



# OCEAN-BASED FISH FARMING: Pollution, Pathogens & Environmental Impacts

**W**HILE SOME ASSERT that farming fish in cages at sea is the only sustainable way to meet the growing global demand for seafood, the reality is that the practice is far from sustainable. Producing fish in nets and cages in the open ocean contributes to the degradation of the world's seas, marine life, and ecosystems. These cramped facilities—akin to industrial animal factories on land—pollute the environment far beyond the places where they are located. The egregious harms caused by fish farms at sea demonstrate their unacceptability as an organic system of production.

## FARMS POLLUTE AND BREED DISEASE

Ocean-based fish farms can be an enormous source of untreated fish feces, uneaten feed, and dead fish. They all directly dump into the ocean—as much as several thousands of pounds a day—and eventually settle on the ocean floor, dramatically altering oxygen levels and reducing populations of bottom-dwelling mollusks, crustaceans, and plants. In Scotland, their 350 salmon farms generate more sewage than the country's entire human population.<sup>1</sup>

In the densely packed sea cages of homogenous fish, which are the norm for ocean-based fish farms, diseases emerge and rapidly spread. In Norway, for example, the highly contagious furunculosis skin disease quickly spread to roughly 70 percent of its ocean-based fish farms after the industry received infected juveniles from Scotland.<sup>2</sup> Not only do crowded conditions enhance opportunities for the transmission of common pathogens and disease, but they also create the optimum conditions for the evolution of *more virulent* strains.

## FARMS REDUCE THE SURVIVABILITY OF WILD FISH

Wild fish often linger near fish farms because they can obtain relatively easy access to food without the need to forage. Manufactured feed pellets, partially digested food, and feces freely flow through fish farms at sea providing a convenient source of food without the need to scavenge. This ultimately makes these wild fish less fit for survival. Processed diets also impact fish physiology by changing the fat content and fatty acid composition of their tissues. Such synthetic diets can also interfere with reproduction of wild fish and adversely affect their egg quality.

## FISH INEVITABLY ESCAPE INTO THE OCEAN

In the tumultuous ocean environment, fish farms are highly susceptible to breakages and breaches from predator attacks, storms, and strong currents allowing millions of farmed fish to escape annually. Vandalism, equipment failure, and human handling errors also cause regular escapes. Decades of experience have demonstrated the impossibility of preventing fish escapes from farms in the open ocean, regardless of system design or containment management plan. Over 24 million escapes have been documented around the world in a little over two decades.<sup>3</sup>

When farmed salmon escape and interbreed with wild salmon, their offspring experience diminished survival skills, reduced fitness, and potentially altered timing of developmental stages.<sup>4</sup> Overall, escaped

farmed salmon and offspring of interbred salmon are less likely to survive past juvenile stages than wild salmon. However, due to the genetic selection for increased growth rate and size, the farmed fish that do survive soon out-compete wild salmon for resources.

## ESCAPED FISH RESTRUCTURE FOOD WEBS

Escaped farmed fish increase predation in marine ecosystems and compete with wild species for food. They also migrate and inhabit areas where they were previously absent, significantly changing regional food webs.

In Japan, for example, escaped farmed trout invaded streams and adversely impacted riverbank ecosystems that connect the stream to nearby forests. Invading trout out-competed native charr for insects on the stream surface, causing the charr to alter their diets and consume bottom-dwelling aquatic insects instead. This reduced the aquatic insect population, which normally feed on algae, and increased algal blooms. Algal blooms decrease oxygen levels in aquatic systems. Increased predation of insects from charr decreased the number of adult insects that emerged from the river—the primary prey of spiders living on the stream banks. This subsequently decreased spider populations. Thus, the impacts from a single ecosystem change created a “trophic cascade” of multiple and interconnected impacts that extended beyond the ocean, to streams and forest species, including birds that rely on spiders for prey.<sup>5</sup>

## ESCAPED FISH SPREAD DISEASE

Diseases and pathogens spread well beyond fish farms once fish escape into the ocean. In Canada, for example, the Infectious Salmon Anemia virus was transmitted from fish farms to nearby river ecosystems by escaped fish. In Norway, escapees found in nearby rivers were the suspected cause of the furunculosis skin disease epidemic among wild populations. In Scotland, three out of four salmon escapes occur from farms impacted by Infectious Pancreatic Necrosis,<sup>6</sup> a contagious viral infection associated with intensive farming conditions. In the U.S., little data on fish farm escapes is collected and none on the spread of pathogens and disease.

## FARMS CREATE RISKS FOR MARINE PREDATORS

Large marine species are at risk when they swim near fish farms, attracted by the high density of fish, fish feed, and waste. Sea birds can become trapped in farm nets, exhaust themselves trying to break free, and die. Seals and sea lions have drowned after becoming caught in nets. In 2006, at least 46 sea lions died at a salmon farm in British Columbia, Canada, after they failed to escape entanglement.<sup>7</sup> Sharks and other predators have been killed by farm owners wanting to protect their fish and facility against predation. Thousands of seals have been shot in Scotland in the name of protecting the welfare of farmed salmon.<sup>8</sup>

## ORGANIC FARMERS STEWARD THE ENVIRONMENT

**Organic is a system of farming and food processing that combines traditional knowledge, experience, modern innovation, and scientific research to optimize food production, quality, and taste. Organic farmers tap into the best of what nature has to offer by controlling weeds, pests, pathogens, and disease with products derived from nature. Synthetic, toxic materials are largely prohibited, and allowed only under certain prescribed conditions until alternatives are found. Genetically modified seeds and plants—GMOs—are strictly prohibited under all circumstances. Each aspect of this intentionally-managed system come together to produce healthy, nutritious, and flavorful organic food. To allow organic certification of fish grown in farms that pollute the ocean in so many ways would breach consumer trust in the integrity of organically grown food and the organic label.**

To access CFS's full report, go to [www.centerforfoodsafety.org](http://www.centerforfoodsafety.org).

## OCEAN-BASED FISH FARMING AND ORGANIC DON'T MIX

Despite this track record of ecological harm, the U.S. Department of Agriculture's National Organic Program is poised to release standards for raising certified organic fish and it is seriously considering allowing fish farmed at sea to be certified organic. Yet, based upon Center for Food Safety's extensive research of ocean-based fish farms, it is clear such facilities can never be certified organic because of the ecological damage they cause. Food production systems must not demonstrably harm the environment or human health and ocean-based fish farms cannot meet that high bar.

## ENDNOTES

<sup>1</sup>Clover, C. (2011) “Pollution from fish farms ‘as bad as sewage.’” *Telegraph (UK)*, 19 September. Available at: <http://www.telegraph.co.uk/news/uknews/1355936/Pollution-from-fish-farms-as-bad-as-sewage.html>.

<sup>2</sup>Naylor, R. et al. (2005) “Fugitive Salmon: Assessing the Risks of Escaped Fish from Net-Pen Aquaculture.” *BioScience*, 55(5), May: 427-437.

<sup>3</sup>Based on figures compiled by Center for Food Safety, as of October 2014.

<sup>4</sup>Congressional Research Service. (2010) *Open Ocean Aquaculture 7*. 9 August; McGinnity (2003); DOI and DOC. (2000) *Guide to the Listing of Distinct Population Segment of Atlantic Salmon as Endangered*. November 2000. Available at: [http://www.nefsc.noaa.gov/press\\_release/2000/salmonguide00.01.pdf](http://www.nefsc.noaa.gov/press_release/2000/salmonguide00.01.pdf).

<sup>5</sup>Baxter, C.V. et al. (2004) “Fish invasion restructures stream and forest food webs by interrupting reciprocal prey subsidies.” *Ecology*, 85(10): 2656-2663.

<sup>6</sup>Salmon Farm Protest Group. (2003) “Mass fish farm mortalities and escapes threaten the survival of wild salmon,” *Salmon Farm Protest Group press release*, 1 August. Available at: [www.salmonfarmmonitor.org/pr010803.shtml](http://www.salmonfarmmonitor.org/pr010803.shtml).

<sup>7</sup>Testimony of Dom Repta, Coastal Alliance for Aquaculture Reform. (2007). Oral testimony at the National Organic Standards Board (NOSB) Meeting, 27-29 March. Washington, DC. Available at: <http://www.ams.usda.gov/AMSv1.0/nosb>.

<sup>8</sup>Cramb, A. (2009) “Scottish fish farmers ‘conducting secret seal slaughter.’” *Telegraph (UK)*, 5 April. Available at: <http://www.telegraph.co.uk/earth/wild-life/5110053/Scottish-fish-farmers-conducting-secret-seal-slaughter.html>.