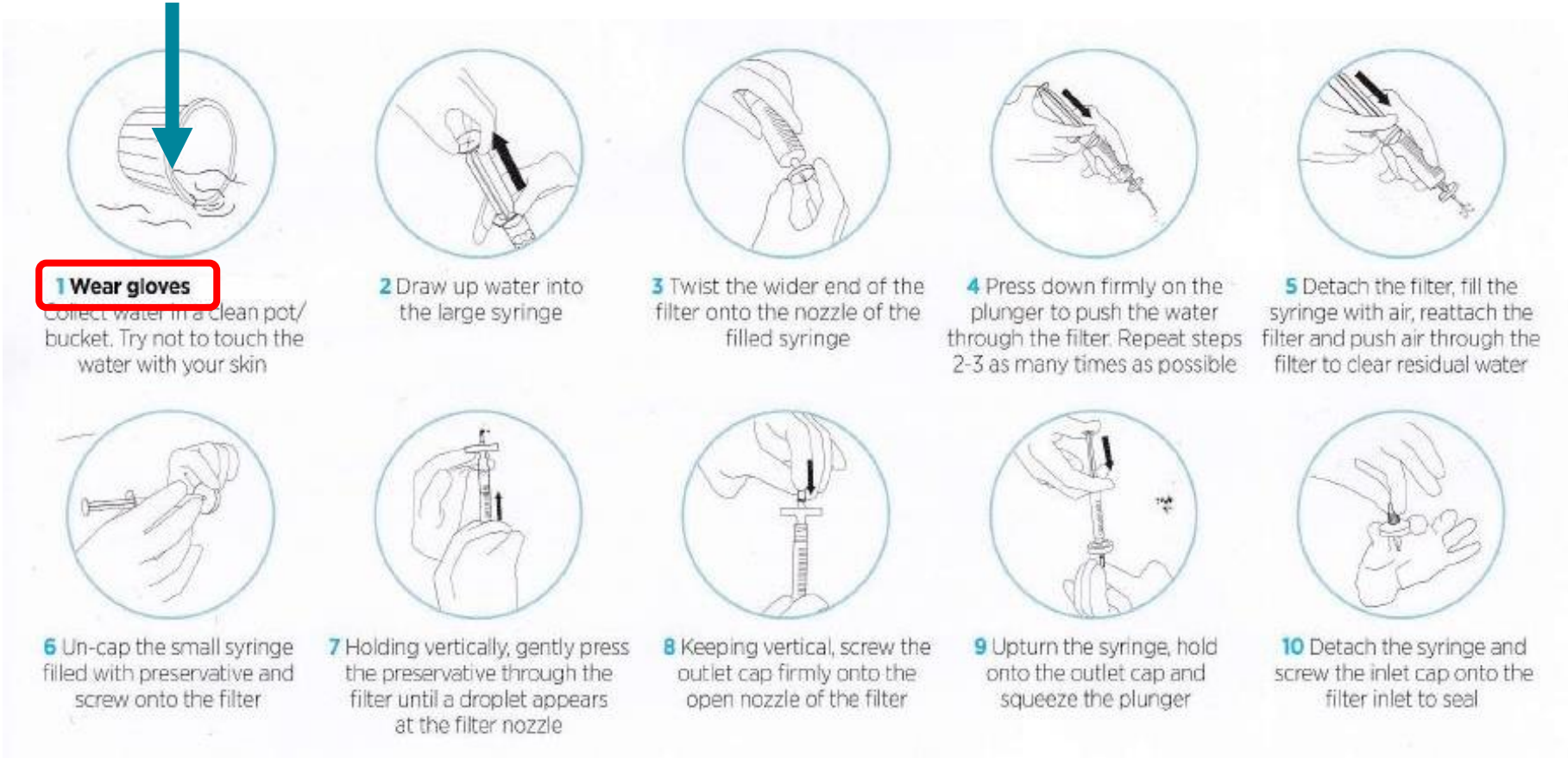


Demonstration …

Freshwater Habitats Trust

eDNA kits: How to collect your sample

STEP 1: Collect the water samples in the bag provided, using a clean sample pot (50ml) attached to a bamboo cane. Collect 20 samples per kit (20 x 50ml). Aim to space the samples 10 metres apart (total 200 metres).
Mix the water in the bag together before filtering.



Protect yourself - protect the site

Freshwater Habitats Trust

Clean Water for Wildlife
Health and Safety Guidance Note

LOTTERY FUNDED

This guidance note provides an outline of best practice in terms of health and safety when collecting your Clean Water Samples. This includes the use of the PackTest nitrate and phosphate water testing kits and considers the risks you should be aware of when collecting samples from a variety of freshwater habitat types – incl. ponds, lakes, rivers, streams and ditches.

In an emergency please contact the emergency services - 999

Your responsibility

Whilst taking part in the Clean Water for Wildlife survey you have the responsibility of ensuring that you undertake the sampling considering you own health and safety and the health and safety of others around you. You should not put yourself in a position that could place you, or others, in danger. You are under no obligation to participate in or continue with the survey if it is not safe to do so. You are under no obligation to visit a particular site, even if the survey organisers have suggested it. If you have any health and safety concerns about the survey, you should stop the survey and raise your concerns with Freshwater Habitats Trust peoplepondswater@freshwaterhabitats.org.uk.

Risk assessment

Before undertaking the Clean Water for Wildlife survey, you should consider the health and safety hazards associated with the site where you plan to collect your water sample and whether individual circumstances or any medical conditions expose you to particular hazards. Generic areas of risk when undertaking the Clean Water for Wildlife survey is given below. However, you should identify the potential risks specific to the site you are visiting and apply practical precautions to minimise the level of any risks. You should also pass this health and safety information on to anyone else who is helping you undertake the Clean Water for Wildlife survey.

Access permission

Permission to visit your field site will have been sought from relevant landowners/ managers in advance of your visit. Always obtain permission from the landowner or tenant to enter any private land not subject to open access legislation, before collecting your clean water sample. You may not need permission to collect a water sample where the pond, river, lake, stream or ditch can be accessed from a public footpath, or where the waterbody is within open access land. If you can contact the landowner to explain what you are doing and why, this is always the best option. Do not continue with the survey if access permission is refused. In all cases, please abide by The Countryside Code www.countrysideaccess.gov.uk.

Parking

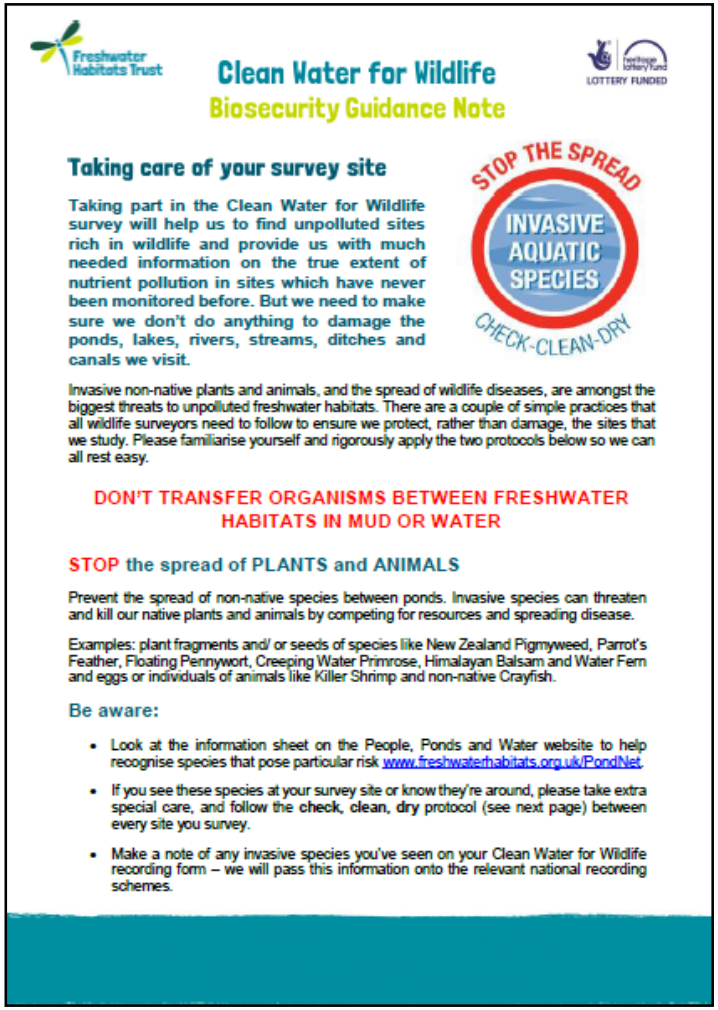
When visiting a site take care to park cars sensibly, preferably off-road, and do not block entrances. A notice in the car window can be useful to alert locals to your purpose and contact details (a car windscreen sign can be downloaded from our website).

Mobile phones

It is advisable to carry a mobile phone, as they may be useful in case of an emergency. Please note that mobile phones may not work in some remote areas. In case of an emergency you can use either the European Emergency Number (112) or 999 (see www.eena.org for more information). 112 can be dialled even if the keypad is locked.

Contact

Clean Water for Wildlife is one of three projects within Freshwater Habitats Trust's 'People, Ponds and Water Project', funded by the Heritage Lottery Fund
Project Administrator
T: 01865 595502 e: peoplepondswater@freshwaterhabitats.org.uk



Freshwater Habitats Trust

Clean Water for Wildlife
Biosecurity Guidance Note

LOTTERY FUNDED

Taking care of your survey site

Taking part in the Clean Water for Wildlife survey will help us to find unpolluted sites rich in wildlife and provide us with much needed information on the true extent of nutrient pollution in sites which have never been monitored before. But we need to make sure we don't do anything to damage the ponds, lakes, rivers, streams, ditches and canals we visit.

STOP THE SPREAD
INVASIVE AQUATIC SPECIES
CHECK-CLEAN-DRY

Invasive non-native plants and animals, and the spread of wildlife diseases, are amongst the biggest threats to unpolluted freshwater habitats. There are a couple of simple practices that all wildlife surveyors need to follow to ensure we protect, rather than damage, the sites that we study. Please familiarise yourself and rigorously apply the two protocols below so we can all rest easy.

DON'T TRANSFER ORGANISMS BETWEEN FRESHWATER HABITATS IN MUD OR WATER

STOP the spread of PLANTS and ANIMALS

Prevent the spread of non-native species between ponds. Invasive species can threaten and kill our native plants and animals by competing for resources and spreading disease.

Examples: plant fragments and/ or seeds of species like New Zealand Pigmyweed, Parrot's Feather, Floating Pennywort, Creeping Water Primrose, Himalayan Balsam and Water Fern and eggs or individuals of animals like Killer Shrimp and non-native Crayfish.

Be aware:

- Look at the information sheet on the People, Ponds and Water website to help recognise species that pose particular risk www.freshwaterhabitats.org.uk/PondNet.
- If you see these species at your survey site or know they're around, please take extra special care, and follow the **check, clean, dry** protocol (see next page) between every site you survey.
- Make a note of any invasive species you've seen on your Clean Water for Wildlife recording form – we will pass this information onto the relevant national recording schemes.

https://freshwaterhabitats.org.uk/projects/clean-water/

Protect yourself - protect the site

We advise that you always work in pairs

Find a safe place to access the water to collect your sample

Regard all water as a potential source of disease. There are several pathogens that can be contracted from water.

- Do not immerse open cuts in water
- Do not ingest pond or river water
- Do not consume food or drink or smoke cigarettes during survey work
- Wash hands thoroughly after a survey.

Protect yourself - protect the site

Freshwater Habitats Trust

Prevent the spread of non-native plants, animals, fungi and diseases, e.g. Chytrid, Ranavirus , etc.

CHECK – CLEAN – DRY and stop the spread

- **CHECK** your equipment and clothing for live organisms, plant fragments or seeds, even the difficult to see spots.
- **SCRAPE** wet/dry mud off all footwear and equipment with a stiff brush (a screwdriver may be useful to clean shoe treads).
- **CLEAN** and wash all clothing, equipment and footwear thoroughly.
- **DISINFECT** equipment (nets and footwear) in bleach solution, 1 part bleach (from a supermarket bottle containing 5% bleach – check the bottle label) to 16 parts water (e.g. for 5 litres of solution; add 300 ml of bleach to just under 5 litres of water).
- **DRY** all clothing and equipment, as some species can survive for days in damp environments. UV from sunlight can help to kill organisms, leave equipment to air dry completely in a sunny location before using at the next site.

INVASIVE SPECIES AND DISEASE ARE A THREAT TO ALL FRESHWATER SITES

Freshwater Habitats Trust

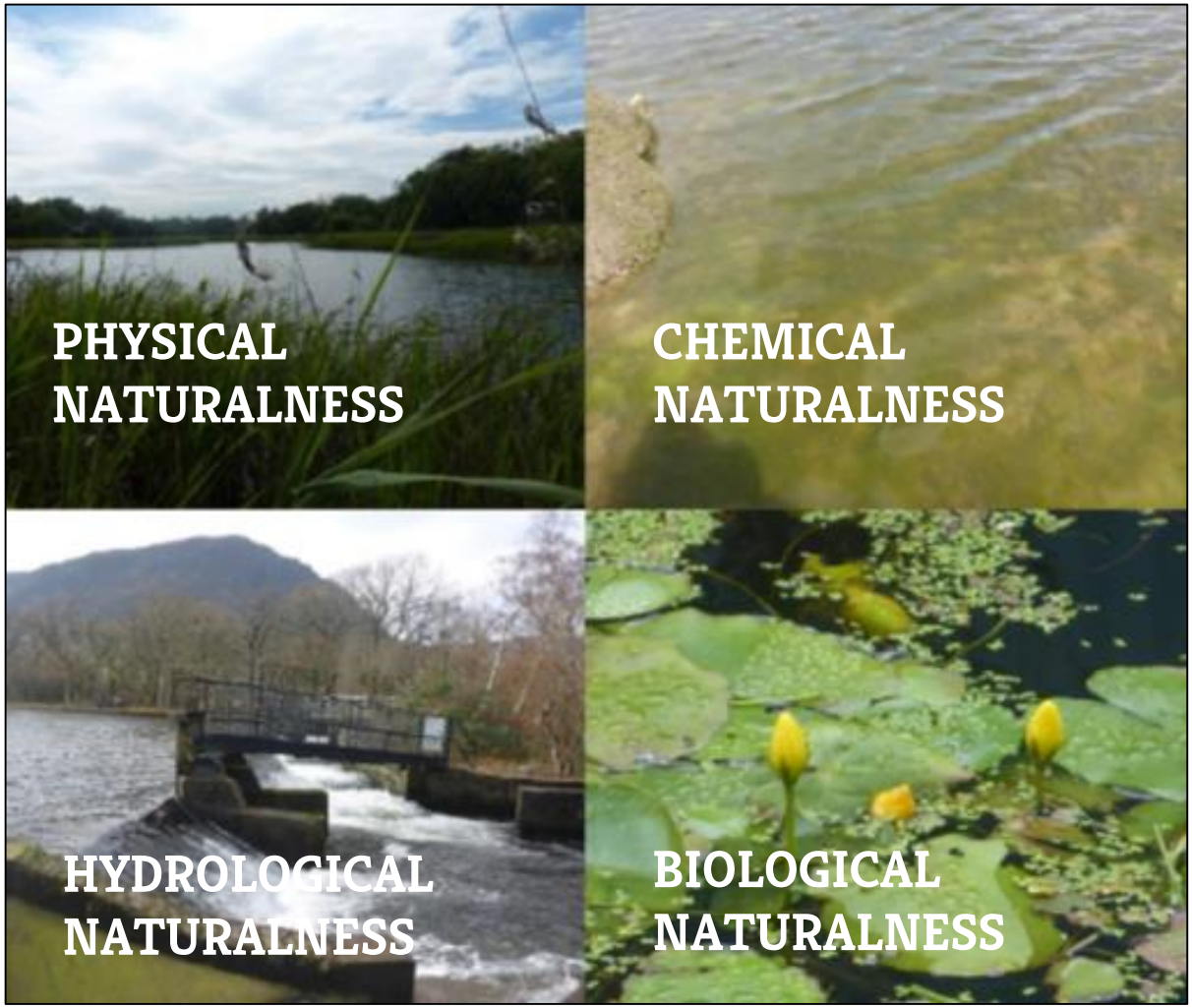
Lake Habitat Information

National Trust

Lake Habitat Information.....

Lake Naturalness Assessment

The main part of the assessment involves assigning naturalness class to four elements of lake functioning



http://priorotyhab.wpengine.com/contribute/

Physical Naturalness

Physical naturalness

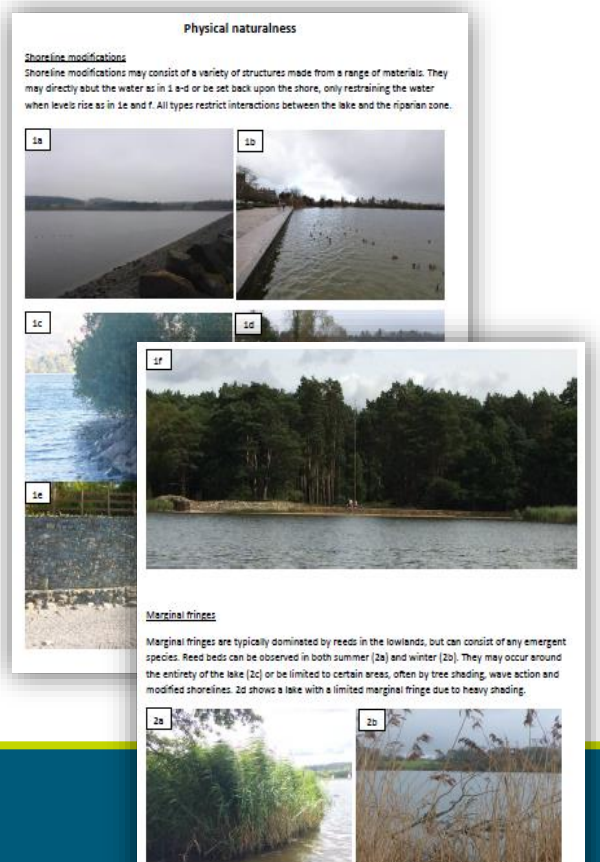
Naturalness class (circle one) 1 2 3 4 5

Confidence class (circle one) High Medium Low

Sub-categories assessed (tick all that apply)

☐ Shoreline condition ☐ Lake morphology

☐ Riparian land



Class	Physical naturalness		
	Sub-categories		
	Shoreline condition	Riparian land up to 10 m from high water mark	Lake morphology if artificial
1 natural	No evidence of human physical modifications of the shoreline. A marginal fringing wetland is likely, particularly in lowland lakes.	Riparian land is all semi-natural.	The edges shelve gently allowing colonisation by plants
2	Physical modifications of limited spatial extent - no more than 5% of shoreline). A marginal fringing wetland is likely, particularly in lowland lakes	Riparian land is predominantly semi-natural (90%).	Colonisation by plants should be possible at least 10m from the edge
3	Physical modifications and non-natural riparian land use of moderate spatial extent – no more than 1/3 of the shoreline. Marginal fringing wetlands are restricted in perimeter extent and depth.	Riparian land semi-natural for at least 2/3 of its extent	Colonisation by plants should be possible at least 3m from the edge.
4	Physical modifications extensive up to 2/3 of the shoreline	Riparian land semi-natural for at least 1/3 of its extent	The edges may be steep resulting in little habitat that can be colonised by plants. Only a very narrow strip of emergent, floating or submerged plants may exist.
5 least natural	Modification of the shoreline is widespread with more than 2/3 of the shoreline reinforced. Marginal fringing wetlands are absent.	Riparian land semi-natural for less than 1/3 of its extent	If the site is artificial the edges may be steep resulting in little or no habitat that can be colonised by plants. Only a very narrow strip of emergent, floating or submerged plants may exist.

Physical Naturalness

Physical naturalness

Naturalness class (circle one)

1 2 3 4 (5)

Confidence class (circle one)

(High) Medium Low

Sub-categories assessed (tick all that apply)

☒ Shoreline condition

☒ Lake morphology

☒ Riparian land

Class	Physical naturalness		
	Sub-categories		
	Shoreline condition	Riparian land up to 10 m from high water mark	Lake morphology if artificial
1 natural	No evidence of human physical modifications of the shoreline. A marginal fringing wetland is likely, particularly in lowland lakes.	Riparian land is all semi-natural.	The edges shelve gently allowing colonisation by plants
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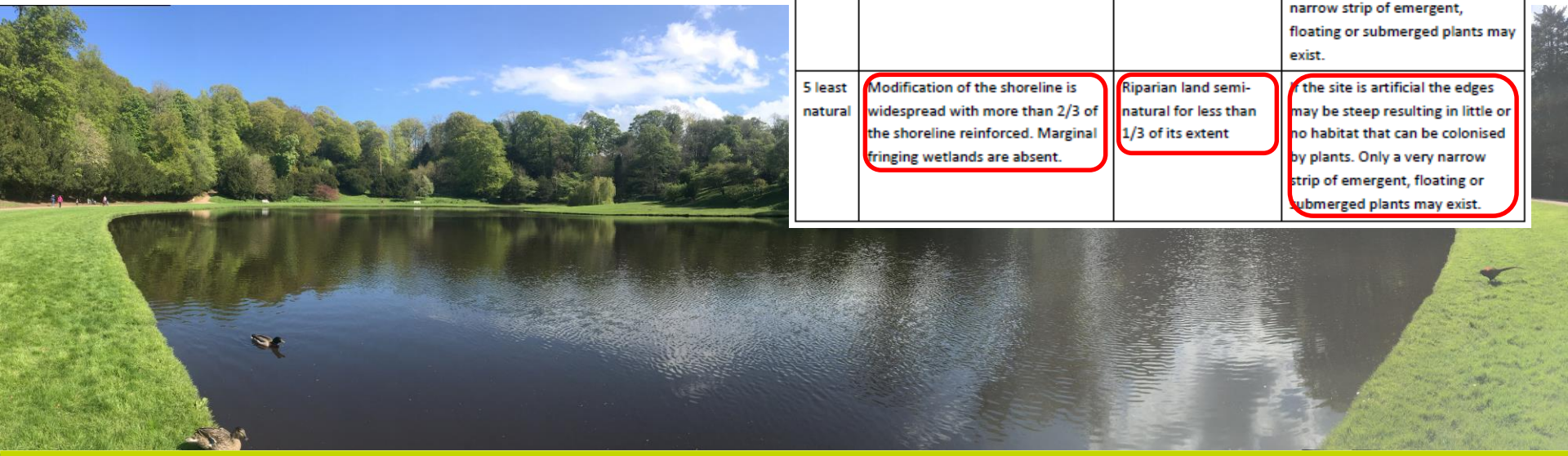
4	Physical modifications extensive up to 2/3 of the shoreline	Riparian land semi-natural for at least 1/3 of its extent	The edges may be steep resulting in little habitat that can be colonised by plants. Only a very narrow strip of emergent, floating or submerged plants may exist.
5 least natural	Modification of the shoreline is widespread with more than 2/3 of the shoreline reinforced. Marginal fringing wetlands are absent.	Riparian land semi-natural for less than 1/3 of its extent	If the site is artificial the edges may be steep resulting in little or no habitat that can be colonised by plants. Only a very narrow strip of emergent, floating or submerged plants may exist.

Studley Royal: Half Moon Pond



Hydrological Naturalness

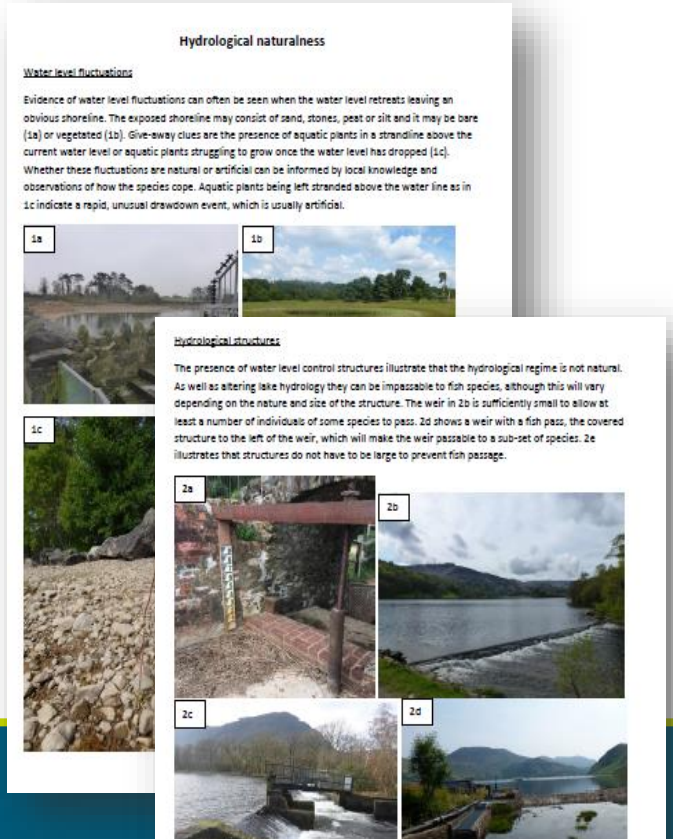
Hydrological naturalness

Naturalness class (circle one) 1 2 3 4 5

Confidence class (circle one) High Medium Low

Sub-categories assessed (tick all that apply)

- ☐ Structures
- ☐ Inflows and outflows
- ☐ Water level fluctuations



Hydrological naturalness

Water level fluctuations

Evidence of water level fluctuations can often be seen when the water level retreats leaving an obvious shoreline. The exposed shoreline may consist of sand, stones, peat or silt and it may be bare (1a) or vegetated (1b). Give-away clues are the presence of aquatic plants in a strandline above the current water level or aquatic plants struggling to grow once the water level has dropped (1c). Whether these fluctuations are natural or artificial can be informed by local knowledge and observations of how the species cope. Aquatic plants being left stranded above the water line as in 1c indicate a rapid, unusual drawdown event, which is usually artificial.

1a 1b 1c

Hydrological structures

The presence of water level control structures illustrate that the hydrological regime is not natural. As well as altering lake hydrology they can be impassable to fish species, although this will vary depending on the nature and size of the structure. The weir in 2b is sufficiently small to allow at least a number of individuals of some species to pass. 2d shows a weir with a fish pass, the covered structure to the left of the weir, which will make the weir passable to a sub-set of species. 2e illustrates that structures do not have to be large to prevent fish passage.

2a 2b 2c 2d

Class	Hydrological naturalness		
	Sub-categories		
	Structures	Water level fluctuations	Inflows and outflows
1 natural	No structures affecting water levels or creating barriers	Natural seasonal water level fluctuations are expected.	Any inflows and outflows are natural, the surrounding land is not drained and ditches are absent.
2	Structures such as sluices and impoundments may be present, but are passable to most fish species, most of the time.This may be due to the presence of a fish pass or because the structure does not present an insurmountable obstacle.	Water levels naturally fluctuate or mimic a naturally fluctuating regime in a seasonal fashion (water levels higher in winter than in summer) and only moderate in extent. This may occur via active management of the water levels or naturally behind a structure if water levels can fall below its height in summer.	No additional ditches enter the lake, but inflows and outflows may have some modifications
3	A structure is present which is impassable to most fish species, most of the time	Water levels fixed and unable to fluctuate naturally.	Outflows may have been modified to reduce lake extent. Alternatively surrounding land may have been drained with ditches forming artificial inflows
4	Large impassable (all fish species, at all times) structure is present	Water levels are heavily depleted by abstraction resulting in considerable drawdown (but by less than 2m depth).	
5 least natural	Very large impassable structures present	Drawdown of more than 2m depth annually.	Lakes in this category are likely to be water supply reservoirs or part of hydro-electric schemes.

Hydrological Naturalness

Hydrological naturalness

Naturalness class (circle one)

1 2 **3** 4 5

Confidence class (circle one)

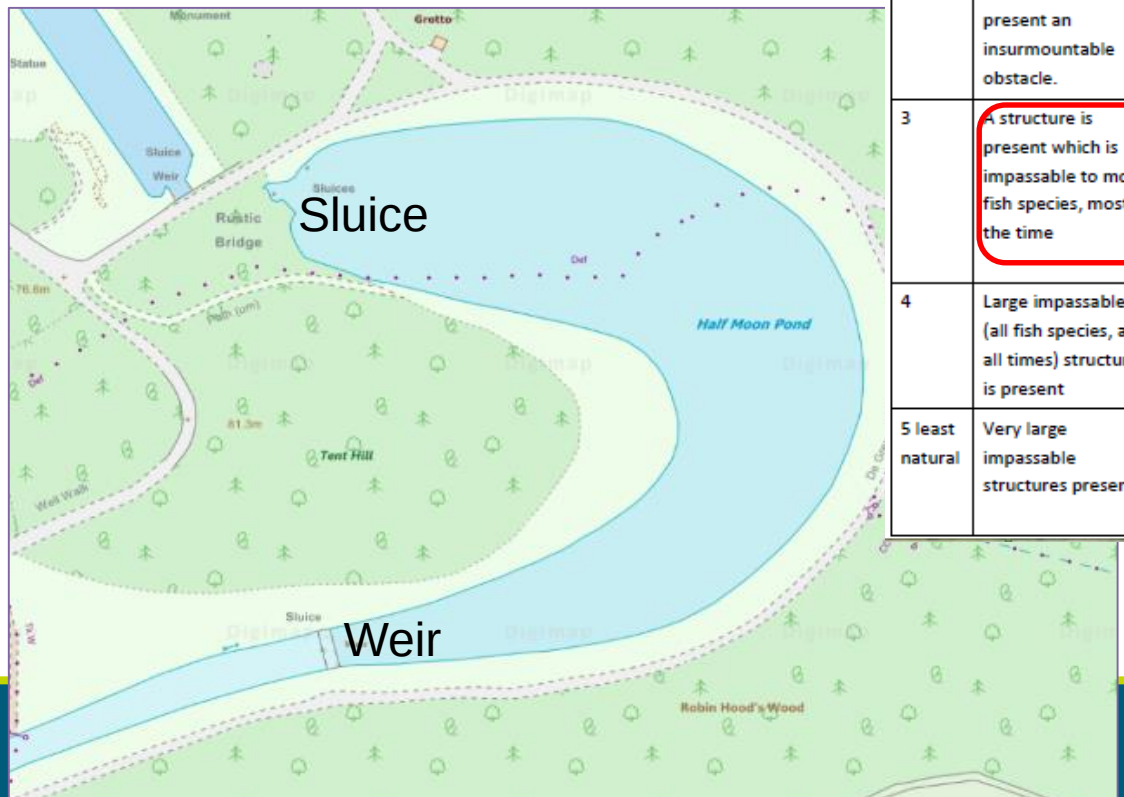
High Medium Low

Sub-categories assessed (tick all that apply)

☒ Structures

☒ Inflows and outflows

☒ Water level fluctuations



Class	Hydrological naturalness		
	Sub-categories		
	Structures	Water level fluctuations	Inflows and outflows
1 natural	No structures affecting water levels or creating barriers	Natural seasonal water level fluctuations are expected.	Any inflows and outflows are natural, the surrounding land is not drained and ditches are absent.
2	Structures such as sluices and impoundments may be present, but are passable to most fish species, most of the time.This may be due to the presence of a fish pass or because the structure does not present an insurmountable obstacle.	Water levels naturally fluctuate or mimic a naturally fluctuating regime in a seasonal fashion (water levels higher in winter than in summer) and only moderate in extent. This may occur via active management of the water levels or naturally behind a structure if water levels can fall below its height in summer.	No additional ditches enter the lake, but inflows and outflows may have some modifications
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Studley Royal Half Moon Pond

Chemical Naturalness

Chemical naturalness

Naturalness class (circle one) 1 2 3 4 5

Confidence class (circle one) High Medium Low

Form(s) of assessment (tick all that apply)

- ☐ Water clarity
- ☐ Algae
- ☐ Plant distribution
- ☐ Water chemistry test
- ☐ Biological sampling

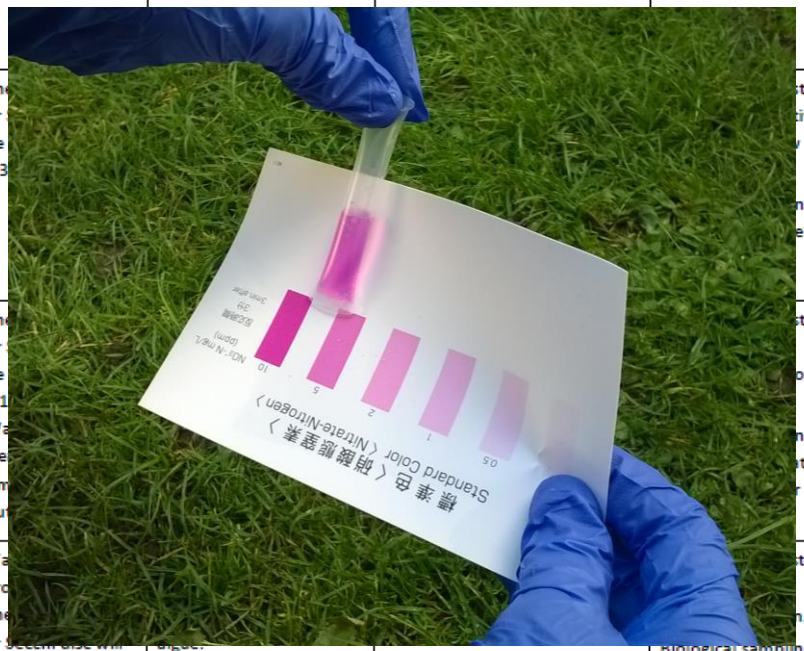
Chemical naturalness

In catchments containing a lot of peat, water may naturally be peat stained. This is natural and not a sign of impacted water quality. Despite being brown the water is still relatively translucent as below.

In contrast water bodies with a lot of sediment in the water are impacted either by high sediment loads from the catchment or often because the sediment is resuspended in the lake, usually either by boat traffic or carp. The water in these lakes look like the below and the water is opaque.

Lakes with excess nutrient loads often support algae, these come in various forms but often make the lake water green like the below

Class	Chemical naturalness			
	Method			
	Water clarity	Algae	Submerged plant distribution	Water quality or biological sampling
1 Natural	The lake substrate or Secchi disc will be visible through ≤ 3m of water.	Algal growth of any type will be negligible	Submerged plants will grow wherever the substrate is not too coarse to enable plant growth	Water quality test kits do not register any positive results. Biological sampling indicates no
2.	The or be ≤ 3			t tive ng els
3	The or be ≤ 1 Wa cle tim but			t of ng te
4	Wa bro The or be visible through ≤ 50cm of water.			t n. Biological sampling indicates high impacts on water quality
5 Least Natural	Water will be brown or green. Unable to see the bottom under 25 cm of water or more.	Frequent algal blooms. There may be extensive filamentous algae.	No submerged plants are present.	Water quality test kits register very high pollutant concentrations. Biological sampling indicates major pollution issues



Chemical Naturalness

Chemical naturalness

Naturalness class (circle one): 1 2 **3** 4 5

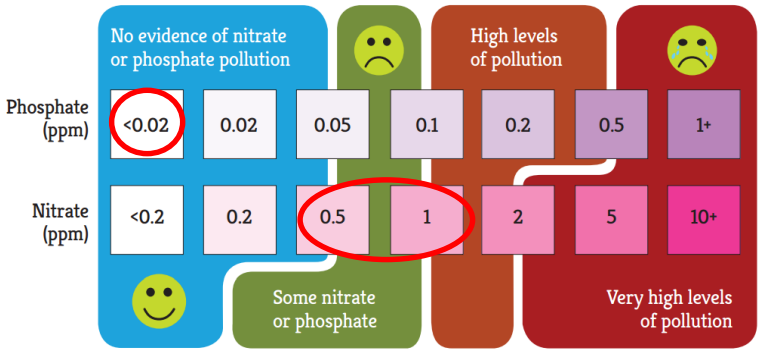
Confidence class (circle one): **High** Medium Low

Form(s) of assessment (tick all that apply)

- ☐ Water clarity
- ☒ Algae
- ☒ Plant distribution
- ☒ Water chemistry test
- ☐ Biological sampling

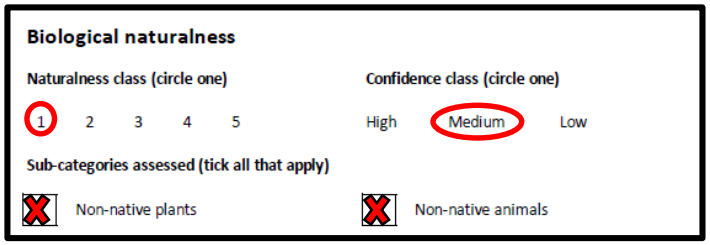
Studley Royal: Half Moon Pond

N&P tested 11/05/2019



Class	Chemical naturalness			
	Method			
	Water clarity	Algae	Submerged plant distribution	Water quality or biological sampling
1 Natural	The lake substrate or Secchi disc will be visible through ≤ 3m of water.	Algal growth of any type will be negligible	Submerged plants will grow wherever the substrate is not too coarse to enable plant growth	Water quality test kits do not register any positive results. Biological sampling indicates no evidence of pollution
2.	The lake substrate or Secchi disc will be visible through ≤ 3m of water.	Noticeable algal growth may occasionally occur particularly in high alkalinity lakes, but this will not be persistent or widespread. Filamentous and epiphytic algae will be rare.	Submerged plants may be limited to a depth of less than 3 m.	Water quality test kits register positive results but at low concentrations. Biological sampling indicates low levels of pollution
3	The lake substrate or Secchi disc will be visible through ≤ 1m of water. Water maybe clear at certain times of the year but not others.	There may be moderate extent of filamentous algae and algal blooms may occur particularly in spring and autumn, but will not be persistent. Plants may have a heavy epiphytic burden.	Some submerged plants will be present but these are unlikely to be abundant or grow to great depths unless they are species tolerant of nutrient enrichment. Alternatively there may be an abundance of submerged plant growth early	Water quality test kits register moderate levels of pollution. Biological sampling indicates moderate impacts on water quality.
4	Water will be brown or green. The lake substrate or Secchi disc will be visible through ≤ 50cm of water.	There may be frequent algal blooms or large extents of filamentous algae.	Submerged plants will be very sparse if present	Water quality test kits register high levels of pollution. Biological sampling indicates high impacts on water quality
5 Least Natural	Water will be brown or green. Unable to see the bottom under 25 cm of water or more.	Frequent algal blooms. There may be extensive filamentous algae.	No submerged plants are present.	Water quality test kits register very high pollutant concentrations. Biological sampling indicates major pollution issues

Biological Naturalness



Biological naturalness

Naturalness class (circle one): 1 2 3 4 5

Confidence class (circle one): High Medium Low

Sub-categories assessed (tick all that apply)

☒ Non-native plants ☒ Non-native animals

Class	Biological naturalness	
	Non-native plant species	Non-native animal species
1	No evidence of non-native species in the lake or on the riparian land.	No evidence of non-native species in the lake or on the riparian land.
2	Non-native plants should occupy no more than 5% of shoreline or lake area.	Non-native animals should rarely be encountered and not be creating an obvious impact. For some species such as carp their impact may be more easily spotted than the individuals. When the water is constantly a muddy opaque brown, only floating plants remain and there is no other form of sediment disturbance such as boat traffic, carp are likely to be the cause.
3	Non-native plants occupy up to 25% of the shoreline	At least one non-native animal found when appropriate search technique is used.
4	Non-native plants occupying up to 60% of the shoreline	Multiple non-native animals found when searched for.
5	Non-native plants occupying more than 60% of the shoreline or lake area	Non-native animals are numerous, individuals found with little effort.

Studley Royal: Half Moon Pond

Biological naturalness refers to the presence of **non-native species**. You may observe these on your visit directly or know of their presence due to reports or online databases. In some instances signs have been erected to inform visitors about the presence of these species and anglers are an excellent source of information on the fish in a lake.

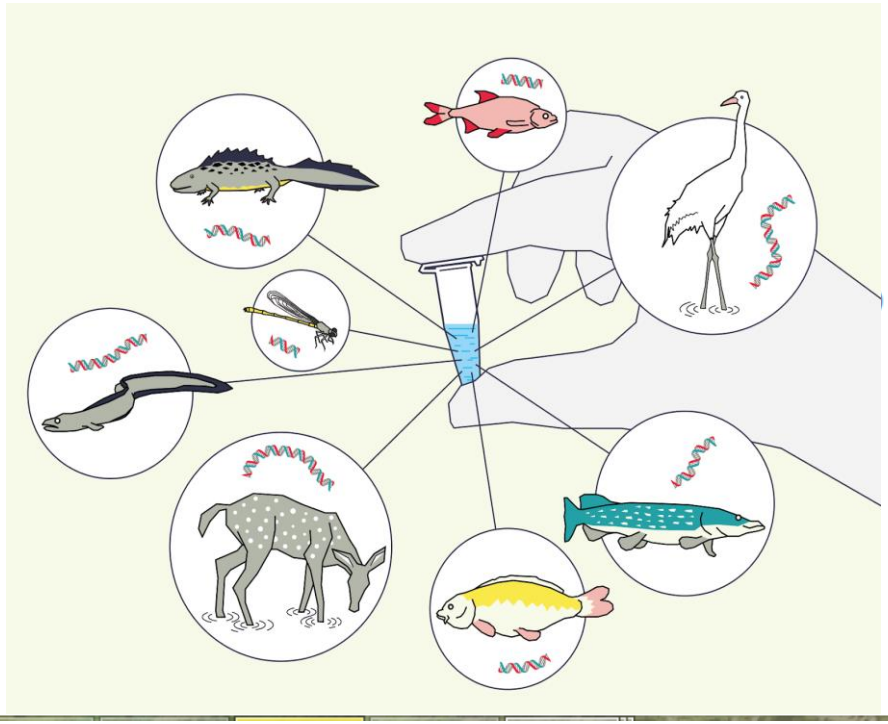
The plant species are the easiest to spot, but if you know about animal species this information should be included too.

Plant functional groups & Species of interest

Plant functional groups (tick all that apply)

- ☐ Rosette forming short stiff leaves
- ☐ Floating leaves but rooted
- ☐ Free floating
- ☐ Submerged linear leaves
- ☐ Submerged broad leaves
- ☐ Submerged fine/dissected leaves
- ☐ Emergent broad leaves
- ☐ Emergent narrow leaves
- ☐ Filamentous algae

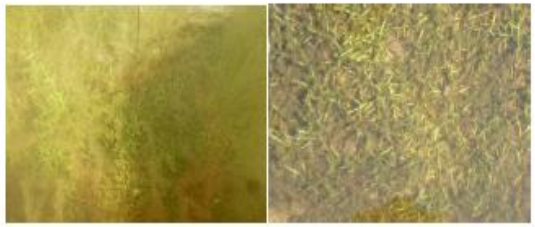
Species of interest (tick all that apply)



Plant Functional Groups

Here are some examples of the species that belong to the plant functional groups listed on the form. Not every species you may come across is included, so these pictures only illustrate the type of plants you may observe.

Rosette forming stiff leaved plants



These plants can form dense swards on the lake bed, superficially looking a bit like a lawn, or grow singly.

If washed up on the shore or u

Floating leaved rooted

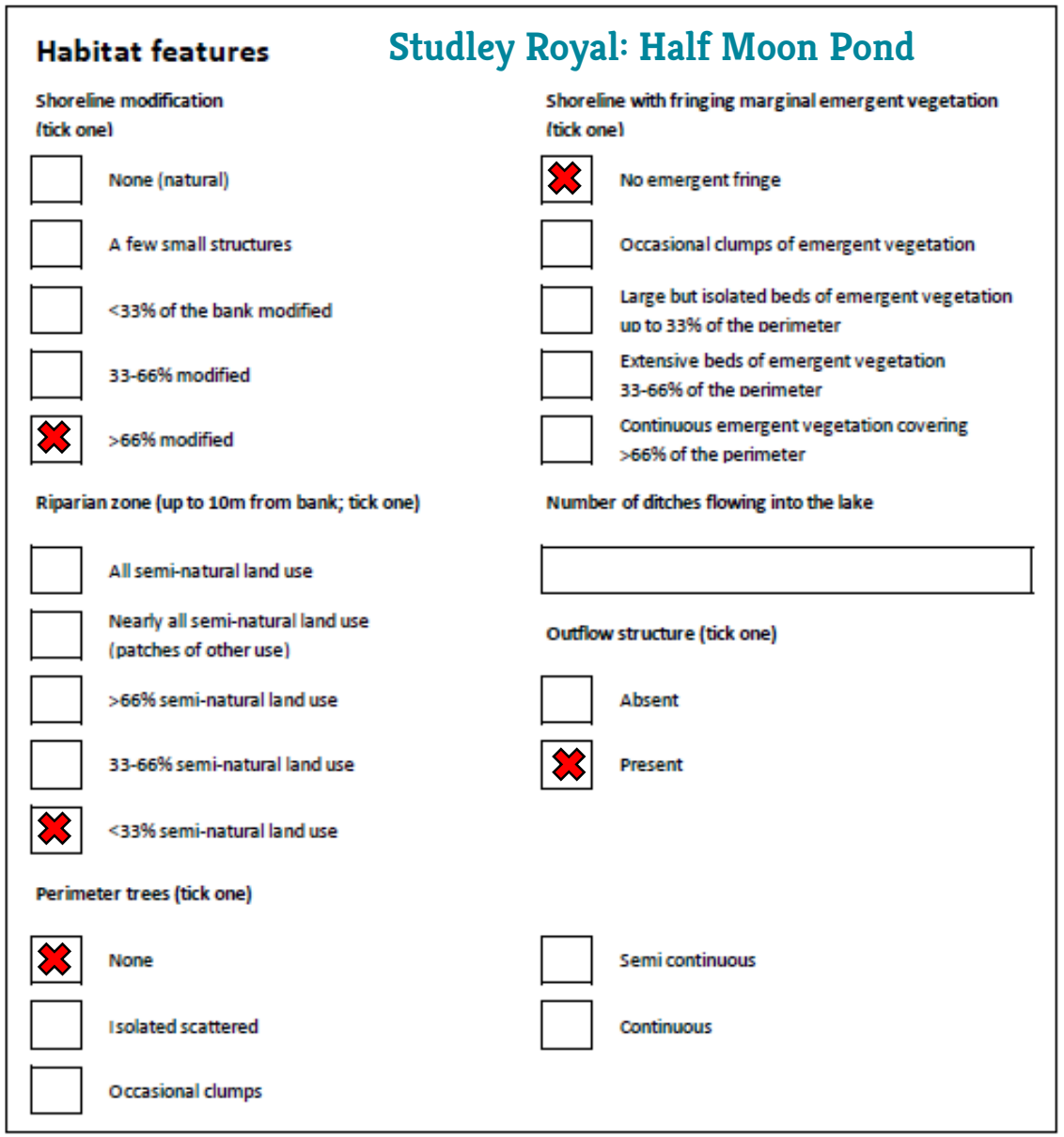
Typical floating-leaved plants are the water lilies although other floating leaved plants may be observed. The picture of the water lilies also includes some duckweed which is free floating (see below).

Free floating-leaved plants

Habitat features

In assessing the physical and hydrological naturalness you will have considered these habitat features.

- Shoreline modification
- Riparian zone
- Perimeter trees
- Fringing marginal emergent vegetation
- Number of ditches
- Presence of outflow structures



Habitat features — **Studley Royal: Half Moon Pond**

Shoreline modification (tick one)

- [ ] None (natural)
- [ ] A few small structures
- [ ] <33% of the bank modified
- [ ] 33-66% modified
- [x] >66% modified

Riparian zone (up to 10m from bank; tick one)

- [ ] All semi-natural land use
- [ ] Nearly all semi-natural land use (patches of other use)
- [ ] >66% semi-natural land use
- [ ] 33-66% semi-natural land use
- [x] <33% semi-natural land use

Perimeter trees (tick one)

- [x] None
- [ ] Isolated scattered
- [ ] Occasional clumps
- [ ] Semi continuous
- [ ] Continuous

Shoreline with fringing marginal emergent vegetation (tick one)

- [x] No emergent fringe
- [ ] Occasional clumps of emergent vegetation
- [ ] Large but isolated beds of emergent vegetation up to 33% of the perimeter
- [ ] Extensive beds of emergent vegetation 33-66% of the perimeter
- [ ] Continuous emergent vegetation covering >66% of the perimeter

Number of ditches flowing into the lake

[ ]

Outflow structure (tick one)

- [ ] Absent
- [x] Present