# How Aquaculture Works

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**[Fish Image Gallery](http://animals.howstuffworks.com/enlarge-image.htm?terms=Fish+-crafts&page=0&gallery=1)**

Introduction to How Aquaculture Works

When you order a seafood dish at your favorite restaurant, you usually can't help but think of fishermen in old-fashioned wooden boats harvesting their catch from the local lake, river or sea. However, chances are that your delicious herb-crusted [salmon](http://animals.howstuffworks.com/fish/salmon-info.htm) or pan-seared tilapia actually came from a farm similar to those that produce other [protein](http://healthguide.howstuffworks.com/protein-in-diet-dictionary.htm) products such as beef or chicken. **Aquaculture** is fish farming, and a whole lot more. In fact, it's one of the fastest growing [food](http://recipes.howstuffworks.com/food.htm) industries in the world.

[**Fish Image Gallery**](http://www.howstuffworks.com/enlarge-image.htm)

Aquaculture is the farming and husbandry of freshwater and marine animals and plants in controlled environments. Aquaculture goes way beyond food production. Hatcheries provide bait and game for both sport and commercial fishermen. How about ornamental plants and[fish](http://animals.howstuffworks.com/fish) for those lovely koi ponds? You can thank aquaculture for them, too.

Although aquaculture serves many purposes, the most important one is to supply food for humans. It also supports the food chain at a lower level by producing algae and other plant organisms for animal feed.

Did you know that fish is one of the world's most important sources of protein? Because aquaculture products are relatively inexpensive, the world depends on fish products as a vital source of nourishment. For this reason, the world's poorest populations depend heavily on aquaculture, too. Since the 1950s, the demand for fish has doubled [source: [Costa-Pierce, et.al.](http://science.howstuffworks.com/zoology/all-about-animals/aquaculture5.htm)] Recently, the aquaculture industry around the world has boomed because certain aquatic organisms, like Atlantic salmon and Chilean sea [bass](http://animals.howstuffworks.com/fish/bass-info.htm), which have become scarce due to overfishing.

In this article, we'll explore the development of aquaculture and the issues facing this quickly growing industry. First, let's look at a few different types of aquaculture.

# Types of Aquaculture

Technology is paving the way for many new types of aquaculture. Let's take a look at a few of the main forms.

**Fish farming** is the primary form of aquaculture. [Fish](http://animals.howstuffworks.com/fish) farming is cultivation of fish for commercial purposes in man-made tanks and other enclosures. The most common types of farmed fish are [catfish](http://animals.howstuffworks.com/fish/catfish-info.htm), tilapia, [salmon](http://animals.howstuffworks.com/fish/salmon-info.htm), [carp](http://animals.howstuffworks.com/fish/carp-info.htm), [cod](http://animals.howstuffworks.com/fish/cod-info.htm) and [trout](http://animals.howstuffworks.com/fish/trout-info.htm). With the increase in over-fishing and the demand on wild fisheries, the fish-farming industry has grown in order to meet the demand for fish products.

**Mariculture** is the branch of aquaculture that cultivates marine organisms either in the open ocean, an enclosed portion of the ocean, or tanks or ponds filled with seawater. Finfish (like[flounder](http://animals.howstuffworks.com/fish/flounder-info.htm) and whiting), shellfish (like prawns and [oysters](http://animals.howstuffworks.com/marine-life/oyster-info.htm)), and sea plants (like kelp and seaweed) are cultured in saltwater. Mariculture products are also used for cosmetics, jewelry -- such as cultured pearls -- and fish meal.

**Algaculture** is the type of aquaculture that cultivates algae. Most algae harvested is either microalgae (phytoplankton, microphytes or planktonic algae) or macroalgae, commonly known as seaweed. Although macroalgae is used for a variety of commercial purposes, its size and cultivation needs make it hard to grow. Microalgae are easier to harvest on a large scale.

To successfully harvest algae, an algae farm needs the right temperature range, [light](http://science.howstuffworks.com/light.htm) source and nutritional characteristics in the water source. Algae is most commonly cultivated in**open-pond systems**, such as ponds, pools and lakes. However, these systems don't allow for control of light or temperature. Yet, they're the most popular type of pond system, since they're cheaper to build and produce the highest yield of algae.

On the other hand, **closed-pond systems** remedy some of the problems with the open-pond systems. Closed-pond systems are pools or ponds that are covered. Even though the closed-pond system allows more species to grow, it tends to be smaller in scale, so it produces a smaller crop. One variation of the closed-pond system is the **photobioreactor**, a system that incorporates a light source. For example, placing a greenhouse cover over a pond or pool creates a photobioreactor. Although nutrients must be brought into this type of system, it can produce high-yield crops. In fact, it can even produce excess crops, which could end up destroying the system. However, with proper care, photobioreactor systems produce successful results.

**Integrated multitrophic aquaculture** (IMTA) is a more advanced system of aquaculture. In a multitrophic system, different species with various nutritional needs are combined into one system. IMTA uses the waste products of one species as feed or fertilizer for another species. For example, seaweed grows from the phosphorus and ammonia that fish and [shrimp](http://animals.howstuffworks.com/marine-life/shrimp-info.htm) excrete. Shellfish feed on the solids that fish and shrimp produce. Although there are many different types and degrees of IMTA, the main principle behind the system is balance. An efficient IMTA is environmentally and economically sustainable because it recycles nutrients.

This is a high-tech way to grow fish, but fish farming has been around for thousands of years. Next, you'll learn how fishmongers kept fish alive 2,000 years ago.



**Aquaculture has a place in world history. This Japanese fish market that likely was part of an aquaculture system.**

# Aquaculture History

As we learned earlier, the aquaculture industry has experienced tremendous growth throughout the past few decades. But, the cultivation of aquatic organisms has been practiced since ancient times. Throughout the ancient world, aquaculture played an important role in [food](http://recipes.howstuffworks.com/food.htm) production. It was also a big part of social and economic landscapes of many cultures.

Aquaculture may just trace its roots to the ancient [water](http://science.howstuffworks.com/environmental/earth/geophysics/h2o.htm)-oriented civilizations of the East, where [fish](http://animals.howstuffworks.com/fish/fish-info.htm) served as a main part of people's diets. During the Tang dynasty, carp cultivation thrived in [China](http://history.howstuffworks.com/asian-history/history-of-china.htm). In the 5th century B.C., Fan-Li is noted to have raised carp in ponds. Going back 2,000 years in Asia, fishmongers sold live fish, which they kept in woven baskets right in the markets and in bamboo cages in ponds outside the markets.

European aquaculture grew as exploration and trade with the East developed. In [ancient Rome](http://history.howstuffworks.com/ancient-rome) and Gaul (modern France), [oyster](http://animals.howstuffworks.com/marine-life/oyster-info.htm) cultivation thrived. Like the ancient Chinese, ancient Romans bred fish in ponds. Due to the scarcity of fish in Europe in the [Middle Ages](http://history.howstuffworks.com/middle-ages/middle-ages.htm), aquaculture was used to offset the cost of fish. However, transportation improvements made fish easier to obtain, resulting in a decline in European aquaculture.

Aquaculture didn't become widely practiced in North America until the late 1900s. But, people were already exploring the possibilities in the United States and in Canada a few years earlier. In the United States, Stephen Ainsworth of West Bloomfield, N.Y. experimented with the cultivation of brook [trout](http://animals.howstuffworks.com/fish/trout-info.htm) in 1859. While Ainsworth's interest in aquaculture remained a hobby, Seth Green in nearby Caledonia Springs, N.Y., made big money from the fish hatchery he built in 1864. Green expanded his business to supply fish eggs to more than 200 people who were interested in cultivated fish for both profit and hobby [source: [Anderson](http://oaspub.epa.gov/eims/eimscomm.getfile?p_download_id)]. One of the first fish major hatcheries in North America was constructed in Newfoundland, Canada by Norwegian Adolph Nielson in 1889. This site was one of the most expansive and technologically-advanced in the world [source: [Government of Newfoundland and Labrador](http://www.releases.gov.nl.ca/releases/1997/drr/0128n04.htm)].

Although aquaculture has been practiced since ancient times, the greatest growth has occurred in the last two decades. Next, we'll learn about the development of contemporary aquaculture.



**Modern aquaculture facilities, like this one in China, provide fish for food and other resources.**

# Contemporary Aquaculture

As we've learned, aquaculture has existed for many centuries in various forms. However, the farming of sea life as a major industry is a relatively recent phenomenon. As a result, methods for aquaculture production and the role of the aquaculturist continue to evolve.

Aquaculture is a lot like agriculture. Agriculturists carefully select areas with rich soil and favorable weather conditions for farms. On the same token, aquaculturists find aquatic sites with the right temperature, salinity and fertility where organisms can flourish. This can be a challenge for aquaculturists.

Aquaculture grows as people learn more about the basics of the biology of aquatic species. But the introduction of new organisms to aquaculture is a lengthy process. It takes a decade of research to cultivate an organism properly. Here are the factors aquaculturists weigh when choosing potential new aquatic organisms**:**

* reproductive habits
* requirements of eggs and larvae
* adaptability to crowded conditions
* feeding habits of organisms.

The overexploitation of wild [fish](http://animals.howstuffworks.com/fish) has recently brought on a surge in the domestication of marine species. The natural supply from the sea just isn't keeping up with demand these days. So, we turn to farming the waters, rather than hunting them, to sustain the production of fish and other aquatic organisms.

On the next page, we'll learn about some of the issues surrounding aquaculture.

# Issues Surrounding Contemporary Aquaculture

The aquaculture industry continues to grow very quickly, and so have many problems and issues surrounding it. Living conditions and potential diseases affecting aquatic organisms are two top issues. Aquaculture's impact on the environment is another big issue. Some animal rights activists criticize aquaculture and, more specifically, [fish](http://animals.howstuffworks.com/fish) farming, due to the unnatural, crowded conditions in which fish live. In some cases, more than fifty thousand fish are kept in a two-acre area [source: [Costa-Pierce, et.al](http://science.howstuffworks.com/zoology/all-about-animals/aquaculture5.htm)].With all the fish cramped in a small space, fish waste turns into pollution very quickly. And when the fish rub against each other and bump against their holding tanks, it can cause disease and infection. As it turns out, crowding is usually not a problem, because knowledgeable aquaculturists often use fish accustomed to high-density conditions.

One pesky disease for farmed fish is sea lice. This disease appears to cause trouble especially for Atlantic [salmon](http://animals.howstuffworks.com/fish/salmon-info.htm) and nearby wild fish. Some researchers allege that farmed salmon with sea lice infections will wreak havoc on the wild salmon population in the very near future. On the other hand, researchers on the other end of this argument suggest that the link between sea lice and salmon is tenuous at best. They say that sea lice have been a problem for wild salmon long before salmon farming began.

Another problem when harvesting organisms in the river, lake or sea is the presence of pesticides and other harmful chemicals in the [water](http://science.howstuffworks.com/environmental/earth/geophysics/h2o.htm) sources.

Physical and chemical contamination can be hard to control in an aquatic environment. However, these properties may actually be used to an aquaculturist's advantage. Animal waste may be used as powerful [fertilizer](http://home.howstuffworks.com/question181.htm) if properly utilized by aquaculturists.

With proper management by aquaculturists and careful government regulation, aquaculture promises to evolve as an economically prosperous business. It's also an important player in the development of environmentally sustainable and responsible industries. See the next page for lots more information on aquaculture.