

# Scientist Statement on the Aquaculture Industry's Impact on Marine Ecology and Human Health

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From providing a primary source of protein for a large portion of the world's population to regulating climate and weather patterns, the world's oceans and marine systems underpin critical global ecological processes. As scientists in marine biology, public health, life sciences, and related fields, we are deeply concerned about any activity—such as over-fishing and pollution—that contributes to the decline of important marine systems and their value to people who depend on them.

By replacing wild-caught fish with farmed fish, aquaculture has the potential to reduce the pressure on marine systems and limit the overall human impact on the marine environment. Unfortunately, prevailing practices used in the rapidly growing carnivorous fish farming industry are currently having the opposite effect. Scientific studies have identified the following impacts, all of which are associated most closely with salmon farming which makes up the overwhelming majority of carnivorous fish aquaculture:

**Over-fishing to supply feed:** Carnivorous fish aquaculture, including the most common form, salmon aquaculture, currently results in a net loss of fish protein from the ocean system. This is because at least three pounds of wild fish are required to produce one pound of farmed fish.<sup>1</sup> The salmon aquaculture industry alone used 2.2 million metric tons of fishmeal in 2004, much of it coming from increasingly degraded fisheries. Many wild fisheries are reaching their maximum sustainable level of take at around 90 million tons per year, of which one-third goes to meal and oil production, currently the main ingredients in salmon feed.<sup>2</sup>

**Concentration of contaminants:** The high concentration of fish meal and fish oils in salmon feed has been shown to lead to significant levels of PCBs and other environmental contaminants in the farmed salmon typically available to consumers.<sup>3</sup>

**Displacement of wild populations:** Large numbers of farmed fish regularly escape from ocean net pens. These farmed fish threaten the viability of wild populations by competing with them for food and habitat and by interbreeding with them, introducing their farm-adapted genetic makeup to wild populations that have adapted to survive in specific environmental conditions.<sup>4</sup>

**Parasites and disease:** In the crowded conditions of ocean net pens, pathogens and parasites that occur at low levels in the wild, such as sea lice, multiply rapidly. Scientists have repeatedly documented the transfer of disease and parasites from ocean net pens to wild fish populations.<sup>5</sup>

**Wastes, chemicals, and antibiotics:** The concentration of fish waste, pesticides, and antibiotics overload and pollute local ecosystems with nutrients and toxic chemicals.<sup>6</sup>

Carnivorous fish aquaculture, especially salmon aquaculture, has expanded rapidly in the last few years. Nevertheless, salmon and other fish farming utilizes the same basic net pen techniques that were

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<sup>1</sup> Naylor, R. et al. Effects of aquaculture on world fish supplies. *Nature* **405**, 1017-1024 (2000).

<sup>2</sup> Cermaq Listing Prospectus: Offering and Stock Exchange Listing of Cermaq ASA, p. 83 (30 September, 2005).

<sup>3</sup> Hites, R.A. et al. Global Assessment of Organic Contaminants in Farmed Salmon. *Science* **303**, 226-229 (2004). Foran, J. et al. Quantitative Analysis of the Benefits and Risks of Consuming Farmed and Wild Salmon. *Journal of Nutrition* **135** (2005)

<sup>4</sup> Naylor, R. et al. Fugitive Salmon: Assessing the risks of Escaped Fish from Net-Pen Aquaculture. *BioScience* **55: 5**, 427-437 (2005).

<sup>5</sup> Krkosek, M., Lewis, M.A., & Volpe, J. Transmission Dynamics of Parasitic Sea Lice from Farm to Wild Salmon. *Proceedings of The Royal Society B* (2005).

<sup>6</sup> Folke, C., Kautsky, N., & Troell, M. The Costs of Eutrophication from Salmon Farming: Implications for Policy. *Journal of Environmental Management* **40**, 173-182 (1994).

developed more than 30 years ago. Because we believe aquaculture can benefit rather than degrade human health and the marine environment, we call on policymakers and industry leaders to adopt technologies and operating practices that move the industry toward long-term sustainability:

- The industry should move away from ocean net pen systems to closed systems that are capable of effectively containing farmed fish and allowing for the recovery of pollutants and the reuse of waste.
- While transitioning to effective containment systems, aquaculture operations should adopt a number of remediating practices including the mandatory reporting of escapes, the tagging of farmed fish, and the use of reproductively sterile stock. Fish farming operations should report on the chemicals and drugs used in the marine environment and meet water quality and environmental exposure standards for those substances.
- The industry should replace a significant portion of fish meal and fish oils with sustainable and less contaminated sources of protein and oils. If aquaculture producers are to fulfill the promise of their industry, they should set a goal of “no net loss of ocean biomass” from their operations and take the steps necessary to reach it.

As a rapidly growing industry, it is important that sustainable and healthful fish farming practices be adopted early before aquaculture operations expand to the point where they result in severe damage to the marine environment. As scientists, we stand ready to help the aquaculture industry understand the impacts of their operations on the marine ecology and human health, adopt more sustainable fish farming techniques, and fulfill the promise of relieving rather than deepening the debilitating human impacts on the marine ecosystem.

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