



**Institute of Fisheries  
Management**

# **FISHERIES HABITAT CREATION**

**INSTITUTE OF FISHERIES MANAGEMENT**



# OVERVIEW

- Management planning
- A bit about rivers
- Resilience against climate change
- Importance of habitat
- Fish productivity
- Protecting fish from predation
- Encouraging other aquatic life
- Plants
- Stocking
- And stuff.....

# What is a management plan?

- \* Putting it simply, a fishery management plan is a document that:
- \* Analyses the *current situation* at a fishery;
- \* Sets out some *principles* that should be followed in management;
- \* Details *goals and objectives* for the fishery;
- \* Says how they are to be *achieved*;
- \* Considers the stakeholders/users; and
- \* Says how they are to be *monitored*.

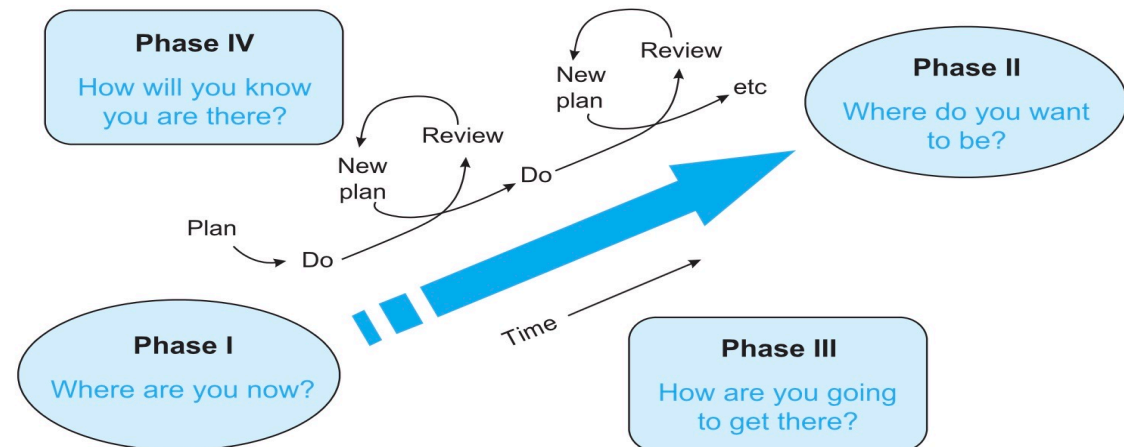
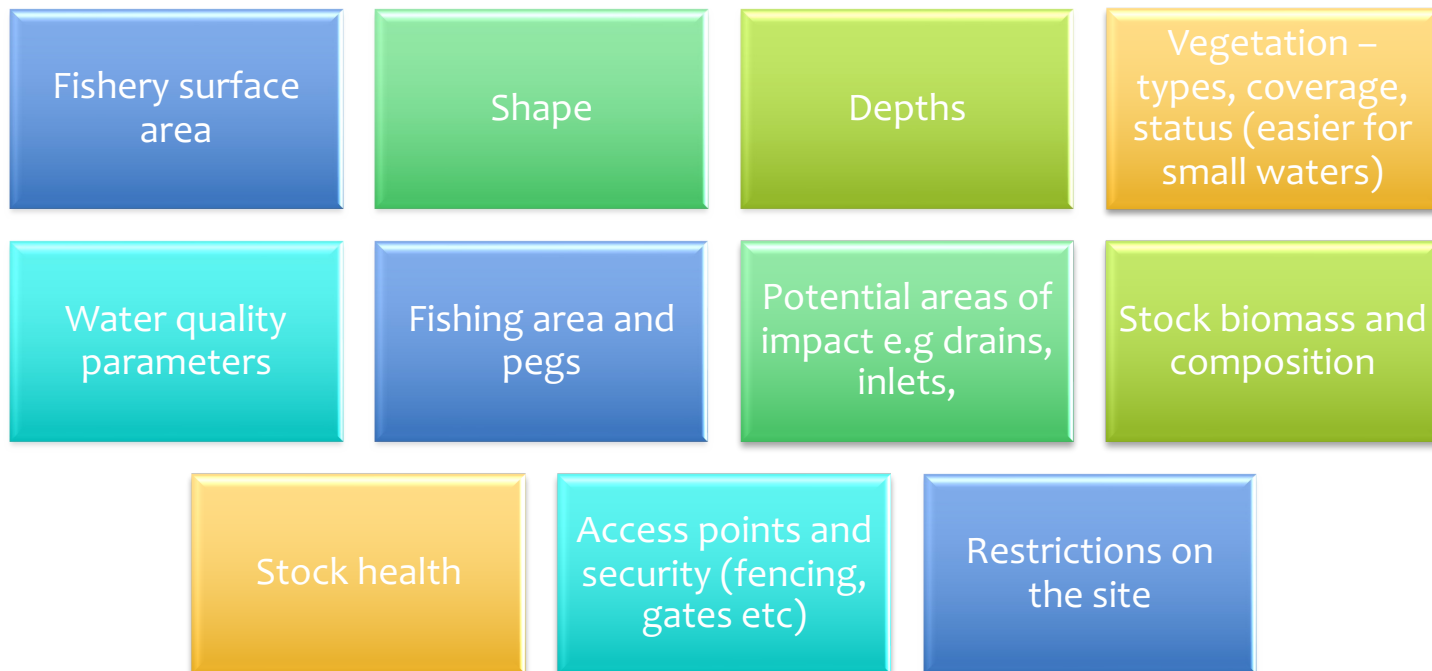


Figure 1. The four main phases in writing a fishery management plan.

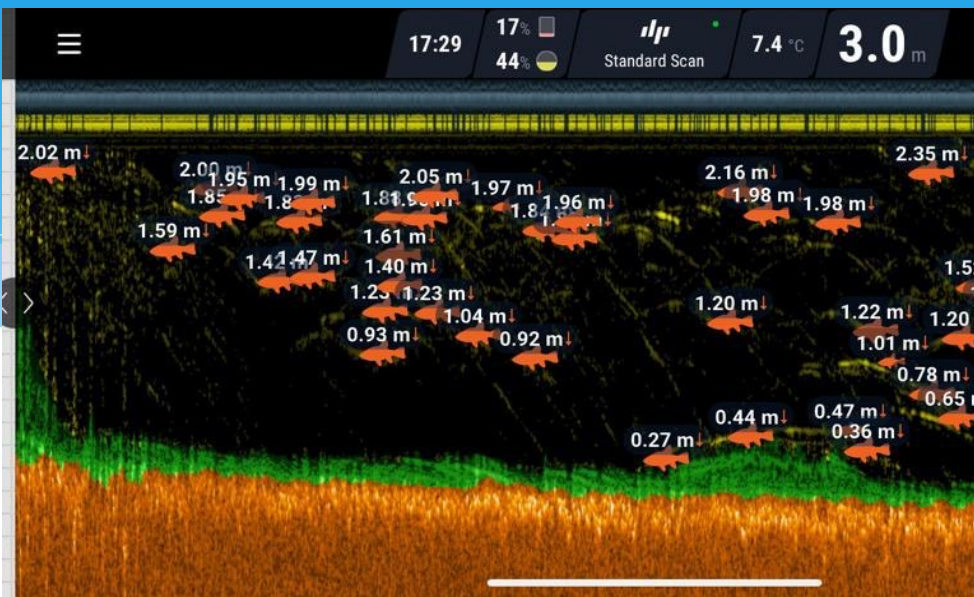
# Gathering the Information

*What do we need to know to help build our plan?*

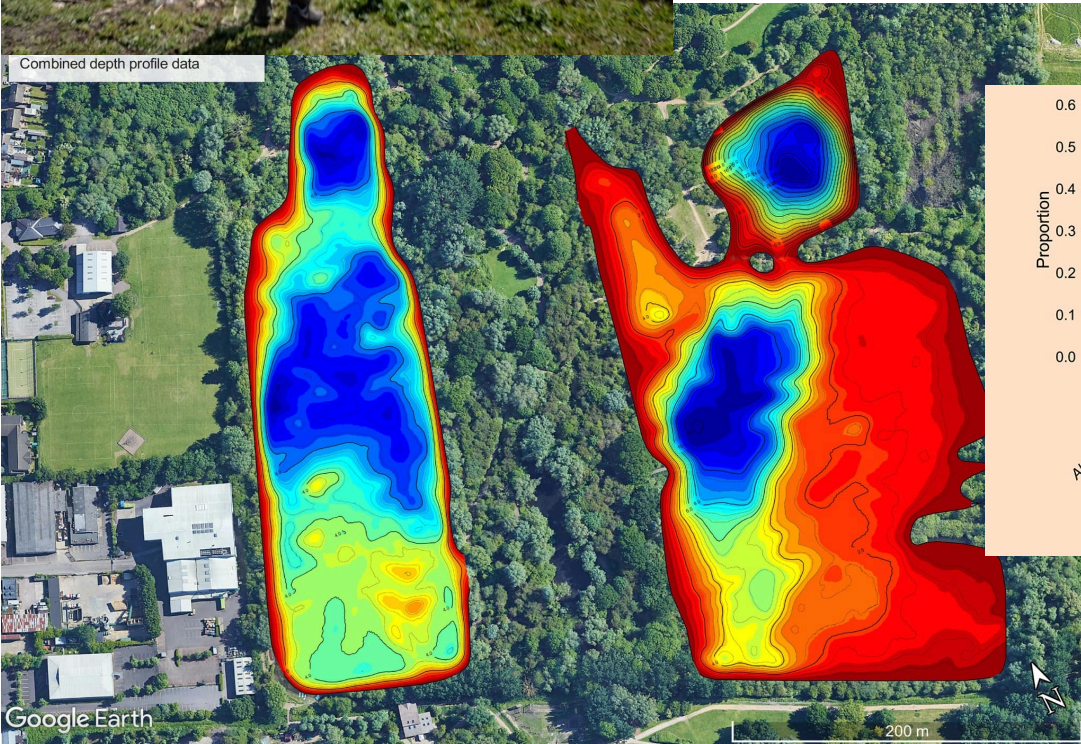




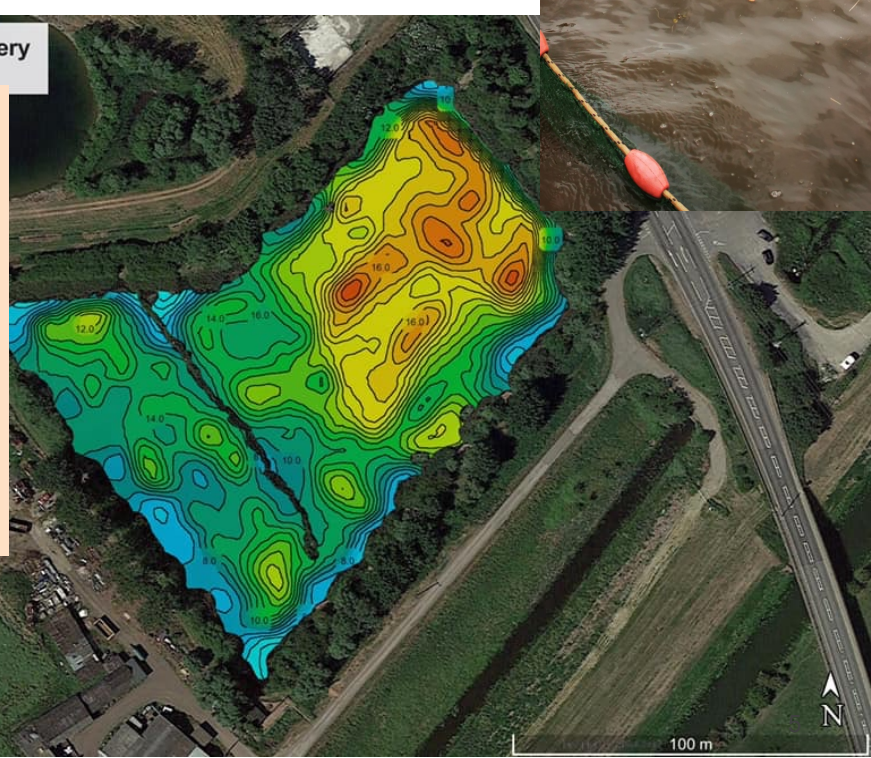
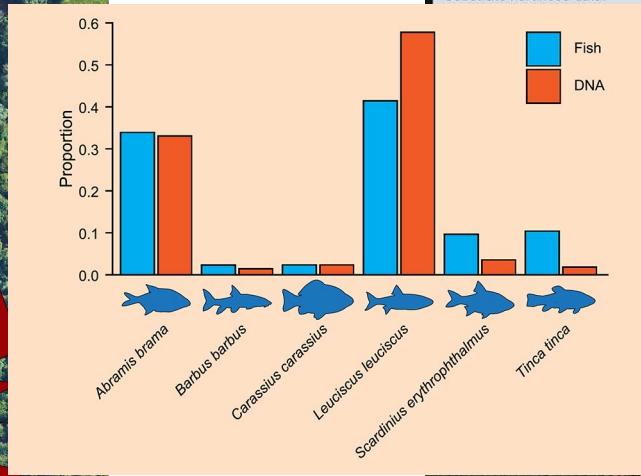
# Lake Surveys



Combined depth profile data

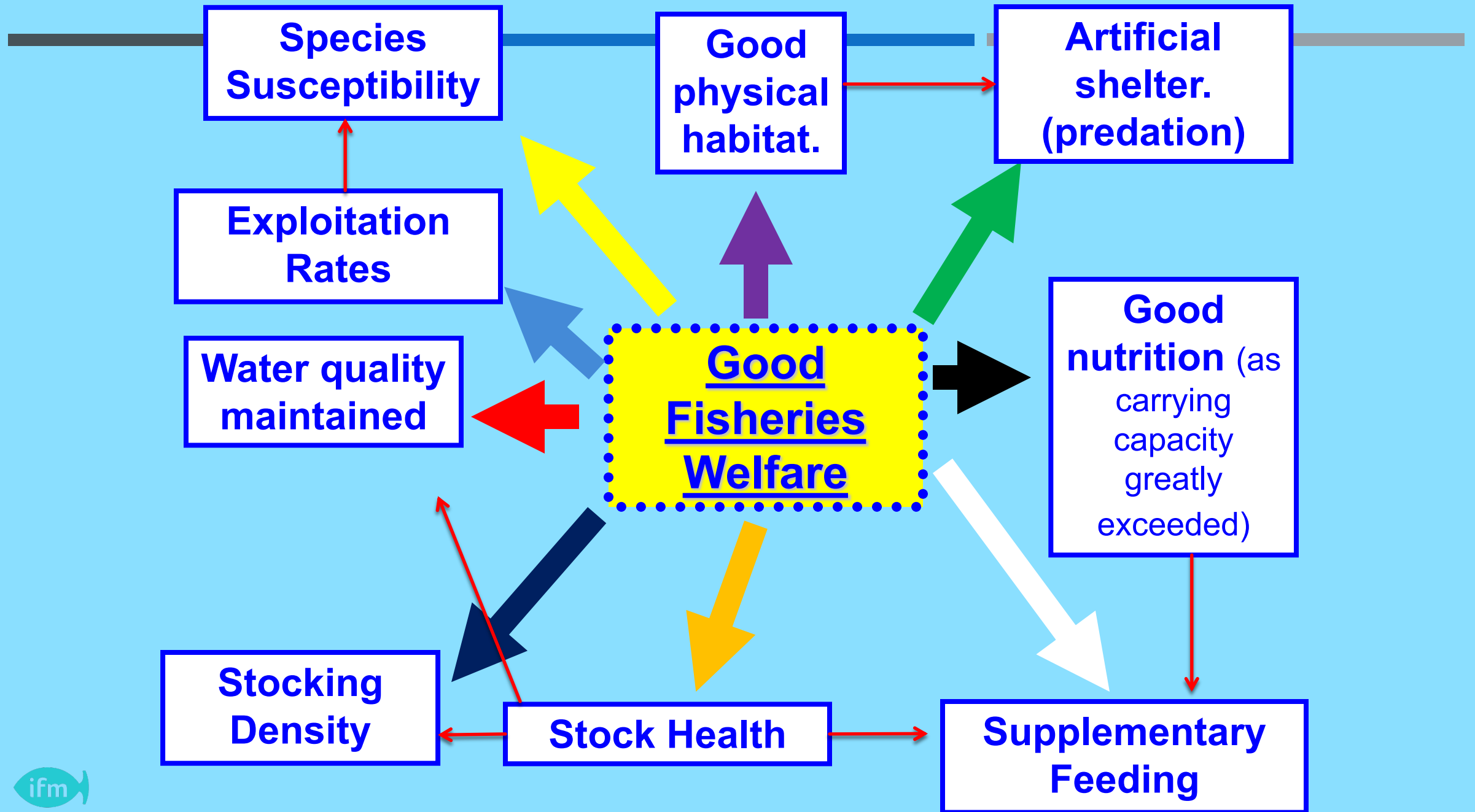


Trinity Farm Fishery  
Substrate hardness data.



Google Earth

Google Earth



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# HABITAT IMPROVEMENT

- If you want to improve the habitat in your fishery, you probably want to provide better conditions for the fish and enjoy better fishing.
- You can make lasting improvements to your fishery that will benefit both the fish and the environment as a whole.
- Where habitat has been engineered, modified or otherwise degraded in the past then fisheries improvements may produce good habitat for other wildlife, as well as better fishing.











Newport Winter League 2022-23

Venue: M W CAK  
Date: 26 FEB

Peg No	Angler	Weight	Team
17	[REDACTED]	DNW	
18	[REDACTED]	DNW	
19	[REDACTED]	DNW	
20	[REDACTED]	DNW	
21	[REDACTED]	0-0-4	
22	[REDACTED]	DNW	
23	[REDACTED]	DNW	
24	[REDACTED]	3	
25	[REDACTED]	3	
26	[REDACTED]	2	
27	[REDACTED]	2	
28	[REDACTED]	A	
29	[REDACTED]		
30	[REDACTED]		
34	[REDACTED]	D.N.W	
35	[REDACTED]	D.N.W	
36	[REDACTED]	D.N.W	
37	[REDACTED]	D.N.W	
38	[REDACTED]	1-5-0	
39	[REDACTED]	0-8-4	
40	[REDACTED]	3-14-6	

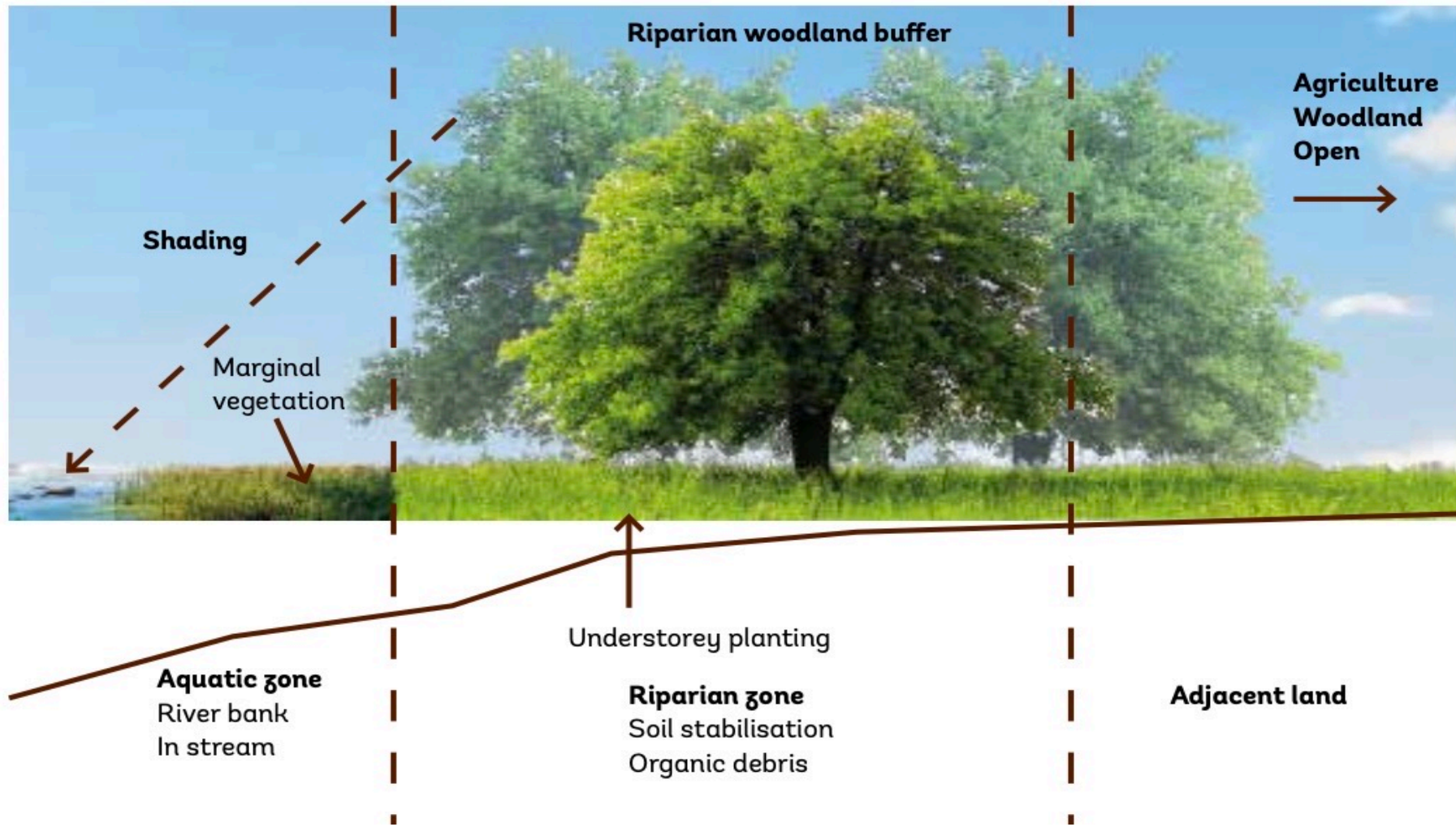




**Rivers like it Rough!**



Images courtesy of Wild Trout Trust



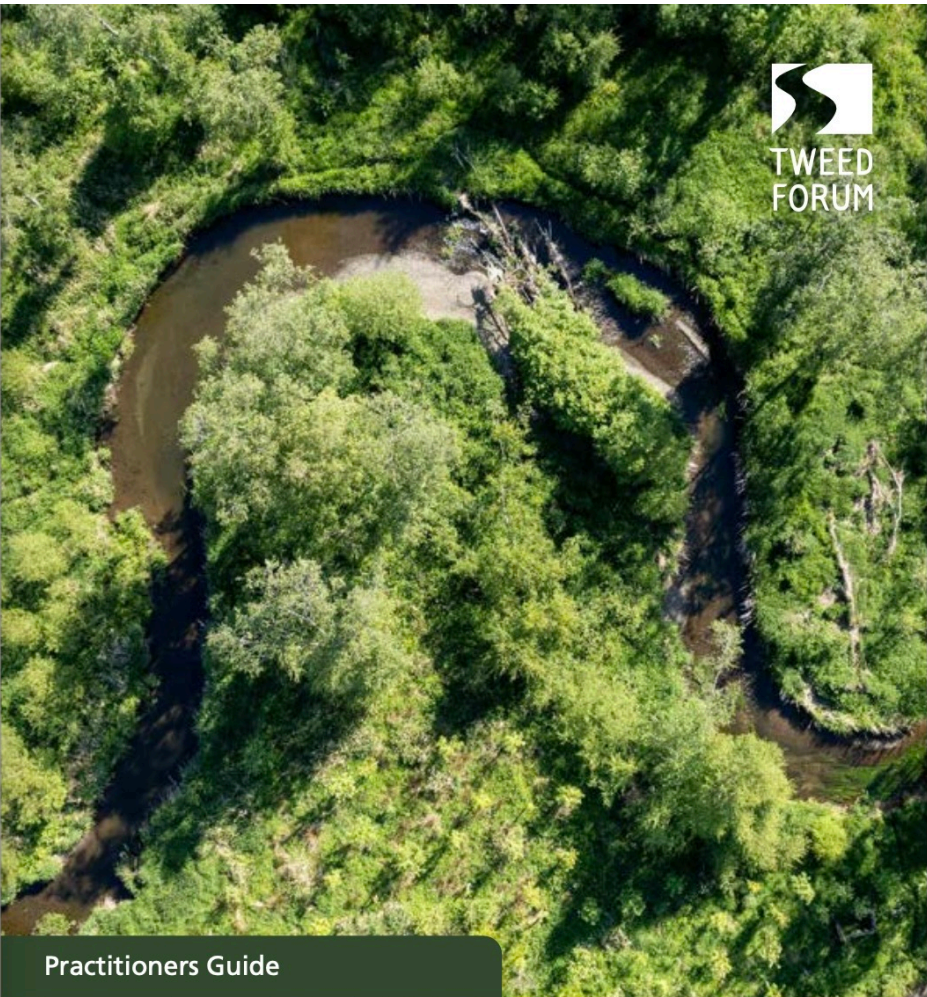
The riparian zone is defined as the area of land adjoining a river channel and includes the river bank but not the wider floodplain. Trees in the riparian zone can provide shade to cool the stream, stabilise stream banks and act as a source of nutrients and woody debris



# THE FUNCTIONAL ROLES OF DIFFERENT VEGETATION COMPONENTS

Zone	Location	Component	Functions
Aquatic zone	River bank/ in stream	Tree roots/coarse woody debris	Stream bank erosion control; provision of thermal refugia; shelter from predators; and nutrient uptake. Coarse woody debris creates habit and cover for wildlife and thermal refugia. Woody debris can also help to slow flood flows.
		Herbaceous vegetation	Provides shade at stream margins; erosion control; sediment retention; nutrient source (e.g. leaf litter and terrestrial invertebrates); uptake of nutrients; and habitat for wildlife.
Riparian zone	Marginal land/ floodplain	Canopy and trunks of trees and shrubs	Shade moderates water temperature and in-stream productivity, and increases nutrient sources (e.g. retained leaf litter, wood and terrestrial invertebrates) and uptake of nutrients.
Adjacent land	Areas adjoining the riparian zone	Woodland and shrub and field layer vegetation	A woody buffer between stream and adjacent land use can improve soil structure which increases infiltration and slows surface water run-off, leading to uptake of nutrients and retention of sediment.





Practitioners Guide

# Riparian Woodland Creation

Management

## Key Drivers for Establishing Riparian Woodlands at Scale

There are many reasons to create riparian woodland. However resource and funding are limited and therefore you ideally want your efforts to deliver the maximum output every time. The key is to understand your catchment and know the priority issues and areas within it allowing you to target your effort to achieve multiple benefits and or allow focus areas to be identified. This understanding and focus can also aid funding applications if the evidence for your work is based on sound science.

There are a number of common issues that can be addressed with good native/riparian woodland.

### Reduction of diffuse pollution

While diffuse pollution from sources such as fertilizer application and manure management can be significantly reduced by improving land and soil management in the surrounding area, a buffer of native/riparian area woodland will improve water quality and riverine habitat by interrupting the pollutant pathways.

### Nutrient runoff

Excessive nutrient runoff can cause eutrophication – over-enrichment of the water – which reduces water quality and may result in toxic blooms. The most common nutrient issues are caused by nitrogen and phosphorus that are common in agricultural use.

### Sediment run off

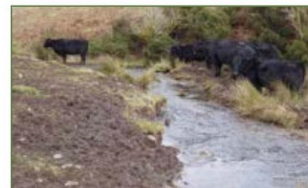
This is mostly caused by disruption of the soil surface by cultivation, drainage or trampling by livestock. Sediment run off can lead to silting up of water courses, which can damage the instream ecology and reduce water clarity.

### Pesticides

These can harm essential fly and insect life crucial to a healthy river system.



Poaching by livestock can cause significant issues



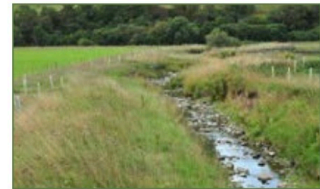
Significant poaching by livestock (note the sediment pathway in the foreground)

### Carbon storage

Trees store carbon as they establish and grow, and their leaf litter and debris increase soil carbon storage.

### Riverbank protection

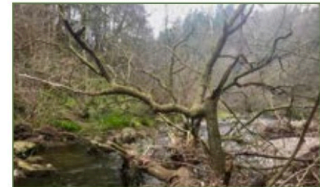
The roots of riparian trees protect the riverbank from erosion by binding the riverbank soils. This also helps protect the instream bed and reduces channel erosion. The presence of roots and trees also helps deflect and reduce water flows, again aiding in the overall protection of the water course.



A wide buffer and planted trees will help stabilise the bankside and water course

### Instream habitat

Trees enhance in-stream habitat and processes by helping stabilise banks and encouraging natural process to occur when they or their boughs fall into the water course.



A fallen tree providing valuable instream habitat

### Natural flood management

Trees in general, but specifically within the riparian areas, can aid with holding water back during high flows, increasing water infiltration and reducing surface water run off rates. This helps slow the flow of the water course and thus can help towards the reduction of damaging flood events.



Well-designed riparian woodland and buffer areas holding back water in high flows

### Shade and cool water

Trees growing along the banks of water courses provide shade, helping reduce water temperature during sunny periods. This helps offset the effects of global warming and maintain the conditions needed by indigenous aquatic life, including fish such as the salmon.

### Ecological connectivity

Riparian woodland will be an integral part of a more connected landscape and aid in the movement of wildlife between habitats. It will also enhance diversity by creating habitat hot spots or islands across a landscape. This should be taken into account when planning your woodland to maximise its impact.

- Articles
- Any time
- Since 2024
  - Since 2023
  - Since 2020
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About 86,800 results (0.07 sec)

- Sort by relevance
- Sort by date
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- Review articles

- include patents
- include citations
- Create alert

**Environmental hydraulics of large woody debris in streams and rivers**  
 CJ Gippel - Journal of Environmental Engineering, 1995 - ascelibrary.org  
 ... Preferred terms are large **woody** (or organic) **debris** or coarse **woody** (or organic) **debris**. The abbreviation **debris** is used in this paper to refer to **woody** material in stream channels that ...  
 ☆ Save Cite Cited by 312 Related articles All 6 versions

**Relationships between riverine fish and woody debris: implications for lowland rivers**  
 DA Crook, AI Robertson - Marine and Freshwater Research, 1999 - CSIRO Publishing  
 ... The characteristics of **woody debris** accumulations and their effects on hydraulic and ... of the **woody debris** relative to the size of the **river** or stream. In larger **rivers**, **woody debris** is more ...  
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**Large woody debris jams, channel hydraulics and habitat formation in large rivers**  
 TB Abbe, DR Montgomery - ... Rivers: research & management, 1996 - Wiley Online Library  
 ... **woody debris** (LWD) into structurally distinctive jam types in the alluvial channel of the Queets **River** ... fundamental to the dynamics of forested **river** ecosystems and provide insights into ...  
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Hydraulic guidelines for the re-introduction and management of large woody debris

Access through your institution Purchase PDF

Ecological Engineering  
 Volume 163, 1 May 2021, 106197

# Riverine large woody debris introduced for natural flood management leads to rapid improvement in aquatic macroinvertebrate diversity

Ashley Deane<sup>a,b</sup>, John Norrey<sup>a</sup>, Emma Coulthard<sup>a</sup>, David C. McKendry<sup>a</sup>, Andrew P. Dean<sup>a</sup>

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https://doi.org/10.1016/j.ecoleng.2021.106197 Get rights and content



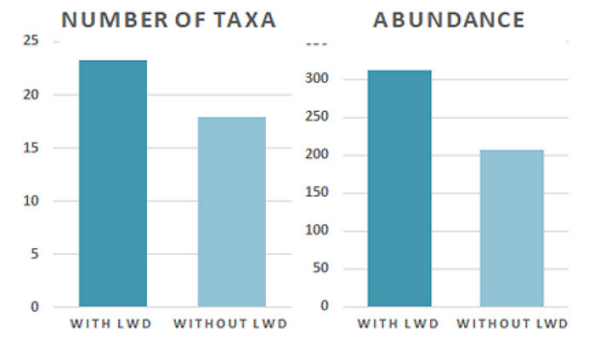
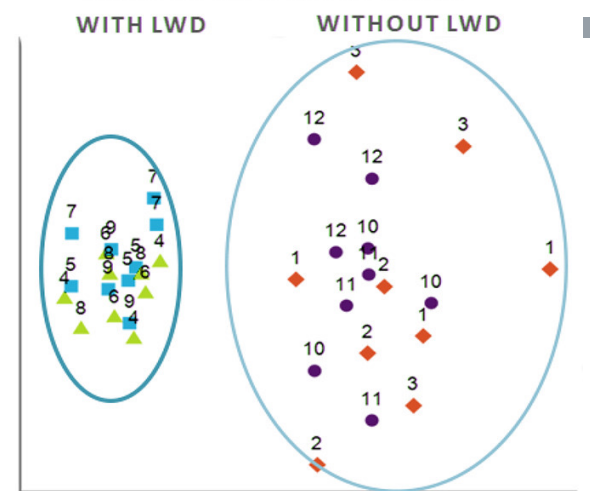
## Sites With Large Woody Debris (LWD)



## Sites Without Large Woody Debris (LWD)



## NMDS for River Invertebrates



RIVER RESEARCH AND APPLICATIONS  
*River. Res. Applic.* (2010)  
 Published online in Wiley InterScience  
 (www.interscience.wiley.com) DOI: 10.1002/rra.1354

## THE INFLUENCE OF RIPARIAN SHADE ON LOWLAND STREAM WATER TEMPERATURES IN SOUTHERN ENGLAND AND THEIR VIABILITY FOR BROWN TROUT

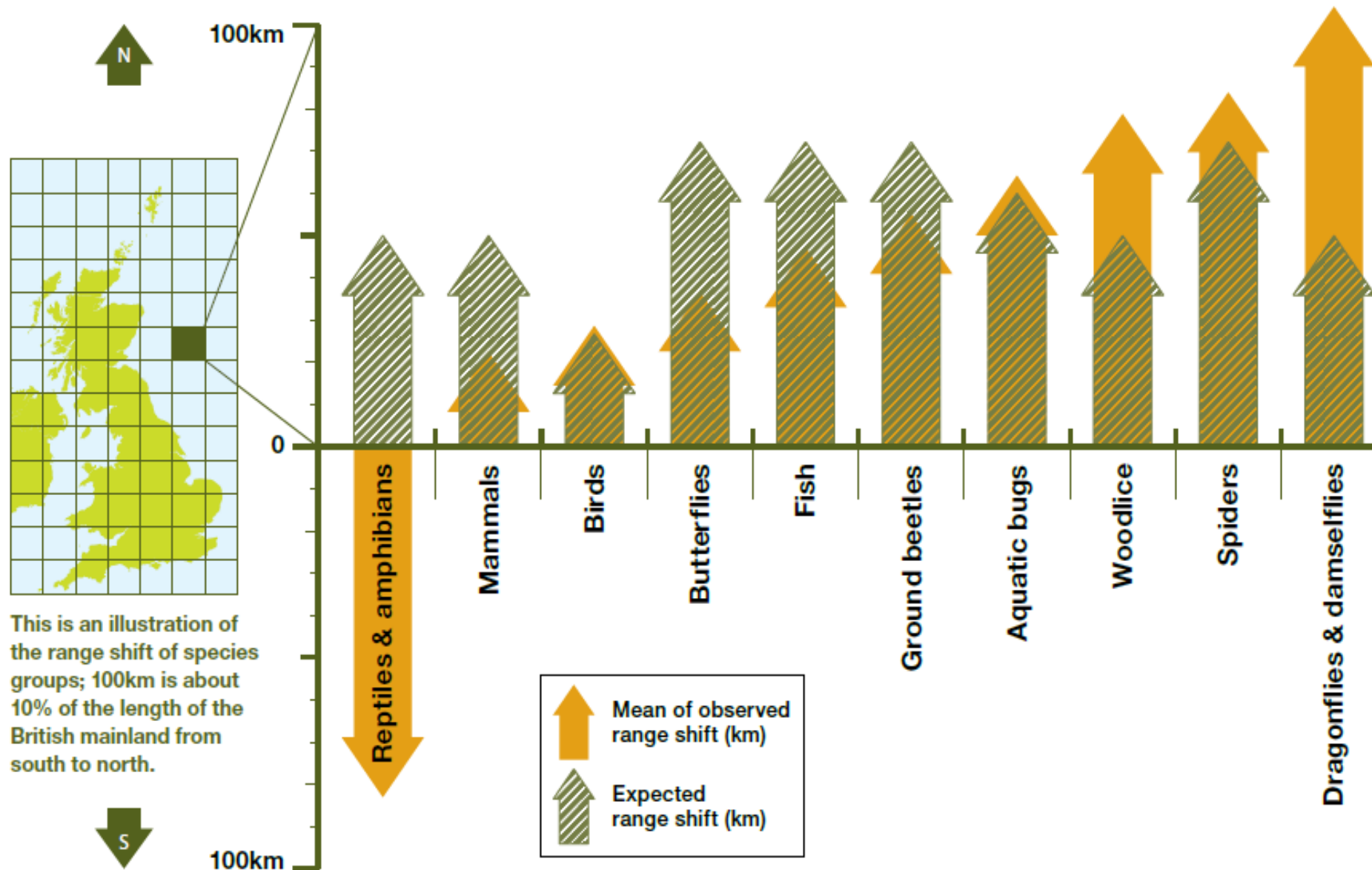
S. B. BROADMEADOW,<sup>a</sup> J. G. JONES,<sup>b</sup> T. E. L. LANGFORD,<sup>b</sup> P. J. SHAW<sup>b\*</sup> and T. R. NISBET<sup>a</sup>

<sup>a</sup> Centre for Forestry and Climate Change, Forest Research, Alice Holt Lodge, Wrecclesham, Farnham, Surrey, GU10 4LH, UK

<sup>b</sup> Centre for Environmental Sciences, School of Civil Engineering and the Environment, University of Southampton, Southampton, SO17 1BJ, UK



# WIDESPREAD BIODIVERSITY RESPONSE TO CURRENT CLIMATE CHANGE

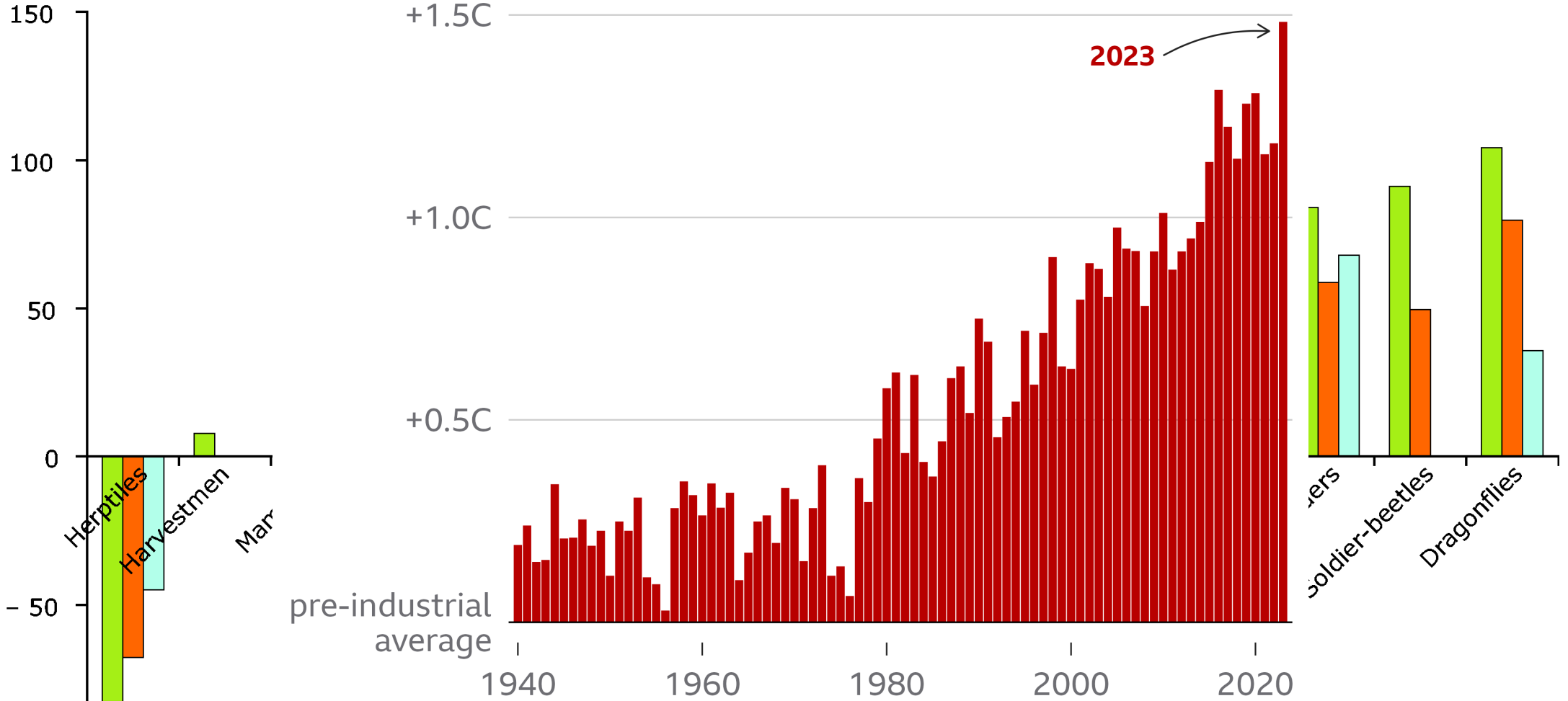


# Hottest year on record

Global average temperature by year, compared with pre-industrial average (1850-1900)

RANGE SH

Average northward shift



Source: ERA5, C3S/ECMWF

BBC

Ecology and Hydrology (CEH)



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# HOW FISH POPULATIONS WORK

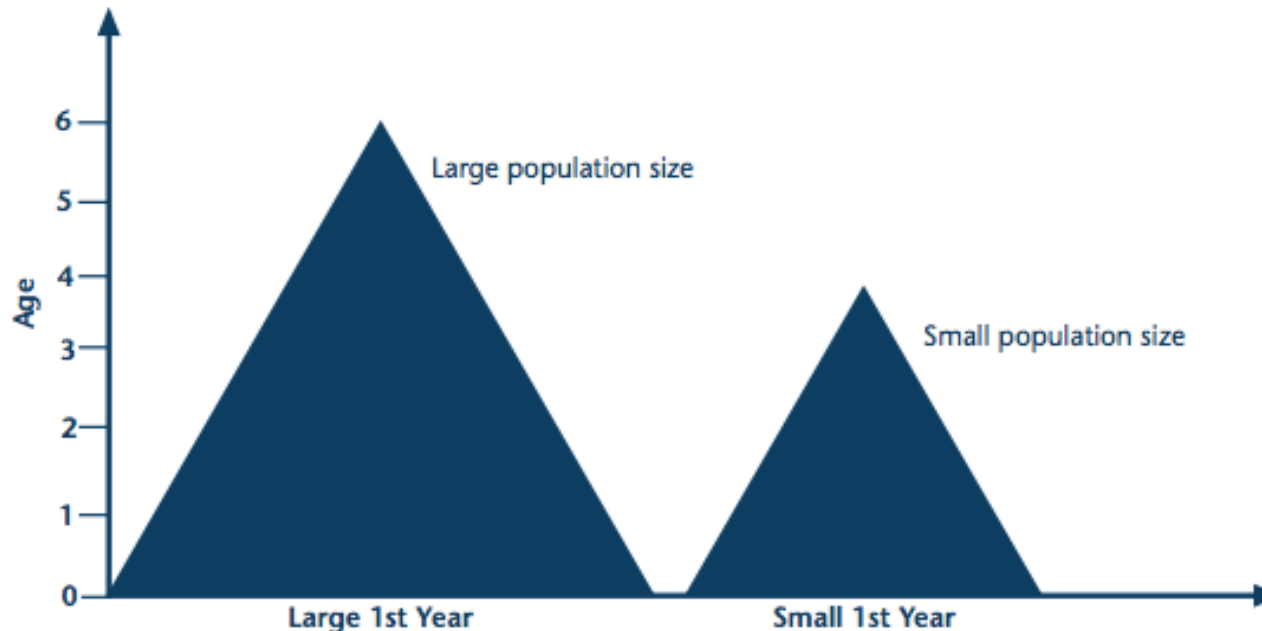
- A successful fish population is one that prospers within the limits of its environment.
- If a water body contains all the elements needed to satisfy the basic requirements of a fish species, then that population is more likely to be successful.
- In many cases there will be habitat constraints, predation, competition and disease, as well as variable weather conditions at critical times.
- Changing weather patterns driven by climate change will have a big impact on survival rates



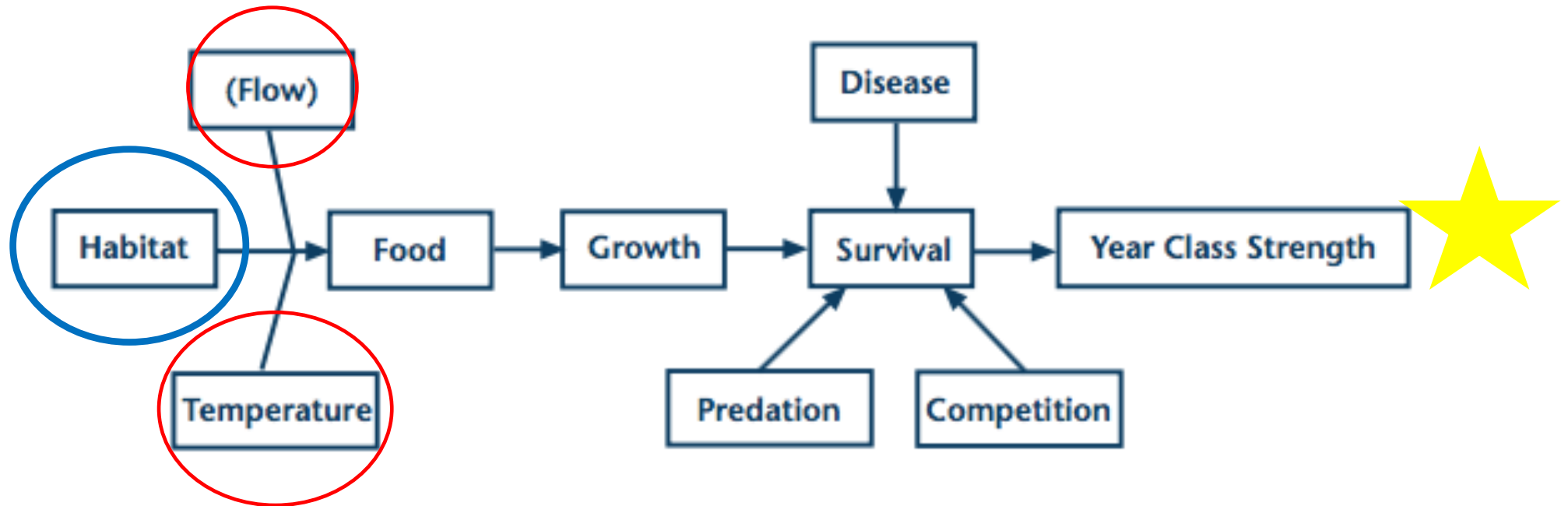
# NATURAL VARIATION

- The number of fish surviving their first year of life largely determines their overall contribution to the population.
- If many fish survive the first year, then that “year class” will be more numerous in later years

Classic Population Pyramid



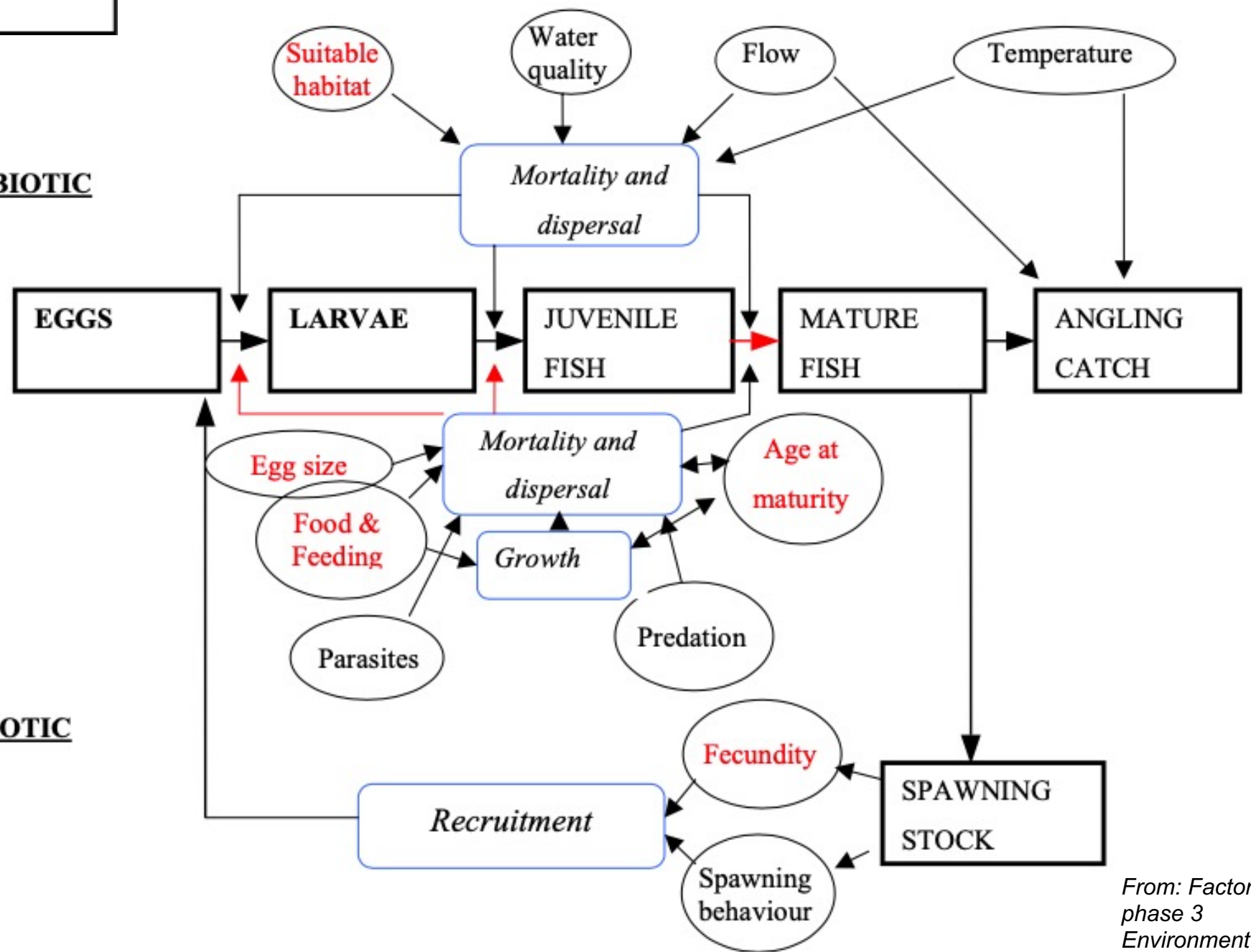
# FACTORS INFLUENCING YEAR CLASS STRENGTH IN COARSE FISH





**ABIOTIC**

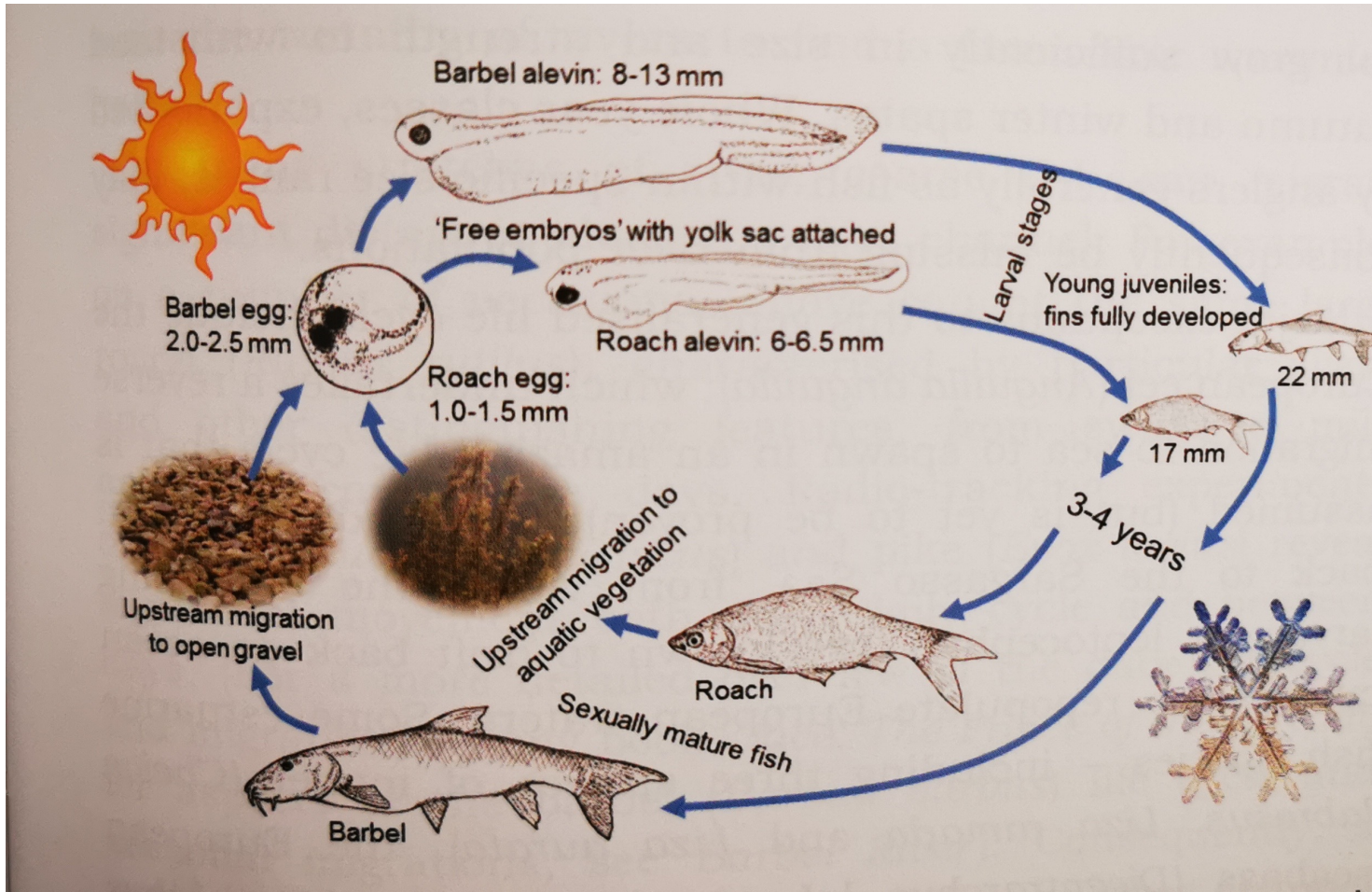
**BIOTIC**



Model illustrating the complexity of factors that govern fish abundance in a cyprinid fishery

From: Factors affecting the recruitment of riverine coarse fish: phase 3  
Environment Agency: R. Musk & R. Britten (2007)

# COARSE FISH BIOLOGY - LIFECYCLES



- Life cycle of a roach and barbel, as typical of many vegetation and gravel spawning coarse fish species, showing seasonal cycles and indicative sizes
- Note the migration to suitable habitat. This behavior is often overlooked in coarse fish

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## IMPORTANCE OF HABITAT – CONNECTING THE SPAWNING DOTS

- Once hatched young fish emerge as alevins and need to find somewhere to hide whilst they consume the yolk sac. This is usually attached to the vegetation or in the gravel in which they hatched
- After this stage they are free swimming and actively search out food items.
- At this point good cover and refuge is important
- Fry are often found in backwaters, slow flowing reaches, marginal areas, ditches and berms
- These areas provide plenty of food and heat which facilitates rapid growth and protection from the numerous predators







# FRY HABITAT



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# WHY DO WE NEED TO CREATE OR MANIPULATE HABITAT?

- Some lakes or fisheries can be devoid of habitat.
- Reasons could be natural such as erosion or man-made such as sheet piled or brick banks.
- The term habitat in this context doesn't just mean for fish, it covers the whole ecology.
- Fortunately, there are some simple solutions that can help even the most barren of lakes.















- Not all habitat is good habitat!



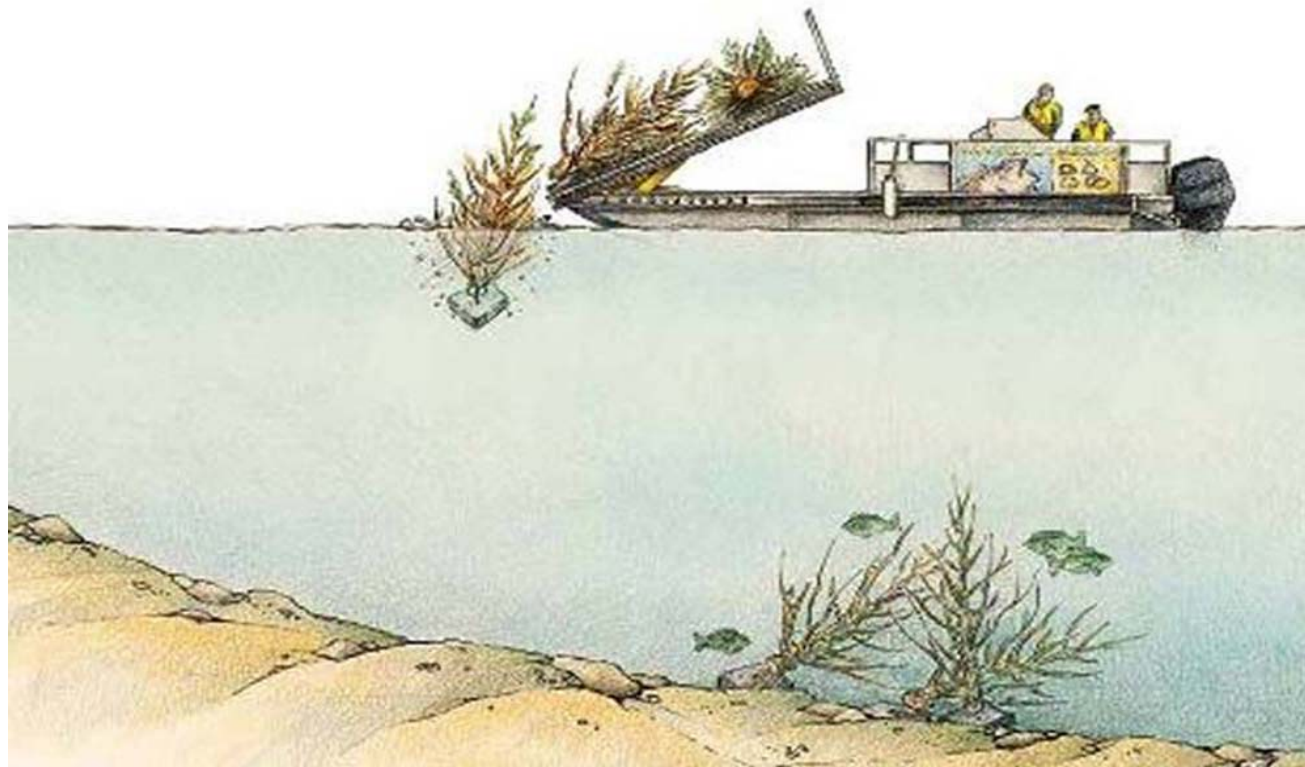


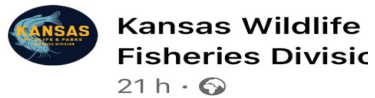
- 
- Physical habitat improvements can provide refuges and spawning sites, as well as improving fish food production.
  - A variety of materials can be used to create underwater reefs.
  - These provide valuable submerged fish habitat and refuges from predatory birds.
  - A well-designed reef should have both overhead shading and internal structures.



## Shelter / Feeding







Looking for a place to to the holiday? We have or drop off for residents ne Lake. Please place your designated area to the January 7th. Alternately the provided trailers in t Tonganoxie High Schoo

On January 7th we will l additional cedar trees, l artificial habitat in the la If you are interested in c cut trees, helping load k sinking trees, or providi concrete blocks or balir Kramer at nick.kramer@



# Seasonal and diurnal patterns of littoral microhabitat use by fish in gravel pit lakes, with special reference to supplemented deadwood brush piles

A. Maday · S. Matern · C. T. Monk · T. Klefoth · C. Wolter · R. Arlinghaus

Received: 22 May 2022 / Revised: 14 January 2023 / Accepted: 17 January 2023  
© The Author(s) 2023

**Abstract** The habitat quality of the littoral zone is of key importance for almost all lentic fish species. In anthropogenically created gravel pit lakes, the littoral zone is often structurally homogenized with limited fish habitats. We supplemented deadwood brush piles in the littoral zone of eight gravel pit lakes and investigated the diurnal and seasonal use of this and other typical microhabitats by six dominant fish species. Shoreline habitats were sampled using point abundance electrofishing during day and night in all four seasons, and patterns of fish abundance were compared amongst unstructured littoral habitats, emerged macrophytes and brush piles. We caught a total of 14,458 specimens from 15 species in the gravel pit lakes. Complex shoreline structures were used by all

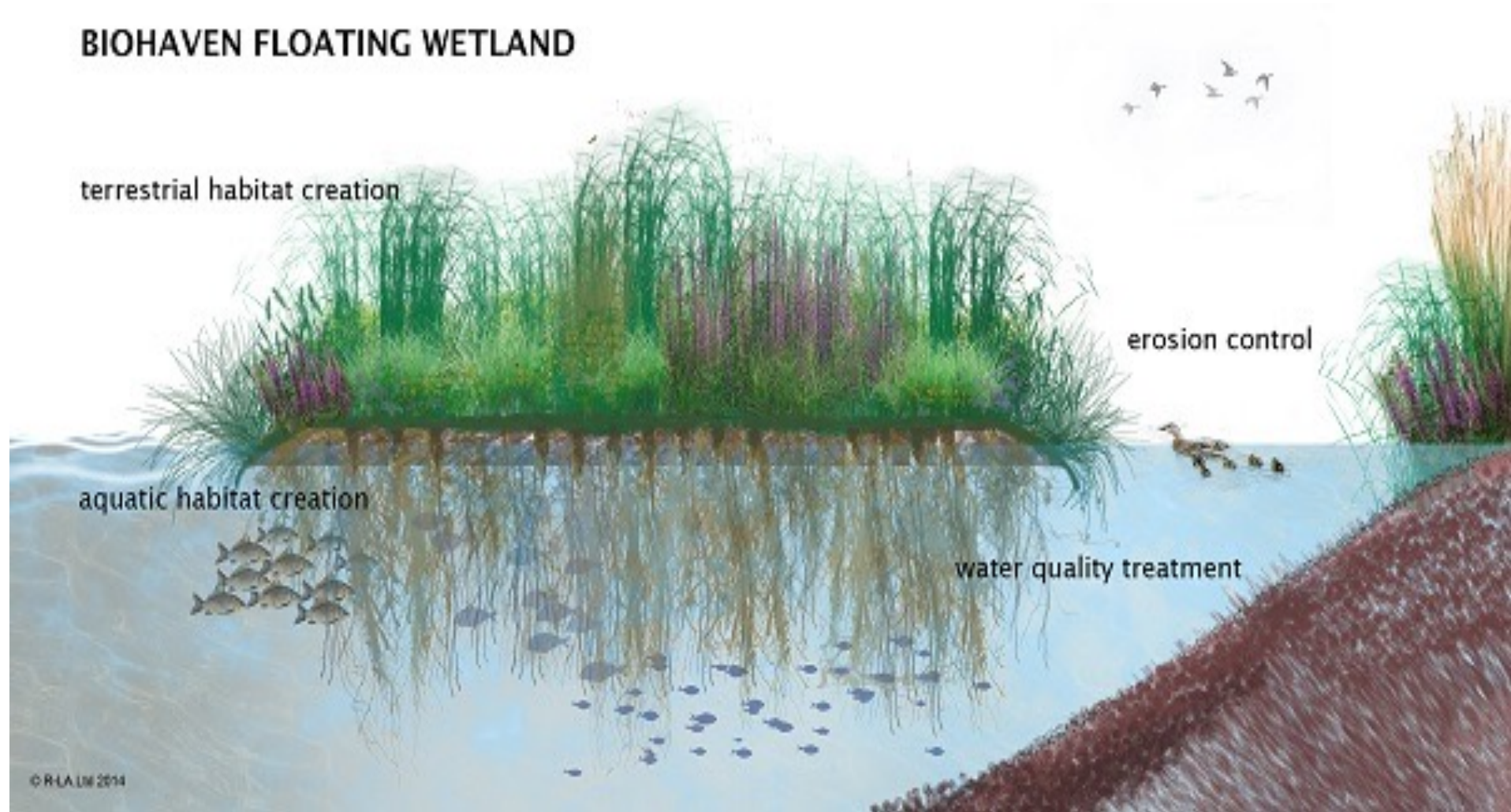
fish species that we examined, especially during day-time, whilst the use of unstructured habitats was highest during night. The newly added brush piles constituted suitable microhabitats for selected fish species, perch (*Perca fluviatilis*), roach (*Rutilus rutilus*) and pike (*Esox lucius*), particularly during winter. Supplemented deadwood provides suitable fish habitat in gravel pit lakes and may to some degree compensate for the loss of submerged macrophytes in winter by offering refuge and foraging habitat for selected fish species.

**Keywords** Fish distribution · Deadwood · Habitat enhancement · Fisheries management · Point abundance electrofishing · Quarry lake



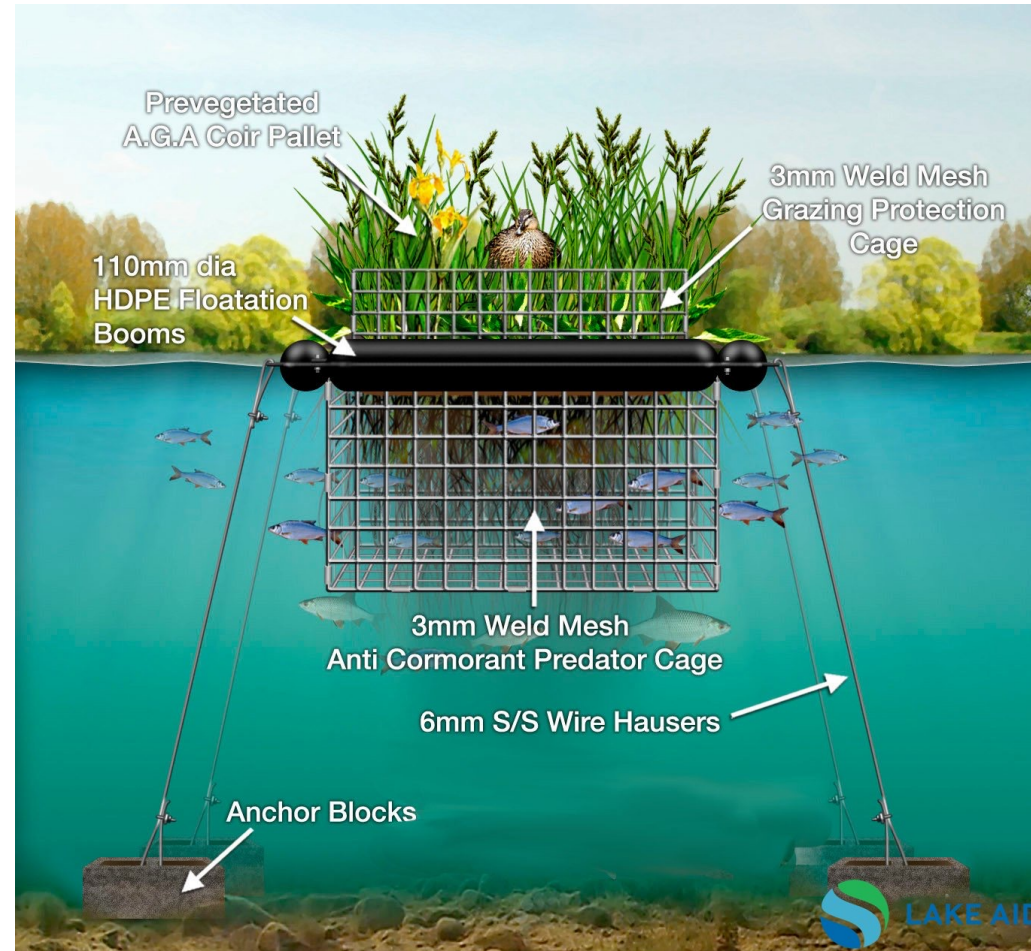
# FLOATING ISLANDS

## BIOHAVEN FLOATING WETLAND



# BENEFITS

- Help to reduce bank erosion
- Provide wildlife sanctuary
- Protection from predators
- Aid natural biological functions
- Take up pollutants
- reduce nutrient levels (N&P)
- Improve aesthetics
- Increase bio-diversity (aquatic & terrestrial)



Source: AGA Group

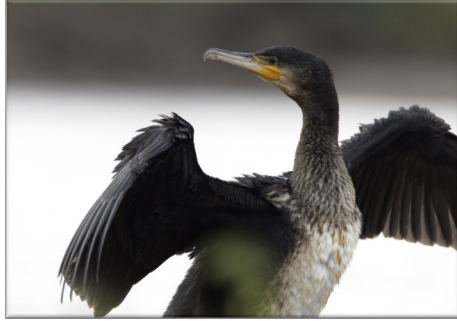








# HABITAT IMPROVEMENTS TO REDUCE PREDATION



Thanks to Richard & Jake at the AT

# HABITAT IMPROVEMENTS – *NATURAL*

- Reedbeds.
  - Planting of native tree species
  - Sanctuary areas
  - Lily beds.
  - Submerged weed
- 
- Ideal spawning habitat, <nutrient load, degree of protection, invertebrates....
- 
- Improves water quality, resilience and aids recruitment
- 
- But cormorants may still feed.





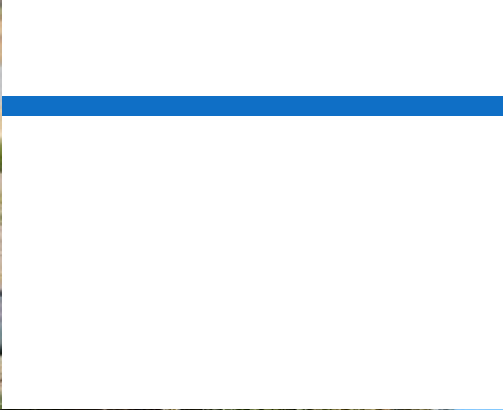
© AE Fisheries



# MAN-MADE E.G. REFUGES

- Floating/submerged
- Beneficial vs. hindrance (**snag**/bird table)?
- Structure, overhead cover, material -Provide spawning habitat, inverts,  
< nutrient load & protection
- Target areas of fish migration /highest predation
- Upkeep of planted areas
- Not just a loafing/resting area for cormorants!



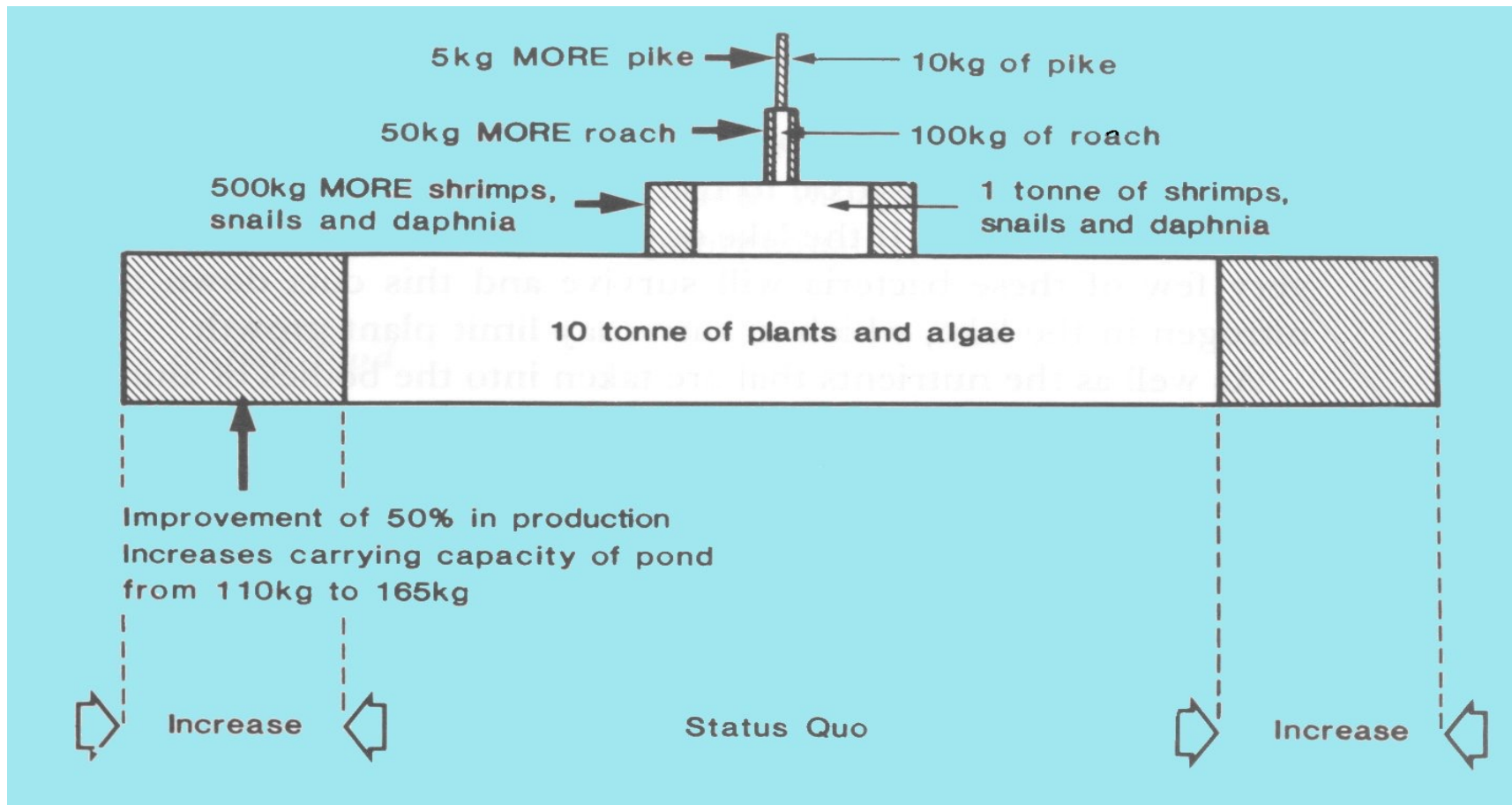


**How to make a floating island**  
with Andy Eaves



# STOCKING DENSITIES...

- Reflect the waters *carrying capacity*
  - This is determined by quality of habitat, amount of nutrients, therefore food available, amount of space available.



# Plants. A Brief Introduction

# c.151

species of native  
aquatic flowering

plant in UK (Preston & Croft  
+ 3)



*Slides courtesy of Tim Pankhurst of Plantlife*





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**+ 29** (16%)

aliens

**= 180**

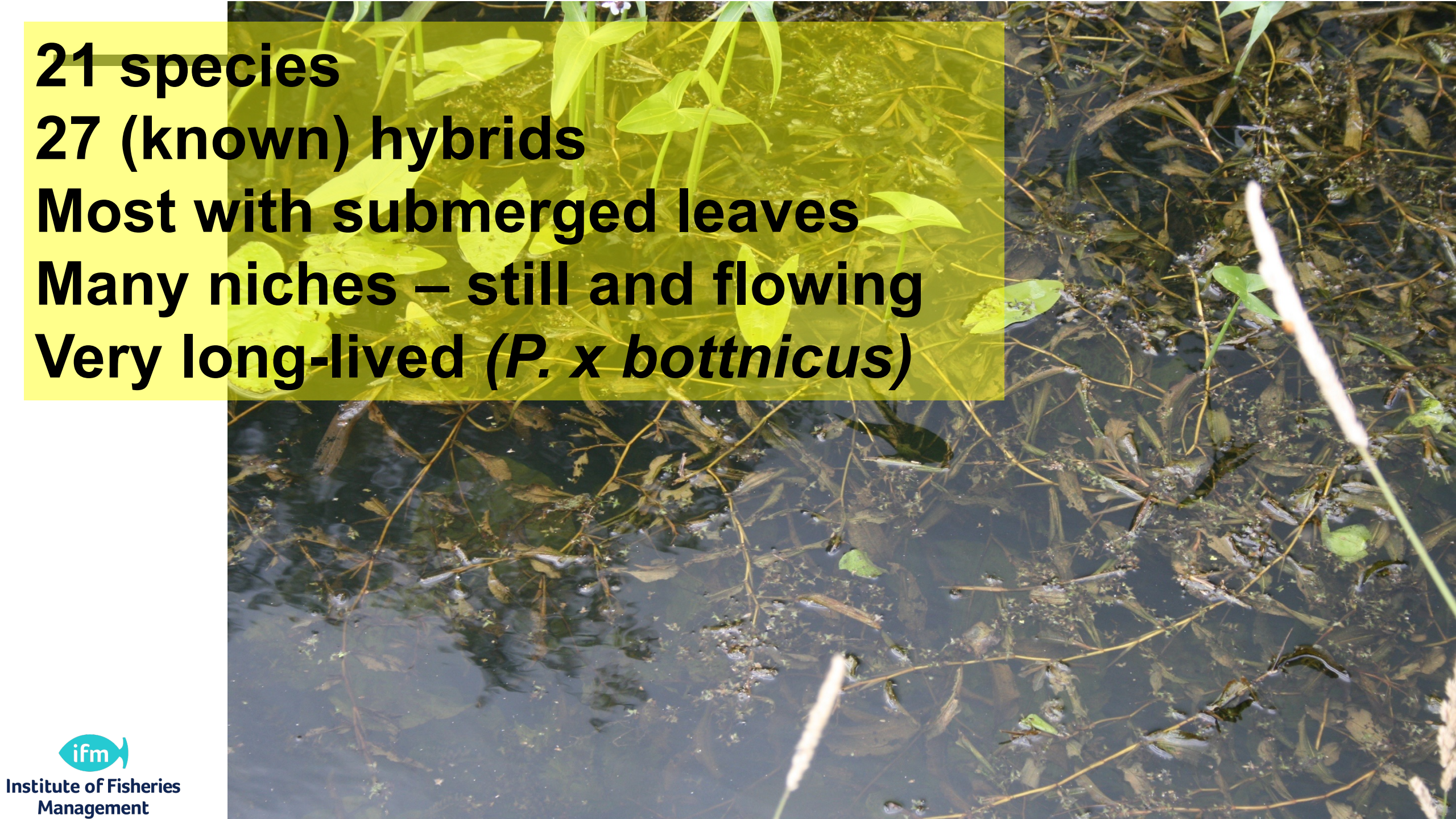
species of aquatic  
flowering plant





# Pondweeds - *Potamogeton*





**21 species**  
**27 (known) hybrids**  
**Most with submerged leaves**  
**Many niches – still and flowing**  
**Very long-lived (*P. x bottnicus*)**



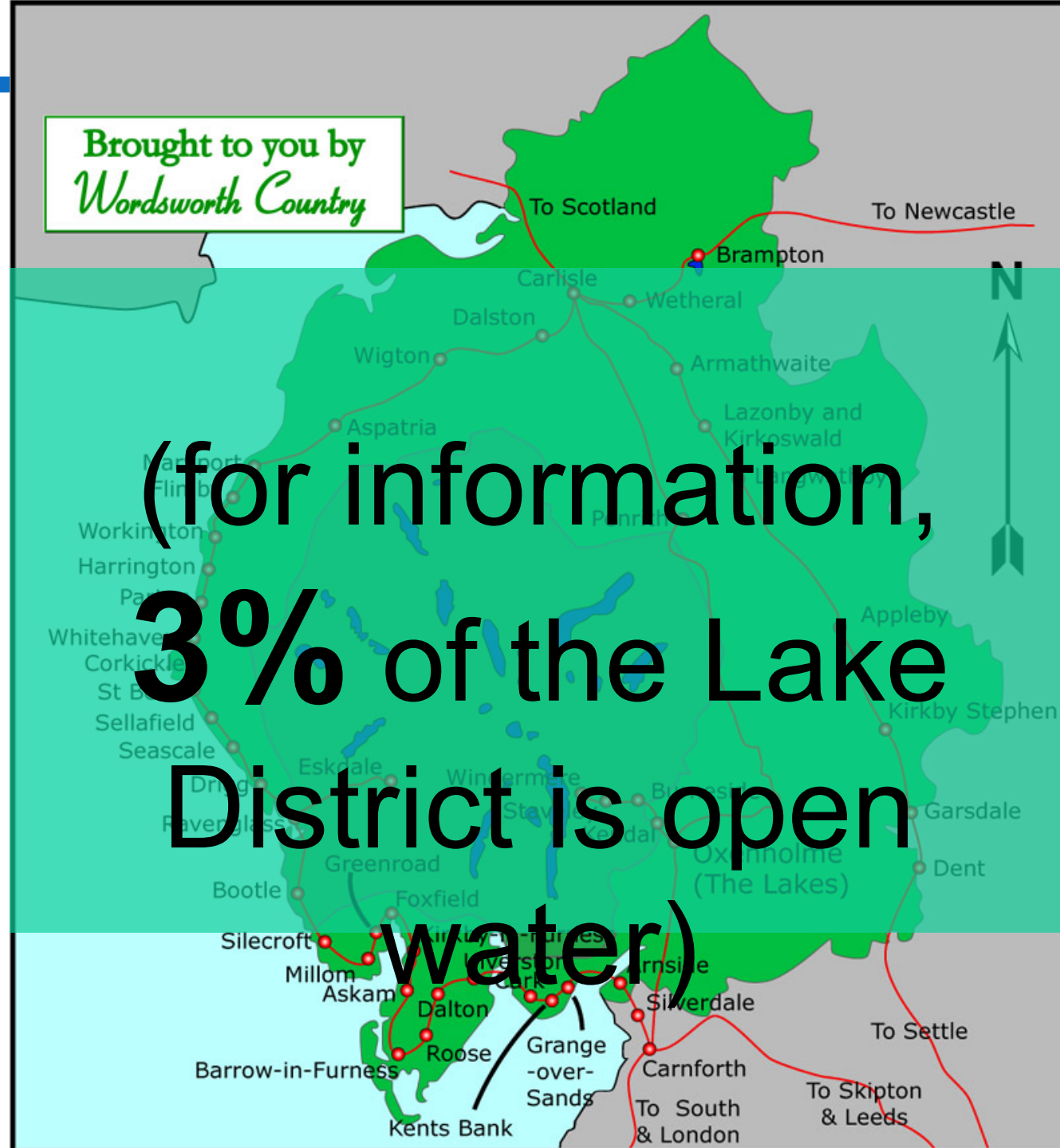
About 8% of the UK  
flora...

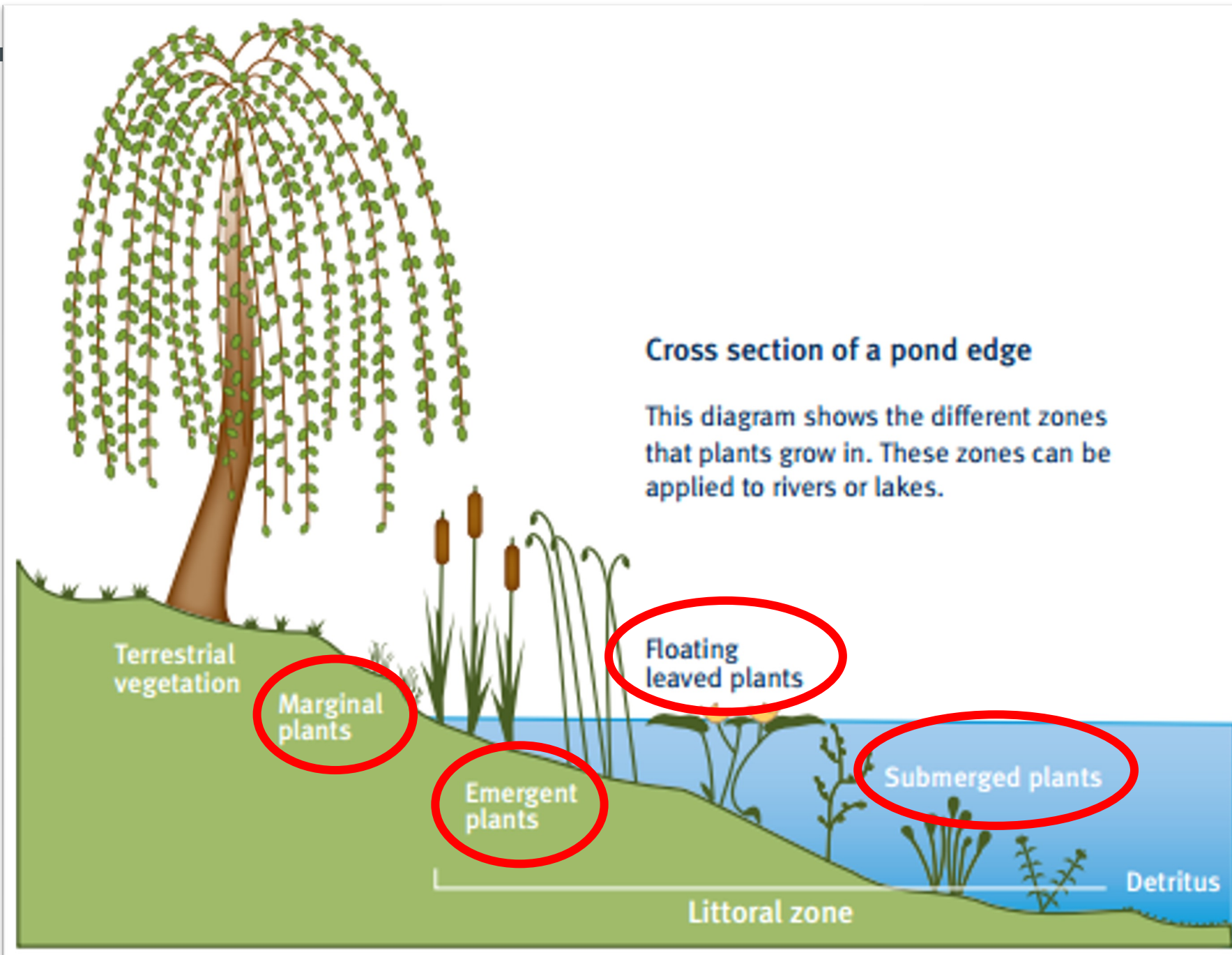
...growing in

**0.0001%**

of the land area

*Cole, B., King, S., Ogutu, B., Palmer, D., Smith, G., Balzter, H. (2015). Corine Land Cover 2012 for the UK, Jersey and Guernsey. NERC Environmental Information Data Centre*





### Cross section of a pond edge

This diagram shows the different zones that plants grow in. These zones can be applied to rivers or lakes.

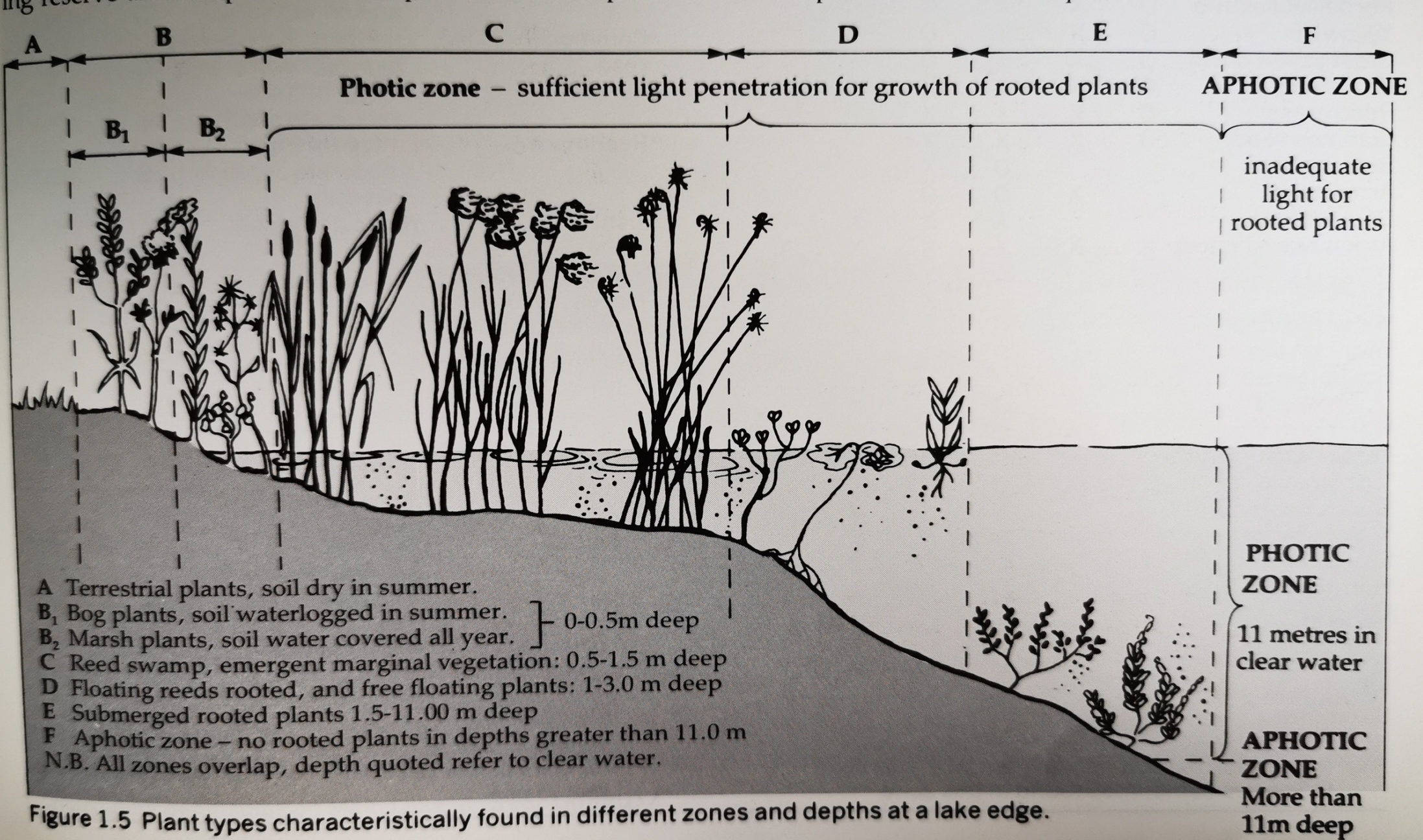


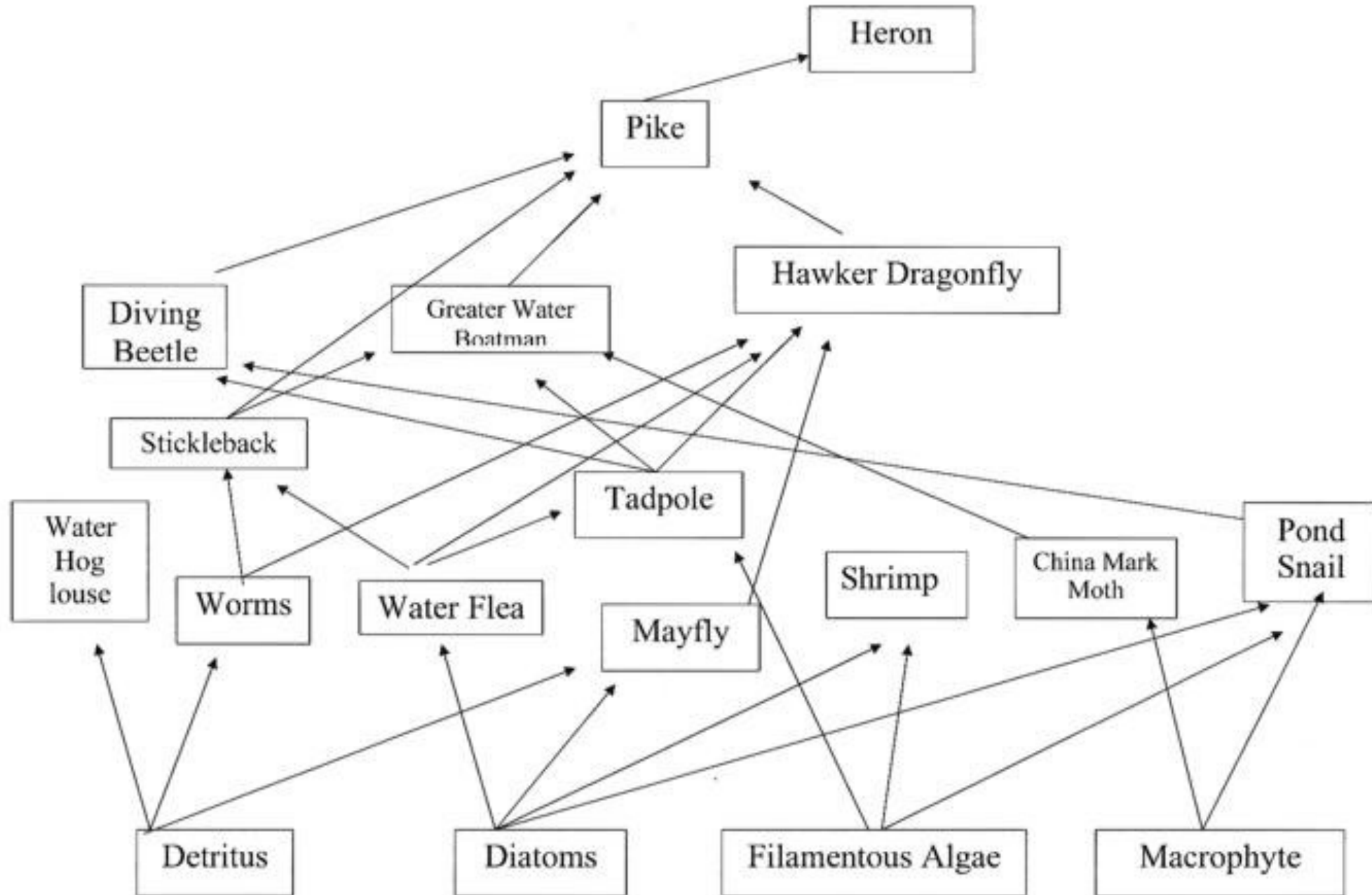
Figure 1.5 Plant types characteristically found in different zones and depths at a lake edge.



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**5 x biomass of  
invertebrates in  
submerged  
vegetation than  
on bare  
substrate**

# Generalised Food Web of a Pond





# STOCKING A NEW LAKE

- Leave lake barren for first year
  - (Maturation period – bacteria, vegetation, habitat)
- Survey habitat before introduction
  - (water quality appraisal, bug & weed life in the water)
- Phased stocking program to 150 kg /ha
  - Larger fish (12 cm) fare better than smaller for initial stocking
  - Stock in cooler months but avoid high winter.





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## ALTERNATIVES TO STOCKING:

- Improve **natural** recruitment, i.e. encourage natural spawning.
  - Study breeding requirements of species of interest
  - Provide spawning habitat & fry refuges
    - (weedbeds, brushwood bundles, floating islands)
  - Egg / fry predator control
  - Habitat improvement
    - No fishing zones, floating islands, fertilising

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## ALTERNATIVES TO STOCKING:

- Improve nutrition of fish to encourage growth.
  - How much natural food is there for the fish?
  - Examine bait policies, are fish reliant on 'incomplete' diet of boilies
  - Trout vs Carp pellets

# PROBLEMS FROM OVERSTOCKING

- Water quality issues. DO, Nitrites etc
- Eutrophication (nutrients)
- Nutritional deficiencies
- Poor health (diet and pathogenic)
- Destruction of the habitat
- Competition
- Stunting
- Rapid depletion of natural resources
- Poor utilisation of stock





THANK YOU



Institute of Fisheries  
Management

[Paul.Coulson@ifm.org.uk](mailto:Paul.Coulson@ifm.org.uk)

[www.ifm.org.uk](http://www.ifm.org.uk)