

## **My Experience With Aquaponics**

I had never visited an island (or simply even been a boat) before my trip to Catalina. Catalina was an eye-opening experience because the land is conserved. On the boat ride to Catalina, I remember looking back and seeing all the smog surrounding the place I had just left. It does not cross my mind everyday how polluted the air around me is in Los Angeles until I visually saw that thick gray layer from afar. It's easy to become distant with nature, especially since I live in such an industrialized city. Everyone takes nature for granted because it's so easy to overlook its importance when you have so many other things to worry about. I appreciated this Catalina trip because it stripped me away of my worries and connected me with nature. Reminiscent to the feeling I get during a camping trip, I realized just how necessary nature is. Because I am so desensitized to buildings, cars, and factories, I overlook the root of our existence: nature. We, humans, would be nothing without nature, yet we create a divide between nature and us.

The last five minutes we were on the island, we were introduced to this innovative invention. I had never seen one or heard of one before. There were fish on the bottom and plants on top; it was incredible and unlike anything I've ever seen. That five minutes spent briefly going over what the aquaponic system is and how it works inspired me. The aquaponic system amazed me how the fish and the plants thrived off of each other. It's such a brilliant concept that I wanted to build an aquaponic system right away. But I had never built anything before. I had no experience with tools and no knowledge of what goes into this perfect system. All I knew was that the aquaponic system was one of the coolest things I had ever seen. Not only does it help with sustainability, but also it creates a new food

source for us. In the process of aquaponics, there is no animal cruelty, no pesticides, and no sneaky chemicals that we will later ingest.

As we left Catalina and headed back to smoggy Los Angeles, the boat trip back I was thinking about how I have to build my own aquaponic system. As enthused as I was about aquaponics, this was also a whole new concept for me and I had a lot of learning to do. Once I started doing a little research on the materials I needed to build the aquaponics system, BOOM, I hit a wall. The total cost of the materials for the system was more than I anticipated. Right then and there I realized why aquaponic systems are not as popular as I would think. I also hit another wall when it came to putting the materials together. If I messed up installing the PVC pipe correctly, then the whole system wouldn't function properly. I started doubting myself on my ability to build a successfully running aquaponic system. Setting my self-doubt aside, I found many tutorials on the web to help beginners like me to build an aquaponic system. It does cost time and money though, which is why I would imagine most people hold back on building their own system. I live in an apartment and have limited space. The biggest question I had about the system if I built my own small one is would it be worth it? Would the amount of produce from the plants exceed the monetary investment? This is a big concern with aquaponic systems. I found out through economic analysis of aquaponic systems that aquaponic systems are more worth investing in on a large commercial scale than on a small scale. I really became interested in aquaponics after the experience I had at Catalina Island. To learn more about aquaponics, I interviewed Diane Kim, the undergraduate programs director and SPOT (San Pedro Ocean Time-series) data coordinator.

## **Diane's Experience With Aquaponics**

**Me:** When were you first introduced to aquaponics?

**Diane:** Summer of 2012 by a graduate student at USC who was studying microbial communities in aquaponics systems. I was immediately intrigued by the idea of the near-closed loop system for growing food because of its sustainable nature and also because the platform provided great opportunities for teaching and research.

**Me:** What inspired you to build the aquaponic system with the kids at Catalina?

**Diane:** I wanted to reconnect students back to their food. I wanted them to think critically about where their food comes from and the problems associated with current commercial agricultural methods -- so we spent the first part of the program talking about why the way we're growing most of our food today is not sustainable, which include degassing of nitrous oxide (a very potent greenhouse gas) and nutrient run-off into coastal ecosystems (that can trigger massive algal blooms that can lead to "dead zones" or areas of depleted oxygen that cannot sustain multicellular life) by the use of synthetic fertilizers, the degradation of soils by monocultures, the need for pesticides, etc. While I wanted to highlight these issues, I wanted to SoS Food program to be solutions-oriented, so we focused most of the program on two sustainable and alternative methods of growing food in aquatic systems -- shellfish aquaculture and aquaponics. I wanted to empower students with the knowledge that their choices matter, that they can make a difference, so building an aquaponics system together was a very important part of the program.

**Me:** How did you guys get in done in such a short amount of time?

**Diane:** We had great guidance from a graduate student (mentioned above) and David Rosenstein, who is CEO of EVOFarms and one of the leader in aquaponics, plus an army of undergraduates (well, 16 anyway) who were passionate about learning how to grow food in a sustainable way. The tools and materials (which cost about \$400) helped too. :) We build the system in 2-3 days, then inoculated the system with nitrifying bacteria (the magic elixir of any aquaponics system). The students didn't get to plant the system because we had to let it sit for a couple of weeks for the bacteria to establish, but I sent them updates like the one below after planting:



**Me:** Where did you get the materials from to build the system?

**Diane:** Most of the materials were bought from Home Depot (PCV pipes, connectors, valves, bell siphon, 2x4s) and a pet store (1 pump). We also had to buy some hydrocorn

(expanded clay), which is what we filled the grow bed with and planted in. The hydrocorn can be purchased from a variety of places. We also bought an IBC tote, which is a food-grade plastic bin that can contain ~250-300 gallons (came with a metal frame that we also used). Totes are used commercially to ship food products. We cut the tote and used 1/4 of it for the grow bed and 3/4 of it for the fish tank.

**Me:** How was the system successful?

**Diane:** I think the greatest success was in seeing how excited students were about building an aquaponics system. Many of them said that they would build one for their apartment/home to grow a portion of their food. I believe that growing your own food is one of the most liberating and revolutionary things a person can do, so to be able to empower students in taking charge of where and how their food is grown was probably the greatest measure of success for me. We also got TONS of chard, heirloom tomatoes, and kale this summer, so that was pretty great too! :) We also use the system as a teaching tool and it's been a great point of discussion surrounding issues related to food production, so we're accomplishing everything we set out to do and more. Couldn't be happier, except maybe if we could install a bigger system out on the island! stay tuned...

**Me:** Was it worth putting in the time and effort into building?

**Diane:** ABSOLUTELY.

**Me:** What advice would you give to people like me who want to build their own system?

**Diane:** That you can do it. You just need a bit of guidance and planning, but you're totally

capable of taking charge of your food, and not just by building your own aquaponics system but also by choices and demands that you make.

**Me:** Do you see aquaponic farming becoming a dependable main resource for food?

**Diane:** I think we're going to have to think about changing how we grow our food very soon and very quickly -- the way we're growing most of our food is not sustainable. that is, it cannot go on indefinitely. At some point, the natural ecosystems that we rely on for food production will collapse. So I see sustainable and alternative methods of food production an absolute necessity that we will depend on to sustain our growing population. Aquaponics is one really great sustainable method. It won't solve all of our problems, but I can see it being able to supplement a substantial percentage of a family's or community's food. As the method is improved, that percentage will grow. Considering that it's 90% more water efficient than traditional agricultural methods, seems like a great alternative for growing food in the desert (CA)!

### The Bigger Picture

There are over 7 billion people on Earth. Earth's population is only going to keep growing from here on out. This brings up the reasonable question, how do we keep feeding our growing, **hungry** planet?

There has come a time to start utilizing new resources for food and that time is now. We are overfishing our oceans. The food industry uses the ocean as a source for food, but is not giving life back to where it was taken from. And we all know how flawed the meat industry

is (refer to meat.org). So what are our other options? Aquaponics creates an opportunity for people to produce their own food without harming the environment. Matter of fact, aquaponics is GREAT for you and the environment. Food is in such high demand due to the overpopulation on our planet and in order to produce mass amounts of food at one time, the food industry goes as far as using pesticides and genetically modified organisms to cut corners. Aquaponics is a perfectly balanced system, no chemicals needed! Aquaponic systems are very accessible because they can essentially thrive anywhere.

What exactly is aquaponics?

*“A food production system that combines conventional aquaculture (raising aquatic animals such as fish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment.”* <http://www.evofarm.com/2013/12/30/aquaponics-farming-for-change/>

Aquaponics in theory sounds great. It conserves water, uses less energy than any other farming technique, and chemical free. I was amazed and inspired when I saw my first aquaponic system. I was inspired to go out and build one myself. When I looked up all the materials I had to buy to make the system, I was a little less inspired. As someone who has no experience with tools, I wasn't too sure how successful of a system the average person can build. Luckily, for all the people like me who are skeptical of their building abilities, there is a book called “The Complete Idiot’s Guide to Aquaponic Gardening” that is user friendly. *Create your plan. List your small goals and big goals. Know your strengths and limitations. Do you want to DIY or use a kit? Will the aquaponic system be inside or outside?*

## The Least You Need to Know

- There are as many individual system designs as there are aquaponic gardeners, but there are only a few fundamental types of systems.
- Write down your goals as well as your gardening-related strengths and limitations—you may be surprised by what you learn.
- You can learn a lot from a small starter garden—it's better to make your inevitable mistakes with only a few living things.
- Once you've learned how to garden with aquaponics, there may be ways to make a modest profit by expanding from a family-based system to a micro-farm.

So on a small scale, an aquaponic system for your backyard garden is a neat idea, but can it produce for a family let alone a whole community? Although individual aquaponic systems in your home is beneficial, it won't be enough for a main food source. Aquaponics works well as a food source when done on a large scale.

After reading over a few economic analysis of aquaponic systems, it is clear that aquaponics needs to be done on a commercial scale in order for systems to produce a significant amount of food for communities. It's not that small aquaponic systems aren't worth investing in; they just have a slow rate of return considering the investment. An economic analysis of a commercial scale aquaponic system was done in the U.S. Virgin Islands and concluded that aquaponic farms can in fact be profitable. They tested out three different sizes of aquaponic systems; 6 unit farm, 12 unit farm, and 24 unit farm. They found out that the most profitable aquaponic farm is the 24 unit farm because the internal rate of return was over 20%. Another economic analysis report done recently in May 2013 in Hawaii showed the profitability and sustainability of commercial scale aquaponics.



# Economic Performance

	Agriculture Vegetable Sector <sup>1</sup>	Aquaculture <sup>2</sup>	Aquaponics <sup>3</sup>
Return on Asset/ Internal Rate of Return	ROA = 10%	ROA = 11%	IRR = 27%
Gross Profit	\$3,460 per acre	\$178,858 per farm	\$43,065 per acre or \$86,130 per farm
% of Farms with Gross Profit	75%	58%	100%

Gross Profit = Sales Income – Variable Cash Expenditures

This economic analysis came to the conclusion that commercial scale aquaponics is economically feasible. It's even been shown in this analysis that it can be more profitable than terrestrial agriculture and aquaculture. So why isn't it being utilized as a more popular resource for food? Aquaponics is more labor intensive than these other methods. The analysis also showed that the internal rate of return for fish in the aquaponic farms is not yet profitable enough.