Mythbusting Marine Aquaculture

Aquaculture is well-established in many countries and continues to grow worldwide. The U.S. is a global leader in aquaculture technologies and scientific advances, but has a relatively small aquaculture industry. Significant advances in fish farming technology and use of best management practices have decreased the environmental footprint and increased the economic performance of marine aquaculture over the last 40 years.

Currently, the US imports the vast majority of its seafood, much of which is produced in countries with fewer environmental regulations than American consumers and policy-makers would demand of domestically produced seafood.

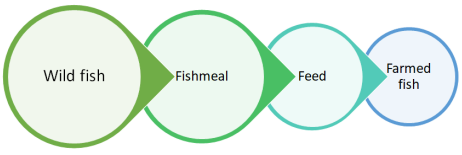
Wild fisheries in the U.S. have limited ability to expand to meet the increasing demand for seafood given the requirements under the Magnuson-Stevens Act for sustainable fisheries. Marine finfish aquaculture represents an opportunity to provide domestic, healthy seafood, create jobs, contribute to coastal economies, and bridge the growing gap between supply and demand for additional sustainable seafood.

With this potential, why is the marine finfish aquaculture industry not expanding? Concerns over water quality impacts and degradation of the seafloor, effect of fish escapes on genetic diversity, sustainability of using wild fish meal and fish oils for feeds, the use of antibiotics, and potential transfer of disease from farmed to wild populations reduces social acceptance of marine aquaculture and further complicates efforts to simplify complex and uncertain regulatory processes.

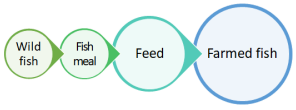
Myth: Fish Feed is Unsustainable

Fish-in, fish-out ratio (FIFO)

How much wild fish do I need to produce 1 lb. of farmed fish?



1970: 6 - 8 lbs.



2015: 0.5 - 0.8 lb.

Use of fish meal and fish oil in aquaculture feeds has led to concerns over the sustainability of marine aquaculture. Feed must contain all the essential nutrients needed to keep fish healthy and growing. Modern fish feeds are formulated from a variety of ingredients in carefully determined proportions to provide a balanced mix of nutrients and energy at the lowest practical cost. Feed typically accounts for more than half of the operating costs of an aquaculture farm and ingredients are 70 percent of the cost of making feed. The cost of fish meal and fish oil increased dramatically in the last decade and spurred development of replacement ingredients.

Traditionally, fish feeds have contained a high percentage of fish meal and fish oil because these ingredients provided a cost-effective means to satisfy the nutritional requirements of fish. Over the past 20 years, successful incorporation of plant-based ingredients has reduced reliance on forage fish as a feed ingredient. In fact, partial or total replacement of fish meal and fish oil is already the norm in commercial feeds.

Nutritionists who design feed have to account for about 40 essential nutrients. These include vitamins, minerals, amino acids (the building blocks of protein), and some fats. Proteins can be supplied by a wide variety of plants (e.g., soybeans, barley, rice, peas), fishmeal, or other animal trimmings. Likewise, fats can be supplied by plant or fish oils. New ingredients are constantly being developed to improve efficiency, sustainability, and reduce costs. For instance, proteins can be derived from yeast and insects, and oils from algae or marine microbes are used to meet essential fats requirements.

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Myth: Aquaculture Farms Use Too Many Antibiotics and Other Drugs

In animal husbandry, treating disease with medicine is necessary. However, antibiotics are considered a last resort to manage cultured fish stocks. Best management practices to prevent and control disease include limiting density, administering vaccines and probiotics, providing proper nutrition, and judicious use of antibiotics.

The Food, Drug and Cosmetic Act governs the availability and use of aquatic animal medicines. There are currently no antibiotics approved for use on cultured marine fish. The absence of an FDA-approved therapeutic drug is a major challenge for the marine aquaculture industry for disease management. Access to a legal treatment option would allow culturists to treat infected fish and control losses.

Successful completion of the technical requirements for drug approval is time-consuming and expensive, with new drug approvals for fish being even more difficult to obtain than new drug approvals for virtually any terrestrial animal. In the 1990s, new aquaculture drug approvals required a minimum investment of $3.5 million over the course of a decade. More recently, a new drug approval can cost in excess of $40 million and expanding the indications for a drug for other uses can cost as much as $8 million.

Myth: Escaped Fish Impact Wild Stocks

The primary concern with escaped fish is the notion that they will adversely impact wild stocks either through genetic mixing, competition for food or habitat, or disease. Fish may escape in singular events like severe storms, from damaged nets, or during harvest operations, but the design of net pen systems and anti-predator nets, shore-based rearing for part of the grow-out period, improved fish handling practices during stocking, rearing, and harvesting have significantly reduced the number of escapes.

Luckily, most escaped farmed fish have low fitness for the wild and quickly become easy victims of predators. For escaped fish that may survive and reproduce, risks can be mitigated, where necessary depending on the severity of the threat. Mitigation measures include using local broodstock or sterilization of farmed fish.

Myth: Pollution from Aquaculture Farms Harms Sea Life

Water quality and bottom habitat can be impacted near aquaculture facilities when nutrients exceed the site's ecological carrying capacity. However, our ability to avoid these impacts has significantly improved over the past 20 years through a better understanding of siting, optimal pen configurations and farm orientation, improved feeding, better feed formulations, and better farm management practices.

Pollution risks are regulated under an established Clean Water Act framework administered by the EPA and state programs, with robust accountability mechanisms. These agencies regulate discharges of nutrients, chemicals, and solid wastes from fish farms through permitting, careful monitoring, and review.

Pollution can be prevented and mitigated with proper siting and management, and the use of new technologies. Siting farms in well flushed areas with adequate current and depth reduces water quality impacts. Siting can also decrease benthic impacts. Modern tools to inform site management decisions include electrochemical analysis, image analysis, and modelling. Underwater cameras help monitor and regulate feeding to minimize waste. In addition, most commercial net pen farms have eliminated the use of anti-foulants on nets and are using mechanical robotic net cleaners.

Location, location, location!

Siting is an important part of the solution to minimizing adverse environmental impacts from aquaculture. Selecting an appropriate location, coupled with best management practices, appropriate regulation, and monitoring, allow for environmentally sound marine aquaculture. Proper siting reduces water quality and benthic impacts, reduces potential for escaped fish to interact with wild populations, reduces risks of diseases spreading to wild populations, helps to minimize entanglement with marine mammals and other wildlife, and limits conflicts with other commercial and recreational uses.