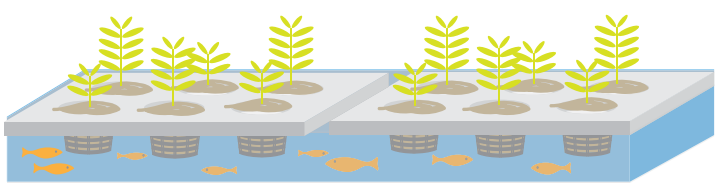
Aquaponic DIY

In Your Backyard



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Introduction

1.1 What is this manual for?

1.2 Introduction of Aquaponic system

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Aquaponics system is a food production system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment. In normal aquaculture, excretions from the animals being raised can accumulate in the water, increasing toxicity. In an aquaponic system, water from an aquaculture system is fed to a hydroponic system where the by-products are broken down by nitrification bacteria into nitrates and nitrites, which are utilized by the plants as nutrients. The water is then recirculated back to the aquaculture system.

2

Aquaponic System

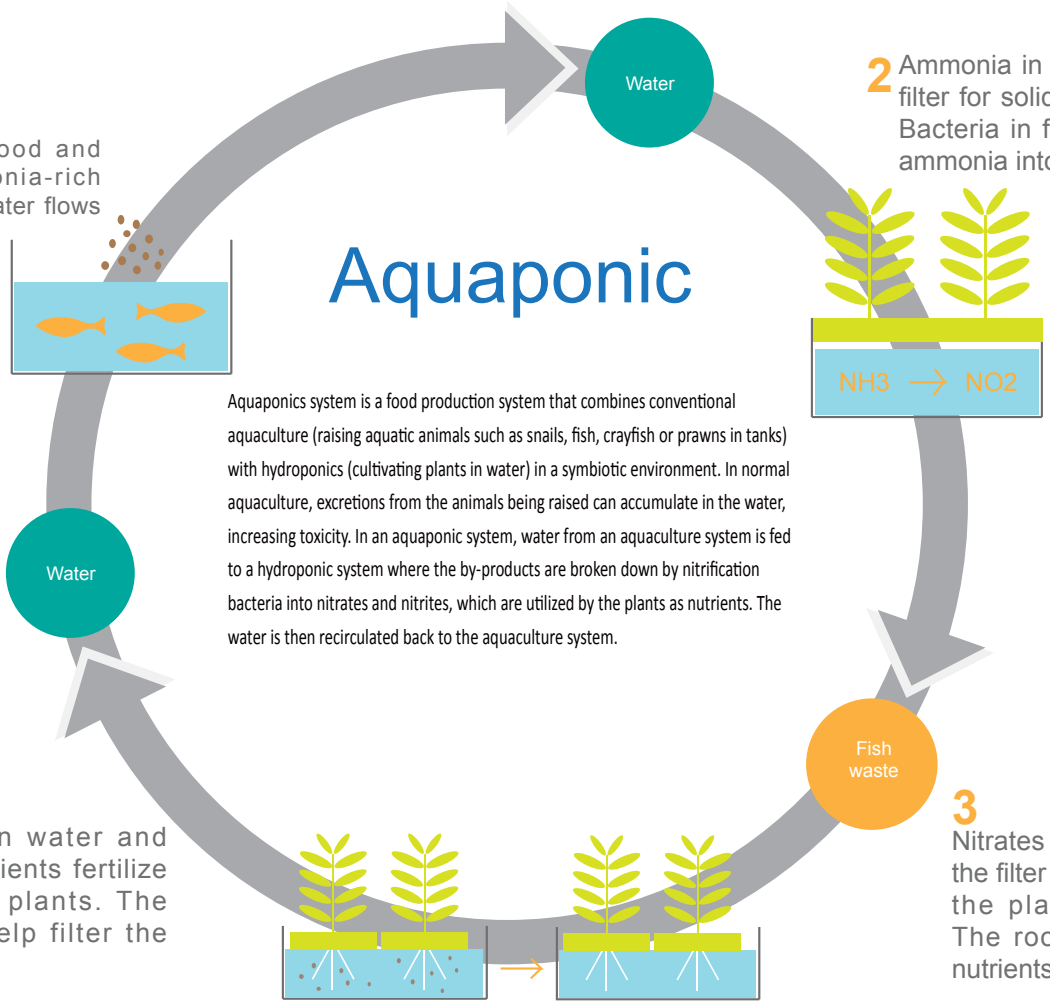
2.1 How Aquaponic Works?

2.2 The Nitrogen Cycle

2.3 The Benefits of Aquaponic

2.4 Why Hydroponic Plants Grow Faster

Aquaponic



1 Fish are fed food and produce ammonia-rich waste. Waste water flows to the filter.

2 Ammonia in the water enters filter for solids and sediment. Bacteria in filter break down ammonia into nitrites.

3 Nitrates and water leave the filter and flow through the plants root zone. The roots soak up the nutrients.

4 Plants take in water and nutrients. Nutrients fertilize and feed the plants. The plants also help filter the water.

5 Clean water flows back into the fish tank and the cycle repeats

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4. Plants take in water and nutrients. Nutrients fertilize and feed the plants. The plants also help filter the water.
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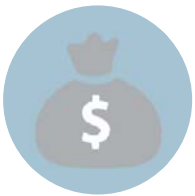
2.2 Benefit of Aquaponic

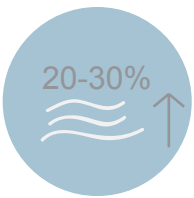
Save water usage due to re-circulation



Growing production is more efficient

Can be easily adapted to different climate

No need for pesticides and fertilizers.



The production rate of Hydroponic is 20-30% faster than growing in soil.

Require minimal labor

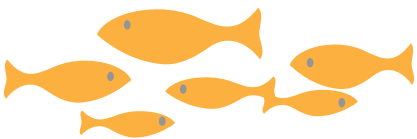
Annual Production

400kg

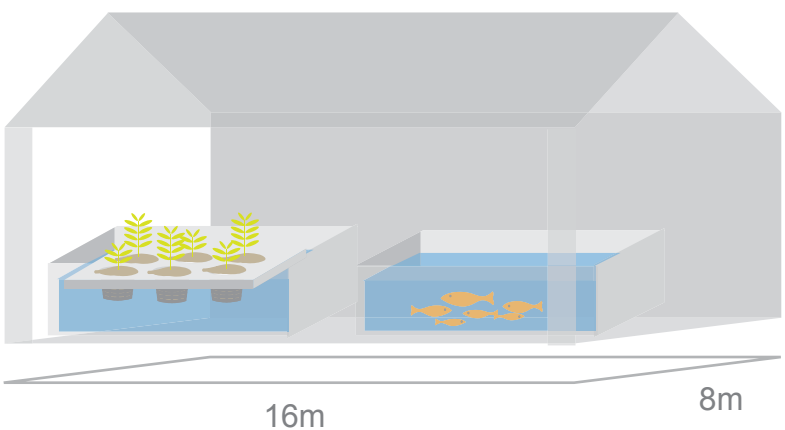
Vegetables

+

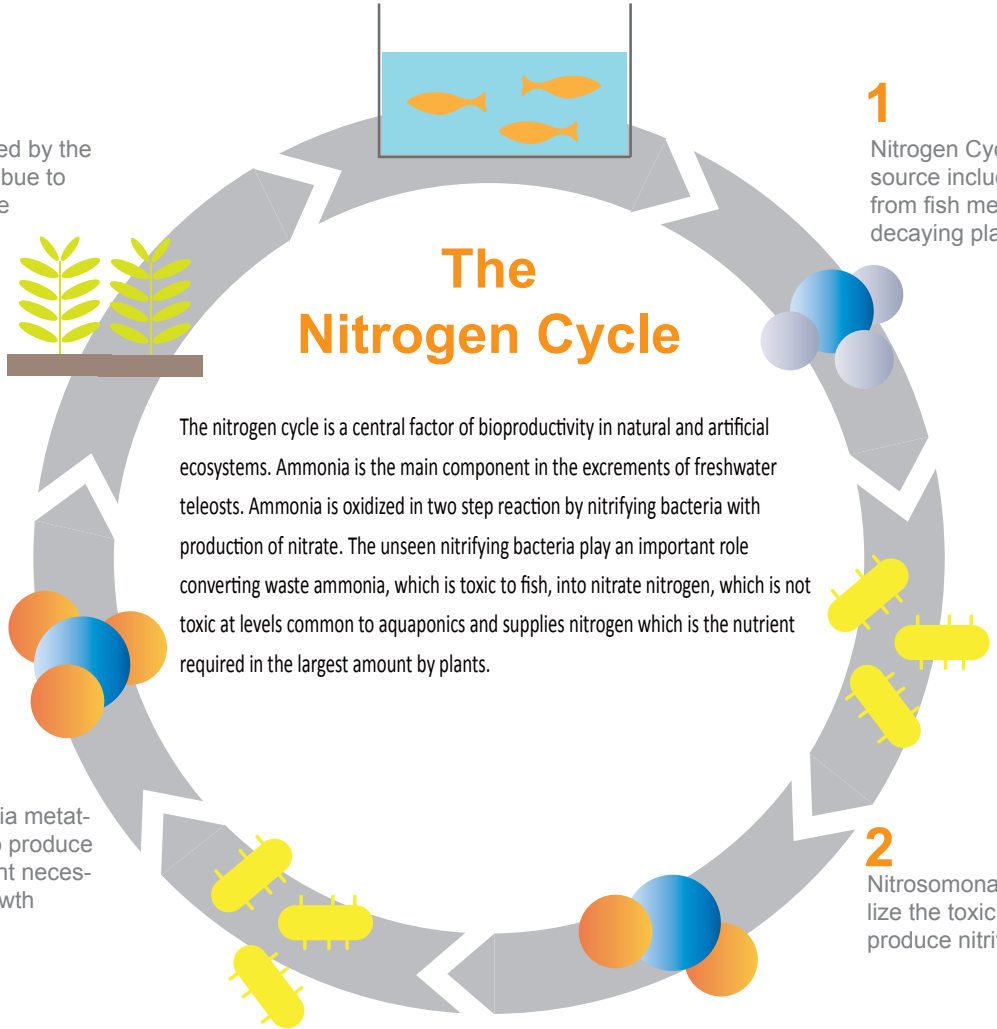
100kg



Fish



The Nitrogen Cycle



The nitrogen cycle is a central factor of bioproductivity in natural and artificial ecosystems. Ammonia is the main component in the excrements of freshwater teleosts. Ammonia is oxidized in two step reaction by nitrifying bacteria with production of nitrate. The unseen nitrifying bacteria play an important role converting waste ammonia, which is toxic to fish, into nitrate nitrogen, which is not toxic at levels common to aquaponics and supplies nitrogen which is the nutrient required in the largest amount by plants.

1

Nitrogen Cycle starts with the source including waste product from fish metabolism and decaying plants

2

Nitrosomonas bacteria metabolize the toxic ammonia to produce nitrites NO2

3

Nitrobacter bacteria metatbolize the nitrits to produce NO3, a key nutrient necessary for green growth

4

Plants are fertilized by the nitrates and contibue to proceed this cycle

2.3 Key Element- The Nitrogen Cycle

Aquaponics system is a food production system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment. In normal aquaculture, excretions from the animals being raised can accumulate in the water, increasing toxicity. In an aquaponic system, water from an aquaculture system is fed to a hydroponic system where the by-products are broken down by nitrification bacteria into nitrates and nitrites, which are utilized by the plants as nutrients. The water is then recirculated back to the aquaculture system.

2.4 Why Hydroponic Plants Grow Faster

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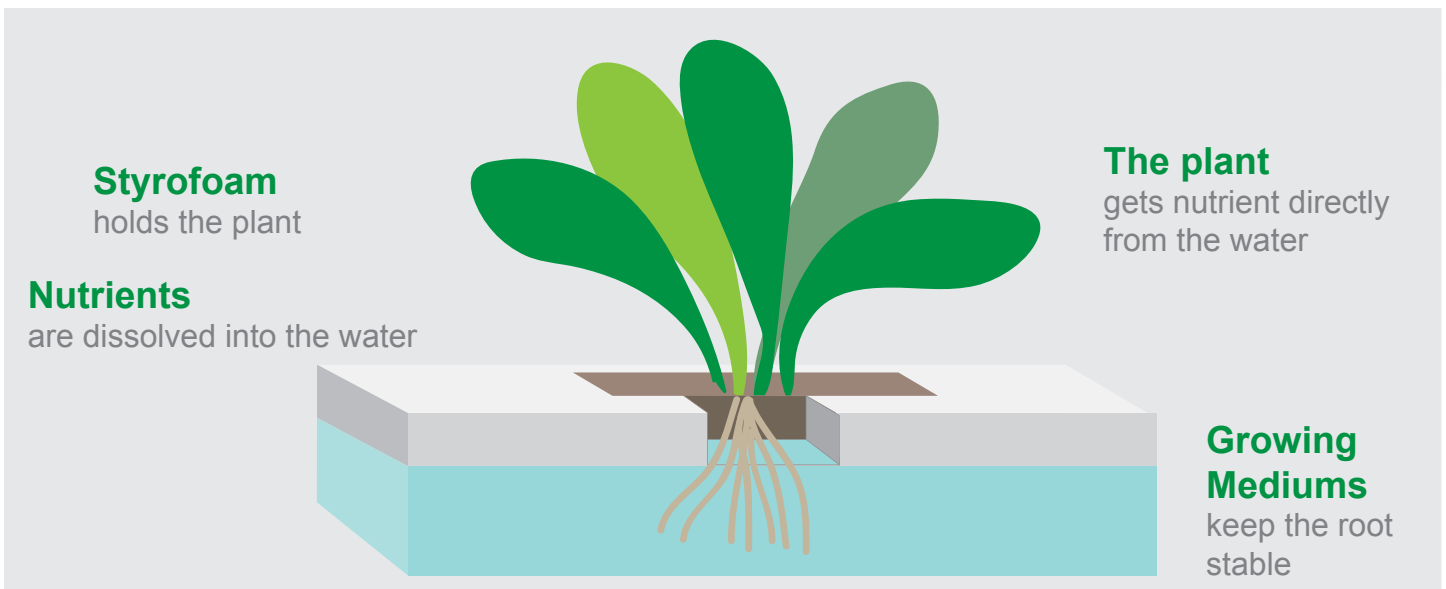


3

How to Construct a Aquaponic System

3.1 Vegetation choice

3.2 Fish Choice

3.3 Things that you need

3.4 Step-by-step construction guide

Vegetation Choice

plants were selected based on their ability to grow fast and resist disease. Plant seedlings were grown in rockwool and transferred to holes in Styrofoam sheets floating in the plant troughs. The plants were grown in the greenhouse at the air temperature of 22-25 degree Celsius

Hihg growing speed

Tomato

Eggplants

Midium growing speed

Basil

Chives

Lecttuce

Cucumber

Spinach

Fish Choice

The most common aquaponic fish is tilapia which grows well under a wide range of water quality conditions. Other fish adapted to aquaponics but requiring more stringent water conditions than tilapia are rainbow trout, largemouth bass, yellow perch.

Barramundi

The barramundi feeds on crustaceans, molluscs, and smaller fish (including its own species); juveniles feed on

Bass

The barramundi feeds on crustaceans, molluscs, and smaller fish (including its own

Tilapia

The barramundi feeds on crustaceans, molluscs, and smaller fish (including its own species); juveniles feed on zooplankton. The barramundi is

Yellow Perch

The barramundi feeds on crustaceans, molluscs, and smaller fish (including its own species); juveniles feed on

Rainbow Trout

The barramundi feeds on crustaceans, molluscs, and smaller fish (including its own species); juveniles feed on zooplankton. The barramundi is euryhaline, but stenothermal. It inhabits rivers and descends to estuaries

Things That You Need

Styrofoam

Mesh pot

Pencil and paper cutter or styrofoam cutter

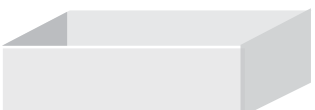
Growing medium
Rockwool

Seeds

Seeding nutrient

Pump

Air tube



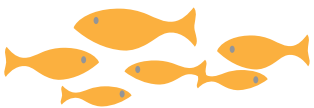
Tank

Pipe

Tank

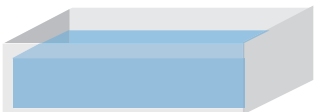
Air tube

Cylinder container with only one open end



Fish

Gravels in diffreent sizes,from 0.3-1cm diameter



Water
ph6-7,22-24C

Pump

Pipe

Floating raft Set-up

1

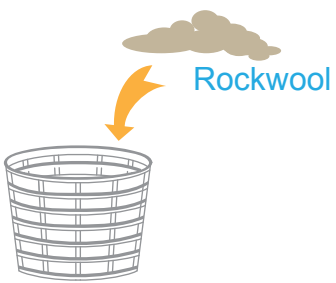
Put the growing medium(rockwool) into the mesh pot, moisture them a

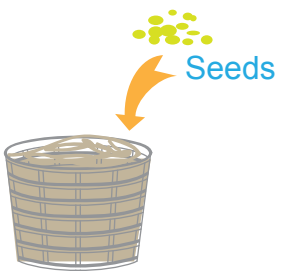
2

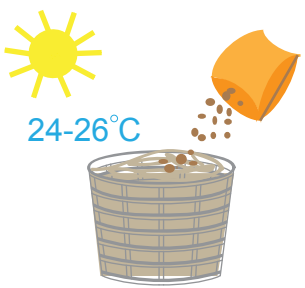
Insert seeds into the medium. For tomato, pepper, eggplants basil , broccoli and cabbage, use two seeds per pot; for herb, 6-8 seeds per pot. You can start with growing more pots for each type of crops , so you can select the best you can keep.

3

Place the pots in a warm place (around 24-26 C). Water them everyday and adding some seeding solution.





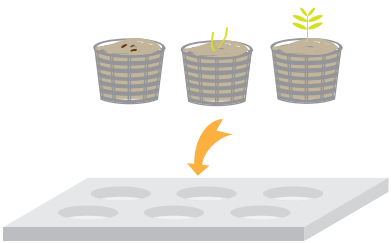


4 .

We need to wait couple of days to let it sprout. Once sprouting, cutting off the others and leave the best one.

5 .

When to put it into the Styrofoam plate? When the plant is 6-7 cm tall, and roots starts to show through the side of mesh pot. This usually takes 1-3 weeks.

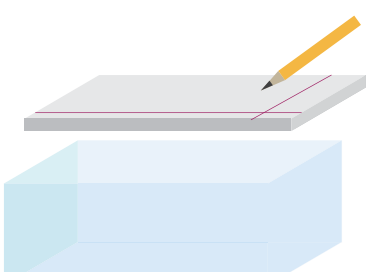


Floating raft is Ready!

Hydroponic System Set-up

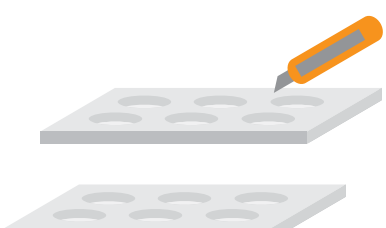
1

Find a container to use as a reservoir such as a fish tank. Measure the dimension of the container and mark the Styrofoam the size that can fit into the tank, which will be 3 cm shorter at both width and length than the tank size.



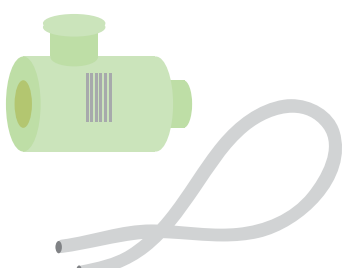
2

Mark the Styrofoam with 5cm diameter of circles(or the size of your net pot and trace them) with 5cm between two circles. The circle is for the net pot for the hydroponic plants. Now use the paper cutter and Styrofoam cutter to cut off the edges and holes you just marked.



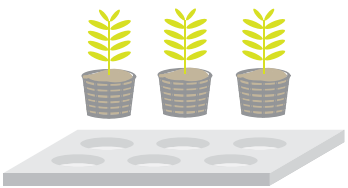
3

Now connect the air line to the pump and attach air stone in the free end. Make sure the airline is long enough, which should go into the middle of water to provide oxygen bubble to the plant roots.



4

Put the net pot into designated hole of Styrofoam



5

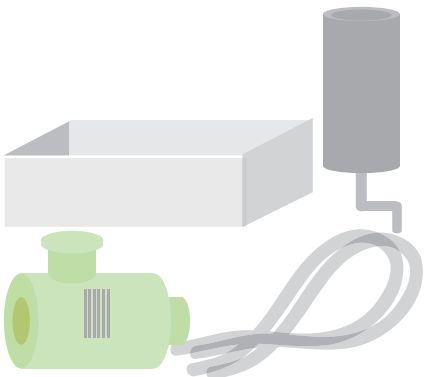
Fill the water to the half of the tank then put the Styrofoam on the water, and put the airline in the water. And now adjust the water level to 4 cm blow the edge of tank.

6

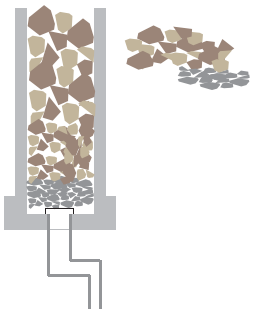
Now turn on your pump, the Hydroponic part is finished.

Aquaponic System Set-up

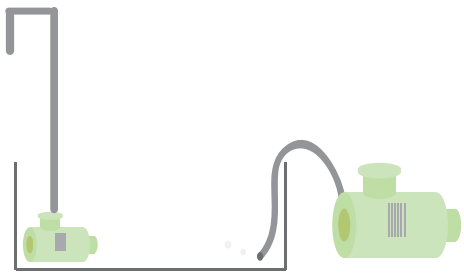
1
Get a tank, 1 pipe, fish tank water pump with pipe, cylinder container with tube at one end and some gravel in different sizes.



2
Fill the cylinder container with gravel, at the bottom should be finer gravel and becomes bigger to the top



3
Put water pump with pipe into the fish tank and put airline into the tank which connect to the air pump shared with floating raft tank.



4

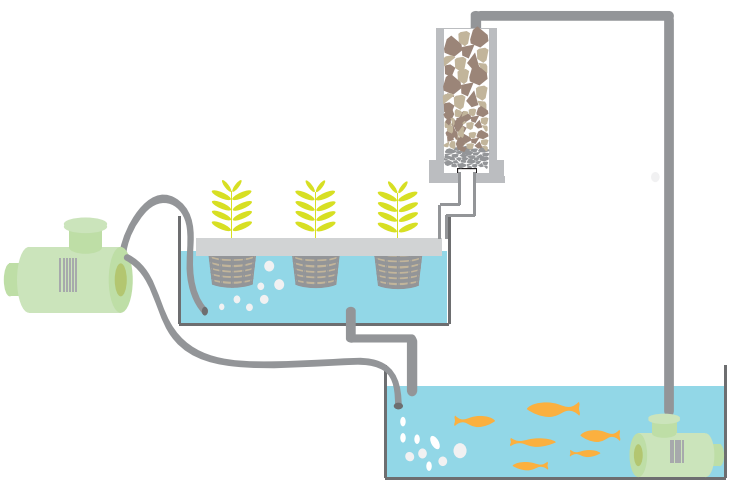
Place floating raft tank higher than fish tank so the water can naturally flow to the tank,the amount of the watter current can be control by the valve.

5

Fill fish tank with water and place fish in it.turm on air pump and water pump.Now the Aquaoinic system is ready!

Caution!

-water ph should be maintain at 6-7
-water temperature should be maintain between 22-24degree.



4

Trouble Shooting

3.1 Water

3.2 Plants

3.3 Fish

3.4 System

Trouble Shooting

WATER

1.Problem: Water is green
Reason: Too much algae due to water having too many nutrients and too much light
Solution: Feed less, shade tank, darken sides of grow beds

2.Problem: Water is dirty
Reason: Usually too much food and fish are not eating it all or system is under-filtered
Solution: Feed less, use towel/sock filter on return water to filter out sediment, check for blockages

3.Problem: Water is foaming in an established system
Reason: Detergents or other chemicals have been introduced into the system
Solution: Perform 50% dechlorinated water changes every day until the foaming is gone.

4.Problem: pH over 7.5- pH less than 6.5
Reason: Acidity of water is too low or too high, levels are determined by components, water source
Solution: Quick pH level changes are hazardous to fish!

PLANTS

1.Problem: Plant leaves do not look healthy.
Reason: Usually is a mineral deficiency, can also be toxins or environment factors.
Solution: Check fish food contents and nutrients.

2.Problem: Plants are not growing or growing extremely slow
Reason: pH may be too high or not enough nutrients in water
Solution: Check pH, increase feed if fish finish it all too quickly or reduce number of plants in system

3. Problem: Aphids eating plants
Reason: It's normal, nature happens.
Solution: Plant dandelions, carrots to attract ladybugs, buy a bag of ladybugs from local nursery,look to see if ants are farming the aphids at which they will kill your ladybugs ntroduce ladybugs at night

4. Problem: Caterpillars eating plants
Reason: It's normal, nature happens.
Solution: Use garlic spray on plants, put caterpillars into tank as free fish food or use biological insecticide like "Dipel"

FISH

1. Problem: One, some, all fish are at surface of the water and not normal for them when not feeding.
   Reason: Lack of dissolved oxygen, fish are consuming more oxygen than water provides
   Solution:
   (1)Immediately add air bubbler, manually splash water but try not to stress fish
   (2)Water/air exchange introduces oxygen into the water
   (3)If pH levels are low, add “pH increase” equivalent but not too much.
   Changing PH by 0.2 in a short time can be harmful.
   (4)Reduce fish/water volume ratio, increase amount of air, stones or bubblers

2.Problem: Fish are jumping out of tank
   Reason:
   (1)water level is too high (this is not the main reason this happens, see “piping “above)
   (2)fish are trying to eat flying insects
   (3) extremely poor water quality
   Solution:
   (1)reduce water level, cover tank with wire mesh/netting
   (2)cover fish tank with netting to keep fish in
   (3)test system levels, filter water sediment better

3. Problem: Fish aren't eating in colder weather
   Reason: Fish eat less the colder the water gets, which less ammonia too, so keep an eye on plants.
   Water temperature controls fish metabolism,
   Solution: Feed less or stop feeding

4. Problem: algae on fish
   Reason: algae does not grow on fish, it is the fungus that grow on your fish!
   Solution: consult local fish shop

SYSTEM

1. Problem: System is leaking water
   Reason: Parts are old and cracking, sealants/tape defective
   Solution: Seal holes in pipes with Teflon plumbers tape temporarily, then replace worn parts use ball valves to shutoff water flow to parts of system that are leaking and fix.

2. Problem: Red worms appeared
   Reason: Came from feed or nature
   Solution: Do nothing, red worms are your friend and free fish food, research other types of worms

MORE INFOMATION

Aquarticles.com	http://aquarticles.com
Aquaponics Journal	http://www.aquaponicsjournal.com/articles.htm
Aquaculture Network Information Center	http://www.aquanic.org/index.htm
You Tube	http://www.youtube.com/results?search_query=aquaponics
Google Video	http://video.google.com/videosearch?q=aquaponics#

EXTEND READING

about.com/od/plantsgrownhydro/a/The-Best-Plants-To-Grow-In-A-Hydroponic-Garden.htm
http://ibcofaquaponics.com/building-a-system/
http://3stepsforfood.com/how-our-aquaponic-systems-work/
http://www.wikihow.com/Benefit-from-Hydroponic-Indoor-Gardening
-A Commercial-Scale Aquaponic System Developed at the University of the Virgin Islands
James E. Rakocy*, Donald S Bailey, R. Charlie Shultz, and Jason J. Danaher
-evaluation of aquaponic technology in Alberta, Canada