

# Fish 2.0 Market Report: Aquaponics

## An Investor Update on Sustainable Seafood



**FISH**2.0

### Aquaponics: Commercializing a Sustainable Agriculture Method

Aquaponics is a centuries-old agricultural technique that is attracting new interest because it offers production location flexibility, has a low environmental impact and meets an increased food demand. Aquaponics combines fish farming, also known as aquaculture, with hydroponics, growing produce in water systems. The fish and plants grow in a symbiotic environment, reducing waste and resource utilization, which leads to cost savings and greater production yield ratios.

According to research firm IndustryARC, the global aquaponics industry is currently valued at \$300 million and is expected to grow at an annual rate of 30% for the next several years, crossing the \$1 billion mark by 2020. As the global community faces rampant water shortage crises and extreme volatility in energy prices, aquaponics has the potential to be the next big thing in food cultivation. Aquaponics farms are extremely productive—yielding roughly 200,000 pounds of produce per acre, using at least 90% less water and land than dry-land farms, maturing products faster, and offering co-location with key distribution markets such as cities and export hubs.

Aquaponics has traditionally been practiced by small-scale farming operations; however, major academic and research organizations are actively investing in and developing technologies for commercial use. Large-scale aquaponics is still early stage, but growing resource constraints are catalyzing the adoption of this agricultural solution. Aquaponics farms are budding all over the world, from warehouses in London to major operations in the Abu Dhabi desert. As the industry grows worldwide, opportunities in aquaponics include investments in:

- **Scaling current aquaponics farm operations**, improving margins and yields
- **Technology innovations** and improvements that increase efficiency and yields of aquaponics at scale
- **Businesses capitalizing on regional growth opportunities** in resource-constrained environments, such as deserts and islands
- **Distribution businesses** that bridge the gap between large-scale producers and wholesale or retail markets

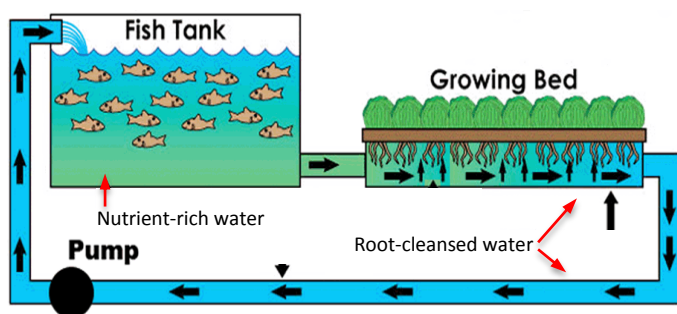
## Aquaponics Is a Tried-and-True Method

Aquaponics is a farming method that populations around the world—notably the Aztec civilization and people throughout Asia with rice paddies—have used for thousands of years. Given increasing pressure on natural resources and the booming global population, this method of food cultivation is gaining renewed appreciation as an efficient and reliable method to feed communities located in a multitude of environments.

## Fish and Produce Grow Together in One System

Aquaponics systems grow fish and produce in a single system. The fish are fed an outside source of food and produce waste. These wastes then provide the essential nutrients that allow the plants to grow. In turn, the plants play the critical role of filtering the water that recirculates to the fish tank. Figure 1 offers a simplified diagram of the aquaponics growing cycle. The main components of an aquaponics farm are vegetable growing beds, fish tanks, and pumps or pipes to circulate the water between the produce and fish. Instead of growing the plants in soil, producers place them in water beds to grow. Common methods include floating the plants on the surface in a wooden frame, or over a rock bed. Figure 2 shows a vegetable and fish tank structure in an active large-scale aquaponics system.

**Figure 1. Aquaponic System Flow Diagram**



Source: Tucson Aquaponics Project

**Figure 2. Aquaponics System Example**



Source: M.L. Aquaponics

## Focus Is on Improving Yields

Though farms grow fish and produce together, most commercial-scale aquaponics farms tend to focus on produce yields rather than on fish production.

- Produce reaches maturity for sale faster than fish. This speed of growth allows multiple plantings per year and offers a higher market value.
- Also, the yield ratios of produce are better than those of fish. For example, 9kg of lettuce requires just 1kg of nutrient-rich water to grow, whereas a 1kg fish needs to consume at least its weight in food to grow.

Industry research is focusing on how to improve fish yields in these systems, particularly as farm operations increase in size.

The following table lists common fish and plant products produced in aquaponics systems.

Fish Species	Produce Types
• Tilapia	• Basil
• Ornamental fish	• Salad greens
• Catfish	• Non-basil herbs
• Others include shrimp, barramundi and carp	• Tomatoes
	• Head lettuce

## Aquaponics Improves Resource Efficiency

Aquaponics realizes several important benefits over dry-land agriculture, including reduced energy and water use and a more efficient operating model. The traditional agriculture industry uses vast amounts of water resources—food production consumes more than 70% of global freshwater sources. In addition, farming tends to be energy intensive and requires constant labor over great swaths of land.

Aquaponics methods use far fewer resources:

- They consume up to 95% less water and 90% less area compared with dry-land farming.
- Systems can operate at scale and produce multiple crop cycles per year in challenging grow-out environments such as urban areas, building rooftops and even desert environments.
- Fish waste provides an environmentally sound alternative to fertilizer and the system recirculates all water, reducing overall waste and generating high input-efficiency rates.

The operational efficiencies of aquaponics yield benefits for businesses and communities, including:

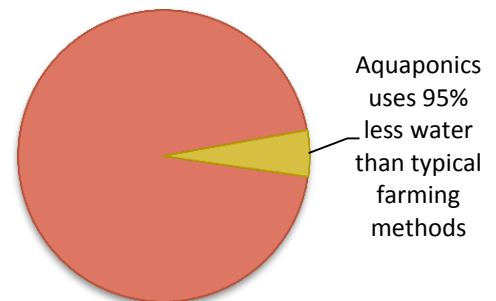
- Year-round cultivation in enclosed spaces
- Accelerated, high-quality crop production
- A contained growing environment that eliminates the need for antibiotics or pesticides
- Optimization of resources, since the system rears vegetables and fish in a single symbiotic environment

## Aquaponics Provides Multiple Social Benefits

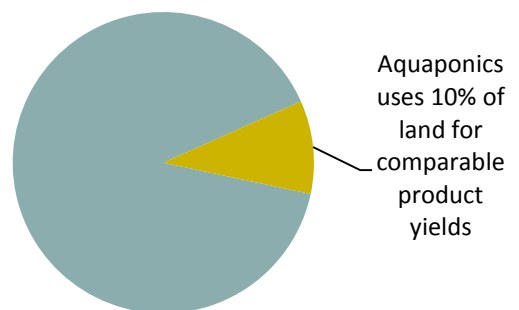
In addition to offering the benefits of reduced energy use and improved nutrition, aquaponics yields many community benefits, including:

- Better nutrition options in underprivileged communities: urban environments that are known as “food deserts” could greatly benefit from locally grown produce; communities in infertile land areas could access fresh produce and protein
- Unique job opportunities: a new generation of farmers in urban and suburban areas could emerge
- Meeting demand for local produce: locations close to distribution markets support the consumer farm-to-table movement

### Dramatic Reduction in Water Use



### More Efficient Land Use



### Urban Aquaponics Farm



Source: aquaponicsplan.com

### Desert Aquaponics Farm



Source: CNN.com

## Challenges Lie in Scaling

The aquaponics farming is beginning to transition from small-scale or “backyard” operations to commercial-size farms that distribute to major consumer food retailers and the hospitality industry. Despite the benefits that aquaponics offers, the industry faces some challenges in scaling, including:

- Prospective challenges to acquiring organic certification, which is necessary to support premium pricing
- Resistance from existing agricultural industry interests
- General lack of business or consumer understanding of aquaponics

## Environmental Benefits Outweigh the Challenges

While aquaponics farms have traditionally been small scale, their many environmental benefits are sparking increased investment and development of operations around the world.

- Climate change and resource-constrained environments bode well as areas for aquaponics farm developments. Regions with water resource constraints are using aquaponics production systems to cost-effectively meet future food needs. For example, substantial investments have been made in desert operations in the Middle East and the US, and also in developing commercial aquaponics farms on islands in Hawaii and in the Caribbean.
- Aquaponics farming is equally attractive for urban or space-constrained environments. For example, in the US, systems are being constructed on supermarket rooftops in city centers for direct distribution to consumers, and in the UK, urban warehouses are being converted into aquaponics farms to distribute to local markets and restaurants.

## Aquaponics Investment Opportunities

Challenges to growing the aquaponics industry lie in economically scaling operations, improving ecosystem health technologies, and educating consumers and businesses. However, as awareness of the benefits grows and as scaled operations become more viable, this market has the potential to take off. Currently, investment funds, technology venture investors and direct farm investors are exploring the industry. A broader group of investors can get involved as the industry grows, taking advantage of opportunities in:

- **Scaling current farm operations.** Commercial farm operations are set up initially as pilot projects to prove the efficacy of new technologies that are necessary in environmentally demanding or unique operating ecosystems. In order to fully realize economies of scale, these businesses must expand and are seeking capital to do so.
- **Aquaponics facilities and equipment manufacturers with improved technologies.** As farms seek to expand, demand for more efficient structural elements (pumps, filters, heat sources and so on) will increase. Furthermore, technologies to maintain a sound ecosystem balance in large-scale operations will be in high demand. For example, there have been advancements in the efforts to produce a high-quality fertilizer from fish, which farms can sell in addition to produce. Furthermore, technologies to accelerate the fish grow-out phase are in high demand, as these will increase the overall profitability of aquaponics systems.
- **Distribution businesses able to link suppliers and buyers.** Consumers are expressing growing demand for locally produced food, and aquaponics supports that local and regional consumption model. By establishing relationships with local grocers and distributors, aquaponics farms can meet a specific industry need.

### Key Sources

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