



**Testimony of  
Rebecca Goldberg, Ph.D.,  
Environmental Defense  
Concerning Marine Aquaculture  
Before the U.S. Commission on Ocean Policy  
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Thank you for the invitation to testify today on the subject of marine aquaculture. I am a Senior Scientist at Environmental Defense's New York office, and hold advanced degrees in biology (ecology) and in statistics. I am the author or co-author of a number of publications, including articles in the scientific journals *Science* and *Nature*, concerning the environmental effects of aquaculture.

My presentation today draws heavily on a report, *Marine Aquaculture in the United States*, which I co-authored last year for the Pew Oceans Commission. Because the report has been distributed to members of the U.S. Commission on Ocean Policy, and is also available online at [www.pewoceans.org](http://www.pewoceans.org), I will not repeat most of the report's discussion or analysis. Rather, I will briefly present some background information on aquaculture and then discuss five selected key issues and recommendations to address them.

### **Background**

Aquaculture is seen by many experts as the best means to boost the global seafood supply. The total global fisheries catch has peaked, and significantly greater quantities of wild fish are unlikely to be obtained from the seas. Aquaculture is the only available means to significantly supplement fisheries catches at a time when world population and affluence are increasing.

Aquaculture production worldwide has grown rapidly in recent decades, and at a somewhat slower rate in the United States. Freshwater catfish dominate US aquaculture production, which totals almost \$1 billion per year. Marine fish, chiefly oysters, clams, and salmon, are roughly a third of US aquaculture production by weight. Growth in production varies considerably by species, with production of farmed Atlantic salmon and hard clam enjoying considerable growth in recent years.

### **Issues and recommendations**

Like other forms of animal production, aquaculture can cause environmental degradation, although the extent and type of environmental impacts varies considerably with the type of fish raised and the production system used. The most environmentally controversial type of aquaculture in the United States is salmon farming in coastal netpens. Not only are salmon farms placed directly in public waters, but the porous nature of netpens means that salmon wastes are discharged directly into coastal waters, and as I discuss below, that cultivated salmon frequently escape farms. In contrast, cultivation of filter-feeding mollusks, which clean water by removing particles, is far less controversial.

In my testimony today I would like to highlight five issues and recommendations related to federal oversight of and programs for aquaculture, including one issue that is especially pressing here in New England.

### **Aquaculture effluent:**

Wastewater discharges from fish farms can contain large amounts of fish feces and uneaten feed. For example, by one estimate a salmon farm of 200,000 fish releases an amount of nitrogen, phosphorous, and fecal matter roughly equivalent to the nutrient waste in untreated sewage from 20,000, 25,000, and 60,000 people respectively. In addition, discharges can include chemicals such as antibiotics and "biological pollutants" such as bacteria, parasites and escaped fish.

Under the Clean Water Act, the Environmental Protection Agency (EPA) must develop industry-by-industry "effluent guidelines" -- essentially national minimum standards for wastewater discharge permits. EPA has never developed effluent guidelines for aquaculture, although under the terms of a consent decree the agency must now promulgate guidelines for aquaculture by June 2004. It is critical that these guidelines address the range of potential environmental impacts from aquaculture discharges by encompassing biological pollutants as well as the nutrients and other chemical pollutants more traditionally considered by EPA.

*Recommendation:* EPA should promulgate effluent guidelines for aquaculture. Depending on the aquaculture system, these guidelines should include limits on nutrients, total suspended solids, human and non-human pathogens, pesticides, antibiotics, and biological impairments due to the introduction of non-native organisms. Along with regulating effluents, federal agencies could provide incentives, such as loans and cost-share programs, for aquaculturists to adopt pollution prevention measures.

### **Offshore aquaculture:**

The National Oceanic and Atmospheric Administration (NOAA) is promoting offshore aquaculture -- aquaculture in the exclusive economic zone (EEZ) -- as a means to expand aquaculture in areas where there are fewer user conflicts than closer to shore. However, to be commercially profitable, offshore aquaculture facilities will need to offset the substantial costs of establishing and maintaining offshore facilities by raising valuable

fish on a large scale. Huge offshore finfish farms might well suffer similar environmental problems to those that now dog nearshore salmon farms.

The federal framework to protect the environment from potential impacts of offshore aquaculture might be termed an unfinished patchwork, with holes and mismatches. The resulting uncertainties has meant an ad hoc and often unsatisfactory application of federal laws to the few offshore aquaculture projects that have proceeded to the point where developers sought approvals. The Army Corps of Engineers (ACOE) has taken the lead in regulating offshore facilities, issuing permits under the Rivers and Harbors Act of 1899 and the Outer Continental Shelf Lands Act. The ACOE does not, however, have a clear legal mandate under either of these statutes to protect the environment and lacks expertise to weigh the full ecological impacts of offshore aquaculture facilities.

*Recommendation:* Through a combination of regulatory and legislative changes, offshore aquaculture facilities should be required to receive both discharge permits from EPA under the Clean Water Act and an approval from the National Marine Fisheries Service (NMFS) based on a standard of "no significant adverse effect on marine resources."

If a new agency for oceans governance was created, as is sometimes proposed in oceans policy circles, it could assume lead responsibility for oversight of offshore aquaculture.

### **Transgenic fish:**

A number of researchers have now created transgenic fish -- fish that have been altered via genetic engineering techniques to have added genetic material. Fish are genetically engineered with the intention of introducing or amplifying an economically valuable trait, and one US company is now trying to commercialize salmon genetically engineered for faster growth. The escape of these or other transgenic fish from fish farms could harm wild fish populations through interbreeding, if introduced genes spread through wild fish populations and ultimately weakened them. Escaped transgenic fish could also harm wild fish through increased competition or predation.

The Food and Drug Administration (FDA) has decided to regulate transgenic fish and other animals as animal drugs. However, while FDA is the appropriate agency to regulate the safety of these fish as food, it lacks an environmental mandate and expertise necessary to protect against the potential ecological effects of transgenic fish. Moreover, under drug law FDA must keep all information about a pending drug application, including even its existence, confidential. The only exception is for information publicly disclosed by the manufacturer. Thus the public cannot generally participate in FDA decision-making about transgenic fish, for example by providing comments.

*Recommendation:* Congress should amend federal law so that the approval of transgenic fish for commercial sale requires evidence of ecological as well as food safety, and the approval process is transparent and open to public participation.

### **Aquaculture research -- reducing aquaculture's dependence on wild fisheries:**

With the exception of salmon farming, US aquaculture is dominated by small and mid-sized companies with a limited capacity to support research and development activities. Government funded research thus plays a large role in the development of new technologies and management practices for US aquaculture.

Targeted research could help to reduce a number of aquaculture's environmental impacts. A prime example is the use of fishmeal and fish oil as key components of feed for many farmed finfish and crustaceans. Since most fishmeal and fish oil are made from wild caught fish, farming some types of fish can require several times the amount of wild fish as inputs as is ultimately obtained in farmed fish outputs. These aquaculture systems actually deplete rather than supplement wild fisheries, and there are strong ecological and economic rationales for lessening aquaculture's dependence on wild fish for feed.

*Recommendation:* Appropriations to NOAA and other federal agencies for aquaculture research should target key environmental goals. One goal should be to reduce aquaculture's dependence on fisheries inputs by reducing the fishmeal and fish oil content of feed and by emphasizing the farming of fish that feed at low trophic levels (i.e. that are not highly carnivorous).

### **Protecting endangered wild salmon:**

Wild salmon runs are listed as endangered on both the east and west coasts of the United States, including the remaining runs of Atlantic salmon in Maine. The escape of Atlantic salmon from Maine salmon farms has been identified by NMFS and the US Fish and Wildlife Service (USFWS) as one of the major impediments to restoration of wild Atlantic salmon, largely because of the potential genetic harm to the few remaining wild salmon from interbreeding between escaped farmed and wild fish. The result has been conflict between salmon farming and conservation interests, since Atlantic salmon is the primary species of salmon farmed and Maine is the largest center of salmon farming in the United States,

NMFS and USFWS have proposed a number of reasonable measures, such as better containment of farmed salmon and disease control measures for farmed salmon, in order to minimize the impact of salmon farms on endangered wild salmon. However, such technologies and practices have not yet been broadly adopted by salmon farmers, and salmon farming continues to jeopardize wild Atlantic salmon.

*Recommendation:* Federal officials should support NMFS and USFWS decisions and activities to protect remaining wild salmon runs, including measures that require alteration of salmon farming practices.

### **Conclusion:**

Aquaculture is the only means to significantly add to seafood supplies, and the industry should and will undoubtedly continue to grow. The challenge is for aquaculture to grow

in a manner that truly augments fisheries and does not harm marine ecosystems. There are a number of steps that the federal government can take to answer this challenge, some of which I have presented today. There are also steps, which I have not discussed today, that should be taken by other levels of government and by the private sector.

Thank you.