

## **The Risks of Aquaculture**

### **Weighing the Evidence on Worker Safety, Public Health, and Environmental Effects**

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Media reports and organized campaigns by competitors and environmental groups have drawn widespread attention to hazards of aquaculture production of seafood. The purpose of this presentation is to offer perspectives that may be useful in sifting the criticism, so that resources can be focused on the most serious problems rather than the trivial or rhetorical ones.

Full disclosure: As a trade publication that serves commercial fishermen in what is sometimes called “Salmon Country,” *Pacific Fishing Magazine* under my editorship has viewed salmon aquaculture, and finfish aquaculture in general, with a mixture of suspicion and admiration. Salmon farming is a powerful competitor in the marketplace, and its products have displaced fishermen from many traditional markets, contributing to a lot of hardship on the coast. Net cage salmon farming also presents environmental hazards that can harm wild fish stocks and marine environments. But aquaculture is also a remarkable engine of innovation from which we have much to learn. The aquaculture industry is a smart, well-organized, and profitable competitor that will not go away no matter how much we object to it. So the magazine has been a voice for the “loyal opposition,” seeking not to abolish finfish aquaculture, but to support debate and reform that could make this new industry into a neighbor our readers can welcome.

#### **Worker Safety**

I have found little public data on aquaculture worker safety, but the available sources suggest that fish farming in Norway and North America is probably no worse than commercial fishing, and in many cases it may be far safer. In Norway, Halvard Aasjord and Turid Myhre of the SINTEF Fisheries and Aquaculture Center found a fatality rate in salmon aquaculture of about 9.13 fatalities per 10,000 man years, about the same as Norway’s fishing fleet. They attributed this high death rate to lack of regulations requiring safety training and drills (which are mandatory in Norway’s fishing industry). Most of the fatalities and injuries were linked to unskilled operation of boats at the farms. In British Columbia, most fisheries-related fatalities occur when crewmembers fall into the water. *Hatchery International*, an aquaculture industry publication, reported that risks of cold water immersion may be higher in aquaculture than in fishing in the province “because most farms are isolated, and many aquaculture workers work alone.”

However, fish farms tend to be located in sheltered waters or at least near shore, resulting in less worker exposure to dangerous weather and sea conditions than is possible in many commercial fisheries. Most observers believe that fish farming is safer work than commercial fishing in general, at least in developed nations, where relatively regulatory systems and democratic governments tend to look out for workers.

In many developing nations, the combination of authoritarian governments and widespread poverty has set the stage for shrimp farming operations that produce grotesque conditions for workers (including widespread reports of slave labor in some countries). These operations also are reported to practice routine destruction of productive coastal marshes and mangrove forests, forced dislocation of coastal and wild harvesters, and chronic use of illegal and toxic chemicals that can cause permanent injury and even death to consumers. Environmental groups appear to have a good case that much of the world shrimp farming industry has not yet met basic standards for worker safety, public health, and conservation.

### **Public Health**

In this arena, it is useful to bring a critical eye to media reports about seafood safety. There are real problems here, but in my judgment the media and the activist community sometimes bark up the wrong tree.

Critics of the aquaculture industry made hay in 2004 with a well orchestrated media campaign based on a study that found higher levels of PCBs in farmed salmon than in wild salmon. The resulting alarm about farmed fish helped drive many consumers back to wild salmon in 2004, which was great news for many of my friends in the fishing industry. However, the levels of contamination observed were on the order of 40 times lower than the FDA standard for food safety. Whether that FDA standard is low enough is a worthy question, and there are intelligent opinions on both sides. It may make sense to convene a scientific consensus conference on this issue. But for now, I'm not terribly worried about PCBs in farmed salmon.

The most serious public health issues in aquaculture concern the use of banned substances, such as malachite green, which can persist in the flesh and cause irreversible disease and even death in consumers. Malachite green is a fabric dye that also functions as a fungicide and parasiticide in fish. Its chemical formula is expressed as  $C_{23}H_{5}N_2$ , and it is marketed under a variety of trade names. It is widely used to control outbreaks that threaten aquaculturists' livestock. Like several other compounds banned from aquaculture, the stuff does its job so well that farmers in some countries find it hard to quit using it. Malachite green is considered a carcinogen. In the United States, the FDA in 2003 was reported to screen imported seafood for only five of the more than 30 drugs used in aquaculture overseas. Some shipments of farmed salmon from Chile and farmed shrimp from several countries have been found to contain malachite green, and enforcement appears to be stiffening, with authorities seizing product and levying fines.

Personally, I do not buy farmed shrimp if I can help it. I look forward to the day when I can have confidence in the product, but I'm not persuaded yet. On the other hand, I think the salmon farming industry and the governments that regulate it have the capacity to meet high standards for food safety. While they still have work to do in this area, they appear to be interested in doing it well, in order to preserve market share.

## **Environmental Risks**

Environmental risks from aquaculture resemble those from livestock agriculture. A fish farm is basically a feedlot, and the drive for efficient production in agribusiness (both at sea and on land) has generated some serious density-dependent hazards. These include eutrophication of waters, release of drugs and other substances to the marine environment, the spread of density-fostered diseases to neighboring wild fish, consumption of ambient forage fish that stray into the net pens, inadvertent harm to marine wildlife near the farms, and the introduction of alien invasive fish species that can compete with vulnerable wild fish stocks.

Another issue is the potential for shrimp farms to drive overfishing as their demand for feed increases. There is some evidence that this is already happening in Southeast Asia, where governments are poorly equipped to regulate fishing; rapid growth of farmed shrimp operations has fostered fishing effort that targets forage fish which in some cases do not even have known species names, much less stock assessments and scientifically established catch limits. It has been said often that raising carnivores as livestock is fundamentally questionable ecological practice. I think there's some merit in that view. This is particularly true of shrimp, which have a low conversion rate of feed into usable human food. Salmon farmers have achieved far more efficient conversion rates, and

In salmon farming, two of the most serious environmental issues are the spread of disease to wild fish and the potential for escaped Atlantic salmon to harm native fish. There is considerable evidence that a sea lice infestation originating in salmon farms in the Broughton Archipelago spread fatal lice loads to young pink salmon smolts as they migrated to sea from nearby streams, which may have caused the collapse that occurred in the region's pink salmon fishery in 2002.

There is also evidence, much of it collected by John Volpe at the University of Alberta, that escaped Atlantic salmon have successfully reproduced in some British Columbia streams and rivers, and they have attempted to spawn in many more. Atlantic salmon are wily, determined creatures that are not easily contained. They are being raised in an environment where storms and sea lions tear open their cages. They are entering streams whose natural populations of Pacific salmon are, in some cases, depleted, so they may find an ecological niche they can exploit. They are a high order predator, and they will not be easy to exterminate once they have become established.

## **Conclusions**

However serious the problems in salmon aquaculture may be, they are dwarfed by those in shrimp culture. Salmon culture mostly occurs in nations that are relatively capable of regulating the industry and that have democratic institutions. Shrimp culture, by contrast, occurs largely in nations where profound class divisions, autocratic governments, and weak regulatory regimes make it hard to see how meaningful control of this industry's hazards is possible.

Culture of marine finfish species such as cod, sablefish, halibut, and tuna is also increasing. Most of the issues in these industries will be similar to those in salmon farming.