

Fish health and management series: Introduction

National Fisheries Services

Every year, over 100 stillwater fisheries suffer severe outbreaks of fish disease. These cause the deaths of 1000's of fish and damage the businesses or angling clubs that run them. This can mean a loss of fishing and is a distressing sight for anyone who enjoys fishing. Recovery can take a long time and be very expensive. In some cases, anglers will never visit a fishery again if they have seen dead fish.



The sad sight of a fish mortality

But, most of these disease outbreaks could be avoided. Although in many cases it is diseases that kill the fish, it is usually the management of the fishery that has put them at risk. The underlying causes of fish deaths in our stillwater fisheries can be managed, preventing the losses that damage fisheries and businesses.

What causes fish disease?

Organisms that cause disease, including parasites, viruses, bacteria and fungus are called pathogens. Some of these pathogens are present in our fisheries all the time. They are native to our waters and are a natural part of our biodiversity. They do not usually cause disease problems as the immune system of healthy fish will fight the challenge of the pathogen.

Pathogens can cause disease if:

1. they are introduced to a new fish population that does not have a natural resistance to the pathogen;
2. the fish's immune system is reduced, because the fish is ill, in poor condition or stressed.

Introduced diseases

This is most common with pathogens introduced from abroad. These are known as Category 2 and novel parasites, and notifiable fish diseases. For example, the viral disease Spring Viraemia of Carp causes the death of carp, if infected fish are introduced from parts of Europe or Asia where the virus is present.

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Stress

Healthy fish, living in a good environment, will have strong immune systems. However, if the fish live in a poor environment, they may become stressed. This reduces their immune system making them unable to fight pathogens, increasing the risk of disease outbreaks. Even introduced diseases (like Koi Herpesvirus) may be more likely to cause death if the fish are stressed.

But, fishery managers can reduce the risk or impact of disease on their fisheries. In stillwaters the fishery manager is often able to change the things that cause stress to fish, ensuring they are healthy and the fishing is good.

Fish health and management fact sheet series

We have produced this set of fact sheets to provide the basic information that can prevent fish disease outbreaks in your fishery. They cover the main diseases to be aware of, the management of habitat and water quality and the management of fish stocks and fish introductions. Should a disease outbreak occur, they explain what to do if fish are dying and how to help your fishery recover afterwards.

Each fishery is unique, so these fact sheets can only provide an overview. You should always seek specialist advice. But many of the steps in preventing disease outbreaks are easy.

Following good fisheries management advice will protect your fish, your fishery and your business or angling club.

Fact sheets in the series

- Looking out for fish disease
- Fishery habitat
- Water quality
- Fish stocking density
- Stocking your fishery
- Fishery biosecurity
- What to do if fish are dying
- Life after a fish mortality



A healthy fishery at dawn

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Fish stocking density


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Having a lot of fish in your fishery can encourage anglers, but only if the fish are healthy. Too many fish can:

- help the spread of disease by creating more chances for a pathogen to find and infect a new host;
- reduce water quality by lowering oxygen levels and increasing the levels of toxins and suspended solids within the water;
- damage habitat by reducing the number of plants;
- increase fish stress through competition for food and space.

However, every fishery is different and can hold varying numbers of fish. There are no set limits as to how many fish can live in a water before disease problems occur. But obviously, the more fish you have, the greater the risk. However, there are steps you can take to reduce the risk of disease occurring by having too many fish.

A guide to different fish stocking densities. The risk increases with the more fish you have.

Categories of stillwater fisheries	Average number of fish	Risk
Natural (fish populations maintained by natural recruitment)	~200lb of fish/acre	Low
Improved (fish populations maintained by natural recruitment and some stocking)	~325lb of fish/acre	
Intensive (fish populations maintained by stocking to maximise stock density)	~750lb of fish/acre	

How high stock densities help the spread of disease

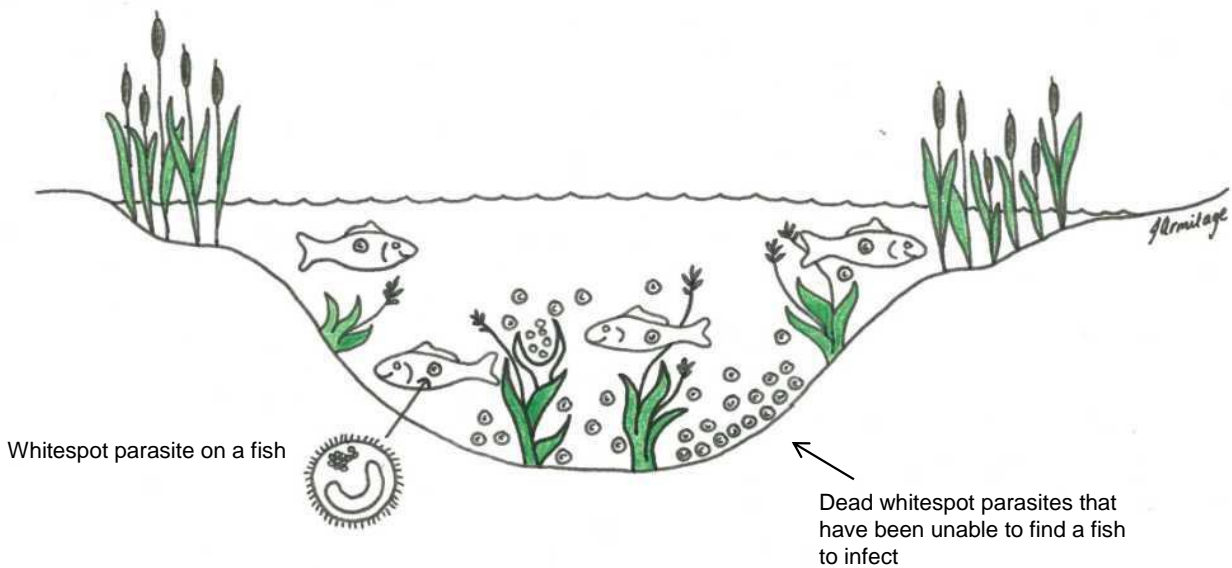
A mixed species fishery with a very high stock density (~1000lb of fish/acre) started to lose large numbers of roach, rudd and bream. The deaths started during the summer when temperatures were high. The fish were infected with high numbers of the parasite, *Ichthyophthirius multifiliis* (whitespot). The high stock density meant that it was easier for the parasites to find a fish to live on. It also meant that the fish were more stressed, making it harder for them to fight off the infection.

High stock densities can therefore increase the number of pathogens surviving within a fishery. Regulating stock densities is therefore very important in controlling parasite numbers.

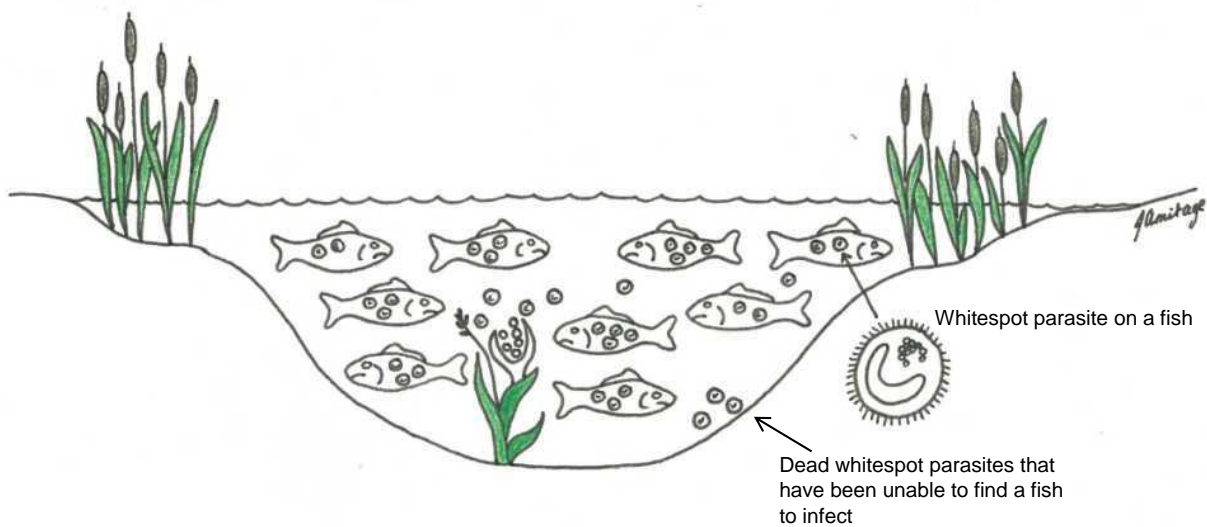
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In a fishery with a low stock density, it is harder for a parasite to find a fish to infect. The parasites that don't find a fish will die, so the number left in the fishery is kept low.



In a fishery with a high stock density, it is much easier for a parasite to find a fish to infect. The number of parasites that die because they can't find a fish is therefore lower.

What's in your fishery?

The most important thing to know is how many fish you have in your fishery and how well they are doing. The anglers who fish your water will be quick to tell you how good (or bad) the fishing is, and this can be checked through match weights. But finding out how many fish are in a water is more difficult.

If you have built, or are building a new fishery, then you are in control of what fish go in. However, if the fishery is established or you are new to its management, then working out the stock density can be more difficult.

It is important to remember that stock density is not just about the number of fish that are in your fishery. It is also about how big your fish are, how well they have grown and whether they have produced young. Keeping a record of the number and size of the fish caught is therefore very important.

How many fish do you have?

You can find out how many fish are in a water using a netting or electrofishing survey, or by keeping a record of the fish that your anglers are catching. Surveys should be done by experienced fisheries consultants and can give you very accurate results.

Often a full survey is too expensive, or simply too difficult due to the types of habitat and features within the fishery (for example the fishery may be too deep, have an uneven bed or there is too much plant growth). In this case, angler catches can be monitored. Again, support from an experienced consultant may help you understand the results.

In both cases, fish scales can be looked at. This can tell you how old your fish are and, importantly, how well they are growing. Good growth is good news. This shows that the water is not overstocked and that there is enough food for the fish. If the fish are not growing well then it may be time to take action. Remember, if they are not growing, they may not be feeding.

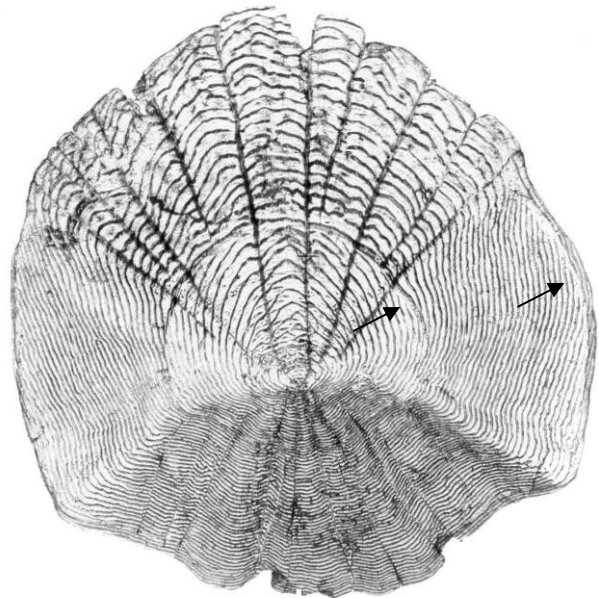
If there are too many fish present, angler catches can drop before any sign of disease or decline in the fish is seen. In many cases, catches can be improved by removing some fish, rather than stocking more.

Managing high stock densities

Some fisheries do have high stock densities and don't have any problems with the health of their fish. For this to happen, you do need to think about how you manage your fishery.

Supplementary feeding

If you do have high stock densities then you may need to supplementary feed. This will reduce stress levels caused by competition for natural food sources. You do need to be careful though about what type of



Using scales to age a fish. This chub was 2+ years old (annuli shown by arrows)

food you feed your fish. This is because high-fat diets may be bad for the long-term health of your fish. A balanced food source is always recommended and it is best to get expert advice.

Remember that the weather will also affect how your fish feed. In the winter, feeding may be unnecessary as the growth of your fish will slow and they need less food. Most importantly, remember that poor weather conditions also affect anglers. If the fish are having to rely on anglers' bait for food, and there are not as many anglers fishing as usual, then you may need to supplementary feed your fish. If you operate a close season on your fishery then you may also need to supplementary feed during this time.

Aeration

If you have a lot of fish, more oxygen will be taken from the water. Heavily stocked fisheries may need to aerate the water to provide more oxygen for the fish. There are many different ways to aerate a fishery but the aim is to increase the contact between the water and air. This allows more oxygen to pass into the water and will keep your fish healthy. It is therefore very important that you regularly monitor the water quality.



A fish survey by electrofishing

Removing fish

If you do have high stock densities in your fishery and the fish are reproducing, then you may need to consider removing some of them. The number of fish that you remove and their size, won't necessarily change the current stock density. But it will stop it from getting any higher as the fish grow and start reproducing themselves. This is good fisheries management and will enable you to maintain your desired stock density without any further problems. Remember that removing some fish isn't always a bad thing.

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Fishery biosecurity

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In a fishery, disease can be spread by fish and other animals, people, vehicles and equipment. Anything that comes into contact with infected fish or the water they are held in, can spread disease.

By using biosecurity, you can reduce the risk of spreading disease both on and off your site, as well as within your site (such as from one pond to another). In many fisheries, the use of biosecurity may be difficult, but anything you can do will help reduce the risk of introducing fish disease.

What types of biosecurity do I need to think about?

Some biosecurity methods are not always suitable for use at every fishery, and some are easier to set up than others. But if you know what options there are, you can choose the best one for your fishery. Remember that as someone involved in managing of a fishery, or simply as a keen angler, you should be thinking about how best to protect your fish. Good biosecurity is the answer.



Stocking fish

The risks linked with introducing new fish to your fishery are high. This is because of the risk of new diseases being introduced. Breeding your own fish on site can reduce these risks, especially if your fish are breeding happily in the fishery without any intervention. But if this is not possible then quarantining your new fish in a separate pool could be an option. If you do need to buy your fish from elsewhere, always get them health checked and buy them from a reliable source. For more information on stocking fish see the 'Stocking your fishery' fact sheet in this series.

Disinfection

The key pieces of fishing equipment that need to be disinfected are waders, nets, weigh slings and un-hooking mats. However, compared to introducing new fish to your fishery, the risks of transferring diseases on fishing equipment is low. Therefore be realistic!

Some fisheries actually provide their own equipment, such as nets and un-hooking mats. This reduces the risk of anglers moving diseases onto and off the site, but obviously this can be expensive to set up and so may not be suitable for every fishery.

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How to disinfect equipment

The two most common ways of disinfecting equipment are:

3. Thoroughly drying equipment for a minimum of 48 hours, preferably in direct sunlight. This is the best method but is not always possible.
4. Using chemical disinfectants (generally iodine-based solutions (iodophors) or Virkon® Aquatic).

Disinfecting fishing equipment isn't difficult, providing the facilities are there to do it and advice is given on how. More details on how to use chemical disinfectants on fishing tackle and equipment are available in our fact sheet on 'Disinfecting fishing tackle to control fish disease'.

Remember that for the sake of around 15 minutes (the time it takes for most disinfectants to work) you could help stop a potentially devastating disease entering a fishery.

Water source

For most fisheries, the source of water flowing into the site cannot be changed. However if you are creating a new fishery then this is something to think about. You need to try and use a water supply that does not flow through another fishery or watercourse. This can help stop the spread of disease into your fishery. It is therefore best to use water from a borehole or spring. If there are several ponds on site then it is best to separate the water supplies and outflows. This will reduce the risk of spreading disease between ponds.

Site security

By having fewer entry and exit routes to and from your fishery, you can have more control over what comes in and out. You don't necessarily need a 6ft fence around your fishery, but by having designated parking areas and places for people to disinfect their equipment you can reduce the risks of introducing diseases.

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Fishery habitat

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Having different habitats in your fishery such as trees and bushes on the bankside, aquatic plants in the water, areas of deep and shallow water and islands will not only improve the appearance of the site but also the health of the fish.

Different types of habitat will help to reduce competition between fish, not only for food, but for space and cover as well. They also provide areas where fish can hide if they feel threatened, reducing their stress levels. The habitat within a fishery affects water quality, which is also very important in preventing fish disease.

Main considerations for fishery habitat

Depth

Changes of depth in a fishery create a varied environment:

Shallow waters warm up faster. Having areas of deep water will provide shelter for fish when the shallower water gets too warm.

Shallow waters provide good spawning sites and are excellent for the growth of juvenile fish.

Deeper water gives the fish somewhere to hide out of the reach of predators (such as otters and birds), especially if underwater features are added.

Aquatic plants



Aquatic plants within a fishery, including bankside vegetation, reed beds and water lilies

Aquatic plants are very important in a fishery as they put oxygen into the water. But they also provide food and shelter for fish and invertebrates, and can provide suitable spawning sites for fish. A lot of fish (such as carp, roach and bream) feed on the plants and invertebrates living on and around them, while others (such as tench and crucian carp) feed mainly on the invertebrates.

Having different types of plants within your fishery can also have added benefits:

Floating reed beds can be used to provide more shelter (especially from birds) and more habitat.

Marginal reed beds also provide good cover and habitat for juvenile fish.

The roots of plants are also very important as they can:

- help to stabilise the banks and beds of fisheries;
- take up nutrients (such as phosphate and nitrates) from the soil, surrounding water and from the waste produced by fish.

If you have a high stock density in your fishery then having aquatic plants can help to improve water quality by removing un-needed nutrients and reducing the amount of suspended solids in the water.

Bankside vegetation

Bankside vegetation can bring many benefits to a fishery, but it does need to be carefully managed to avoid problems. The presence of trees and shrubs on the bankside provides shade and shelter. This reduces the effects of temperature extremes. They also increase the stability of the bank, reducing the amount of suspended solids in the water (this reduces aquatic plant growth and can damage the gills of fish).

Too much shade will reduce the number of aquatic plants, while leaf litter will increase the amount of decaying material in the water. The type of trees and plants can also affect water quality by changing the pH of the water (for example the run-off from coniferous tree plantations makes the water acidic). Bankside vegetation is easy to manage and the benefits of having some, outweigh the effects of not having any.



Areas of bankside vegetation at a fishery

Reducing silt levels

The build-up of silt on the bottom of a pond is caused by the breakdown of plant litter and uneaten food, including anglers bait. It is low in oxygen and is acidic and not much will grow in it. A build-up of silt in a fishery can:

- reduce the number of plants and invertebrates in the water. This will reduce the amount of food and habitat for fish;
- reduce the depth of the pool. This will cause increased temperature changes and will reduce the amount of habitat;
- affect water quality, especially by lowering dissolved oxygen levels.

Removing silt can be very expensive so it is best to avoid the problem in the first place. A balanced environment should prevent the build-up of silt, however, by having reed beds, pools and ditches within your fishery to trap the silt, you can help prevent it occurring. Marginal plants will also help to stabilise the banks, reducing the amount of soil and debris falling into the water. Trying to reduce the amount of plant litter and uneaten food entering the water is also important.

What to think about when creating a new fishery

A new fishery should always be allowed to mature and the water quality stabilised before fish are introduced. This will also help habitat development, which will provide natural food sources for the fish. A new fishery should ideally be left for a year before any fish are introduced. However, as a minimum, the fishery should be left for a full spring and summer season to allow the number of plants and invertebrates to grow.

The added benefits of good fishery habitat

Remember that if you have lots of different types of habitat in your fishery, it will attract other wildlife, such as insects, birds and mammals. Having lots of wildlife will make the fishing experience more pleasurable. It can provide a relaxing atmosphere and may encourage anglers to return.



Some of the other types of wildlife that you can attract to your fishery by having lots of good, varied habitat (from left to right: swan and cygnets, damselfly and

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Looking out for signs of disease

National Fisheries Services

As a fishery manager or a keen angler you need to recognise the first signs of fish disease. By identifying these signs you can take quick action and help prevent fish deaths.

What to look out for

A small number of fish showing unusual behaviour or disease symptoms does not necessarily mean that all your fish will die. Fish can sometimes recover without intervention. This is why it is important to regularly check the health of your fish. If the problem does not go away, or if it gets worse, then always seek advice from your local Environment Agency fisheries officer.

By regularly checking the health and condition of your fish, you can detect problems early, before they start to die. There are a number of signs that you should look out for.

Behavioural changes

These changes can be seen from the bank by anyone visiting the fishery and should be easy to spot. They include:

- sluggish behaviour (known as lethargy);
- gasping at the surface;
- congregating near inlets and outlets;
- reduced catch rates, suggesting that the fish are not feeding.

Clinical symptoms

These symptoms can be seen by anglers when they catch fish or during routine netting operations.



Thin (emaciated) fish suggest that there is either not enough food in the fishery or the fish are unwell.



Fish can sometimes suffer mouth damage during hooking. If this gets worse it could stop the fish from feeding.



Bulging eyes can be caused by infection or loss of water balance.



Sunken eyes can be caused by emaciation or infection.



Lesions or ulcers are caused by bacterial infections but may develop because of physical damage.



Bleeding under the skin can be caused by infection or physical damage.



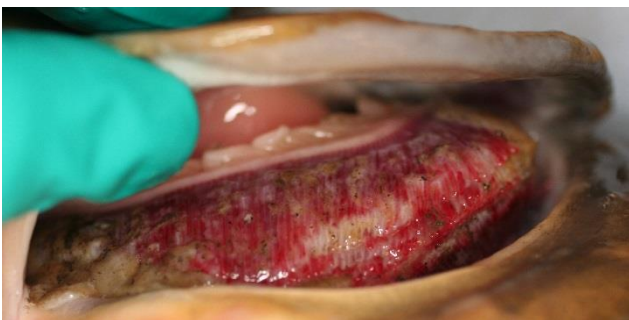
Fin rot is caused by a bacterial infection but can develop from damage to the fins.



Fungal infections on the body are an indicator that the fish are in poor condition. Excess mucus on the head suggests that the fish are being exposed to an irritant.



Fluid in the body cavity (known as dropsy), is caused by bacterial infection or loss of water balance.



Dead (white) tissue in the gills can be caused by toxins and debris in the water, or infection.

Most of these symptoms can be caused by several things including disease, poor water quality and physical damage (from rubbing while spawning, regular handling or predator attack). If you don't know what is causing the problem get professional help.

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Stocking your fishery

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Stocking fish is important in managing a fishery. It can bring many benefits to a fishery, including adding new species and increasing angler's catches. The UK now has many successful fish supply businesses, supported by high quality fish farms. But stocking is one of the highest risks to a fishery. It is important that you fully understand these risks, before you stock fish and do everything you can to reduce them.

You may want to stock fish if you:

- are developing a new fishery;
- want to increase angler's catches;
- want to add a new fish species or change the mix of species in the water;
- want to change the type of fishery, for example from a match water to a specimen fishery.

The risks of stocking fish

Understanding the risks of stocking new fish will help you reduce the likelihood of them affecting your fishery. The main risks from stocking new fish are:



- introducing new disease and parasites;
- these fish failing to establish in your water;

the sudden increase in the number of fish, which can damage the ecology of the water.

Protecting your fishery

You can reduce the risk of stocking causing problems in your fishery by following the simple steps laid out below. Stocking can add great value to a fishery, but bad stocking can cause long term harm. It is important not to take short-cuts and to ensure you protect your fishery:

Do you really need to stock?

Stocking new fish can often increase angler's catches, but it may not always be the best way to do this. If in doubt, get expert advice on improving catches and always take the long term view. For example, developing better spawning habitat may improve catches in the long term.

Make sure that there is room for your new fish. Checking how well your original fish are growing, will tell you if your fishery has space for the new fish to feed and grow. If the water is already overstocked, then removing some fish may

Stocking fish into a fishery

provide more food and habitat for those that remain and improve angler's catches. This is very important if

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angler's catches have shown a decline. The fish are probably still there, but they will not feed as much if they are stressed.

What will a successful stocking do?

Make sure you know what results you want from the stocking of more fish, and make sure you can show when you've done it. If your aim is to increase angler's catches, use match records or collect angler's catch information to see if it has worked. If you wanted to introduce a new species, keep an eye on how they are growing.

Adding a new species

Stocking is often used to add new species to a fishery. Increasing the mix of fish species is often a good idea, but make sure the species you are going to stock will not damage the fish already there. For example, tench and crucian carp do not compete well with common carp.

Make sure that the water you have is suitable for the fish species you want to add. All fish species have different needs. Making sure the fish can thrive in your water will ensure the stocking is successful.

It is also worth checking why a species is not present already. It may be that no-one has ever stocked them. But, if they have been in the water and not done well, you may save some money by not trying to introduce them again.



Careful consideration is needed before stocking pike for the first time in a water

Stocking consent

Always make sure you get written permission to stock from the Environment Agency. This will reduce the risk of introducing diseases that are harmful to your existing fish, unsuitable species being introduced or damage to your fishery or the wider environment.

Getting written permission to stock from the Environment Agency is a legal requirement. A 'Site Permit' sets out what you are allowed to stock, what species of non native fish you are allowed to keep and under what conditions. For more information contact our Customer Service Line on 03708 506 506 or log on to www.gov.uk.

Finding a source of fish

Make sure you find a reputable fish supplier. We cannot recommend a supplier, but other fisheries near you will be able to tell you who they have brought fish from and if they were happy with the service and the quality of the fish. If you choose a supplier listed in the angling press or in other adverts, make sure they supply references, and check them.

Once you have found a good supplier stick with them. Buying fish from only one source greatly decreases the risk of introducing disease. It also means that if a problem occurs, you can speak to your supplier, knowing that they are the only fish that have been introduced.

Fish grown on fish farms have a lower disease risk than those cropped from other fisheries. Ensuring that you are buying farmed fish will help protect your fishery.

Health checks

We will insist that stocking consents are supported by a valid health check if your fishery is on-line (this is one where water can flow from one body of water to another, or is in the floodplain). We do not usually ask to see a health check for fully enclosed stillwaters. But, you can ask to see one, and we recommend that you do. We, or fisheries consultants, can advise you on what you should expect to see on a health check.

Fish farms have additional checks carried out to look for the most serious fish diseases.

No health check can completely guarantee that stocked fish are totally free of diseases or harmful parasites. But it is the best protection that you can have when stocking fish.



A health check on a sample of fish

Ornamental fish

Ornamental fish, such as koi carp, ghost carp or goldfish, can add novelty value to a fishery.

However, the disease controls placed on fish

meant for the ornamental trade are lower than those for fish grown just for stocking. Some parts of the ornamental trade have also suffered badly from diseases, such as Koi Herpesvirus. We strongly recommend that you should never stock ornamental fish and very strongly advise against getting unwanted fish from garden ponds for your fishery.

Be a smart fish buyer

The vast majority of fish suppliers in England and Wales will provide you with healthy fish, good advice and good service. But, like other trades, there are some suppliers who may not give you the quality of fish you would expect. We, and the trade representatives, work hard to ensure that everyone works within the law and provides healthy fish. However, there are steps you can take to protect yourself from rogue traders:

- Never buy fish from people who approach you first. Beware of cheap deals and suppliers who want to avoid paperwork. If a deal sounds too good to be true, it probably is.
- If you are offered cheap fish, ask yourself why they are so cheap.
- Only buy fish when they are part of your long term plans. Do not be tempted by offers or deals.
- Always be present when the fish are stocked. If you are not happy with the quality of the fish, send them away. Always put the value of your fishery first. If the fish arrive in a bad condition that is the suppliers problem, not yours.
- Never accept fish that were not on the original order. They may not be covered by the consent and they may not be part of your plans.

- Never pay for fish with cash. Buying with cash may be cheaper, but you lose all the consumer protection that can help you if something goes wrong.
- If you want us to be present at a stocking because you have concerns then contact us.

Good stocking

If you are buying fish from a good supplier they should give you all the correct advice about when to stock fish. Often they will only offer coarse fish for sale in the cooler months of the year. If you are moving fish, we recommend only stocking coarse fish between October and March.

Stocking can be very stressful for the fish. This stress can lead to disease problems. Stocking in late autumn and winter will reduce this stress, as the amount of oxygen in the water is high and the fish are not so active.

If you are developing a new fishery, or looking to increase the numbers of fish in an established water, you should add the fish gradually, over a period of time. Adding a large number of fish all in one go can upset the balance of the ecology in the water, causing water quality and habitat problems.

Successful stocking

Following this guide will help your fishery and stocking to be successful. Stocking is a very important fisheries management tool, and when it's done well, it can be a great success. Disease problems after stocking are not common, but do affect a number of fisheries each year. Following this guide will ensure that your fishery is not one of them.

If you are in any doubt, make sure you get expert advice, either from us or a fishery consultant. It is much better to stock with caution than rush into stocking for quick returns. Once the fish are in the water it can be very difficult to put right any problems.

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Water Quality

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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.

Water quality issues that need monitoring

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.

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:

- 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.



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

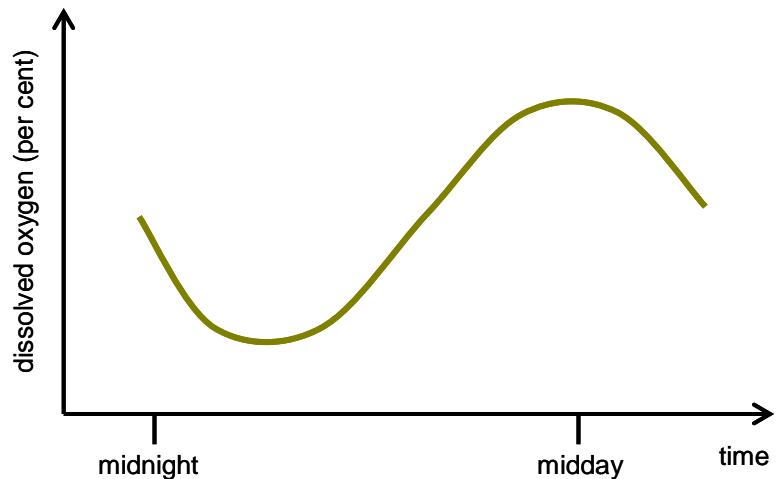
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Algal blooms

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 (CO₂) 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:

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

Tel: 02084 745244 or 07825 111723. Email: fish.health@environment-agency.gov.uk

What to do if fish are dying

National Fisheries Services

The sight of dead fish is devastating for any fishery manager, club or angler. Taking action at the first sign of dead fish can reduce the number of fish lost and allow the fishery to recover quicker.

What you should do

If you do have fish dying at your fishery there a number of things you need to do immediately:

Stop fishing!

This will reduce the stress levels within the fish population, helping the fish to recover. This will help to lower the total number of fish that may die. It will also protect other fisheries from the potential spread of disease on fishing tackle. Fishing should only start again when fish have stopped dying and all the remaining fish are healthy.



Report it!

Act quickly and report any fish deaths to the Environment Agency immediately on 0800 80 70 60. We will investigate by discussing the problem with you. If a disease outbreak is suspected then we will examine a sample of fish. Our examinations look for what disease is killing the fish. We will also give advice on how to reduce losses and prevent future problems.

Don't try to rescue the fish!

If they have a disease then they will take it with them and infect other fish elsewhere. The stress of moving them will also make them worse, leading to more deaths.

Never re-stock!

Do not put fish into a fishery with an on-going mortality problem. The new fish will only suffer from the same problems and may bring other diseases with them. It will also increase stress levels in the new and old fish causing more deaths. This will cost you more money.

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Why it is a good idea to get your fish checked

Getting the mortality investigated will help you work out what is killing your fish, whether it is related to a disease outbreak, the site management or both. This will help you make improvements to prevent future fish deaths. A full review of the management and conditions in the fishery is therefore essential. It should highlight any factors that would have caused stress to your fish and contributed to the losses, such as:

- were there too many fish;
- was there a problem with water quality;
- was the habitat or water quality unsuitable for the fish population;
- was there a risk of disease introduction to the site, either through lack of biosecurity or recent fish introductions?

Working out what caused the mortality is very important. It is likely that changes to the fishery management will reduce the risk of further problems. Remember that if the mortality occurred because of a disease then the surviving fish could still be infected. Though changing the management of the site won't remove the disease, it can help the fish stay healthy, making it easier for them to fight infection. It can even keep the number of pathogens lower, meaning fewer fish will be infected.

Can I use treatments to stop my fish dying?

The simple answer is no. Using treatments in a fishery is very difficult and can be illegal. The amount required can be very large depending on the size of the water and this will cost you a lot of money. When you use treatments you also need to make sure that every fish gets the same treatment, otherwise it won't work. In a fishery this is impossible.

Most importantly, the use of treatments is only a short-term solution. You really need to determine why there was a problem in the first place. Otherwise something else will just come along and cause problems.

In order to completely remove a disease from a fishery you need to de-stock, drain and lime the fishery. This is a drastic option and will be very costly, but for most diseases it is unnecessary.

Understanding how to prevent disease outbreaks is always better than looking for a cure.

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Life after a fish mortality

National Fisheries Services

A fish mortality can severely damage a fishery and its quality of angling. But, there is no reason why the fishery cannot recover and be successful in the future.

Before allowing fishing again it is vital that you know what caused the mortality. This will help stop it from happening again and guide the future management of the fishery. Looking at the management and conditions within the fishery is therefore very important and will benefit the future of the site and business. When to re-open a fishery will depend on the cause of the fish deaths, but the following can be used as a general guide:

Recovery of your fishery

Always give your fishery time to recover after a mortality. This will help you make sure that the losses have stopped and will allow the natural balance of your fishery to re-establish. Working out what caused the mortality will help you to decide how much time is needed for your fishery to recover.

If poor conditions in the fishery (such as habitat and water quality) caused the losses, then these problems will need to be sorted before the fishery can fully recover. Dead fish can affect water quality, so always remove them as soon as they appear. Regular monitoring of the water quality will also help you to work out when the conditions have stabilised.



A healthy fishery

If the fish died because of a disease, then the pathogens are still likely to be in your fishery. In order to prevent a second outbreak you need to help your surviving fish recover as quickly as possible. Good water quality, stress free conditions and balanced nutrition, will help them to build up an immune response so that they can fight infection and reduce the risk of further losses. Keeping your fish healthy is therefore very important.

A fishery can take time to recover. It is always wise to get professional advice on how best to proceed and when to re-open your fishery. If you don't give your fish time to recover, or if the conditions remain unsuitable, then further losses are likely.

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Fishing

Only re-open your fishery once the mortality has stopped and the conditions are suitable. Allowing fishing to re-start too soon could stress surviving fish and lead to further losses. When fishing does re-start, allow the numbers of anglers to build up slowly. Keep angling pressure low and don't have matches as soon as you open the fishery for business again. Using and improving biosecurity is also important as it can help protect your fishery and other fisheries from disease.

Re-stocking your fishery

Before you decide to re-stock after a fish mortality, think carefully about what type of fishery you are trying to develop and if stocking is actually necessary. Think about the following questions as they should help you to achieve the best from your fishery.

What caused the mortality?

A high stock density could have been a contributing factor in the mortality. You don't want to increase the stock density to a level that could cause the same problems again, resulting in more deaths.

Also think about what other factors could have been involved, such as poor water quality and lack of habitat. If there were problems with the conditions in the fishery then make sure these have been improved before you even consider stocking more fish.

How many fish did you lose?

Think about how many fish you lost. Even if you lost 25 per cent of your population, you may not need to re-stock. Remember that if the conditions are right in the fishery and the fish are healthy, they will reproduce naturally. This will allow the numbers of fish to increase slowly over time and by reducing the risks linked with re-stocking, it will be better for the fishery.

What species of fish did you lose?

If the fishery was a single-species fishery then the effect of the mortality is likely to be higher than in a mixed species fishery. In terms of the future of the fishery, it may be better to run a mixed-species fishery as the impact of a fish mortality is likely to be less. So think carefully about which species of fish to stock.



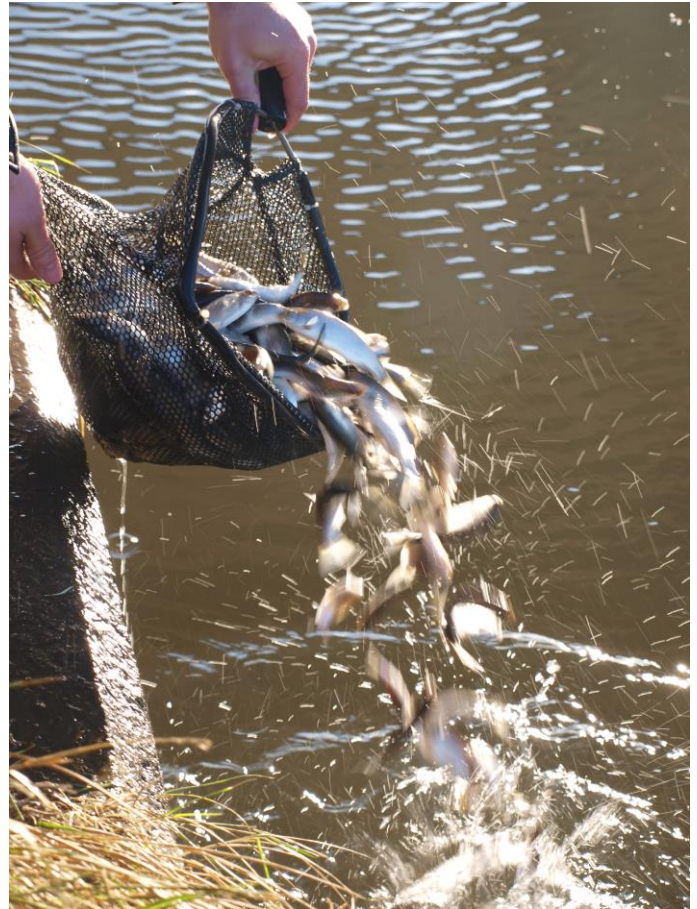
What it's all about – happy anglers!

How successful has the fishing been since you re-opened the fishery?

Always bear in mind that once the surviving fish have recovered, they will start feeding again. You don't need lots of fish to provide good catches for anglers. So if the fishing is good after you have re-opened, leave it as it is and don't re-stock.

Are you actually allowed to re-stock your fishery?

If your fishery had a notifiable fish disease outbreak (such as Spring Viraemia of Carp or Koi Herpesvirus) then your fishery may have a Designated Area Order. This means that you can't stock fish into your fishery without getting the permission of Defra. You also won't be able to move fish out of the fishery. This is to protect other fisheries and bodies of water.



Stocking fish into a fishery

What should you do if you are going to re-stock?

If you are able to and do decide to re-stock, a few simple ideas will help to reduce the disease risks:

Create a fishery plan and slowly build up your stock to meet these aims.

Don't stock the fish all at once. Introducing small groups of fish over a long period of time will reduce stress levels. It will also enable you to keep an eye on the health of the old and new fish following introductions.

Stock fish during lower temperatures from autumn to early spring. Moving fish during this time will be less stressful. It will also reduce the risk of disease outbreaks, producing healthier stock.

For more information on stocking fish see the 'Stocking your fishery' fact sheet in this series.

Remember that a fish mortality is not always the end of a fishery. You just need to know how to prevent it from happening again.

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