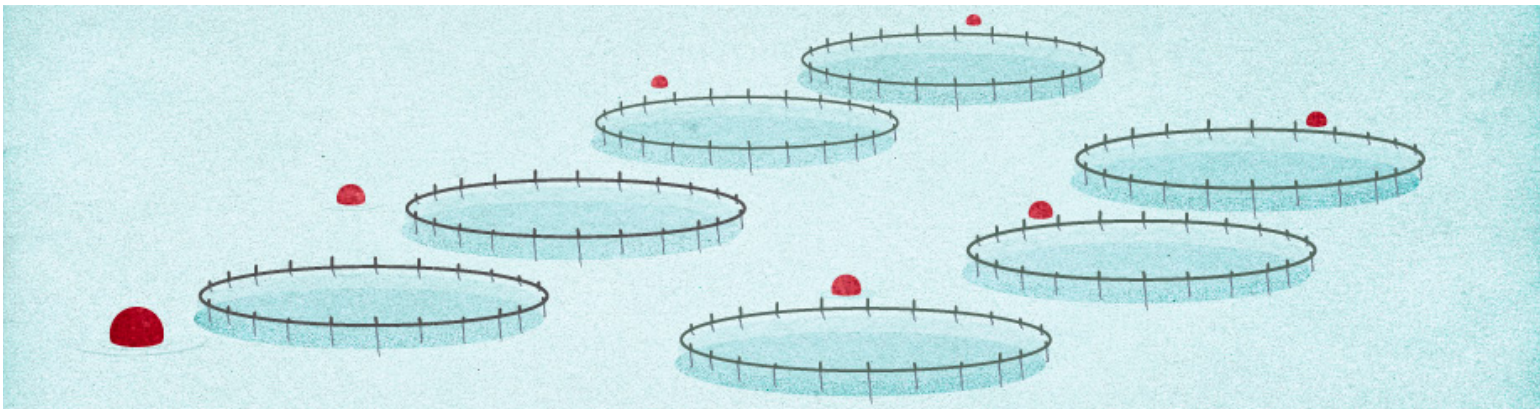


# aquaculture

the blue revolution



**AQUACULTURE HAS BEEN AROUND FOR MILLENNIA.** But aquaculture as an industrial food system is in its adolescence, suffering from major growing pains. The industry has the potential to mature into the most sustainable food production system on the planet—the science and technology are there. Significant social, cultural, and policy barriers must be overcome by developing new markets, new approaches to investment, and new distribution systems.

## KEY STATS

» Aquaculture is the breeding, growing, and harvesting of plants or animals in the water, including ponds, lakes, tanks, and the ocean.

» By value for saltwater (mariculture) products, finfish account for 63%, followed by crustaceans (21%), shellfish (12%), and seaweeds (4%).

» A \$130 billion-dollar industry, aquaculture accounts for about half of global seafood consumption.

» By global volume, seaweeds are the largest product, accounting for nearly half of all mariculture production, followed by shellfish (43%), finfish (9%), and crustaceans (1.8%).\*

» Nearly 90% of world aquaculture production comes from Asia, with 60% from China.

» Aquaculture provides jobs for more than 16 million people worldwide and is growing (5.5% increase in people involved in fish farms per year).

## CHALLENGES



*In Asia, people have traditionally raised fish and shrimp in ditches alongside rice paddies or livestock, using waste and plant material as feed. Product was for personal consumption or local trade. In contrast, modern, business-oriented aquaculture, like farming on land, tends to be capital-intensive and uses new technologies and science to grow high-density single-animal farms, driving many unsustainable practices:*

**STOLEN GENERATIONS** Fish don't like to spawn in tanks. To get around their picky mating practices, we typically harvest eggs or juveniles from the wild and grow out the babies, leaving fewer fish in the sea to make the next generation.

**FEED** Between 15 and 30 pounds of small fish—ground into fish meal and fish oil—is necessary to grow one pound of tuna. We're killing lots of nutritious and edible wild fish to grow a few trendy and high-value farmed fish to feed even fewer people.

**WASTE** Everybody poops. And no feeding system is 100% efficient. Open-water, fed-aquaculture operations produce waste (mostly nitrogen and phosphorous) that pollutes local marine environments. Rarely do farms pay for any cleanup. Land-based systems require expensive waste management technology. However, more farms are wising up to the idea that effluent can be used as fertilizer, and are creating new revenue streams from that product.

**DISEASE** Bacteria and viruses love a crowd. Growing animals in high densities breeds disease, which can spread to wild populations. Antibiotics used as controls cause more and different problems, not the least of which is creating antibiotic-resistant strains of bacteria in humans who eat the fish.

**RESOURCE FINPRINTS** Heating and cooling systems and pumps are extremely energy intensive; freshwater models, which don't need those systems, compete with agriculture, household, and industrial interests for dwindling water supplies.

**FAULTY MARKETS** Distorted value chains, lack of processing infrastructure, and cultural preferences support the farming of popular, rather than environmentally smart, species.

## OPPORTUNITIES



**AIM HIGH BY EATING LOW:** Seaweeds, shellfish, crustaceans, and plant-eating fish provide nutritious, tasty, and efficient food. By taking nutrients from the water, seaweeds and shellfish turn farms into water filtration plants. Developing new markets to support growth of these species would foster healthier human and ocean communities.

**MULTI-SPECIES FARMS:** By coupling different plants and animals in one system, the waste from one can fuel the growth of the other. Mussels can help clean up finfish farms; abalone can eat seaweed, which grows in the nutrient-rich abalone waste-water.

**FISHERS AS FARMERS:** Regulatory changes and overfishing have hit small-scale fishers hard. By integrating farming, particularly seaweed and shellfish, into seasonal wild fisheries, fishers can stabilize their incomes without sacrificing a life on the water.

## OTHER RESOURCES



**Thimble Island Oysters**  
[www.thimbleislandoysters.com](http://www.thimbleislandoysters.com)

**Olazul**  
[www.olazul.org](http://www.olazul.org)

**Aonori Aquafarms**  
[www.aonori-aquafarms.com](http://www.aonori-aquafarms.com)

**IDREEM project**  
[www.idreem.eu/cms/about-project](http://www.idreem.eu/cms/about-project)

### SOURCES

#### SOFIA 2012

**Chopin (2012)** Seaweed aquaculture provides diversified products.