

Lakes and Reservoirs - *overview*

WHAT ARE LAKES AND RESERVOIRS?

Lakes

Lakes and reservoirs are often referred to as standing waters and encompass a wide range of types and sizes. These range from ponds, gravel pits and slow moving canals to very large natural lakes.

Lakes are large bodies of standing water, either formed naturally or man-made for amenity purposes. Water levels tend not to fluctuate to any great extent and gently shelving margins support a wide variety of flora and associated fauna.

Lakes also serve an important aesthetic role and, within the context of designed parkland, landscapes are important heritage assets.



Reservoirs

Reservoirs, or dams, are man-made bodies of open water serving as public water supply sources, as winter storage for crop irrigation or as flood storage facilities in association with river corridors. Upland reservoirs are commonly known as impounding reservoirs since they are built across river valleys.

A common form of lowland reservoir is known as a pumped storage reservoir since water is pumped from a nearby river source rather than filling naturally as in the case of an impounding reservoir. Water supply reservoirs have developed into important nature conservation assets. The major difference between these water bodies and lakes or other areas of standing water, is the phenomenon of 'draw-down'. This occurs when abstraction from the reservoir exceeds recharge from feeder streams and rivers, typically in summer, causing lowering of the water level.

Clywedog reservoir.

Dam of the Clywedog reservoir.

The reservoir is used for supplying drinking water and preventing floods downstream.

Water is not taken from the reservoir directly, but is released from the dam during dry periods to ensure that there is a sufficient supply for pumping stations downstream.

During wet weather the dam stores excess water so preventing flooding on the Severn river which lies downstream. Built in 1966, the dam is made of 11 concrete buttresses linked by reinforced concrete beams.

At 72 metres it is the highest such concrete mass dam in Britain. The reservoir holds 50,000 million litres of water. Photographed in 1997 near Llanidloes, Wales.

Photo: Martin Bond
Science Photo Library



OTHER FRESHWATER SURFACE WATERS

Gravel Pits

Canals

Ponds

Gravel pits are man made and are sometimes used for water supply. In some cases, disused gravel pits have been restored to form important nature conservation habitats.

Gravel pits can be deep, steep-sided excavations up to several thousand square metres in surface area. The steep sides provide narrow margins and limit the growth of marginal vegetation, although surrounding land can support scrub and rough grassland habitats.

Although water flows through canals via locks and sluices, the movement is so small in comparison with the total volume of the system that they can be construed as standing water.

Today, a few remain as commercial navigation channels, although an extensive network is maintained for recreational navigation. The rest have fallen redundant but have developed as important wildlife habitats.

Ponds are defined as small water bodies between 1m² and 2ha (a water body having a surface area larger than 2ha is termed a lake) that hold water for more than four months in a year. Ponds can be formed naturally in depressions created by glacial activity, natural subsidence or river activity.

They can also be man made, in gardens and village greens, or be created by landowners for fishing, shooting, livestock watering, aesthetic or amenity purposes.

We use water in our homes and gardens, in commerce and industry, and in agriculture. Much of the water supply infrastructure in the UK was developed at the end of the 19th century when impounding reservoirs were constructed in upland locations to provide a direct supply of water to conurbations, which were often many miles away.

Reservoirs were located in positions where the catchment received little or no disturbance, thus the quality of water supplied was often wholly acceptable without the need for either filtration or disinfection. As public hygiene standards evolved, many of these supplies were improved with the provision of chlorination systems. The regulation of water quality ensures that all supplies are now provided with full treatment, including coagulation and filtration.

In England and Wales, two-thirds of drinking water comes from surface water, including reservoirs, lakes and rivers, and the rest from groundwaters. There are also areas that receive water from a mixture of sources.

Water is treated at water treatment works before flowing through water mains, sometimes over considerable distances, to arrive at the tap. Samples are taken at each stage of treatment and distribution along the way and tested by the water company to make sure that the customer receives high-quality water.

(See the accompanying Information Note on Water Treatment and Supply and visit the link below for more information).

[\(http://www.dwi.gov.uk/pubs/tap/\)](http://www.dwi.gov.uk/pubs/tap/)

Lakes and reservoirs support rich and diverse flora and fauna, with some species relying on these habitats for their entire lifecycle.

LAKE AND RESERVOIR CLASSIFICATION

Classification of surface waters is based upon their nutrient status. Eutrophic standing waters are highly productive because plant nutrients are plentiful, either naturally or as a result of artificial enrichment. These water bodies are characterised by having dense, long-term populations of algae in mid-summer, often making the water green. Their beds are covered by dark anaerobic mud, rich in organic matter.

The water column typically contains at least 0.035 mg/l total phosphorus (which includes phosphorus bound up in plankton and 0.5 mg/l or more total inorganic nitrogen – mainly in the form of dissolved nitrate).

Many lowland water bodies in the UK are enriched with nutrient concentrations far in excess of these levels, although there is some geographical variation in the extent of the enrichment.

Some waters, such as Lough Neagh in Northern Ireland, have been enriched as a result of human activity and so have moved in trophic status from a mesotrophic to a eutrophic state. Eutrophic waters are most typical of hard water areas of the lowlands of southern and eastern England but they also occur in the north and west, especially near the coast.

There are no accurate estimates of the amount of eutrophic standing water in the UK. The total area of standing inland water is estimated as 675 km² in England, 125 km² in Wales and 1604 km² in Scotland. Current work suggests that over 80% of this resource in England, some 40% in Wales and approximately 15% in Scotland is eutrophic. On this assumption, the area of eutrophic standing water in Great Britain would be about 845 km².

Measurements made by the Environment and Heritage Service put the area of eutrophic standing water in Northern Ireland at approximately 940 km². The total UK area for eutrophic standing waters is therefore likely to be around 1785 km².

Several occurrences may cause a reduction in biodiversity in eutrophic standing water. The response of any given water body is unique, as some lakes are relatively resistant to change whereas others are more sensitive:

A potential threat, which may override all the others, is climate change. A substantial change in water supply and throughput would alter the character of water bodies and a rise in temperature would produce wide-ranging effects such as acceleration of plant growth.

Pollutants find their way into these waters not only from point sources but also from diffuse sources. Organic and inorganic fertilisers and nitrogen-rich gases cause nutrient enrichment (eutrophication) of the water, with consequent damage to plant and animal communities. Diffuse-source pollution generally exceeds that from point sources.

Changes in land cover can release nutrients from the soil and these may enter water bodies, causing enrichment. The long-term effect of such land-use changes is an increase in the risk of pollution and of siltation, which can smother fish spawning sites and damage aquatic vegetation. These problems are exacerbated by the removal of waterside vegetation which acts as an effective barrier to particulate matter and a sink for nutrients.

Water abstraction for potable supply, industry or irrigation, either directly from a standing water body or from surface feeders or aquifers, can depress water levels and increase water retention time and reduce flushing rate. This may exacerbate nutrient enrichment, cause deterioration of marginal vegetation through drawdown and cause shallow lakes to dry out. For coastal sites, a reduction in the throughput of fresh water could increase the salinity of a water body.

The introduction of fish, the removal of predators and the manipulation of existing fish stocks for recreational fishing leads to the loss of natural fish populations and may affect plant and invertebrate communities. Heavy stocking of bottom-feeding fish, such as carp, can cause turbidity and accelerate the release of nutrients from sediments. This has caused major problems of enrichment in some eutrophic water bodies.

Use of standing waters for recreational and sporting purposes may create disturbance which affects bird populations. Marginal vegetation may suffer from trampling and the action of boat hulls and propellers destroys aquatic plants and stirs up sediment, contributing to enrichment and encouraging the growth of algae. The construction of marinas and other leisure facilities may destroy valuable habitat and can lead to increased pollution.

Release of non-native plants and animals can be very damaging. The signal crayfish has had the dual impact of destabilising the biota of some waters by consuming large amounts of aquatic vegetation and eliminating many populations of native crayfish by spreading crayfish plague.

In their natural state, eutrophic waters have high biodiversity. Planktonic algae and zooplankton are abundant in the water column, submerged vegetation is diverse and numerous species of invertebrate and fish are present.

Bottom-dwelling invertebrates such as snails, dragonflies and water beetles are abundant and calcareous sites may support large populations of the native freshwater crayfish.

Coarse fish such as roach, tench and pike are typical of eutrophic standing waters but salmonids also occur naturally in some. Amphibians, including the protected great crested newt, are often present and the abundance of food can support internationally important bird populations.

BIODIVERSITY

Loch Leven in Scotland and Lough Neagh in Northern Ireland, for example, each support over 20,000 waterfowl, including large numbers of wintering whooper swan. Loch Leven is nationally important for breeding ducks, such as wigeon, gadwall and shoveler, and Lough Neagh is of national importance for breeding great crested grebe.

For centuries, periodic 'blooms' of blue green algae, which may be natural phenomena, have been documented in Llyn Syfaddan (Llangorse Lake), South Wales and in the meres of the West Midlands.

Lakes change naturally over time, slowly filling with silt and vegetation and usually, in the absence of human impact, gradually becoming less fertile. In water bodies which are heavily enriched as a result of human activity, biodiversity is depressed because planktonic and filamentous algae (blanket-weed) increase rapidly at the expense of other aquatic organisms. Sensitive organisms, such as many of the pondweed *Potamogeton* and Stonewort *Chara* species, then disappear and water bodies may reach a relatively stable but biologically impoverished state.

The upland tracts of land in the UK have, for many years, represented a valuable resource for a number of differing activities and these have largely co-existed without mutual disadvantage.

However, as with many aspects of life in the 20th and 21st centuries, the pressures upon these parts of our natural environment have increased substantially, to the extent that conflicts of interests are becoming increasingly evident.

In many parts of the country, where upland water supply systems are common, local geology is such that the land is very sensitive to disturbance. In mid-Wales, for example, a thin surface layer of peat overlies fluvial deposits which include red marls, responsible for serious water quality problems when exposed by ploughing and drainage works. Many rivers, streams, lakes and reservoirs have become degraded, largely through the increased impact of man's activities, resulting in poor water quality, poor wildlife habitat, increased flooding and reduced amenity and aesthetic value. The way that we use water has a direct impact on the natural environment. This means that we must have a plan for the management of water that will protect the long-term future of the environment while encouraging sustainable development.

A number of safeguards have been put in place to enable the restoration and rehabilitation of degraded water bodies. The Environment Agency in England and Wales has a duty to secure the proper use of water resources in England and Wales. It monitors water in the environment and issues 'abstraction licences' to regulate who can take water from the environment. These specify the amount of water someone can take from a location over a period of time. It also has long-term strategy for water resources that looks 25 years ahead and considers the needs of both the environment and society. The Water Framework Directive has established a new, integrated approach to the protection, improvement and sustainable use of surface waters (see accompanying Information Notes on the Water Framework Directive).

More information on how the Environment Agency protects and regulates surface waters can be found at:

http://www.environment-agency.gov.uk/subjects/waterres/?version=1&lang=_e

A case study of an open standing water action plan, carried out jointly by the Environment Agency and RSPB, can be found at:

<http://www.wildlifebcnp.org/northants-bap/Open%20Standing%20Water.htm>

REFERENCES

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