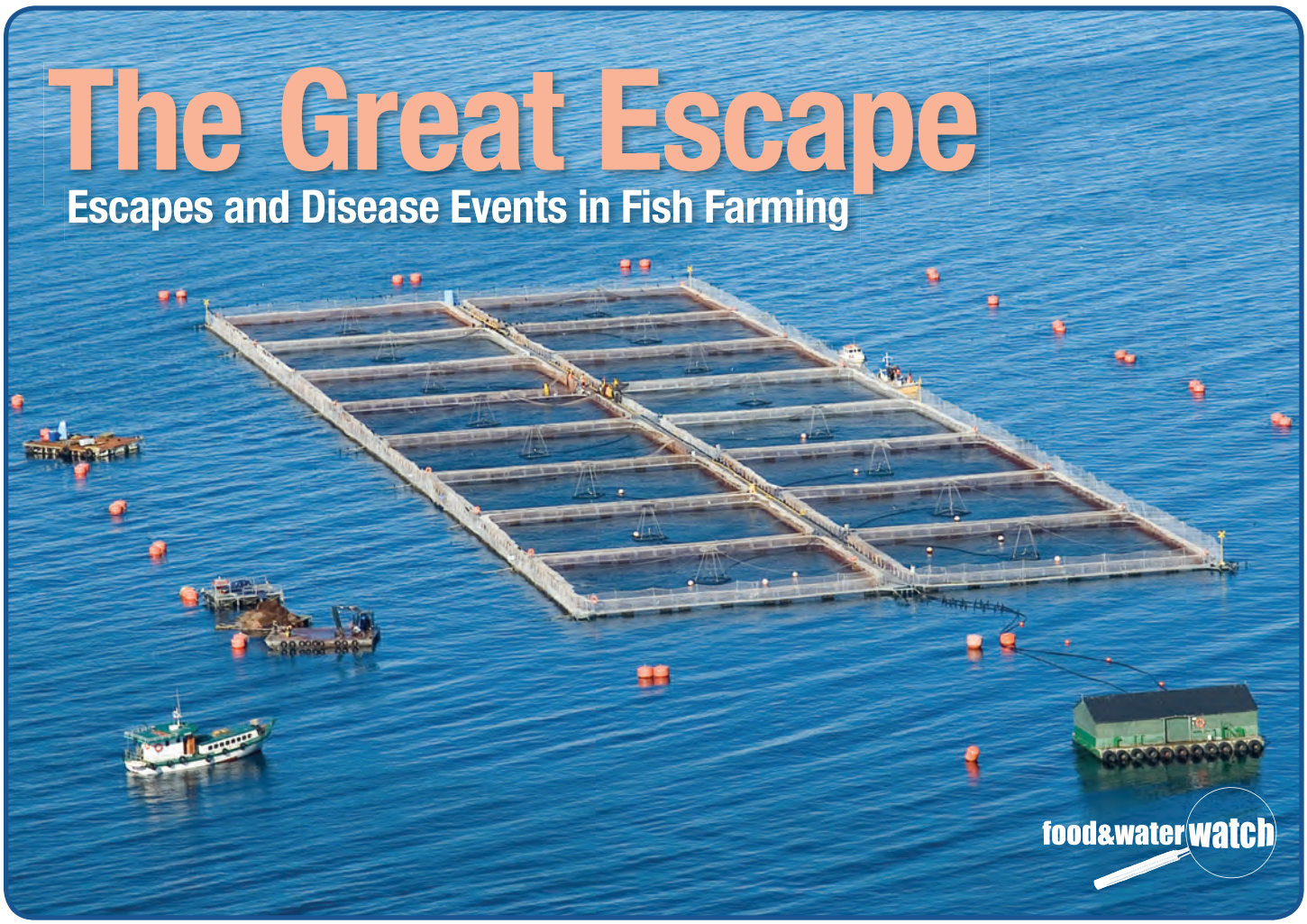
The Great Escape

Escapes and Disease Events in Fish Farming



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Around half of the fish that the world eats for dinner comes from fish farms. Aquaculture is promoted as a sustainable way to meet rising consumer demand for seafood. But fish farming relies on small, wild fish to feed farmed fish, pollutes the waters around it with wastes and chemicals and threatens wild fish biodiversity through escapes and disease transmission.

The magnitude of these effects is poorly understood. The aquaculture industry has expanded rapidly in the last several decades, producing 59.9 million metric tons of fish in 2010. But few countries require mandatory reporting and public release of aquaculture statistics. For example, China was responsible for 61.4 percent of world aquaculture in 2010, and Asia as a whole produced 89 percent, but aside from production totals, very little information is available about the fish farming industry in these countries.

In this issue brief, we analyze available data on fish farm escapes and disease outbreaks to build a picture of the costs of aquaculture.

Escapes From Fish Farms

Escapes are an inevitable part of fish farming. Aquaculture facilities are vulnerable to extreme weather events such as major storms, cyclones and hurricanes,[8] as well as to damage caused by marine predators like sharks,[9] and to equipment failures.[10]

Major escape events are common in the aquaculture industry (see box for several recent examples), and these disasters can release hundreds of thousands of fish into the open ocean. In the few countries that require mandatory reporting of escapes, the numbers for total escapes are staggering. A review of

salmon escapes suggests that up to 2 million Atlantic salmon escape from farms around the North Atlantic each year, which is equal to half the wild salmon in the region.[11] In Norway, 3.93 million Atlantic salmon, 0.98 million rainbow trout and 1.05 million Atlantic cod were reported to have escaped over the nine years from 2001 to 2009.[12]

Food & Water Watch analyzed production and escapes data from four major aquaculture regions where comprehensive reporting on aquaculture escapes is mandatory and publicly released: British Columbia,[18] Norway,[19] Scotland[20] and Australia.[21] (See Figure 1.) The data show that escapes, on average, have tended to increase, although fewer catastrophic escapes have occurred in the studied countries as of late.

Major Fish Farm Escapes

- In April 2007, a violent earthquake hit an aquaculture region in southern Chile, and as many as 5 million fish may have escaped.[13]
- From late December 2008 through early January 2009, a series of massive escapes occurred in Chile, totaling more than 700,000 salmon and trout from various farms, and prompting the leader of the Chilean Senate's Environmental Committee to proclaim the incidents an "environmental disaster."[14]
- In October 2009, a Canadian newspaper reported that 40,000 fully grown Atlantic salmon had escaped from a net-pen facility in British Columbia when a machine removing dead fish from the bottom of the pen broke a hole in the net. The company reportedly recovered less than 3 percent of the escaped fish at the time the article was written, although efforts to recover the fish were ongoing.[15]
- In October 2010, 70,000 harvest-ready salmon escaped from a farm in Norway, resulting in a loss to the company of at least $600,000. Only months earlier, fish at the same location had suffered from an outbreak of pancreatic disease, resulting in high levels of mortality.[16]
- In December 2011, 11 cages were destroyed in a strong storm in Scotland, releasing 300,000 farmed salmon into the Atlantic.[17]

The reported data on escapes underestimates the number of fish that actually do escape from aquaculture facilities, although to what degree is unclear. British Columbia's Environment Assessment Office clarified that the available escapes data is only a minimum number of escapes, as fish farmers typically report only large escapes. They concluded that chronic "leakage" of fish from net pens is not reported and, if assessed, could double the number of total escapes.[22] A study of Chile's farmed salmon industry suggested that 1 to 2 percent of farmed fish could escape.[23]

A more recent study out of Norway suggested that only 12 to 29 percent of the actual number of escaped farmed salmon are reported.[24] This would mean that, between 2001 and 2009, instead of 3.93 million Atlantic salmon escaping, somewhere between 13.55 and 32.75 million salmon would have escaped. Size variability in catches of escaped farmed fish in Norway also support the idea that these fish continually escape in small but constant numbers at all stages of production, including smolt and pre-smolt cultivation.[25]

Spawning activities of farmed fish are another form of fish "escape." Researchers suggest that entire cages full of mature farmed cod could spawn before being harvested.[26] Experiments have furthermore found evidence that the released eggs can successfully develop in wild environments. One experiment in Norway found that after a successful cod spawning event in a small aquaculture facility, 20 to 25 percent of the cod larvae captured in the environment around the facility were offspring of the farm-raised cod.[27] In the following years, 4 to 6 percent of the cod captured in the area around the farm could be linked to those same farmed cod.[28]

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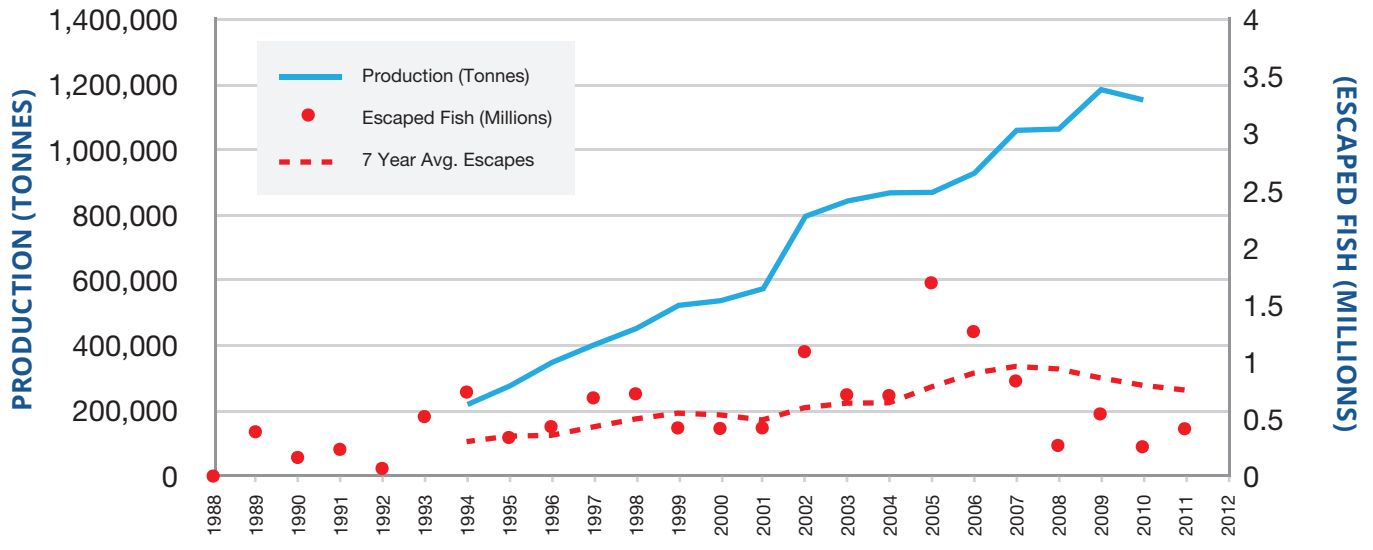
The National Oceanic and Atmospheric Administration (NOAA), the agency responsible for managing U.S. fisheries and regulating aquaculture, wants to greatly increase aquaculture in the United States, with a goal of reaching 1.1 million metric tons of marine finfish production in 2025.[29] Using a 1 percent escape rate, we roughly estimate that as many as 2.5 million fish could escape annually at that level of production.[30]

Figure 1: Increase in Aquaculture Production and Escapes



DATA SOURCE: Comparison of aggregate production and aggregate escapes from aquaculture facilities in British Columbia (1987–2009), Norway (1993–2010), Scotland (2002–2011) and Australia (2001–2011). The escapes trendline is a seven-year average (each point represents the average of that year plus the preceding six years) to control for the impact of extreme weather events triggering massive escapes.

Disease outbreaks in fish farms

Disease outbreaks are another unavoidable consequence of fish farming.[31] In recent years, disease outbreaks have caused partial or sometimes total loss of production in Chile's farmed Atlantic salmon, oysters in Europe and marine shrimp in Asia, South America and Africa.[32] In 2011, disease outbreaks "virtually wiped out marine shrimp farming production in Mozambique."[33]

A study on the global impact of white spot syndrome virus to shrimp farms found that as the virus spread across the globe in the 1990s, it became increasingly severe and has spread even to wild marine populations in Europe.[34] Similarly, the devastating Infectious Salmon Anemia (ISA) virus that hit Chile's salmon farms in 2007 likely entered the industry via diseased salmon eggs imported from Norway in 1996, which suggests that the virus probably persisted in the wild environment for more than a decade before beginning to affect Chile's industry.[35]

Diseases in fish farms can spread rapidly among fish grown in close captivity, which can result in spreading infection to wild populations.[36] For example, sea lice, a parasite that feeds on marine fish, is a common pathogen that spreads between aquaculture facilities and wild populations. In Canada, net pens for salmon are often situated on migration routes of wild salmon, and increased exposure to sea lice from these pens correlates to decreased survival rates for wild salmon.[37]

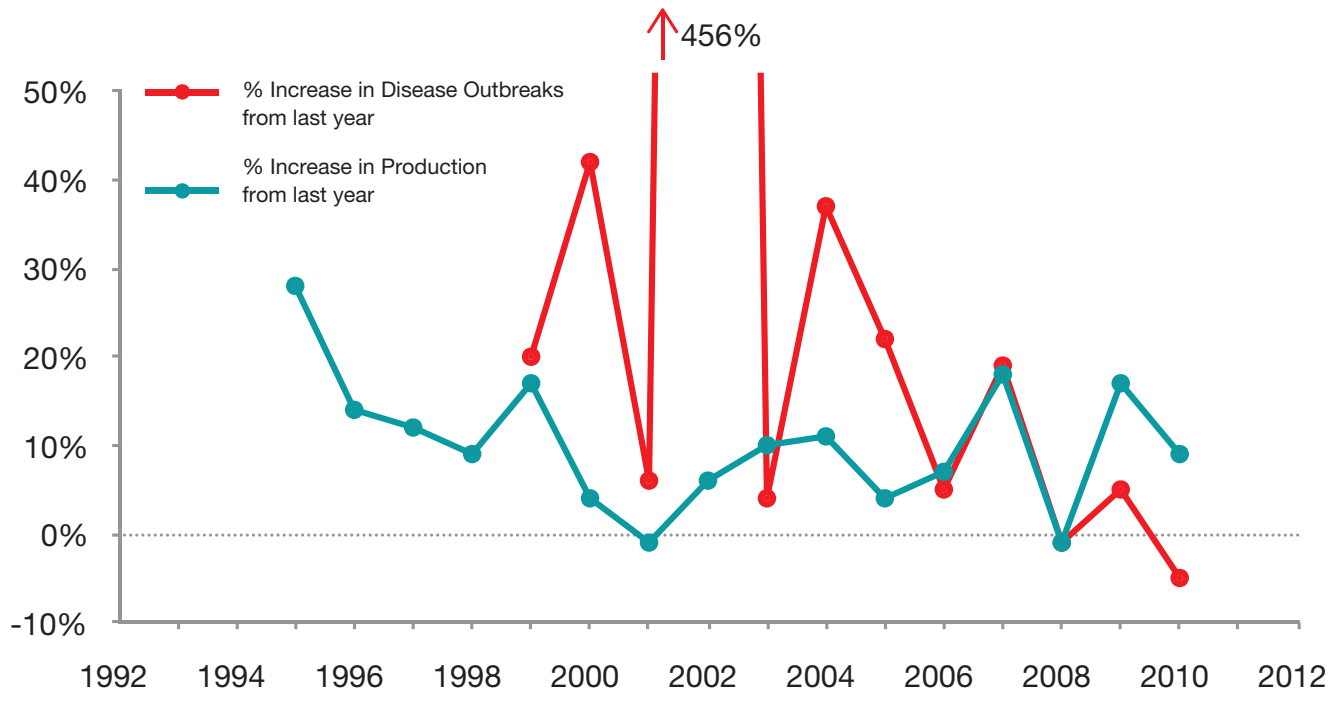
The Canadian government established an investigative Commission of Inquiry (the "Cohen Commission") to review the decline of the wild sockeye salmon in Canada's Fraser River, and the Commissioner concluded that "net-pen salmon farming... poses a risk of serious harm to Fraser River sockeye through the transfer of diseases and pathogens."[38] He further recommended that, if by 2020, regulators "cannot confidently say that the risk of serious harm is minimal, they should prohibit all net-pen farms" in the area.[39]

A 2012 study found that 39 percent of adult wild salmon in the Northeast Atlantic are killed by parasite infections, and suggested that a large source of these sea lice are aquaculture facilities.[40] The large mortality rate found by this study is concerning and also represents a real threat to conservation efforts and the genetic diversity of wild salmon stocks.[41] A lead researcher on the study warned that the industry "needs to minimize the risk of cross-infection of wild fish."[42]

Food & Water Watch analysis of disease outbreaks data from Norway shows that the number of disease events has typically increased each year.[43] (See Figure 2.) In 2002, the number of disease outbreaks spiked by 456 percent to more than 200 total outbreaks, and every year since then there have been more than 200 disease outbreaks in Norwegian aquaculture facilities.

Some fish farming diseases have no treatment other than isolating and culling all of the infected fish. Others are treated

Figure 2: Yearly Percentage Increase in Farm-Raised Salmon Prodution vs. Disease Outbreaks in Norway



DATA SOURCE: Comparison of yearly percentage increase in Norway's aquaculture production to yearly percentage increase of disease outbreaks.

with vaccinations or combinations of chemicals and antibiotics that are either given regularly to the fish in their feed or doused as "baths" over infected fish.[44] Many of these chemicals are not approved for use in the United States because of their health risks to consumers, but fish treated with these drugs still make it into the U.S. market because of the nation's low rates of inspection.[45]

One study found that the use of antimicrobials on fish farms can lead to the development of drug-resistant genes in fish pathogens — genes that could be transferred to bacteria that infect humans. This could make human illnesses more difficult to treat.[46]

Risk to wild fish

Escaped fish are a risk to the marine environment. A review of 23 peer-reviewed studies concluded that hatchery-raised fish can harm wild fish through competition for food and habitat, harming the genetic diversity of wild populations and causing wild population declines.[47] Farmed fish, even before they escape, can spread disease to wild populations.[48]

Competition between escaped farmed fish and wild fish "can be significant" whether they are of the same species or not.[49] In many cases, farmed fish may be invasive species in the area: for example, self-sustained, non-native populations of salmon that originated as escapes from fish farms are now targets for recreational fishers in Chile and Argentina.[50]

In the United States, the Atlantic salmon that are native to the Gulf of Maine region and its river tributaries are listed as endangered under the Endangered Species Act, and the most recent status assessment estimated the likelihood of extinction from 19 to 75 percent in the next 100 years.[51] In that same region, one review of farmed salmon suggests that, "juvenile farmed salmon are chronically escaping into the wild from hatchery sites."[52]

Is all aquaculture bad?

No. Some forms of aquaculture, like most shellfish aquaculture and land-based closed loop recirculating aquaculture, are not plagued with these problems. If we're serious about protecting the environment and providing excellent products to consumers, those are the types of aquaculture that should be pursued.

A recent study to determine the causes of the long-term decline of the sockeye salmon in Canada's Fraser River indicated that a combination of increased competition with pink salmon and contact with aquaculture facilities best predicted the observed population decline.[53] The low returns of sockeye have put "enormous pressure on aboriginal and commercial fishing communities that depend on these fish for food, social, and ceremonial purposes, as well as their livelihoods."[54]

Farmed fish have lower initial genetic diversity than wild fish, and interbreeding between escaped farmed fish and wild fish have resulted in less-fit offspring and a reduction in specialized genetic traits.[55] NOAA acknowledges a large number of genetic, ecological, health and behavioral risks from hatchery fish used to restock diminished wild populations.[56]

An accident waiting to happen

After 30 years of growth, the aquaculture industry is still beset with major escapes and disease outbreaks. New technologies and drugs may make inroads into preventing some of these occurrences, but there is no evidence to believe they will ever be fully preventable. With extreme weather events becoming more frequent due to climate change,[57] storm-related damage to aquaculture facilities is likely to increase. And with countries heavily promoting the large-scale industrial model of fish farming, there will be more and more farms to act as reservoirs for disease.

Aquaculture is increasing worldwide, but our understanding of its broad effects is lagging behind. For instance, the Food and Agriculture Organization of the United Nations regularly reports on worldwide aquaculture production, but not on worldwide fish farm escapes and disease outbreaks.[58] The ocean is a shared resource, and we will all share in the costs of this dirty and damaging industry.

Endnotes

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