Water quality

Fish health and management series

Fish can't survive without good water quality. Poor water quality and any sudden changes can increase stress levels within the fish population. It can even kill the fish.

Different species of fish can tolerate different levels of water quality (for example, trout need a much higher water quality than carp), but they all have limits and are harmed by rapid changes in water quality.

Water quality issues that need monitoring

Dissolved oxygen

Just like most living things, oxygen is needed by fish to survive. For most freshwater fish the amount of oxygen in the water (known as dissolved oxygen) needs to be:

- above 7mg/l (~50 per cent concentration) for cyprinids;
- above 9mg/l (~65 per cent concentration) for salmonids.

If it falls below this level the fish will become stressed and there may not be enough oxygen to keep them alive.

Low levels of oxygen occur if there are not enough submerged aquatic plants, high stock densities and high levels of silt. The amount of oxygen can be further reduced by the presence of bacteria through:

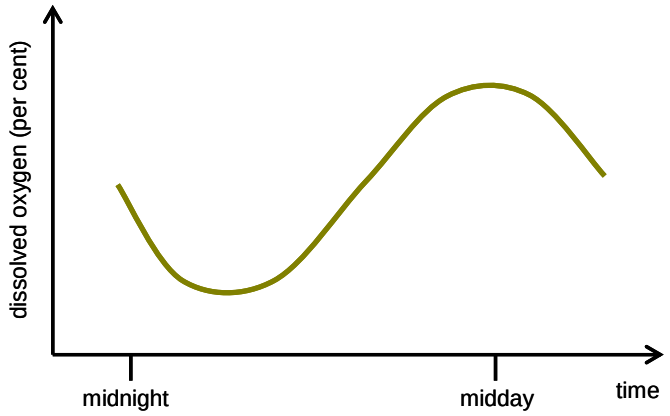
A build-up of leaf litter in a lake can cause water quality problems.

- an increase in the amount of plant litter and uneaten food, including anglers bait (known as organic matter), entering the water;
- the breakdown of algae following a bloom.

Rapid changes in the amount of oxygen can also cause distress and death of fish. This can occur if there is an algal bloom or the lake is very deep.

Algal blooms

Because algae are plants, they produce oxygen during the day but use it during the night. This means that you always get the lowest levels of oxygen early in the morning and the highest levels in the afternoon. The presence of an algal bloom means more plants and therefore greater changes in the amount of oxygen during the day. It is therefore best to monitor oxygen levels during the high (early afternoon) and low (early morning) periods, to get a good idea of how much it changes during the day.



The daily change in the amount of oxygen in a fishery.

Deep lakes

In very deep water the amount of oxygen is low. When this water is mixed with surface water during bad weather, it can cause a decrease in the amount of oxygen in the whole fishery.

Temperature

As water temperature increases, the amount of oxygen it can hold decreases. At the same time, the amount of oxygen required by fish increases, because they are more active when they are warm.

Temperature is also important as it will affect how quickly a pathogen grows and reproduces. An increasing temperature could therefore mean that there are more active pathogens in a fishery. This could lead to a disease outbreak.

pH

This tells us how acidic (less than pH 7) or alkaline (greater than pH 7) the water is. A pH of 7 is neutral. For freshwater fish the most favourable pH range is between 6 and 9. Above and below this fish can die. Small but sudden changes in the pH can also cause stress to the fish and kill them. This is because the pH scale is logarithmic meaning that an increase of 1 unit (such as pH 7 to pH 8) is actually a 10 fold increase.

The type of bedrock and soil, in and around the fishery, can also change the pH:

- A decrease in pH can occur if there is peat or a lot of conifer trees around the fishery. If there is a lot of organic matter to be broken down then the pH will also decrease.
- An increase in pH can occur if the surrounding bedrock is limestone.

The pH will also change when there is an algal bloom. Carbon dioxide (CO_2) is acidic in water. When algae produce oxygen (during the day), they remove carbon dioxide from the water. During the night they do the opposite and take in oxygen and produce carbon dioxide. This means that the amount of

carbon dioxide in the water will change during the day. The pH of the water will therefore change quickly during the day, which will cause problems for your fish.

If the water in a fishery is acidic, the productivity will be low because not many plants and invertebrates can survive in acidic water. By using lime, the pH of the fishery can be increased and therefore the productivity. However, you must always seek professional advice, as adding too much lime can kill your fish.

Ammonia

Ammonia is created from the breakdown of proteins in fish and from bacteria that decompose organic matter. Ammonia levels above 1mg/l will kill fish but levels as low as 0.1mg/l can also be harmful. The amount of ammonia in the water is also changed by other water quality factors such as pH, temperature and oxygen levels.

- As the pH increases, the amount of ammonia increases. It also becomes more damaging.
- An increase in temperature raises the amount of ammonia in the water.
- At low oxygen levels, ammonia becomes more harmful to fish.

If you have a high stock density there will be a lot more waste products to be broken down. This means more ammonia. It is therefore better to keep stock levels low. Reducing the amount of plant litter entering the fishery can also help to prevent a build-up of ammonia.

How to avoid water quality problems

Problems with water quality can cause health problems for your fish and could kill them. It is therefore very important that you check your water quality at regular intervals. You can enhance the water quality of your fishery by:

- making sure there are enough aquatic plants to aerate the water;
- having areas of deep water to reduce the effects of temperature changes.

By regularly checking the water quality (dissolved oxygen, temperature, pH and ammonia) you will be able to spot problems before they develop. This will also help you to understand what is normal for your fishery and is good fishery management.

This fact sheet has been produced by:

Fisheries Technical Services – Fish Health, Ageing and Species, Environment Agency, Bromholme Lane, Brampton, Huntingdon, PE28 4NE

Tel: 01480 483802; Fax: 01480 433873; Email: fish.health@environment-agency.gov.uk