



## How Do I Control Diseases In Fish?

The most common diseases in fish are bacterial infections, fungal infections and parasites. Aeration and water movement are critical for keeping fish healthy, as well as keeping the water clean and free from build up of solids. Do not overfeed your fish, it is very easy to do! Different fish suffer from different diseases. Research into your fish of choice is the key to success.

Bacterial infections usually occur when stress or environmental change has happened. Early diagnosis allows you to change whatever is causing their stress before too many of the fish become sick or die. Remember, prevention is the best cure.

Fungal infections on freshwater fish show up as white 'fluff' on their body and fins. Fungal infections generally occur if fish suffer physical damage or if the fish have already been weakened by another disease. Stress also weakens fish so that they are susceptible to getting fungal infections. Treatment of fungal infections is usually done by treating the water in which the fish are living, effectively treating the water and the fish at the same time. Any water that is being treated with a fungicide should not be pumped through the plant component of the aquaponics system. Always ask if the fish you are buying have been treated with any chemicals as these fish are not fit for human consumption. Aquaponics WA do not use chemicals on any fish.

Parasites are difficult to detect without specialised techniques, and generally the parasites have no or little effect on the fish carrying the parasite. Many fish in the wild carry parasites, this is why it is not recommended to capture wild fish for relocation into a fish tank.

## What Type Of Water Pump Should I Use?

The water head is the highest point at which the pump needs to move water to. Most pumps will have a graph describing what they are rated to pump at certain water head.

As well as water head pumping height, flow is restricted by friction losses. This is the friction of the water against the walls of the pipe work as well as the restriction of any bends in the pipe. Friction losses can be minimised by using large pipes no longer than they need to be with as few bends as possible.

Becoming popular are eco-friendly solar pumps. Aquaponics WA recommends a pump with battery backup. The operation of the pump also needs to be taken into account. Some pumps are designed for working constantly, while others are designed to be turned on and off many times a day.

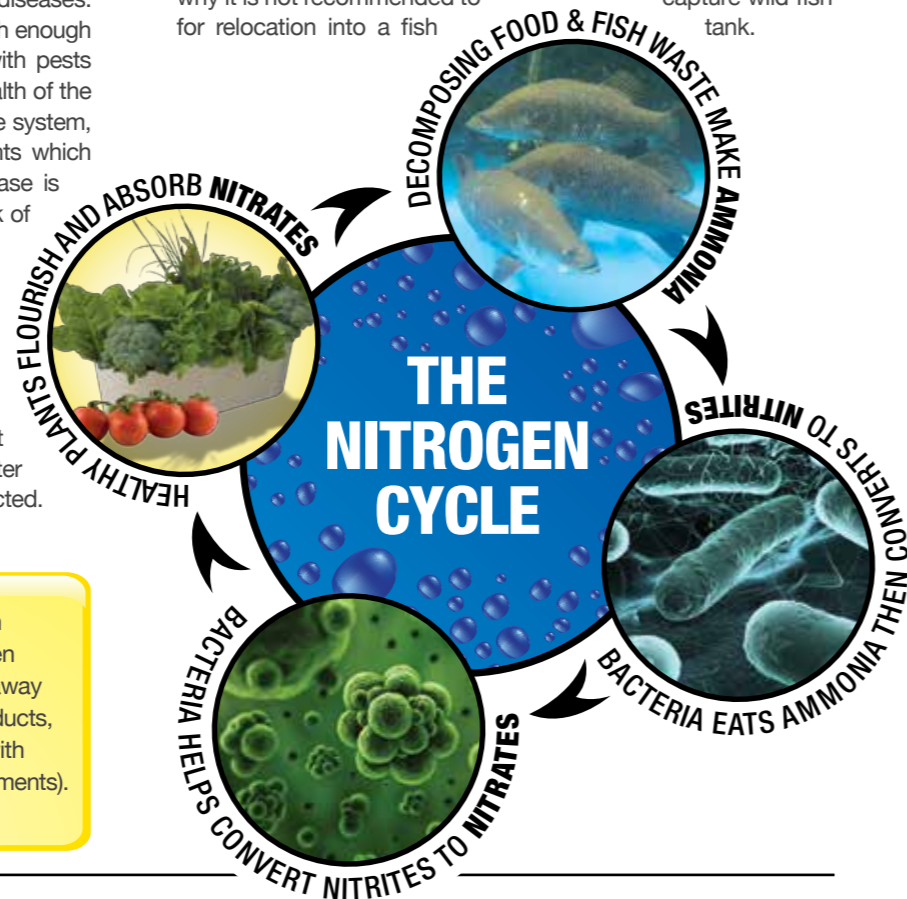
## How Do I Control Pests And Diseases In Plants?

Like soil based plants, healthy plants repel pests and diseases. The best thing for your plants is run the system well, with enough nutrients to allow the plants to flourish. If problems with pests occur, no pesticides can be used, as they affect the health of the fish. Pest affected plants are normally removed from the system, and replaced. Much the same with diseases, the plants which are affected are removed and the source of the disease is tracked down. Many fungal infections occur due to lack of air circulation around the base of plants.

## How Much Work Goes Into Running A System?

Once up and running, the maintenance part of running a system kicks in. These duties include fish feeding, plant seeding and harvesting, mechanical filter clean, water testing and water top ups, unless auto fill valve is connected.

**SAFETY FIRST** Always take care when working with a combination of water, electricity, children and pets. Use low voltage power products and keep away from children, pets and moisture. If using 240 volt products, always use a licensed electrician. Enclose fish tanks with fencing (check your local council for enclosure requirements). NEVER leave water accessible to children.



# AQUAPONICS WA

## Growing your own fish and vegetables at home

QUESTIONS & ANSWERS

## What Is Aquaponics?

Aquaponics is the combination of aquaculture and hydroponics. The water from the fish tank circulates through the grow beds, which are filled with expanded clay or aquaclay. Nitrifying bacteria converts fish waste into available plant nutrients. The water is then filtered by the medium (or mechanical filter if attached), returning by gravity or pump back to the fish tank, giving the fish clean water to live in.



## Benefits Of Aquaponics

- ✓ Reduced water use. Only about 10% of the water required for traditional gardening or aquaculture
- ✓ Reduced or only soft/natural chemical use
- ✓ Little or no pests when set up in a controlled environment
- ✓ No back breaking digging in messy, dirty soil
- ✓ No soil borne diseases and virtually no weeds
- ✓ Can produce fish and plants all year round

## Can I Grow My Own Fish And Vegetables At Home?

Yes. Aquaponics systems vary in size with the smallest being an indoor fish tank with any type of fish. An aquaponics system can be adapted to an aquarium or fish pond that is already operating, or can be started from scratch. The systems used at home can vary in size, according to space.

## Is Aquaponics Organic?

Aquaponics is currently unable to be certified in Australia as organic, although the process of aquaponics is a natural interaction between fish and plants that produce no toxic waste, and does not use any chemical fertilisers or nutrients. Both plants and fish contribute to the cycling process of aquaponics. Natural trace elements and fish food are the only additives to the aquaponics system.

## Do I Need A Permit For My Aquaponics System?

There are no permits needed in Australia to set up a home aquaponics system. Please contact the Department of Agriculture, Fisheries and Forestry at [www.affa.gov.au](http://www.affa.gov.au) for more about commercial systems. Aquaponic courses are available at Challenger Institute of Technology, Fremantle, phone 9239 8200.

## Do I Need A Special Enclosure?

A hot or green house is not necessary, however provides enormous protection compared to being exposed to the elements (weather, pests and diseases). Aquaponics WA recommends enclosures for warm water fish only.

## What Are The Different Styles Of Aquaponic Setups?

**Media based** is the most common style of aquaponic systems. These types of systems use expanded clay in grow beds where plants are grown directly where they are sown. The grow beds are usually flooded and drained periodically, or recycled, allowing water to circulate through the system and air to oxygenate the plant roots and bacteria.

**Deep Flow / Raft** design is used mainly in commercial situations. Please enquire at Aquaponics WA if you are considering this type of setup.

**NFT (Nutrient Film Technique)** systems are the least used in aquaponics due to the expense of good mechanical filtration systems needed. Plants hang in net pots and a small amount of water is run along the base of the channel where the plants roots can access it.



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## What Do I Need For A Successful System?

**Dissolved Oxygen** is required for fish to survive. The amount of oxygen the water can hold depends on the properties of the water, particularly temperature, with warmer water holding less oxygen. High oxygen depletion occurs shortly after feeding. Factors that will change the amount of dissolved oxygen in the system include stocking density (more fish, less oxygen), temperature (higher temperature, less oxygen), salinity of water (high concentration of dissolved salts, less oxygen) and use of air diffusers (smaller bubbles, more oxygen). Water will only absorb a certain amount of oxygen before it becomes saturated.

**Water Temperature** is critical for fish survival. A drop or rise in temperature too great can induce a state of shock, possibly causing fish deaths. Each species of fish has a desirable temperature range, and depending on your climate, heating or cooling of the water may be needed to keep fish happy. Temperatures suitable for some common fish as follows:

Species	Minimum Temperature	Maximum Temperature	Optimum Temperature
Barramundi	20°C	35°C	26-28°C
Trout	0°C	22°C	16-18°C
Silver Perch	10°C	35°C	24-26°C
Murray Cod	10°C	35°C	24-26°C
Black Bream	10°C	35°C	24-26°C
Marron	5°C	22°C	16-18°C
Yabby	5°C	35°C	25-28°C

**Note:** The optimum temperature for fish is not necessarily the optimum temperature for your plants in an aquaponics system. The ideal temperature for the roots of vegetables is around 22°C. Always remember that aquaponics is a compromise between the needs of the fish, the plants and the bacteria.

**pH** is a way of expressing the number of H<sup>+</sup> (Hydrogen) ions in water. Pure water (distilled) has a pH of 7 which is classed as neutral. The pH scale ranges from 0-14, anything below 7 is acidic, anything above 7 is alkaline. The optimum range for aquaponics system pH is between 6.8-7.3, which is a compromise between optimal ranges for the fish, plants and bacteria.

**Water Hardness** depending on its source, can have many dissolved compounds. Large differences occur between the hardness of rainwater (slightly acidic) and bore water (generally much more acidic), due to bore water travelling through the ground and dissolving many compounds, particularly carbonates. The more of the dissolved material in the water, the harder the water is.

**Nutrients** both macro and micro are essential for plants in an aquaponics system. Most of these nutrients come from fish waste. Plants will still grow with little nutrients, but their look, taste and immunity will be compromised. Leafy plants such as silver beet, bok choy and herbs etc., will flourish in an aquaponics system, but fruiting plants such as tomatoes, capsicums, cucumbers will benefit with additional trace elements.

**Water Testing** testing of your aquaponics water is essential to know how your system is performing. Testing every week to two weeks, especially in the first couple years. Normal tests include ammonia, nitrite, nitrate and pH. Ideal ranges for these test are as follows:

Ammonia less than 1  
Nitrite less than 1  
Nitrate optimal 2.5  
pH between 6.8 - 7.3

## What Kind Of Plants Grow In An Aquaponics System?

Plants that do particularly well include leafy green vegetables, vine plants, fruit and fruit trees, flowers and grasses (wheat, barley etc). The cost and turnover time of each crop varies dramatically with leafy greens being able to be produced in a several weeks and root based plants and fruit trees taking longer.

## Is Bore Water Ok in Aquaponics?

In most cases, yes. Check the pH first to find out if it is suitable, then it's best to "settle" the water prior to using it with fish and vegetables. Bore water can have high levels of iron. Bacterial iron will affect the fish health, whereas solid iron shouldn't affect fish. To find out what type of iron is in the water is an expensive exercise so it's better to settle the water prior to using it. Usually settling the water for about one week in a separate tank is enough for the iron to settle to the bottom and you can use the top half of the settled water. Bore water will affect the taste of your fish.

## What Media Should I Use?

The best medium to use in an aquaponics system is expanded clay. Expanded clay is a porous, lightweight, earthy clay aggregate. It's durable and has exceptional capillary properties. The internal structure absorbs nutrient solution, releasing it to the plant on demand. It holds the plant in place but is light enough to allow air penetration to the roots, which prevents excessive acidity and rotting. Expanded clay is pH neutral and is reusable for many years.

## What Source Of Water Can I Use In My System?

Your water needs to be free of toxic chemicals, and if possible, have little or no suspended solids (clay). Water that is clear will make it easier to observe the fish, giving you a clear view of what is happening in the tank. Clear water allows you to monitor any buildup of wastes at the base of the tank, as well as letting you see that the fish are eating all of the food given to them.

Both fresh and salt water can be used in aquaponics. Freshwater is the most common used water as there is a broader range of plants that use freshwater. When using saltwater, plant selection is limited, and is generally used to grow products such as kelp (seaweed).

If using chlorinated water, chlorine must be removed before water can be added to the system. Chlorine can be removed from water by either using a filtration unit, exposing the water to air and sunlight for several days, or using water additives such as sodium thiosulphate that neutralise the chlorine.

## What Kind Of Fish Can I Grow in Aquaponics?

Barramundi, Silver Perch, Trout, Golden Perch, Catfish, Murray Cod, Jade Perch, Australian Bass, Black Bream, Marron, Eels and Yabbies are suited to the climate in Australia as are goldfish, koi and other ornamental fish.

## What Do I Feed The Fish?

The type of fish that are being grown will determine the type of fish food that is used. Floating pellet fish food, which contains no land animal by products is recommended. Food can also come in the form of live food including worms and snails.

## How Many Fish Should I Have In My Tank?

The more fish there are in a system, the more nutrients there are for the plants to consume, but if there are not enough plants to consume these nutrients, the excess build up in the water can cause the fish to suffer. As a general rule, hobby applications can stock up to 20 fish per 1000 litres of water and grow to maturity.

For Yabbies and Marron a stocking density of 10 per square metre is recommended. This assumes that there is sufficient hides on the bottom (ie. shade cloth and/or pvc pipe)

## What Type of Fish Tank Is Suitable?

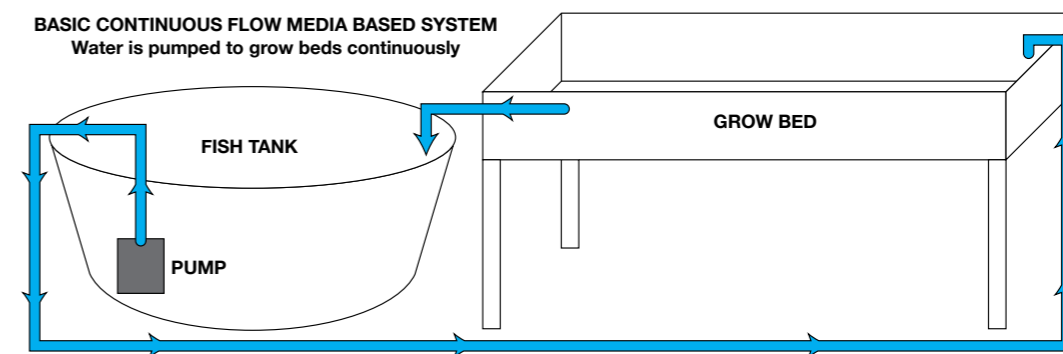
Any kind of water reservoir (preferably round or oval shaped) that is clean, not metal, and has preferably never held chemicals is suitable. This is especially important for plastic tanks, which can retain the chemical residue in its structure, and release it into the water slowly. You can also use bathtubs, in ground ponds, barrels, spas and small rainwater tanks as the fish tank. When using a tank with a flat base, keep an eye on the build up of sludge at the bottom of the tank, and remove as necessary. This build up can cause anaerobic areas to develop, which can increase ammonia levels and release toxins that can be fatal to your fish. To overcome this problem a filter is recommended.

Make sure that your tank is covered from direct sunlight, birds and other predators, or to prevent fish jumping out by using shade cloth type material. Any direct light that gets into the tank will cause algae to grow, which takes away nutrients from the plants you are growing in the grow beds. Fish require very minimal light. Do not use a solid lid as this can be harmful to your fish.

## Why Do I Need Bacteria In My Aquaponics System?

Beneficial bacteria are essential to your aquaponics system as without them, the water can quickly become toxic to fish. Without bacteria, plant nutrients will not become available for the plants to grow in a healthy manner, and the fish choke in their own wastes. The bacteria converts fish wastes into plant available nutrients, by converting ammonia into nitrites and then into nitrates, which the plants use as their main nutrient. The bacteria are aerobic and proliferate where oxygen is highly available. The system can turn anaerobic when there is not enough oxygen, which causes smells to develop.

Bacteria builds up naturally when a system is setup, or it can be manually added in a powder form. Aquaponics WA stock 22.5g sachets of bacteria that treats up to 8000 litres of water and is recommended if you want to get your system running sooner.



## How Deep Should My Grow Beds Be In A Media Based System?

The standard depth of aquaponic system grow beds are the same as those used in the hydroponic industry. The depths can vary from 10cm (100mm) to 30cm (300mm). Lettuce, bok choy some herbs etc., require only 50mm. Most other vegetables such as tomatoes, cucumbers, capsicums, broccoli and silver beet grow best in depths of 150mm. Root type vegetables like carrots, potatoes and sweet potatoes will need 300mm to grow. You will need to consider the growing medium to fish tank ratio which can be up to 2:1. In other words, if you have a 1000 litre fish tank the volume of your grow beds should be between 1000 and 2000 litres.

## What About Filtration?

**Biofilters** are a habitat for bacteria to live. Biofiltration is the term for 'processing of wastes by aerobic bacteria'. The biofilter usually contains biomed, a plastic media which has been designed for maximum surface area to allow colonisation of bacteria, and is very light and easy to handle. The biofilter container is located between the fish tank and the grow beds, usually after simple mechanical filtration and is generally incorporated into the system so that no extra pumps are needed. In a media based system, the medium acts as the biofilter, allowing bacteria to proliferate on its surface area.

**Mechanical filtration** is used to stop solids from entering the grow beds. When solids are allowed to enter grow beds, over time build up occurs and can cause anaerobic areas within the grow beds to develop, which in turn causes toxic substances to develop.

The most basic form of mechanical filtration is to use a foam block underneath the irrigation pipe entering the grow beds. This is cleaned on a regular basis, and stops large amounts of sludge and uneaten food, it is a cheap and very easy way of creating mechanical filtration. More professional methods of mechanical filtration involve using swirl separators / clarifiers, which take either all or part of the fish tank water, passing it through and collecting the solids. These solids are removed manually, and are a great fertiliser for soil based plants around the house.

## What Air Pump Should I Use?

Much like water pumps, air pumps work harder and use more energy the deeper that the stone / diffuser is placed in the water. Purchasing a quality air pump and air stones, ensures that the fish are always kept up to good levels with oxygen availability. Air pumps usually have performance graphs much like water pumps. Alternately, using a larger water pump, an eductor can be added to aerate the water without an additional air pump.

