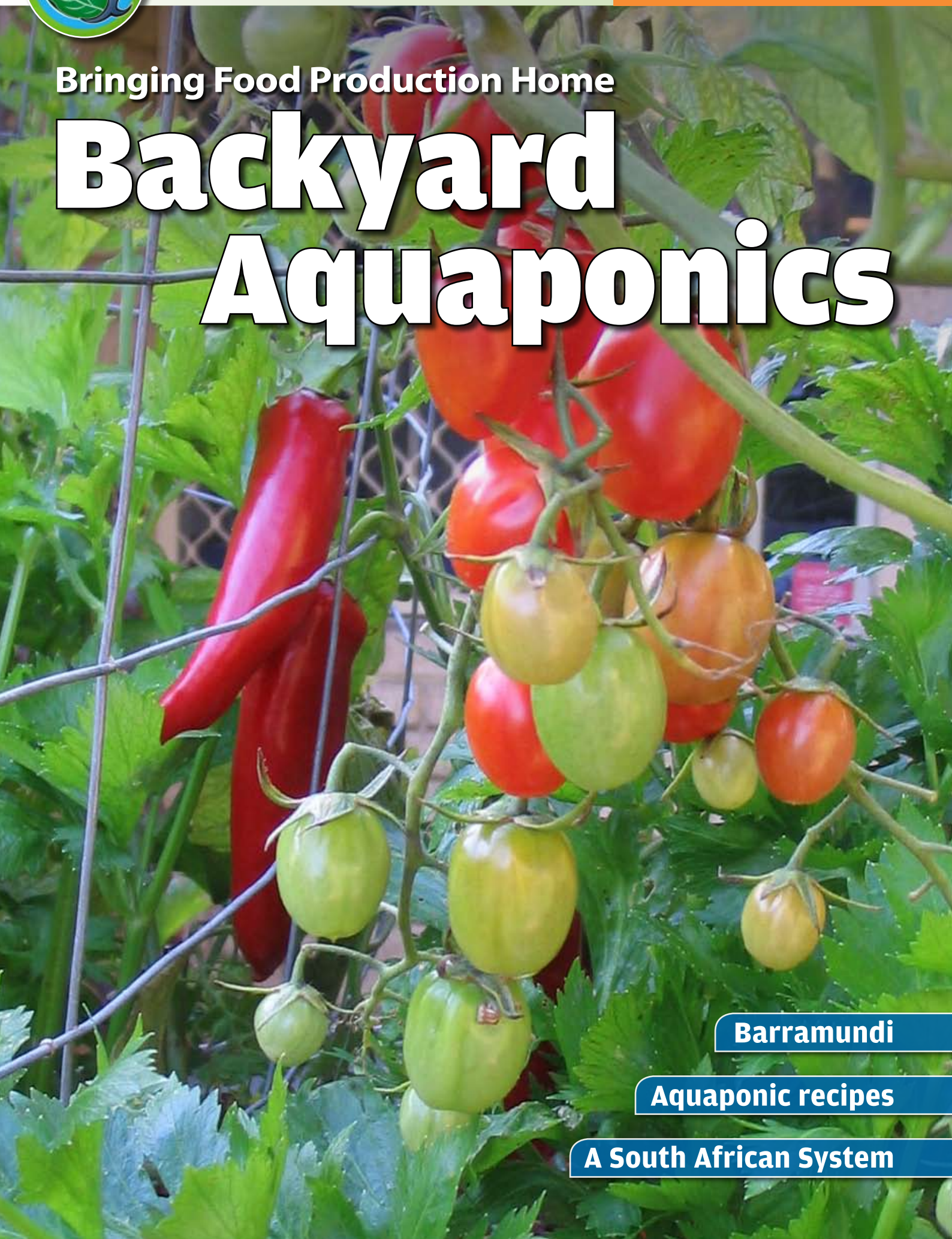
The No.1 Aquaponics magazine for the backyard enthusiast.

Issue 2
Second Quarter 2008

Bringing Food Production Home

Backyard Aquaponics



Barramundi

Aquaponic recipes

A South African System

Welcome...

Welcome to the second edition of the *Backyard Aquaponics Magazine*. The first edition was greeted with a great response, with over 1000 copies downloaded in the first 3 months of release. This has given us the motivation to push forward and make this second edition, and subsequent editions even more substantial.

Of course there's an immense amount of work in producing a magazine like this, and because of the workload we have had to employ extra people to help in the magazine production. This has a two tiered effect, firstly the magazine can be improved with the increased input, but also it means that we must start charging for the publication to help cover some of our production costs. We hope that you enjoy this issue.

Single issues are available, or you can purchase yearly subscriptions. You can download the magazine through links on our main website at **www.backyardaquaponics.com**

Joel Malcolm, *Editor*

So what is Aquaponics?

Aquaponics loosely described, is the combination of aquaculture and hydroponics. Aquaponics means many different things to different people, but it's basically all about growing fish and vegetables in a symbiotic system.

Fish and plants growing happily together.

Backyard Aquaponics

Issue 2 • **Second quarter** • 2008

Backyard Aquaponics Magazine is a quarterly publication which aims to promote the ideas of Aquaponics and home food production coupled with healthy and sustainable living.

Contributors
Steve Cacchione, Tim Courtland, Stuart Haberfield, Joel Malcolm, Jaymie Rains, Paul Ryan, Faye Arcaro, Kevin Cuthbert, Mathieu Edmonds

Magazine Enquiries
magazine@backyardaquaponics.com
Editor: Joel Malcolm
www.backyardaquaponics.com

Who are We?
Backyard Aquaponics Magazine is produced in-house at Backyard Aquaponics.
PO Box 3350
Success, WA 6964
Ph: (08) 9414 9334
www.backyardaquaponics.com

Proofed and edited by:
Adrian Doesburg
Member of the Society of Editors
BRAVO COMMUNICATIONS
Editors - Copywriters - Proofreaders
08 9498 1555 www.bravocomms.com

Design & Lay-out
David Kyslinger - *Moonshine Graphics*

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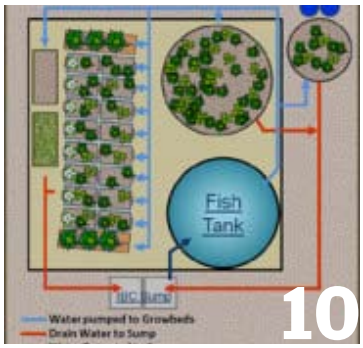


Congratulations to the 2007 Backyard Aquaponics Forum photo competition winner!

Scottie with his brand new Nikon CoolPix camera taking pictures of his aquaponics system…

Scottie's winning photo—"A freaking cool bug!"

Some early contributions for the 2008 competition

The 2008 photo competition is now well underway, with a **first prize** consisting of a large Backyard Aquaponics pack including a shirt, cap, drinks holders, pens, DVD's, books, and much more.

Please see the Backyard Aquaponics forum site for further details.

A South African system

By Kevin Cuthbert

I stumbled upon Aquaponics (AP) quite by chance while researching filtration methods for traditional Aquaculture. What intrigued me most about AP was the savings in costly filtration and aeration plus the added bonus of a secondary crop ie. the vegetables. Add to this the minimal water requirement and the small land footprint required and it almost seemed too good to be true.

As with any new venture, I plunged headlong into it, reading extensively and trying my best to grasp the jargon and meaningless (at that time) technical terms being bandied about on the forum. I have always been interested in projects that are scalable, and AP seemed an ideal candidate. I found tiny systems consisting of a goldfish bowl and a pot plant, right up to massive commercial enterprises producing tons of fish and vegetables. Because we own a restaurant, we have a ready market for the fish, vegetables and herbs produced by my system, and what we grew would, to a large extent, be determined by what we needed in our restaurant. My system had to use as many recycled materials as possible and I decided, from the outset, that I wanted to use it as an educational project for local schools and communities. We have since hosted numerous schools and other groups.

A system constructed predominantly from recycled materials.

With this simple brief in hand, I set about designing my system. My fish of choice was Tilapia (*Oreochromis mossambicus*), which is indigenous to this area and permits to transport and hold are reasonably easy to obtain. I chose Tilapia because they are extremely hardy and tolerate a wide range of water conditions, and from what I had read, thrive in AP systems. With the plants I used the "shotgun" approach and planted as many different types as possible, to find out what grew best in my unique conditions. Because Tilapia grow best at 28 degrees celsius, I decided to put my fish ponds inside a greenhouse and take my chances with the vegetables outside.

Never being one to read instruction manuals, I decided to ignore most of what I had read about fish/water/gravel ratios and just go with my "gut feel". This was my first big mistake. My system consisted of 2 x 2900L plasticlined, mesh reinforced round ponds, 1.7m in diameter and 1.2m deep, a 2500L water tank as my sump and 6 x 210L plastic barrels, giving me 12 x 105L half barrels as grow beds. My grow medium would be a 13mm quarried stone. A pool pump would be mounted next to the sump at the lowest point of my system and pump water up to the fish tanks. The water would drain flow by gravity via spray bars into the gravel grow beds, exit into drains and then flow by gravity back down to the sump.

I identified a suitably sloped piece of land in my garden and went about cutting and reinforcing a terrace about 8m x 8m into the side of the hill. We then laid a concrete slab 6m x 3m with all of the drains, electrical pipes and drains cast in, placed the tanks and constructed the greenhouse tunnel over the top.

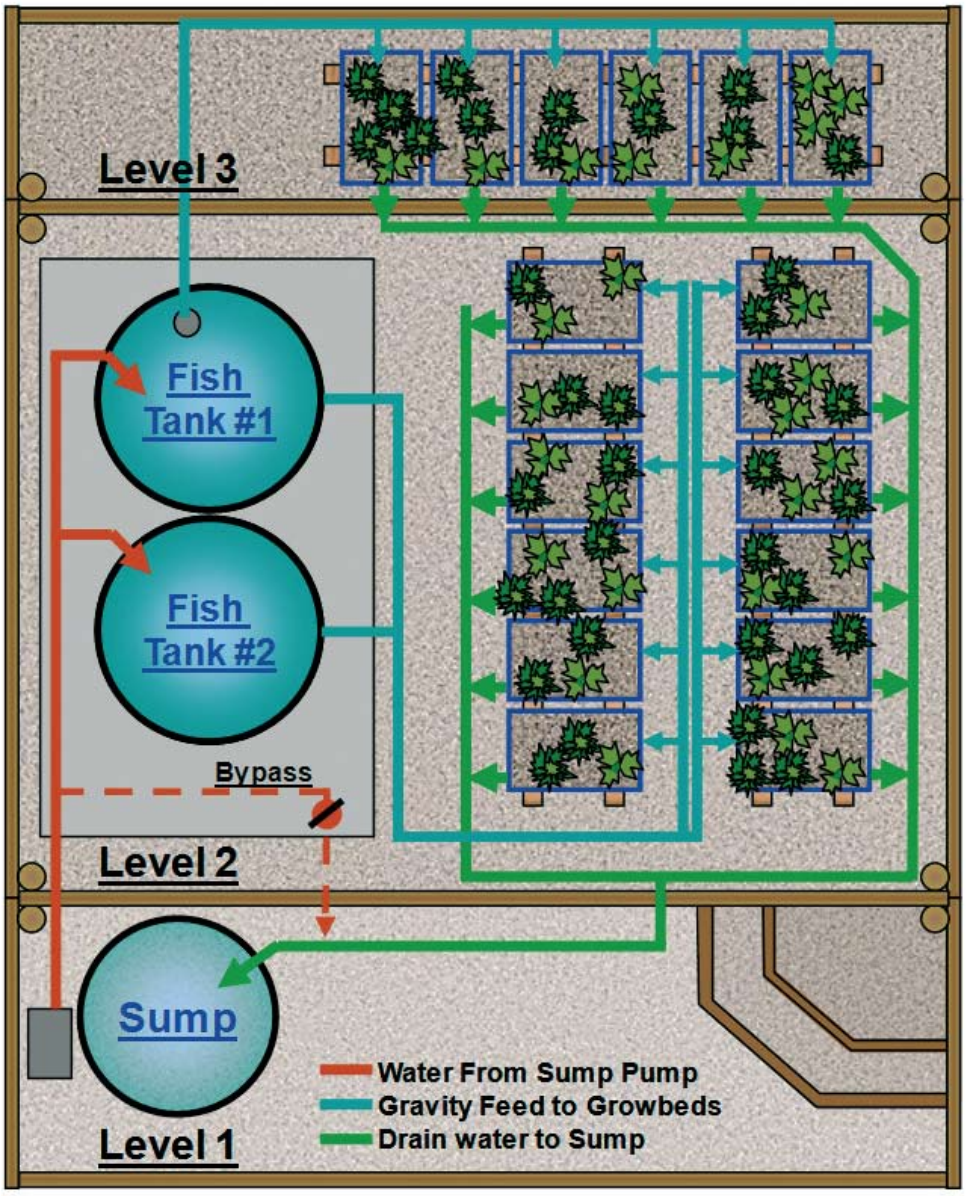
I constructed a dozen or so sturdy little brick walls and laid solid timber supports over these to hold my grow beds of 105L half barrels. I then used triangular stays between the 2 rows of six barrels to hold them perfectly level. After reading extensively about various drain methods, various drain methods, I decided on siphon loops which looked easy and once set up could be left unattended. The other advantage is that the pump could run continuously and they would flood and drain automatically as if by magic. This suited me because of my high stocking densities and low oxygen levels.

These siphon loops, although I am sure work very well for some, just didn't work for me and I battled for weeks with collapsing hose walls, irregular flood cycles, flooding grow beds, flow rates from my spray bars that were either too fast (ie., they never sucked air at the end of the drain cycle) or too slow (ie., they never started a siphon).

Eventually, I gave up and converted all of my grow beds to pipe wi thin pipe drains and a ½-hour on and ½-hour off pump cycle. The grow beds and plants all seem happy now.

Insofar as the plants are concerned, not only did I decide on a very wide variety, but I also planted from nursery-bought seedlings, seedlings that I had raised in seed trays myself, seed directly sown in the gravel grow beds and some mystery plants (which eventually turned out to be butternuts) which I transplanted from my compost heap.

These are the plants that I have trialled and my comments on growing conditions.



A birdseye view of the system. The split levels are used to minimise pumping requirements and let gravity do all the work.

Overlooking Knysna Lagoon which drains with the tide through the Heads (in the distance) into the Indian Ocean

Location: *On South Africa's southern coast 34˚02'12" S • 23˚03'57" E*

Climate: *Knysna has a temperate climate. Summer temperatures can reach highs of 38° and during the winter months (June-August) fall to about 18º Celsius.*

Beans

The first batch of seeds rotted in the grow beds when I was battling with my siphon loops, but the next batch shot up and within a mere 40 days we were harvesting our first crop. This is absolutely unbelievable for a plant that normally takes 90 days to produce in South African conditions.

Impressive plant growth in the half-barrel growbeds only 70 days into the project

We were producing 300g plus every second day from this one grow bed for quite a few weeks.

Tomatoes

My favourite plant in AP, despite a mystery rot that turned the little tomatoes into mush. I removed this plant and since then I have planted 4 grow beds with 4 different varieties which are all doing well.

Mint

The ultimate AP plant. Find something to do with 100kg of mint and you'll make a fortune. The easiest and maybe the best plant to start with, but it does tend to take over and has very invasive roots.

Butternuts

Grow well in my system, but I have had problems with pollination, so I haven't really got any butternuts to full grown yet, but I am persevering with my little pollination brush.

Bean and Tomato plants after 30 days of growth

Basil

Another winner in AP that seems ideally suited to AP conditions.

Lettuce

I planted two varieties and have been very happy with the results.

Tilapia (Oreochromis mossambicus)

Oregano, Watercress and Parsley

Any herb seems to do well with the exception of Rosemary.

I have recently added an additional six grow beds to take up the massive amounts of nutrients churned out by my high fish load. Nature has also taken care of the over-stocking by killing off about 80 and I have sold and re-located another 150, leaving me with 220 fish. The problem that I never anticipated is that these fish grow fast and water quality may be fine one week and critical the next. I also do regular water exchanges to minimise water quality issues.

What I have learnt from this experience…

Start with low fish stocking densities. I started with 450 x 100g fish and no plants. I had been offered an "everything or nothing" bargain so I just took all of the fish and figured I'd just muddle on. Big mistake.

Maintain a ratio of 2:1 of gravel vs. water.
My water was 5800L and my gravel 1260, a ratio of 0.21 : 1. I paid dearly for this when my grow beds could not cope with the ammonia load produced by the massive volume of fish I was holding.

Do not overfeed the fish.
To compound my problems I felt sorry for the fish and couldn't help feeding them, even when all my water tests suggested a problem.

Test, test and re-test.
I assumed that problems happened slowly. I was wrong. With high stocking densities and green water, problems can crop up overnight. Get yourself a water test kit and use it at least twice a week.

Provide adequate drain pipes.
I had 50mm central drains, draining the water by gravity from the ponds and a 40mm inflow pipe delivering water under pressure. This didn't work and I had to send a large proportion of the water to bypass. If I re-designed this system it would have an 80mm drain and a 40mm delivery.

Wash your gravel.
The water can take a LONG time to clear if you don't wash your gravel well. Ask me – I know.

Incorporate a solids filter into your design.
Although you can dump solids directly onto the gravel, especially if you have earthworms in your system, this eventually becomes too much and clogs up the system. A solids filter could also incorporate a biological and purifying component.

Provide extra aeration.
Despite assurances to the contrary, I couldn't get sufficient Dissolved Oxygen into my system without an additional blower. This is probably due to my high fish load and insufficient grow beds.

Have a contingency plan for power outages.
We are prone to power failures in South Africa and this spells disaster for both the fish and the plants. The fish lack oxygen after a few hours and without a constant trickle of water the plants wilt badly in the gravel from the sun.

And then the ultimate question,
"Would you do it again?"
Most definitely. ●

Kevin Cuthbert
SYNAPTOMAN

Jaymie's System

The monster fish tank is lifted into position.

By Jaymie Rains

I was inspired to try aquaponics by seeing Joel Malcolm's backyard system on Gardening Australia. It took me a few days to convince my loving husband that we should be doing this too. It wasn't that hard. Alex could see the merits of this method of food production too. We live on 5000m2 just outside of Townsville, Queensland. We are on a hill with very rocky, poor soils. Traditional soil gardening is very difficult and water intensive.

The next step was preparing a site for a system. We needed somewhere flat and level for a tank to sit on. A bobcat helped out with that.

The greenhouse was built from secondhand materials and is mostly to provide some shade cover and to prevent torrential downpours from overflowing the system. It is roofed with greenhouse film, and shade cloth. The sides are bird netting to allow maximum airflow, but to protect the fish and the plants from the local wildlife.

Sourcing the tanks and grow beds on a second-hand budget is a fun thing. We called in a lot of favours from friends during this project. Fish will be their reward! The tank we have used was for many years a council water tank, but was de-commissioned and left on a friends property. He generously gave it to us, and drove it up here on a front-end loader. The tank needed repairs, Creative1 to the rescue. This man is a master concreter who came to stay and repair the tank. It's not going anywhere!

Sourcing sufficient grow beds to service such a large tank was a challenge in itself. The top of the water tank was cut off and lined to be the first, big bed. A damaged corrugated iron water tank became the second. Then as many blue drums as I could afford at the time. For some reason, there is a demand for blue drums now!

Townsville from Mt Stuart, with Magnetic Island in the distance

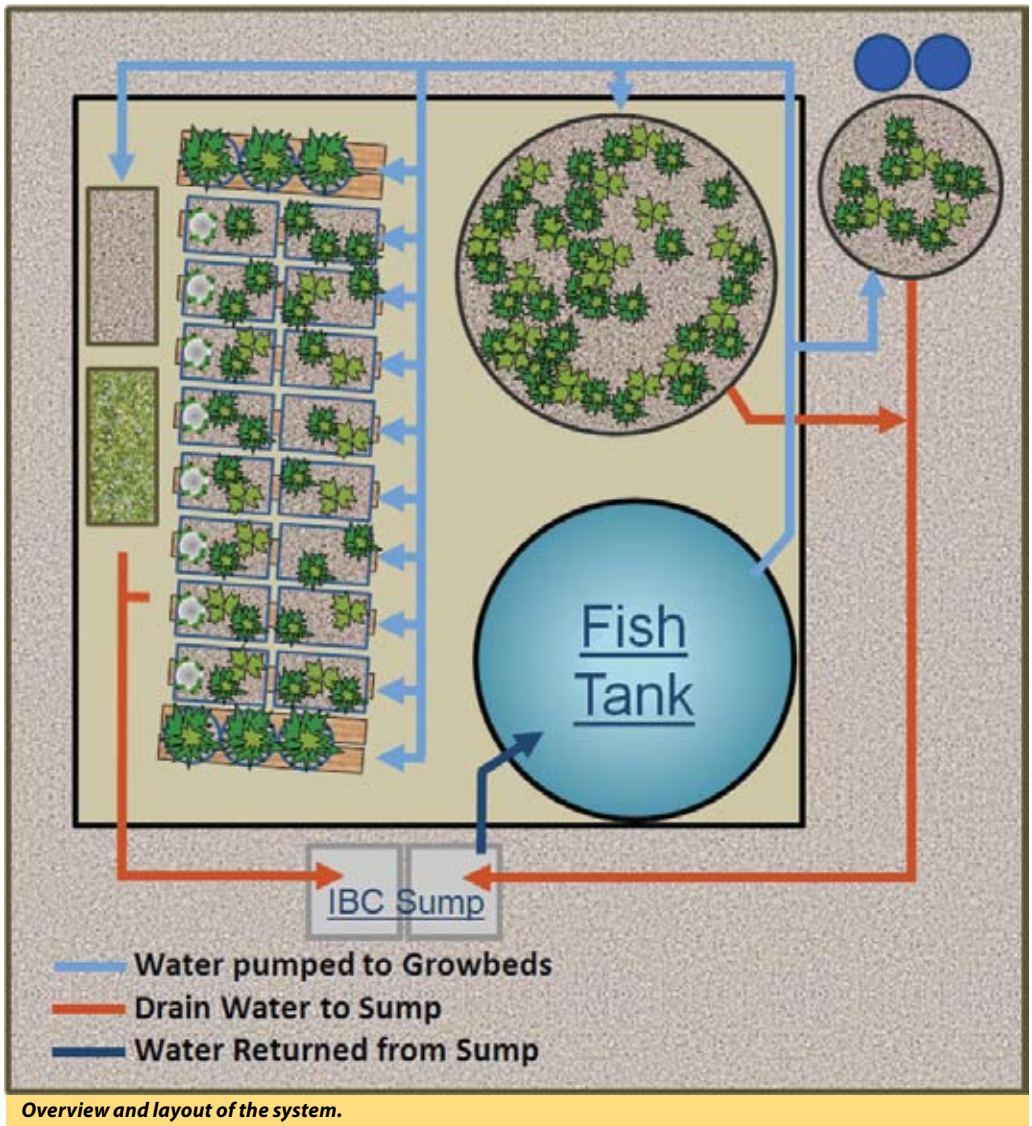
Location: *On the north-eastern coast of Australia, in the state of Queensland. 19° 15′ 36″ S 146° 49′ 1.2″ E*

Climate: *Dry, tropical climate. Average daily temp between 19.7 °C to 28.8°C. December is the warmest month of the year with daily temps ranging from 24.0 °C to 31.4 °C. July is the coolest month with daily temperatures ranging from 13.5 °C to 25.0 °C.*

There are also a couple of second-hand bathtubs and lengths of 150mm PVC pipe.

The pumps and pipes are one of the biggest expenses in setting up an aquaponic system, especially a large one. We have two pumps, one in the fish tank and one in the sump. The fish tank pumps through 32mm pvc past taps and T's before reducing to 19mm poly pipe for delivery to each grow bed. The drainage lines are whatever we could scrounge.

Our first delivery of fish arrived in January 2007. 125 Jade Perch and 125 Si lver Perch fingerlings took up residence



Overview and layout of the system.

in the quarantine tank for a couple of weeks before starting their new life as aquaponic fish.

Most of our plants were started as seeds in each grow bed. As our tiny fish grew and produced ammonia, the bacteria in the grow beds multiplied to deal with it and the seedlings grew to take advantage of the bacteria's work.

We have been running our backyard aquaponic system for 15 months now, and we regularly eat fish from it. Fresh, healthy and tasty vegetables have been a big part of our lives for over a year. We wouldn't be without them now! Recently this year's cohort of fish arrived to take up residence and to keep up the ongoing supply of fish. ●

Jade Perch and Si lver Perch growing well in the large tank.

The system all coming together.

Google SketchUp
– Designing Your Dream Systems...

By Joel Malcolm

This issue's road test gives us a glimpse into the realm of computer-aided design with one of the web's greatest free 3D drawing packages: Google SketchUp.

We will have a look at a few ways in which this program has made life simple for aquaponicists all around the world by assisting them in creating virtual aquaponics systems.

Imagine, you can design and assemble your aquaponics system without even getting your hands dirty and without the small fortune spent on computeraided design (CAD) programs. Thanks to Google SketchUp you can!

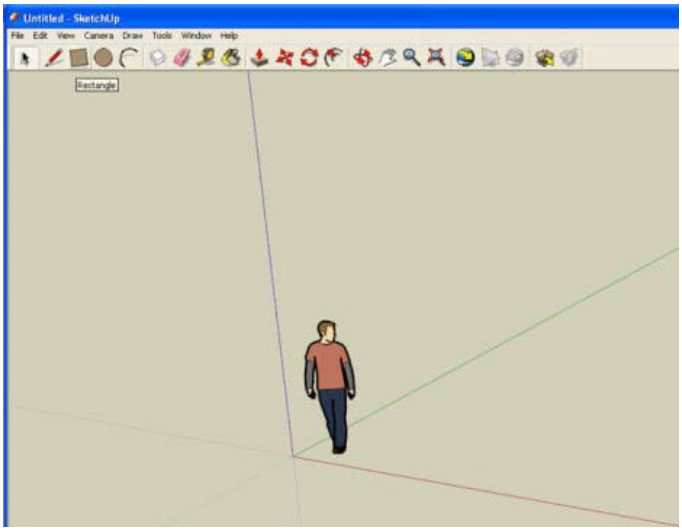
Put simply, this fantastic program allows us to get our designs off paper and into the 3D world using simple-to-use drawing and manipulation tools. In the past, 3D design has been considered the be-all and end-all of the computer graphics industry, something that used to take years to master. With Google SketchUp and its built-in tutorials, you can be creating 3D worlds to impress your friends within no time at all. With enough time and patience, you are only limited by your imagination.

You can download Google SketchUp for FREE here: **http://sketchup.google.com/**

I won' t be teaching you how to use Google SketchUp as there are plenty

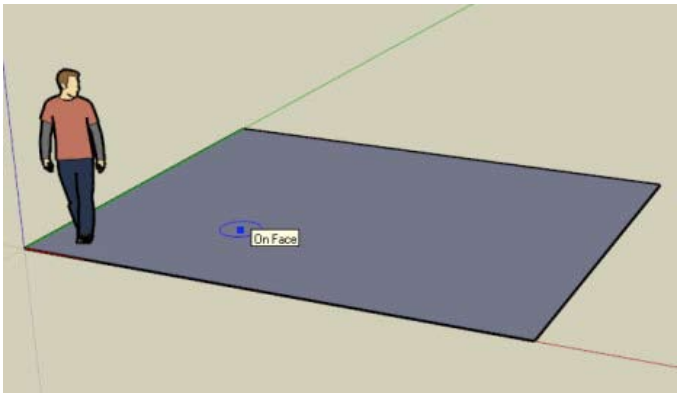
of resources available online. As a starting point I would recommend the video tutorials at Google's website: **http://sketchup.google.com/gsu6vtvideos.html** . You can also check out Aidan Chopra's website which has lots of first-rate video tutorials available; **http://www.aidanchopra.com** . Aidan Chopra has also written a book, *Google SketchUp For Dummies*, which is available in major bookstores.

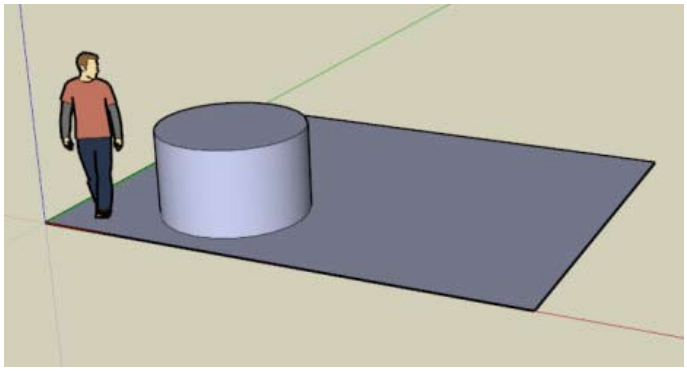
The advantages of being able to design your system in a 3D environment before actually putting it together are numerous.



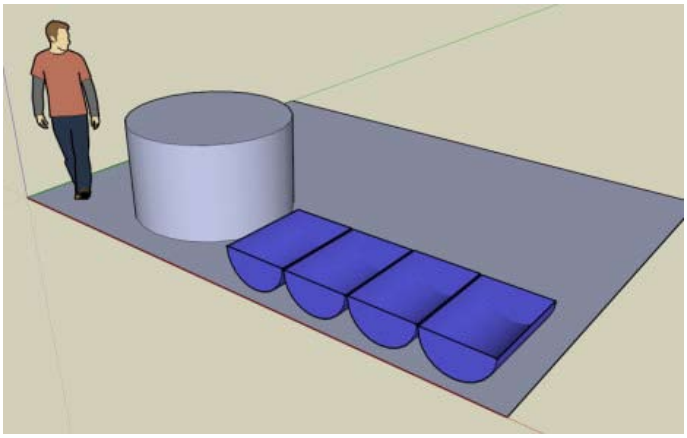
Firstly and possibly most obviously it allows you to know whether components of your system are going to fit within your planned area for the system. To give you an idea of how simple this might be, in the following example we will quickly check to see how a barrel aquaponic system might fit into a certain area.

Google Sketchup has a range of very simple tools and an easy-to-use 3D workspace. A simple way to begin is to map out your available area. If your area is 5m x 3m you can simply use the "rectangle" tool to draw the area on the ground. Once your area is mapped out you can draw your fish tank in by using

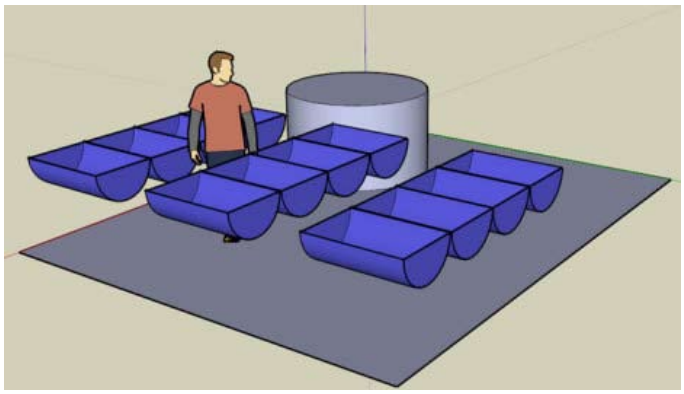




the "circle" tool, setting the radius of your tank. Then using the "push/pull" tool you can simply pull your tank up to the required height, in this case 90cm.



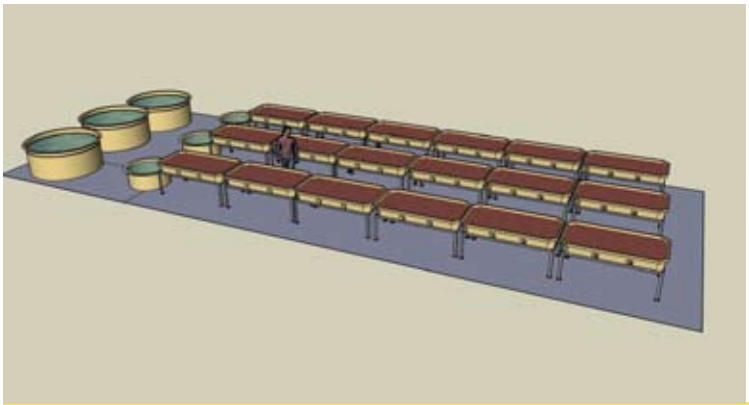
For this system we are going to use half blue barrels for grow beds. To find out how many half blue barrels will fit into our available area I downloaded a preprepared model from the internet. There are numerous models that users have uploaded to the internet and incorporated within the Google Sketchup

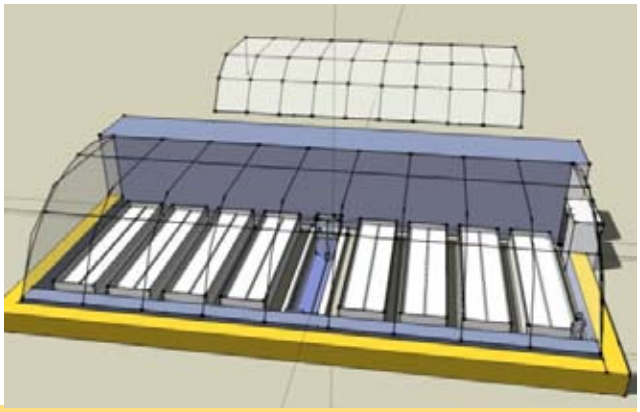


software. There is a searchable 3D warehouse filled with many models of all shapes and sizes. It's a very simple process to download the models and then copy them and move them

around as you require, making sure that you have enough access between your grow beds. Support structures for your grow beds can also be drawn in, which will allow you to have an idea of the materials you will need to complete your support structure. It also allows you to work out your plumbing routes for both irrigation and draining of your grow beds.

Once you get started with sketching up your system plans you will quickly become proficient at manipulating in the simple 3D environment. Systems can become quite polished and look very realistic. You can also import pictures into your model. Surfaces can have many different textures applied to them including translucent textures like glass and water. Shadows can also be added, which is extremely useful when designing an aquaponic system. ●





Here's an assortment of pictures that have been drawn in Google Sketchup. Notice the translucent water in the pictures above and below, and the shadows in the picture below.

Pictures drawn by TimC, Raimiuso and Joel Malcolm

Settling in at the fish Farm

By Stuart Haberfield

Grow beds and NFT inside the greenhouse

After running a successful aquaponics system in my suburban Adelaide backyard, we were frustrated at the restrictions that local councils put on any further expansions. Just by chance we noticed a small acreage for sale in the Adelaide Hills. We had been planning our tree change, and had looked at a couple of properties over the past couple of years, but with our daughter just starting school at the local primary school which was a short walk away, we were reluctant to move until we saw this place. The big attraction was that it already had its aquaculture licences in place, it can take up to 2 years and many thousands of dollars in consultants and fees to get the licence happening, so within 3 days of seeing the advertisement we had a contract to buy the place.

We had a long settlement, enough time to sell our house and existing aquaponics system to my brother in law, and raise the finances required for the big move. Emily was enrolled in the local school here and instead of a short walk, it is now just a short bus ride away.

When we arrived, we were soon to find out what it is like taking over someone else's failed enterprise. The number of small things we fixed over the next couple of months was astounding. For example, the water going into the shed from the

> ***"When we arrived, we were soon to find out what it is like taking over someone else's failed enterprise."***

View over the north ridge in Adelaide, and central part of the Flinders University's hilltop campus

Location: *A coastal city beside the Southern Ocean it is the capital, and most populous city, of the Australian state of South Australia.*
34° 55′ 44.4″ S • 138° 36′ 3.6″ E

Climate: *Adelaide has a temperate / Mediterranean climate, where most of the rain falls in the winter months. Rainfall is unreliable, light and infrequent throughout summer. In contrast, the winter has fairly reliable rainfall. Frosts are rare.*

holding dam was extremely turbid. You couldn't see the fish. This didn't make sense, it was coming in through a sand filter, it should be crystal clear. We noticed their communication book had frustrated comments about how turbid the water was, and instructions to bypass the dam and off gas water straight into the tanks. Something wasn't right. So we had a close look at the sand filter and couldn't believe what we were seeing.

It was plumbed completely wrong. The filter was actually backwashing into the shed on the filter cycle. They had the pipes connected up back to front. So with a 20-minute plumbing job, we had crystal clear water in the shed. We immediately

Grow beds flourishing

started planning our display aquaponics system, as we want the majority of our business focus to be supplying and installing systems at people's homes. A greenhouse already on site was up to the same shoddy standards of many other things, so we dismantled it, and reusing the same hoops, we made wider frames and re-erected it. In October last year, we hosted a hands-on workshop and built our system with the help of the 11 visitors. It was a very successful day, bar a hailstorm and torrential rain at lunch time, and within a couple of hours work after the workshop, we had running water. I will explain the way the system works and have some pictures for the next issue of this magazine.

Since moving, we have experienced a wide range of emotions. It has become blatantly obvious that for the farm to be viable, we need to break the mould and come up with some new and exciting ideas on how to grow silver perch, but also, what to do with them once they are ready for market. As it is about a three year grow out cycle up here due to the short growing season, it is going to be a long time before our first paycheque.

We have taken on a business partner. Dan has done some aquaculture studies, and has a real enthusiasm for sustainable fish farming and environmental best practice, so we are making that our underlying goal and motivating point of all our business decisions. We have our first batch of silver perch in the ponds and aquaponics system, and although temps are down as low as 12 in the mornings, they are feeding well, and we are learning more about these fish every day. We still believe they

Construction Underway.

The system taking shape.

are the best choice for Adelaide's climate, as although you don't get much growth out of them during the winter, they are tough little fish and their eating qualities are excellent. Also, from a licencing point of view, it is much easier to deal with one or two species than to have to get say a batch of trout and a batch of barra health tested every six months, which is a very expensive process.

There are certainly a few benefits to having a backyard system without a licence, the main one being that you don't have to follow so many rules and regulations in SA. Anyway, we are slowly getting underway after a few false starts.

We are now stocking Joel's fantastic plastic grow beds and 1000-litre tanks, and it's nice to see a few heading off to new homes around SA. Soon we will have a range of larger tanks available too. It is also great to be able to supply fingerlings to people when they buy other components, and we have seen a strong demand for the fish. Hopefully, the next few months will see demand for the aquaponics components grow, and in the future, we hope to breed our own silvers. So many plans, so little time. ●

For Further Information visit my website:

http://www.thefishfarm.com.au/aquaponics.asp

Goldfish in the system.

Aquaponically inspired recipes

One of the greatest benefits of having an aquaponics system, is producing your own healthy fresh food *right in your backyard*.

Here we will look at some ways of preparing and best utilising your aquaponic harvest.

Green Tomato Relish

Makes a quick and tasty snack!

By Faye Arcaro

Delicious cheese and green tomato relish toasted sandwiches...

Towards the end of the season when the tomato plants have done their best and it is time to take them out of the system, you are probably left wondering what you are going to do with all those green tomatoes still hanging on the bush that haven't ripened yet. Well here we show you just how you can make the most of them by creating a tasty relish that you will just love to serve with a ploughman's lunch or in a toasted sandwich with melted cheese. The relish will keep for at least six months in the cupboard, and makes a great gift for friends when presented in nice jars.

Diced green tomatoes.

Stewing ingredients

Ingredients

- 1 Tablespoon curry powder
- 1 ½ Tablespoons cornflour
- 1 Tablespoon salt
- 1 ¼ cups sugar
- 1 cup vinegar
- 750g green tomatoes
- 250g onions

Makes about 4 cups

- In a saucepan combine curry powder, cornflour, salt, sugar and vinegar.
- Dice the tomatoes and onions and add to saucepan.
- Stir over cook-top until mixture begins to boil. Continue to boil for a further 20 minutes.
- Pour into warm sterilised jars while still hot.

Tip: To sterilise jars wash in boiling water and stand upside down in a very slow oven. 95-120 degrees Celsius or 200-250 degrees Fahrenheit.

Bruschetta

A refreshing and inexpensive appetiser

By Faye Arcaro

Home cooked bruschetta.

Ingredients

Salsa

- 6 finely chopped tomatoes
- 3 cloves of garlic
- ½ diced red, or spring onions
- 2 tsp sugar
- 2 tsp olive oil
- 3 sprigs finely chopped parsley
- ¼ cup chopped basil

Base

- Sliced continental loaf
- Garlic butter

- Combine all salsa ingredients and refrigerate to allow flavours to develop.
- Spread bread on both sides with garlic butter and lightly fry in pan, turn over and top lightly with salsa mix.
- Sprinkle with grated cheese and allow to melt through or lightly grill. Garnish with parsley.
- A refreshing and inexpensive appetiser that is quick and easy to prepare.

Variation: *You may add prosciutto or bocconcini cheese as an alternative.*

Bruschetta only requires a few simple steps to make a delicious meal..

Bruschetta is believed to have originated as far back as the 15th century in central Italy. Traditional bruschetta consists of thick slices of Italian bread, garlic for flavour and topped with extra virgin olive oil. Salt and pepper are usually added to taste. There are many variations of bruschetta complemented with fresh garden vegetables and herbs, cheese, gourmet meats and olives, the range of toppings is only limited by your imagination.

Although bruschetta is served as an appetiser in most restaurants, it can easily become a light meal when served in generous portions with creative toppings.

Smoked Jade Perch Dip

By Paul Ryan

Ingredients

Smoking Process

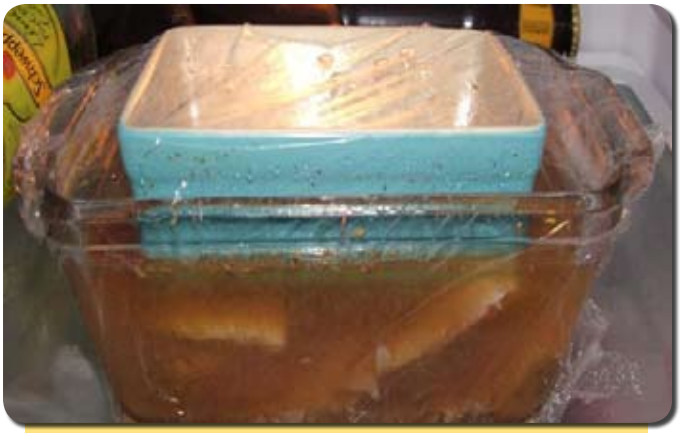
350 grams fish fillets (skinned)
2/3 cup savoury herb wood pellets (can be substituted with other types of pellets or chips)

Brine

500mls water
¼ cup salt
¼ cup brown sugar
1 tablespoon mixed dried herbs
2 tablespoons lemon juice
3 cloves garlic - minced
50ml rum
Tabasco sauce (a good shake)

Dip

350 grams smoked fish - crumbled
¾ cup milk
250 grams Philadelphia cream cheese (left out of fridge to soften)
¼ cup red onion – finely minced
2 tablespoons Italian parsley – chopped
3 tablespoons sweet mustard pickles
½ teaspoon lemon juice
1 teaspoon Worcestershire sauce
2 teaspoons Tabasco sauce (or to taste)
Salt and pepper to taste



Fi llets soaking in brine.

- Fillet and skin Aquaponically grown fish. I used Jade Perch, which are a good choice for smoking, like Silver Perch, due to their high fat content.
- Chop fillets into halves or thirds and place into a bowl containing the brine solution. Put a weight on top to keep fish submerged in the brine solution, cover with plastic film and refrigerate. After 7 hours, remove fish from brine, rinse and pat dry. Leave to sit for 30 minutes.
- Smoke fish for 30 minutes at 150ºC.
- Allow fish to cool before starting to make the dip. If desired, the smoked fish can be refrigerated and the dip made the following day.
- Crumble smoked fish, place into bowl and cover in milk. Allow to stand for 1 hour, in refrigerator. Stir in remaining ingredients, seasoning to taste. Place covered in refrigerator for at least 2 hours to enable the flavours to blend.
- Serve with crackers and enjoy!

Enjoy!

Smoking only takes about 30 minutes (lid on).

Smoked fish softening in mi lk.

The completed dip.

Barramundi

lattes calcarifer

By Tim Courtland

Barramundi are great in an aquaponics system.

Barramundi are a prize fish among recreational anglers. It has become one of Australia's top food fish and it can even be found in restaurants all around the world. The attractive fillets and great flavour make this an ideal fish for food production. The word Barramundi is an Aboriginal word meaning *river fish with large scales*.

From personal experience, the Barramundi I have is a very friendly fish with a unique personality. I have had him in a 6 x 1.5 x 1.5 ft glass aquarium for about 18 months now. I bought him from a local aquarium shop at 10 cm, he is now a whopping 34 cm long. I have a wet/dry sump filtration and a moderate size canister filter to provide the necessary filtration needed for the Barramundi and the three Juvenile black bream.

I have been feeding them a mixture of high protein fish pellets and a homemade frozen food consisting of beef heart, spiralina, multi-vitamins, carrot and spinach. I fear at times that my barramundi is eating healthier than me. On average I would feed them about 50-75 grams of food a day. I could be feeding them a lot more but the filtration would not handle the increased load. The Black Bream will be relocated to my new Aquaponics system this September when the weather warms up a little bit, and they will take up permanent residency in there.

I will keep the Barramundi as long as I can house him. He has become a pet now so I don't think any of us have the heart to eat him. I will most likely sell him when he outgrows the fish tank.

Habitat: In the wild Barramundi can be found in saltwater, estuarine and freshwater in the north of Western Australia, The Northern Territory and Queensland. Most farmed fish are grown in freshwater ponds or tanks. Size: 30-90cm (12-36"), but have been known to grow to well over 150 cm (60"). The legal size for wild-caught fish in Australia is around 60 cm (24").

Temperature: Barramundi are a tropical fish, meaning they live in warm water climates. Optimum temperature is 28˚C (82˚F), although you will have success between 25-30˚C (77-86˚F). Barramundi will survive below these temperatures but food intake and growth rates will be reduced.

pH: 7.5-8.5 is considered an ideal range.

Salinity: Barramundi will live in a wide range of water salt levels, from freshwater dams and rivers to estuaries and seawater. They are catadromous which means they live in freshwater and move to salt water or coastal shallows to spawn.

Food: Barramundi are a carnivorous fish. Their diet consists of a wide range of foods. It could also be said that Barramundi will eat anything that will fit in their mouths.

This species is a heavy feeder and will gain mass quickly if sufficient food is available. In the wild Barramundi will eat a huge range of smaller fish, crustaceans, insects and amphibians. Farmed barramundi are fed on a high-protein fish feed. There are many commercial foods available in a large range of pellet sizes. Barramundi are usually docile but become very active when feeding or hunting prey. It is always a good idea to stand back when feeding these fish!

Growth Rate: Barramundi are considered to be incredibly rapid growers. Growth, of course, will be determined by the feeding rate, as they will continue to eat as much as you can feed them. In cultured fish it is common to see a 2:1 growth rate. This means that for every 2 kg of food you feed the fish, they should grow 1 kg of body mass. It is possible to raise plate-size fish ½Kg (1 pound) within 6 months with a suitable system.

Breeding: Barramundi spawn in brackish and salt water. The larvae move into tidal creeks and coastal pools where they will grow until they are considered juvenile (1 month old) after which they will move upstream into the estuary or further into freshwater. Barramundi are protoandrous hermaphrodites which means that the fish will start off as males and can selectively become female as they mature.

A large barramundi with a Barcoo grunter in the background.

The Barramundi will become sexually mature as a subadult at around three years old and can be about 55 cm long. A very small percentage of sub-adult barramundi may mature directly to females at around four years old, depending on fish populations. Normally barramundi will not become female until they are 6-9 years old and 85-100 cm long. The females can then live for 25+ years in fresh and saltwater conditions. This is a great example of how natural selection ensures that the biggest, strongest and healthiest fish are able to pass on the best genetic traits to the next generations.

Given this interesting and successful breeding strategy, it would be VERY difficult to breed barramundi in even the largest of aquaponics systems.

Nutritional Facts: (per 100g)
Cholesterol 45 mg Sodium n/a
Total fat (oil) 0.9 g
Saturated fat 43% of total fat
Mono-unsaturated fat 32% of total fat
Poly-unsaturated fat 25% of total fat
Omega-3, EPA 11 mg
Omega-3, DHA 50 mg
Omega-6, AA 57 mg

Suitability in Aquaponics: I would consider Barramundi to be an excellent option for use in aquaponics. There are, however, two things that need to be considered.

The first is climate. Because Barramundi are a tropical fish the water temperature of the aquaponics system needs to be at a moderately high level to sustain necessary fish growth. In my opinion it would need to stay at a fairly constant 25˚C (77˚F) or higher. Although barramundi will survive at lower temperatures it is not always recommended. Cold nights of a few degrees lower are acceptable but constant temperatures of less than 25˚C (77˚F) are not. Consider humans can survive at well below our body temperature, but it doesn't mean we will be comfortable at those lower temperatures. It is the same with fish: when a fish becomes stressed due to cold, its growth and general well being can be greatly affected.

The second thing to consider with Barramundi is making sure that you have an adequate and plentiful source of food. Unlike omnivorous fish like Jade Perch, Barramundi really like a high protein/zero vege diet. They will very rarely eat any vegetable matter. The Barramundi's diet should consist of quality foods. You would want a good supply of a good commercial food which is widely available as floating and sinking pellets. You can supplement this with live foods like worms, invertebrates, and feeder fish. The key is to keep a bit of variety in their diet. I am sure that you wouldn't want to eat the same food every day.

I will briefly discuss filtration. Barramundi are a very heavy consumer of high protein foods. You will find a lot of fish poo entering the system and the ammonia produced from the fish's respiration. To keep a decent number of Barramundi and grow them out safely to a moderate eating size, you must make sure that the water filtration is sufficient to take care of the wastes. Aeration is another important factor as all fish with high metabolism burn the oxygen very quickly. It is imperative to keep some water movement or aeration happening ALL the time.

Overall, Barramundi are an excellent option. If you have suitable water temperatures and fingerling supplies you can't go too far wrong. ●

Healthy Fish are Happy Fish...

Part 2

By Paul Ryan

In the last edition of the *Backyard Aquaponics Magazine* we discussed the importance to the health of your fish of temperature, pH, ammonia, nitrite and nitrate. In this edition we conclude this two-part article by discussing dissolved oxygen, water contamination and disease.

At Backyard Aquaponics, regrettably we hear about far too many instances of easily preventable fish losses. Readers, particularly those new to high density fish keeping, are encouraged to read the first and second parts of this article. The first edition of the *Backyard Aquaponics Magazine* is available at **http://www.backyardaquaponics.com/magazine/ BYAP_Magazine_Issue1.pdf**.

Dissolved Oxygen Level

Dissolved Oxygen (DO) is the term used for oxygen dissolved in water. DO in an Aquaponics system is crucial in a number of respects:

- Fish need oxygen to live. Fish obtain their oxygen from the water in which they live, using their gills to absorb the oxygen into their bloodstream.
- The bacteria that convert ammonia to nitrite and nitrite to nitrate require oxygen to function (they work aerobically).
- Although plants produce oxygen through photosynthesis, they also require oxygen to respire. A lack of oxygen supply to plant roots will result in root rot.
- Many Aquaponics systems have worms living in the growing media to help break down fish wastes and leftover root material. A high DO content in the Aquaponic system's water will allow these worms to live in a temporary or permanently flooded environment.

Some important things to know about DO:

- The maximum rate of oxygen saturation for water decreases as temperature increases, meaning it is more difficult to maintain sufficient DO levels at higher temperatures.
- Fish will generally use more oxygen at higher temperatures due to a higher metabolic rate, which together with the previous point highlights the importance of superior aeration at higher temperatures.
- Oxygen saturation also decreases as salinity increases and as altitude increases.
- As was mentioned when discussing pH (previous edition), algae will use oxygen during the night. This will be particularly relevant in a system that is experiencing an algal bloom, something that is common in relatively new systems.
- The effect of nitrite on fish health will be worse in a tank that is low in DO, because high nitrite levels can affect a fish's ability to absorb oxygen into the bloodstream via the gills.

In Aquaponics, DO is maintained using one or a combination of the following methods:

- Agitation of the surface of the fish tank water through water falling as it returns from growbeds. 'Water falls' are widely believed to be the most effective mechanical method of adding DO to water.
- The use of air-stones and/or venturi aerators to add bubbles to the water. It is mainly the agitation of the water surface that results in oxygen being added to the water.

- Oxygen being drawn into the water by the flood and drain action of grow-beds.

It is essential that sufficient DO levels are maintained 24/7. Of course, the greater the density of fish in a system, the greater the DO demand because of fish respiration and conversion of wastes. The inclusion of a means for immediately providing back-up aeration to fish tanks in the case of power failure is essential. Watch out for an article on power backup systems in a future edition of the *Backyard Aquaponics Magazine*.

Water Contamination

To protect the health of the fish, as well as the humans consuming the products of the Aquaponics system, it is important to be aware of and avoid possible sources of system contamination. Among BYAP Forum members there have been a number of major fish kills that have been attributed to contamination, some of which could have been easily avoided.

A few common sources of potential contamination include:

- **Pesticides, fungicides & fertilisers:** Regardless of your own natural inclination towards organic gardening practices, when running any type of Aquaponic system that returns water to the fish tank after having been through the grow-beds, chemical pesticides, fungicides and fertilisers are a definite no-no. They will most likely kill your fish and potentially harm humans consuming system outputs. Instead, predatory insects, natural remedies containing no ingredients harmful to fish, or organic products (only those that do not harm fish) must be used. As well as avoiding the addition of these chemicals directly to the system via application to plants, it is important to be aware of and prevent any possible risk of contamination via spray drift from your own or neighbouring properties.

- **Chlorine and Chloramine:** Chlorine or chloramine is added to town water to kill potentially harmful bacteria. When using town water in an Aquaponics system, it is important to be aware that varying levels of chlorine or chloramine are likely to remain in your water when i t comes out of the tap and these chemicals are harmful

Most insecticides and fungicides are not safe to use in an aquaponic system.

to both the fish and the beneficial bacteria contained in an Aquaponics system. These chemicals can be neutralised using a suitable product purchased from an aquarium shop or the pet section of the supermarket. As an alternative, chlorine is relatively easy to remove by leaving the water in an open container for 24 to 48 hours prior to use. Inclusion of a bubbler or some other form of water agitation will speed up this process. It is also possible to remove chloramines by leaving water in an open container exposed to the sun for approximately one week, though the added stability of chloramine means that it is advisable that a neutraliser be used for its removal.

- **Surfactants:**
  Surfactants such as detergent can be very harmful to fish, so it is important to ensure that these chemicals do not come in contact with your functioning Aquaponics system.

- **Wood Treatments:**
  Many people use treated wood structures associated with their Aquaponic system, such as system enclosures and grow-bed stands. Seriously toxic chemicals, harmful to fish and human, are often used in the wood treatment process. It is essential that any risk of system water coming into contact with the treated wood (e.g., rain water dripping from wood into grow-beds or fish tanks) is eliminated.

- **Copper:**
  The use of copper, for example copper piping, is not advisable in an Aquaponics system. The recirculating nature of most Aquaponics systems, along with increased breakdown rates caused by fish wastes and other factors, may result in a build up of dissolved metal in the system's water. Fish do not have a high tolerance for copper and crustaceans have a very low tolerance.

It is also important to ensure that materials and products used for fish tanks and grow-beds are food-safe and have not previously housed chemicals which are dangerous to fish or humans.

Disease

Anybody who has kept ornamental fish will know that there are many different fish diseases and an endless list of expensive drugs and chemical concoctions used in an attempt to cure them. Because food is being produced by the Aquaponics system for human consumption (fish and/or plants), these drugs and chemicals cannot be used.

It is beyond the scope of this article to list or provide details of all of these diseases. The most common forms of fish disease seen in Aquaponics systems are Ich and common fungus, so these will be discussed. Fortunately salt can be used to treat both of these diseases.

Ich

Ich, (Ichthyophthirius multifiliis) often referred to as 'white spot' because of its appearance on fish, is a parasitic disease. It is very common for this parasite to be present in fish when you purchase them from the fish farm. As a result of the stress caused to fish by the whole moving process, the symptoms of Ich will often present within a couple of weeks after purchase.

These symptoms may include:

- Small white spots, no larger than a pin head, being visible on the surface of the fish. As the disease gets worse, the fish may end up covered in a white slime;

- Fish rubbing themselves against the bottom of the tank or other objects. This is commonly referred to as flashing. It is important to note that Ich is not the only cause of flashing, but frequent flashing is a definite sign of Ich; and

- Redness, often around the fin and tail areas.

Ich can be treated and hopefully eradicated from your system by adding salt to a concentration of at least 3 ppt (i .e., 300 grams for every 100 litres of water in the system). Most fish used in Aquaponics will tolerate this level of salinity, however the Ich's cells burst, being unable to cope with the sudden change in salinity.

Some important points to note when using this treatment:

- Ensure you use a salt that has no additives, such as iodine.

- The life cycle of the Ich parasite includes a free floating stage as well as a period during which they are attached to fish. As the salt will only kill them in the free floating stage, it is important that the treatment is maintained for the duration of the Ich lifecycle, which is approximately 2½ weeks at 21˚C. This life cycle can be sped up by increasing the temperature of the water, but will slow down at low temperatures. For this reason, fish are also more susceptible to Ich at higher temperatures;

- Ich have been known to survive salt concentrations of up to 5 ppt, so if you have fish that are able to tolerate salt at 5 ppt, then it may be worthwhile dosing to this level when treating Ich; and

- Scaleless fish, such as catfish, are more susceptible to Ich.

The salt should not be added gradually, as it is the sudden change in salinity that causes the cells of the Ich to burst. When buying new fish, it is a good idea to treat them for Ich in a quarantine tank before adding them to your system. This will avoid:

- Introducing the parasite to any existing fish;

- The need to use a much larger quantity of salt for treating the whole system; and
- The adverse affects that salt may have on the plants in your system.

Of course if treating fish in a quarantine environment, it is important that adequate bio-filtration is provided, or necessary water changes are undertaken during treatment. If doing water changes, remember to add the necessary amount of salt to the new water being added to the tank. Ich will often manifest when a fish's immune system is compromised due to stress.

Fungus

Fungus will present as white tufts on the surface of the fish, appearing similar to cotton wool.

Fungal organisms will normally be present in all systems, but will not grow on the fish unless the fish have some other form of disease or damage. Flesh or scale damage caused when netting and moving fish is probably the most common cause of fungus problems within Aquaponics. If introduced to a healthy balanced system, fungus is less likely to be an issue and if mild fungus is already present on the fish it will often go away by itself.

A treatment of salt has been proven by BYAP forum members to be effective for fungus. One batch of advanced silver perch that I purchased had quite severe fungus which I successfully treated using 3 ppt salt for several weeks. The salinity treats the wound on which the fungus is growing.

Maintaining fish health in an Aquaponics system is not difficult, but the consequences of not paying attention to the simple principles can be very costly and soul destroying. We at Backyard Aquaponics hope that readers have found the information provided in this two-part article interesting and that it will help current and prospective Aquaponics system owners to establish and maintain a balanced healthy environment for their fish.

Also remember that the members of our popular forum (**www.backyardaquaponics.com/forum**) are an invaluable and rapid source of assistance to those new to Aquaponics, as well as longer-term enthusiasts that have run into a problem. So be sure to drop by and share your experiences. ●

What's happening in the world of Aquaponics

By Mathieu Edmonds

A gardening and hydroponics shop will be run aquaponically as a first step towards developing aquaponic gear in Europe.

The project is to be the first existing European aquaponic equipment provider. The plan is to provide complete indoor and outdoor systems (grow beds, tanks, lamps, pumps...), sell heirloom seeds and plants, fish fingerlings and small-sized energy production systems (windmill and solar panels).

We should start a CSA (Community Supported Agriculture) production system to provide restaurants with herbs and fresh vegetables and filleted fish.

Contacts with hatcheries have been made to provide aquaponicists with pellet-weaned fingerlings such as red-fin perch, sander, rainbow and brown trout, large-mouth bass, tilapia, goldfish and koi.

We have started two small indoor systems. The first outdoor system will be running soon as spring is coming and people's interest is starting.

Aquaponics is creating great public interest here even though it has been known by the fish farm industry for a while and they have looked at it as an added cost, not as a benefit. ●

Any enquiries on aquaponics in Europe can be sent to aquaponie@hotmail.fr.
A website should also be available soon at **www.aquaponie.fr** (French)
and **www.aquaponicseurope.com** (English).

Faye's Story

By Faye Arcaro

Faye in amongst her aquaponic system

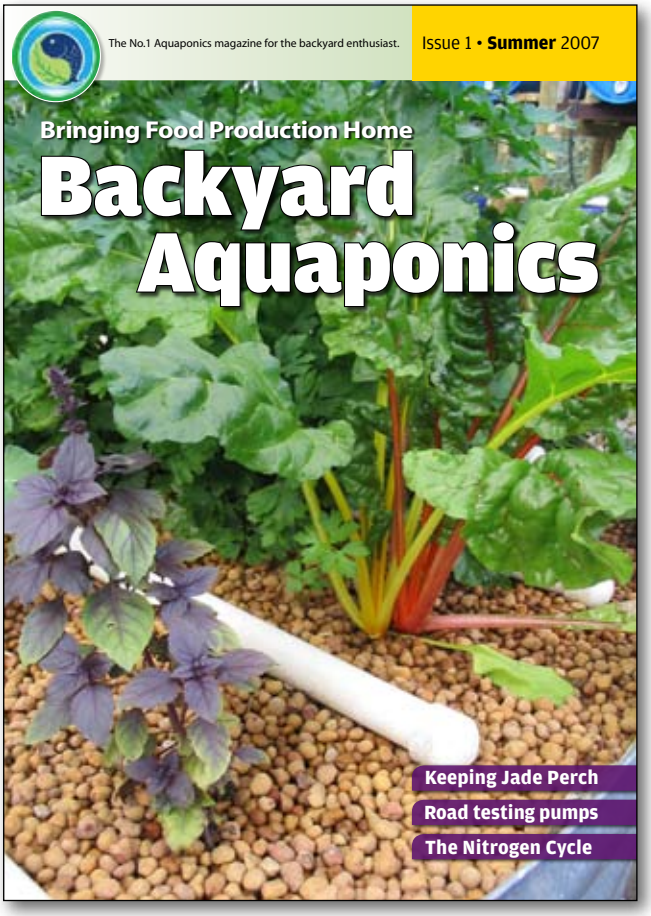
It was late 2006 when my husband Eddy and I were watching Gardening Australia and they featured Joel Malcolm who was growing fish and vegetables in his own backyard. We were so impressed at how healthy the produce was that we became aware of a better way of growing our own food.

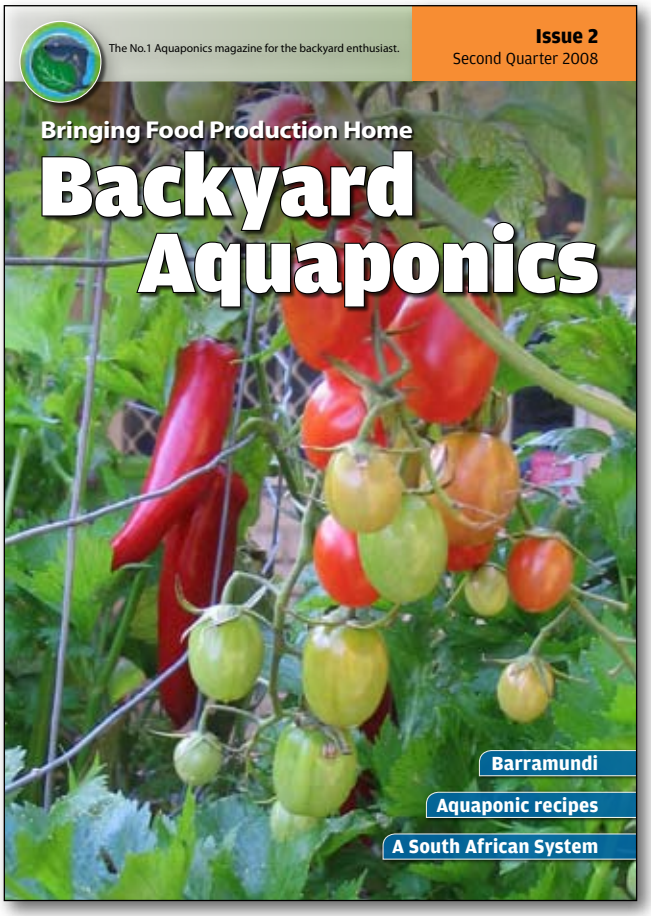
It was early 2007 when Jenny, a friend and client, asked me for advice on growing a vegetable patch. I explained how I felt there was a more sustainable way of growing fruit and vegetables, using less water, more efficient use of space and cleaner gardening using raised beds as well as providing fish. It was agreed that I would do the research and off I went in search of information about aquaponics. As venues organiser for the Perth Garden Club I tried to arrange a visit to Joel's garden. He had been inundated with calls and offers since the show went to air so that just wasn't to be. I explained how I am a passionate gardener, was developing a two-hectare property not far from where he lived, lectured at TAFE and simply needed to gain an understanding of how the concept worked.

I began by helping to maintain his backyard system, worked along with him and spent many hours researching and reading anything to do with aquaponics, sometimes into the wee small hours of the morning. Some of you will know how it goes. At this time Joel had ideas of making systems available to families with an average-sized backyard and talks were underway to manufacture grow beds customised for this purpose.

It wasn't long before all the components had been sourced and were ready for testing. What better location could there be other than my backyard? It was a very smooth operation after Eddy removed a 50ft gum tree, built a patio (with the help of Jenny's husband Peter) and I laid the slabs ensuring a level surface. My dad and I planted seedlings in the expanded clay, Joel seeded the beds with bacteria and one week later over 100 rainbow trout were added to the system. It was only four weeks until the system cycled. The Backyard Aquaponic system received media coverage announcing that the garden would be open to raise awareness of Meningococcal disease. 700 visitors came to the garden over two days, including students from University and TAFE as part of their studies in sustainability, environmental awareness and aquatic environments. The following week I was announced the national winner of the ABC Gardener of the year 2007. Supported by the Australian Open Garden Scheme we held another open day and more than 1000 people attended. ●

Next issue we take an in depth look at Faye's system, we'll see how it operates, and just how productive the system has been for her.





Backyard Aquaponics Magazine

Future Editions and Subscriptions

Work is well under way on the **third edition** of the magazine. We will be showcasing more systems that belong to members of the online discussion forum, there will be information about fish feed and fish diseases, and we'll have an in-depth look at another fish species suitable for use in aquaponics systems. One of the new items to look forward to in the next issue, is a **question and answer** section where we will take some of the most commonly asked questions about aquaponics and provide you wi th straightforward answers from experienced aquaponic system operators.

It's promising to be an exciting issue, packed full of information, pictures and diagrams and we hope to see you then.

Issue 3 OUT SOON

The ***Backyard Aquaponics Magazine*** can be purchased and downloaded from the Backyard Aquaponics magazine website either as individual issues, or as a yearly subscription. Alternatively, we can mail you a copy of the magazine on CD-Rom, or DVD.

If you have any queries, please don't hesitate to contact us.

Backyard Aquaponics
PO Box 3350, Success.
Western Australia, 6964
+61 (08) 9414 9334
magazine@backyardaquaponics.com