

# LESSON 1 SCOPE AND NATURE OF AQUAPONICS

Aquaponics is a way of combining aquaculture or fish farming, with hydroponic growing. This is typically achieved by using the waste from fish tanks to fertilize plants, and waste water from plants to top up water in the fish tanks. The tricky part is to ensure that water taken from plants to fish, is chemically suitable for the fish, and that water taken from fish to plants is chemically appropriate for growing plants.

The nutrient-rich waste from fish tanks can be valuable as plant food to vegetables and herbs grown in hydroponic beds. Chemicals (including nutrients) naturally increase in any water in which fish or other aquatic animals live. Some of these chemicals (such as

ammonia) are the result of excrement from the animals, and others may result from decomposition of dead animal tissue or left over food. As a result of its nutrient composition, water that is used for aquaculture is a useful source of nutrition for growing plants.

## Suggested Tasks: ▼

*Throughout this course you will be provided with suggested tasks and reading to aid with your understanding. These will appear in the right hand column. Remember: these tasks are optional. The more you complete, the more you will learn, but in order to complete the course in 20 hours you will need to manage your time well. We suggest you spend about 10 minutes on each task you attempt, and no more than 20 minutes.*



Golden Perch (*Macquaria ambigua*) is one of a number of freshwater fish species that have been grown successfully in aquaponics.

In hydroponics you don't use soil to grow plants - instead materials like gravel, perlite, river pebbles/stones, lava rock (e.g. pumice stones), clay pebbles or rockwool may be used to anchor plants

into specifically designed, channel-like beds (usually raised at a convenient height). Water (with dissolved nutrients added) constantly reticulates through the beds.



Floating Gardens are the simplest form of aquaponics. Rafts are created to hold a growing media. Plants grow in the media. Provision must be made for water to either be absorbed through the bottom of the raft, up into the root zone; or for the root mass to penetrate through the bottom into the water. Example. A fly mesh bottom, and a media above that is mostly peat moss or sphagnum moss. Moisture will be absorbed up into the moss, keeping the roots wet.

Floating gardens of any size can be used in large ponds, dams or lakes; to grow certain types of plants.

This photo illustrates a small one, growing "Impatiens". Large floating gardens were established and used hundreds of years ago, by native people in Mexico; growing food crops on floating Islands. With fish in the water below, these were perhaps early examples of "aquaponics".

In aquaculture fish is farmed under controlled or partly controlled conditions. Water quality needs to be carefully managed (e.g. faeces from fish might be filtered out and/or dissolved and passed through a tank or tanks where bacteria can convert any excessive ammonia to nitrites then nitrates, before applying the nitrate rich solution to the plant roots).

Aquaponics can be used on a small scale or large and either commercially, or to grow food for your own use at home. Either way, both fish and plants benefit each other by creating a symbiotic relationship to produce a sustainable and integrated aquaponic system, which can yield produce all year long as long as it is in a suitably controlled environment.

## LEARN MORE >>>

### Suggested Tasks

Write down your own definitions of:

- Aquaculture
- Hydroponics
- Aquaponics

Now go online and search for definitions of each of these terms.

Compare these to your own definitions and make note of any differences.

## WHAT GROWS WELL IN AQUAPONICS?

- Plants such as leafy green vegetables, vine plants, fruit and fruit trees, flowers, grasses and seaweed all grow well in aquaponics.
- Freshwater fish and other aquatic animals (e.g. crayfish) can be grown.
- The easier plants and animals to grow will be the ones that are less sensitive to variations in water conditions (e.g. pH, nutrient levels).

Generally speaking, plants that don't demand such high nutritional levels will survive and thrive best in most aquaponic systems. These include: common house plants; leafy crops such as kale, lettuce, pak choi; and herbs such as mint, basil, watercress, among many others. However, all others can grow strongly and vigorously too if the aquaponic system is well established and accurately monitored.

It is advised that the variety of plants and fish you choose to grow meet similar pH and temperature standards in order to benefit from a more successful production.



An example of small scale hydroponics. If you add fish into the black tub that contains nutrient solution, this would become “aquaponics”. It becomes tricky though when choosing a compatible species of fish, and maintaining an appropriate level of plant nutrients in the water. Overcoming incompatibilities is the challenge of aquaponics.

## HOME SYSTEMS

Although a relatively recent idea, home aquaponics is becoming increasingly realistic for the home garden. Systems can be small enough to fit in even a small courtyard, or large enough to fill any amount of space you have available.

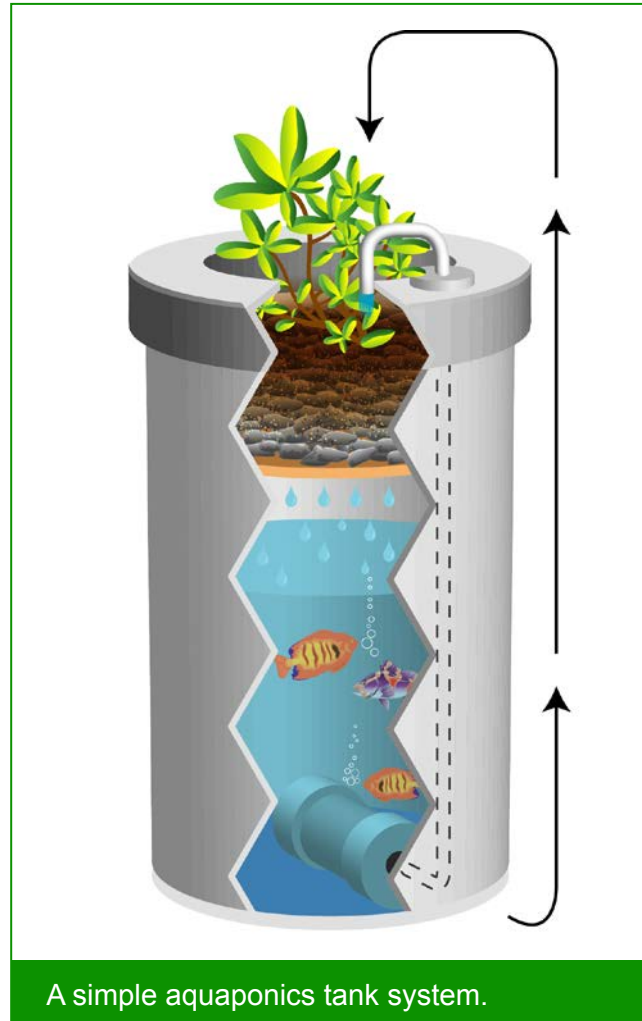
Aquaponics systems are usually made up of grow beds (similar to a corrugated iron raised garden bed), a water pump, an air pump and a filtration system. You can now buy everything you need to get started; kits are readily available and these vary from very simple and inexpensive to quite complex and costly. Before you jump in at the deep end and go for an expensive system it may be best to start small and then add on to the system as your experience and confidence increases. All types of aquaponics kits are now readily available online – try a quick online search.

If you like the idea of aquaponics but are not interested in eating the fish - aquaponic grow beds for plants can be hooked up to existing ornamental fish ponds, as goldfish and other 'non-edible' fish species, work just as well as sources of organic plant nutrients, as edible species.

A very basic aquaponic system simply composed of a fish tank, a filter bed or growbed (for the conversion of nutrients and wastes), as well as a growbed media, a stand, a water pump and a couple of PVC tubes and bell siphons assembled accordingly.

The minimum area required to carry out this basic system should be of at least 1.5 square metres - this way it will be possible to move around the system

as well as to provide a reasonable space for adequate plant growth and development.



A simple aquaponics tank system.

A sturdy plastic fish tank should be placed partially underneath the stand, over which will rest the grow-bed container. The pump placed inside the fish tank provides two functions:

- It firstly serves to aerate the water in the fish tank, along with the assembled PVC tubes and valves.

- Secondly it carries the nutrient rich water from the fish tank into the growbed. A drainage system by another set of assembled and fitted PVC tubes and siphons will also be necessary for the recirculation of water from the filtering gravel grow bed setup (plants/vegetables) back to the fish tank.

## LEARN MORE >>>

### Suggested Tasks

Conduct an online search for "aquaponics kits".

Spend up to 20 minutes looking at different kit systems available.