

# Open Ocean Aquaculture: Factory Farming in the Sea

**Open ocean aquaculture, also known as offshore aquaculture, involves raising fish in large cages or pens in open waters. It is a hazardous system: the fish escape, the waste gets out, diseases in the pens spread to the surrounding sea life, and drugs used to treat the fish leak out into the environment.**

Open ocean aquaculture is not currently allowed in U.S. federal waters (which begin several miles from the coast), but it is already happening in the waters regulated by some states, including Washington and Maine. However, federal regulators have promoted the use of these ocean-based factory farms for years — including awarding \$9.3 million in federal grants to further aquaculture projects around the country — and want to allow offshore aquaculture in federal waters, all in the name of reducing the nation’s “seafood trade deficit.”<sup>1</sup>

Just like farms on land can raise animals in many different ways — ranging from small-scale to industrialized operations — there are many types of aquaculture. Open ocean aquaculture is characterized by industrialized, large-scale open-cage and net-pen systems that are either secured to a structure, moored to the ocean floor or free floating in the ocean.<sup>2</sup> This is in contrast to coastal aquaculture farms that produce shellfish such as oysters, or land-based recirculating (closed-loop) aquaculture systems that are often developed to rebuild local food systems.

## Open Ocean Aquaculture Is an Environmental Disaster

### Pollution

In open ocean aquaculture, seawater flows freely through the pens, spreading the fish waste, uneaten feed, disease, and antibiotics and chemicals used to treat the fish.<sup>3</sup> The waste and feed provide excessive nutrients that fuel the growth of algae and other marine plant life, which can

greatly reduce oxygen levels in the water and lead to habitat loss and the suffocation of sea life.<sup>4</sup> Pollution from nutrients, particularly nitrogen, is a substantial cause of environmental damage in coastal and ocean waters.<sup>5</sup> For every ton of fish produced from open ocean aquaculture facilities, nearly 70 kilograms of nitrogen is released into the water through waste, contributing to this nutrient pollution.<sup>6</sup>

Chemicals used in aquaculture production can pollute the water, including antibiotics, parasite treatments and disinfectants through food pellets, injections or immersion of the fish in chemical baths.<sup>7</sup> Three-quarters of the antibiotics administered to aquacultured fish end up in the surrounding environment, potentially leading to the development and spread of antibiotic-resistant bacteria.<sup>8</sup>



## **Disease**

Diseases are prevalent in aquaculture pens, infecting and killing not only the fish inside, but also passing wild fish.

Parasitic sea lice, which exist in the wild, thrive in open ocean aquaculture pens, where they attach onto salmon and kill them or make them unsuitable for consumption.<sup>9</sup> These lice can attach onto wild salmon that pass by the pens.<sup>10</sup> In Norway, parasitic lice have killed about 50,000 wild salmon every year and reduced the regional number of wild salmon by half, from more than 1 million in the 1980s to less than 500,000 in 2017.<sup>11</sup>

Atlantic salmon that are farmed in open ocean aquaculture facilities are also susceptible to infectious salmon anemia, a disease that causes lethargy, anemia and ultimately death.<sup>12</sup> Cases have occurred around the world, from Norway and Chile to Canada and Maine.<sup>13</sup> The disease spreads quickly and can be transferred to wild salmon and other fish species.<sup>14</sup>

## **Fish Escapes Are Inevitable**

Fish frequently escape from open ocean aquaculture facilities, introducing non-native species into the environment and disrupting the existing sea life.<sup>15</sup> Escaped fish can interbreed with native fish, which can weaken genetic traits important to wild species. Aquaculture-raised fish are bred not for survival in the wild, but for aggressive feeding; when these traits are passed on to wild fish, it can reduce the survivability of offspring and lead to population loss.<sup>16</sup>

Aquaculture businesses attempt to recapture escaped fish, but these efforts are largely unsuccessful.<sup>17</sup> A 2015 study found that about 3 million fish escaped annually from ocean aquaculture operations in six European countries where this form of fish farming is prevalent.<sup>18</sup> Almost three-quarters of the farmed salmon escapes were due to structural failure or to operational error, and two-thirds of all fish escapes were because of mooring failures.<sup>19</sup>

This is not just a European problem. In 2017, more than 160,000 farmed Atlantic salmon escaped from a Washington state ocean aquaculture facility when the facility collapsed completely.<sup>20</sup> The owner, Cooke Aquaculture, was one of the largest aquaculture companies in the world, with nearly \$2 billion in annual sales.<sup>21</sup> The escaped salmon disrupted tribal fisheries in the Pacific, and the

Lummi Nation had to pay buyers to take the escaped Atlantic salmon that their fishers caught, because they could not sell them.<sup>22</sup> Despite efforts to capture the escaped fish, more than three months later Atlantic salmon were still being found more than 40 miles upriver from the facility.<sup>23</sup>

## **Soybeans Are Not the Solution**

Promoting offshore aquaculture as sustainable ignores the fish loss that is inherent in the industrial fish farming model. Many types of farmed fish are carnivorous, and smaller wild fish are caught and turned into aquaculture fish feed, disrupting the wild food chains that these fish support. Feeding wild fish to farmed fish can devastate marine ecosystems and put more pressure on already depleted wild stocks.<sup>24</sup> Each pound of farmed fish typically requires one to two pounds of wild fish to use as feed.<sup>25</sup> Although this ratio recently has decreased, it is not because the system is getting better — rather, it is because fish protein is being replaced by soy protein.<sup>26</sup>

The soy industry has promoted open ocean aquaculture because soy-based fish feed could provide new demand for U.S. soybeans.<sup>27</sup> For example, multinational agribusiness Cargill is heavily invested in promoting aquaculture and making fish feed, and already controls over a third of the global market for salmon feed.<sup>28</sup>

Replacing fishmeal with soy is no solution. Industrial soy has a large environmental footprint, just like wild fishmeal does; the damage just occurs much farther away from the fish farms. Agricultural runoff from U.S. soybean farms has contributed to the expanding “dead zone” in the Gulf of Mexico, where algae blooms and bacterial growth from excess nutrients prevent oxygen from entering the waters, killing all fish and aquatic life.<sup>29</sup> About half of the nitrogen and a quarter of the phosphorus runoff that ends up in the Gulf is from soy and corn fields in the Midwest.<sup>30</sup> In August 2017, the dead zone was the largest recorded since measurements began in 1985.<sup>31</sup>

## **Harm to Fishing Communities**

Open ocean aquaculture also has economic costs. These facilities eliminate fishing jobs and lead to the closure of processing plants in coastal communities.<sup>32</sup> Increased U.S. imports of farmed salmon in the 1990s dramatically reduced prices for wild-caught salmon.<sup>33</sup> Fishermen



*Agricultural runoff from industrial soy farming contributes to the expanding “dead zone” in the Gulf of Mexico, where nutrient excess causes algae blooms and bacterial growth that kill native fish and aquatic life. / Photo by NOAA*

stopped fishing because prices were too low to make fishing economically viable.<sup>34</sup> The 2017 Washington state Atlantic salmon escape could have significant long-term impacts on tribal fisheries, threatening people’s livelihoods and the health of salmon runs that have existed for generations.<sup>35</sup>

## **It Won’t Solve the Seafood Deficit**

Politicians and federal regulators often promote factory fish farming in the United States as a solution to the nation’s “seafood trade deficit.” They contend that by expanding large-scale aquaculture domestically, the country would import less seafood — and export more. But the bulk of imported seafood is shrimp.<sup>36</sup> The call for increased aquaculture ignores the reasons why the United States imports so much fish and the impacts that more aquaculture would have on the U.S. fishing industry.

Retailers and distributors aim to source the cheapest products, and for seafood this often means importing, from countries that sell cheaper fish but have little food safety oversight, where the fish are raised in unsanitary conditions.<sup>37</sup> In 2016, the United States exported about half as much fish as it imported and exports constituted nearly a third of the domestic fish catch.<sup>38</sup> Simply increasing large-scale aquaculture in U.S. waters does not change the

economic drivers that cause the United States to export its domestic catch to foreign markets that will pay more.

## **Conclusion and Recommendations**

Open ocean aquaculture has no place in the U.S. food system. Attempts to use alternative fishmeal ingredients such as soy do not solve environmental problems — they merely shift the burden to other ecosystems and enrich the pockets of big agribusiness corporations. Solutions to the country’s seafood problems will have to be more holistic, including eating a wide variety of fish types rather than just a few mass-produced species, and protecting and responsibly managing our wild fisheries.

### **Recommendations:**

- The United States should not allow open ocean aquaculture in federal waters, and states should ban the practice as well.
- The federal government should not promote research to expand or develop the open ocean aquaculture industry.
- The U.S. Food and Drug Administration needs to tighten regulation of what aquaculture products can be imported into the United States, and to significantly increase its inspection of imported seafood.

## Endnotes

- 1 U.S. Department of Commerce. National Oceanographic and Atmospheric Administration (NOAA). [Press release]. "NOAA awards \$9.3 million to support aquaculture research." October 31, 2017.
- 2 Upton, Harold and Eugene Buck. "Open Ocean Aquaculture." Congressional Research Service. August 9, 2010 at 2.
- 3 *Ibid.* at 10.
- 4 Boesch, Donald F. et al. Pew Oceans Commission. "Marine Pollution in the United States." 2001 at iii.
- 5 Nixon, Scott W. and Robinson W. Fulweiler. "Nutrient Pollution, Eutrophication, and the Degradation of Coastal Marine Ecosystems." In Duarte, Carlos M. (Ed.). *Global Loss of Coastal Habitats*. Fundación BVBA: Madrid. 2009 at 25, 28, 32 and 51.
- 6 Fry, Jillian, David Loce and Gabriel Innes. Johns Hopkins University. Center for a Livable Future. "Ecosystem and Public Health Risks for Nearshore and Offshore Finfish Aquaculture." 2017 at 9.
- 7 Tornero, Victoria and Georg Hanke. "Chemical contaminants entering the marine environment from sea-based sources: A review with a focus on European seas." *Marine Pollution Bulletin*. Vol. 112. 2016 at 20.
- 8 *Ibid.*; Goldberg, Rebecca J., Matthew S. Elliott and Rosamond L. Naylor. Pew Oceans Commission. "Marine Aquaculture in the United States: Environmental Impacts and Policy Options." 2001 at 16.
- 9 Whittle, Patrick. "Any lice with that salmon? Parasite plagues global industry." *Post & Courier* (Charleston, SC). September 19, 2017.
- 10 Castle, Stephen. "As wild salmon decline, Norway pressures farmers." *New York Times*. November 6, 2017.
- 11 *Ibid.*
- 12 McClure, Carol A. et al. "Risk factors for outbreaks of infectious salmon anemia in farmed Atlantic salmon, *Salmo salar*." *Preventative Veterinary Medicine*. Vol. 72. 2005 at 264.
- 13 Johnson, Kirk. "Scientists are divided over threat to Pacific Northwest salmon." *New York Times*. May 2, 2013.
- 14 "Questions remain about case of infectious salmon anemia." *Telegraph-Journal* (New Brunswick). April 6, 2015.
- 15 Dempster, Tim et al. "Recapturing escaped fish from marine aquaculture is largely unsuccessful: alternatives to reduce the number of escapees in the wild." *Reviews in Aquaculture*. 2016 at 1.
- 16 Castle (2017).
- 17 Dempster (2016) at abstract.
- 18 Jackson, Dave et al. "A pan-European valuation of the extent, causes and cost of escape events from sea cage fish farming." *Aquaculture*. Vol. 436. 2015 at 22 to 23.
- 19 *Ibid.* at 23.
- 20 Thompson, Lynn. "State team to oversee response to fish spill." *Seattle Times*. August 27, 2017; Mapes, Lynda V. "Atlantic salmon net pen's Puget Sound collapse wasn't first problem at fish farm." *Seattle Times*. November 7, 2017; Le, Phuong. "Collapse at salmon farm renews debate about fish farming." *Associated Press*. August 24, 2017.
- 21 Mapes, Lynda V. "After salmon spill, firm tried to buy tribe's silence." *Seattle Times*. October 12, 2017.
- 22 Mapes, Lynda V. "Scramble on to keep farmed fish from imperiled wild salmon stocks." *Seattle Times*. August 25, 2017.
- 23 Mapes, Lynda V. "Escaped fish flee far upriver." *Seattle Times*. December 12, 2017.
- 24 Naylor, Rosamond L. et al. "Effects of aquaculture on world fish supplies." *Issues in Ecology*. No. 8. 2001 at 2, 5.
- 25 Upton and Buck (2010) at 11.
- 26 Ytrestøyl, Trine et al. "Utilisation of feed resources in production of Atlantic salmon (*Salmo salar*) in Norway." *Aquaculture*. Vol. 448. 2015 at 368 and 371.
- 27 American Soybean Association. [Press release]. "ASA welcomes release of final Gulf aquaculture rule." January 12, 2016.
- 28 Gagliardi, Nancy. "Cargill's big bet on fish — and the industry's challenges ahead." *Forbes*. August 24, 2015.
- 29 Gallegos, Jenna. "The Gulf of Mexico dead zone is larger than ever. Here's what to do about it." *Washington Post*. August 4, 2017.
- 30 *Ibid.*
- 31 NOAA. [Press release]. "Gulf of Mexico 'dead zone' is the largest ever measured." August 2, 2017.
- 32 Upton and Buck (2010) at 9.
- 33 Gunnar Knapp, Cathy A. Roheim and James L. Anderson. (2007). *The Great Salmon Run: Competition Between Wild and Farmed Salmon*. Washington, DC: World Wildlife Fund at i.
- 34 *Ibid.* at 234.
- 35 Mapes (August 25, 2017).
- 36 NOAA. "Fisheries of the United States, 2016." September 2017 at 81.
- 37 Barboza, David. "In China, farming fish in toxic waters." *New York Times*. December 15, 2007; see Food & Water Watch. "Toxic Buffet: How the TPP Trades Away Seafood Safety." 2016.
- 38 NOAA (2017) at 9, 81 and 92.