

Written Testimony of George H. Leonard, Ph. D.
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INTRODUCTION

Thank you Chairwoman Bordallo, Ranking Member Brown and other members of the Subcommittee on Insular Affairs, Oceans and Wildlife for convening this hearing at such an important juncture, and for inviting me to testify. My name is George Leonard and I direct Ocean Conservancy's Aquaculture Program. I have a Ph. D. in marine ecology and evolutionary biology. For a decade I have worked to protect the long-term health of our oceans by identifying a viable, environmentally responsible seafood supply that is critical to America's environmental and economic strength.

A healthy ocean and a healthy seafood industry are critical to America's environmental and economic strength. Based on my assessment of the scientific literature and recent policy developments, it is my conclusion that the development of an unregulated offshore aquaculture industry in U.S. federal waters presents an imminent threat to ocean and seafood health that Congress cannot ignore. I strongly believe this committee must be responsive to recent developments and work to establish a comprehensive federal permitting and regulatory system for offshore aquaculture before an unregulated industry takes hold. Such a system must create a precautionary framework to ensure that any open-ocean aquaculture in the U.S. avoids the adverse impacts on marine ecosystems, human health and coastal communities that have accompanied the industry's development elsewhere.

OFFSHORE AQUACULTURE: DEMAND AND RISK

Securing a safe and sustainable food supply for an increasingly hungry planet is one of the world's biggest challenges. Fish provides an important source of protein. But, as the globe's appetite for seafood has grown, traditional wild-capture fisheries have been unable to keep up. Overall, 80 percent of the world fish stocks for which assessment data are available are reported as fully exploited or overexploited and are thus unable to withstand additional fishing pressure. Driven in part by the decline of wild fish, aquaculture is expanding rapidly worldwide. It now provides nearly half of the world's supply of seafood. It is the fastest growing sector of the food economy. Nearly 400 species are farmed around the world.¹

Much of the world's farmed fish are herbivores, often raised in closed containment systems, posing limited environmental risks. However, a smaller but rapidly growing sector includes

species high in the food chain, grown in large net pens in ocean waters. These farms pose much larger threats to the ocean – in part because net pens are open systems through which water flows freely, directly affecting the surrounding ecosystem.² At present the United States is a relatively small contributor to global aquaculture production. However, some in industry and government are seeking to foster the growth of domestic open-ocean aquaculture; and recent developments in California and the Gulf of Mexico have pushed that goal far closer to reality.

To date, advocates for domestic open-ocean aquaculture have paid insufficient attention to the significant risks that would accompany the growth of such an industry. A large body of peer-reviewed scientific literature has identified a host of environmental risks and impacts that accompany the farming of fish in open net pen systems. International experience also presents us with a cautionary tale that we ignore at our peril. While much of our understanding to date comes from salmon farming, data from other farmed species suggest these risks are universal and likely to apply to cod, halibut, sablefish, tuna and other species that could be raised in U.S. waters. However, if we proceed with caution, placing a high priority on the protection of wild fish and ecosystems, and let science-based principles guide us, open-ocean aquaculture may be able to play a role in responsible U.S. seafood production. But if done without proper protections in place, open-ocean aquaculture is likely to have serious adverse consequences for human health, ocean ecosystems and coastal communities.

I would welcome the opportunity to share with the committee a detailed scientific assessment of these risks. A large body of peer reviewed scientific research has been published on many of the impacts of aquaculture, including the severe environmental and socioeconomic consequences that have stemmed from developing an industry without proper precautions in place. Below, I summarize the ecological and socioeconomic impacts of primary concern:

1. **Escapes:** Aquaculture is known to be a major vector for exotic species introduction, causing concern over the ecological impacts that escaped species can have on wild species.³ Whether they are native or exotic, escaped farmed fish can negatively impact the environment and wild populations of fish.⁴ For example, it is well known that farmed salmon regularly escape from net pens, negatively impacting wild salmon through competition and interbreeding.⁵
2. **Diseases and Parasites:** It is well documented that intensive fish culture, particularly of non-native species, has been involved in the introduction and/or amplification of pathogens and disease in wild fish populations.⁶ The most striking example concerns the dramatic consequences of the spread of parasitic sea lice from salmon farms to wild salmon⁷ but disease outbreaks in other fish grown in open net pens around the world appear to be common as well.⁸
3. **Nutrient and Habitat Impacts:** By design, wastes from open net pen systems are released untreated directly into nearby bodies of water, and this can have negative impacts on the surrounding environment.⁹ Dissolved nutrients (from excess feed as well as fish excretion) flow freely beyond the farm site while particulate matter often settles directly to the bottom where it can substantially alter both the chemistry and biodiversity of the farm's benthic habitats.¹⁰ New and emerging science suggests the adage "dilution

is the solution to pollution” in open ocean-environments is an oversimplification and not justified by science.¹¹

4. ***Impacts on Predator Populations:*** The presence of large numbers of captive fish held in high density naturally attracts predators such as birds, sharks and marine mammals. Techniques to keep some of these predators at bay often impact their natural behavior and pose entanglement and drowning risks.¹² Some predators that have become habituated to the presence of net pens, and hence a threat to human safety, have been killed by fish farmers.¹³
5. ***Impacts of Drugs and Chemicals:*** Aquaculture often uses a variety of chemicals including antibiotics, pesticides, fungicides, and antifoulants.¹⁴ In some aquaculture systems, use of antibiotics has resulted in bacterial resistance in the environment¹⁵ and influenced antibiotic resistance in humans.¹⁶ Probable human carcinogens in fish feed (most notably PCBs, dioxins, and other organohalogens) have been shown to result in potentially unsafe concentrations in high trophic-level farmed fish¹⁷. Dietary guidelines recommend limited human consumption to avoid deleterious health effects¹⁸.
6. ***Increased Fishing Pressure on Wild Fish Stocks:*** Feed for many of the “carnivorous” species likely to be farmed in open-ocean environments contains very high percentages of fishmeal and fish oil derived from wild-caught forage fish.¹⁹ As a result, these species consume two to five times as much wild fish as they produce in farmed product.²⁰ As global aquaculture has grown dramatically over the past two decades, the total demand for fishmeal and fish oil for use in aquaculture feeds has expanded. If the farming of carnivorous fish continues to grow at its current rate, the demand for fish oil will outstrip world supply within a decade, while a similar result is expected for fish meal by 2050.²¹ This will likely impose additional pressure on wild forage fish stocks with the potential to undermine marine food webs by removing key prey species on which economically and environmentally important wild species depend. Separating fish farming from its reliance on wild fish must occur if aquaculture is to be considered a sustainable means to increase seafood supply.
7. ***Socioeconomic Impact on Fishermen and Fishing-Dependent Communities***
Beyond the environmental risks and human health issues, it is well known that farmed fish compete with wild fish in the marketplace. The increase in farmed salmon in the late 1990’s drove down the price of wild salmon to levels that made it difficult for fishermen to stay in business.²² While price declines may be good for consumers, they can have a range of direct and indirect negative environmental and economic impacts, including industry consolidation, overproduction and elevated fishing pressure on wild fish stocks to compensate for reduced profit margins.

A NATIONAL FRAMEWORK

Despite these real and scientifically-documented risks, the United States appears to be on the verge of an expansion of this new industry into its federal waters – before Congress has a chance to act, and without a national framework in place.

In the Gulf of Mexico, the previous administration contorted the Magnuson-Stevens Fishery Conservation and Management Act (MSA) to justify the development of a legally-dubious (and oxymoronic) “Aquaculture Fishery Management Plan” (FMP) through the Gulf Fishery Management Council. This plan would dramatically expand open-ocean aquaculture in the federal waters of the Gulf of Mexico. Last week, the Secretary of Commerce refused to take definitive action on the FMP, giving tacit approval to the plan. But Congress designed the MSA to regulate the capture of wild fish, not to create and regulate fish farming. The MSA includes neither the key safeguards nor regulatory tools and approaches necessary to ensure that aquaculture is developed and managed to be ecologically sustainable. Furthermore, this piecemeal approach entirely bypasses the high-level consideration of serious policy questions relating to open-ocean aquaculture that is needed before the Nation decides how to proceed.

Meanwhile in California, Hubbs-SeaWorld Research Institute has announced plans to build the first-ever fish farm in federal waters, located west of San Diego. This facility, slated to occupy a space equivalent to 300 football fields, is going through an ad hoc regulatory approval process that includes a patchwork of permits from the Army Corps of Engineers, the Environmental Protection Agency and other federal and state agencies. Because of the disjointed, overlapping and confusing federal regulatory landscape, no single agency would be responsible for the entire environmental and socioeconomic performance of this project.

Plans are also afoot in Hawaii state waters, which, if approved, could pave the way for additional development in offshore waters. Hawaii Ocean Technology is presently seeking permits to develop a massive deep-water fish farm that would hover just below the ocean surface in nearly 3000 feet of water. Unlike existing technology, the farm would not be attached to the bottom but instead hover in the water column. Should it prove technologically feasible, this would open the door for fish farms to move farther into the federal EEZ.

In all of these cases, what is missing is a national framework that codifies consistent, national expectations for this nascent industry. Most importantly, there is no mechanism for monitoring and addressing the cumulative impacts of the industry, which could be far greater than the sum of any individual facilities’ impacts. Until today, Congress has not significantly considered the consequences of these industry developments, and no bill has yet been introduced in the 111th Congress that would seek to regulate the industry before it takes hold.

What is clear is that legislation is urgently needed *in advance of* industry development. If decisive action is not taken by Congress soon, open-ocean aquaculture will likely emerge in federal waters in a piecemeal fashion, without Congress establishing a legislative framework and without the most basic standardized protections in place.

PROVISIONS OF FEDERAL LEGISLATION

A key starting point for development of a strong, precautionary bill should be the recommendations of the high-level commissions and advisory bodies that have already examined this issue. Most notable of these are the Pew Oceans Commission (2003),²³ the U.S. Commission on Ocean Policy (2004),²⁴ and the Marine Aquaculture Task Force (2007).²⁵ Provisions should also draw heavily on California’s Sustainable Oceans Act (SB 201), currently

the most comprehensive law in the U.S. on marine aquaculture.²⁶ SB 201 contains many of the environmental, socioeconomic and liability provisions necessary to protect marine ecosystems yet allow a responsible industry to develop. It is a good model upon which to build an environmentally sound and socially responsible national framework.

GOVERNANCE AND AUTHORITY

To ensure aquaculture development in offshore waters is ecologically sustainable, federal legislation, the National Oceanic and Atmospheric Administration, and the U.S. aquaculture industry must all adopt a precautionary approach, combined with adaptive management, as their guiding principles. Federal legislation should assign NOAA the lead role and responsibility in the environmental evaluation, planning, siting, permitting and regulation of aquaculture in federal waters. As the primary regulatory agency, NOAA should be authorized to require removal of fish stocks, closure of facilities, revocation of permits, imposition of penalties, and other appropriate remedial measures. This power should be exercised where a permittee is not in compliance with national standards; where the permittee's activities have damaged, are damaging or are likely to damage the marine environment in the foreseeable future; or where the permittee is not in compliance with permit requirements. NOAA should be empowered to take immediate remedial action to avoid or eliminate damage—or the threat of damage—to the marine environment.

NATIONAL STANDARDS

Federal legislation must set legally-binding national standards that prioritizes the protection of wild fish, associated habitats and functional marine ecosystems. They must ensure that offshore aquaculture poses negligible risks to fisheries, marine wildlife, and the ecosystems on which they depend; protects the long-term public interest in healthy marine ecosystems (including conserving genetic diversity and the integrity of aquatic ecosystems); incorporates appropriate public input; and develops in an orderly manner.

National standards should include specific management objectives, including measurable performance standards and identification of how impacts are to be assessed, monitored and addressed. For maximum effectiveness, standards should be structured to reward facilities for performance beyond minimum requirements, and must include significant penalties for facilities that fall short.

Broodstock Management and Fish Escapes

Federal legislation should mandate that offshore aquaculture be limited to native species of the genotype native to the geographic region of the fish farm. Hatchery-raised fish, derived from native species, must be cultured in a manner that ensures that any fish escapes will not harm the genetics of local wild fish. To do so, stocked fish should be no more than two generations removed from the relevant wild stock, and have been exposed to no intentional selective breeding. Species of special concern or those of protected status under the Endangered Species Act should not be cultured. Furthermore, "ranching", a farming practice where wild juvenile fish are caught and fattened before being sent to market, should be banned.

All facilities and operations must be designed, operated, and shown to be effective at preventing the escape of farmed fish into the marine environment and withstanding severe weather

conditions and marine accidents. All farmed fish should be marked, tagged, or otherwise identified as belonging to the permittee. To the extent systems fail and escapes occur, facility operators must document such escapes and the circumstances surrounding them, report them immediately to NOAA and maintain publicly available records of such events.

Disease and Pathogen Prevention

Legislation should require NOAA, as the lead federal agency, to develop and implement risk-averse management regulations to prevent ecosystem impacts from disease and pathogen amplification and retransmission. Individual permitting decisions must be informed by an analysis of reported industry-wide, on-farm disease and pathogen data as well as a scientific understanding of disease and pathogen distribution in the wild.

Legislation should mandate that offshore aquaculture facilities be designed, located and operated to minimize the incubation and spread of disease and pathogens without relying on the use of antibiotics, pesticides or other harmful chemicals. However, should chemical treatments be required and multiple treatment options exist, legislation should require that the one with the least environmental impact be used, and that such use be reported and records maintained that are publicly available. In all circumstances, the use of all drugs and chemicals—and amounts used and applied—must be minimized.

Habitat and Ecosystem Impacts

Legislation should require aquaculture facilities to minimize nutrient discharge and ensure that resulting discharge does not negatively impact the local and regional environment. The use of Integrated Multi-Trophic Aquaculture (IMTA) – where finfish, seaweeds and filter feeders or deposit feeders are grown in close proximity to limit the impact of nutrient inputs – should be given a preference over facilities that grow only a single species of fish. Incentives should also be developed to encourage use of other technologies, such as closed-containment farming systems, that fully prevent nutrient discharge.

Legislation should also require that the EPA, in consultation with NOAA, establish numeric effluent limitations for aquaculture facilities operating in federal waters. Those limitations should meet water quality standards, and discharge permits should explicitly address cumulative and secondary impacts at the local and regional level.

Interactions With and Impacts on Marine Wildlife

Legislation should require permittees to develop, and implement a comprehensive, integrated predator management plan that employs non-lethal deterrents. As part of this plan, performance metrics, best available technologies and site selection should be required to avoid entanglement, disruption of migration, and predator attraction or repulsion so as not to affect wildlife or their use of marine habitats. Underwater acoustic deterrent devices should not be permitted. Furthermore, fish farmers must not be allowed to intentionally kill predators of farmed fish unless human safety is under immediate threat.

Use of Wild-Caught Forage Fish for Feed

Wild caught fish ingredients should be used only if they are sourced from populations whose biomass is at or above that which yields optimal yield and from fisheries that are managed using

explicit ecosystem-based management measures that take into account the need for a sufficient prey base within marine ocean food webs. Legislation should require that the use of fish meal and fish oil derived from fisheries not primarily intended for direct human consumption be minimized, and that alternatives to fish meal and fish oil (or fish meal and fish oil made from seafood harvesting byproducts) be used.

REGIONAL ENVIRONMENTAL ANALYSIS

In keeping with a precautionary approach, federal legislation should require regional Programmatic Environmental Impact Statements (PEIS) before committing to any individual project. These analyses should review existing scientific information, anticipate environmental impacts, and provide a region-specific framework for managing marine aquaculture in an environmentally sustainable manner.

Each PEIS should evaluate whether appropriate areas in the relevant region exist for aquaculture development and, if so, siting of marine finfish aquaculture operations appropriately within those areas to avoid adverse impacts on marine ecosystems and ocean user groups. Effects on marine ecosystems, sensitive ocean and coastal habitats, other plant and animal species, and human health should all be considered. Most importantly, the PEIS should evaluate the potential cumulative impacts of multiple facilities in the region, so that a regulatory regime can be developed in advance to avoid the cumulative impacts that only become evident with industry expansion.

RESEARCH AND DEVELOPMENT PROGRAM FOR OFFSHORE AQUACULTURE

Legislation should mandate that a comprehensive, ecologically-based research and development program be designed and supported by NOAA. The program should collect information necessary to ensure permitting and regulation of commercial operations are done in a precautionary manner, and ensure ecological sustainability and compatibility with healthy, functional ecosystems.

The research program should evaluate environmental conditions and operational practices that prevent overexploitation of forage fish and other harm to the structure and function of marine food webs; prevent the escape of farmed fish and resulting negative impacts on wild fish; prevent the incubation and spread of disease and parasites from farmed fish to wild fish without the use of drugs and chemicals; prevent nutrient discharge from impacting marine ecosystems; prevent negative impacts on predators and other wildlife; prevent cumulative environmental impacts of multiple offshore aquaculture facilities; and prevent negative impacts on fishermen and fishing-dependent communities.

The information obtained from this research program, along with the findings of the PEIS, should be regularly reviewed and incorporated into permitting and rulemaking decisions on an ongoing basis.

SITE AND OPERATING PERMITS FOR OFFSHORE AQUACULTURE

Legislation should direct NOAA to establish a full, meaningful, balanced and open process for siting and permitting decisions that provides ample opportunity for state, local and public stakeholder input. It should also mandate that decisions about siting and permitting give priority to the protection of the health of the marine environment in the face of uncertainty about effects on public resources. No permit should be issued if NOAA determines that doing so is contrary to the public interest.

Legislation should also require separate site and operating permits. To provide the long-term access to ocean space needed for capital investment, while simultaneously requiring more frequent review of environmental performance, the length of the site permit should be longer than the length of the operating permit. The initial term for site permits should not exceed 10 years while the initial term for operating permits should not exceed five years.

There should also be a legislative mandate that permits not interfere with existing fishing (including access to fish stocks and fishing grounds) or other uses or public trust values; disrupt wildlife and marine habitats; or alter marine ecosystems. Congress should require that permits not contribute to adverse cumulative environmental or socioeconomic impacts.

Legislation should require NOAA, in consultation with relevant state and federal agencies, to develop criteria for site permits, including: prohibition in sensitive habitats; proximity to other farms; proximity to other ocean users; site size; preliminary habitat and community assessment data; water conditions (e.g., depth, currents, and substrate type), and distribution of other species. Furthermore, it should mandate that the selection of sites be driven by the findings of the regional environmental analysis, and that the applicant demonstrate the site location is optimal to avoid adverse effects on ocean resources and users.

FEES, RESOURCE RENTS, FINANCIAL ASSURANCES AND LIABILITY

Fees for marine finfish aquaculture permits should, at a minimum, be sufficient to pay for the costs of administering the marine finfish permitting program, and for monitoring and enforcing the terms of the permits. In addition, a reasonable portion of the resource rent generated from marine aquaculture projects that use ocean resources held in public trust should be collected from aquaculture operators. Legislation should establish a fee structure to achieve this goal.

Legislation should also require that all structures be removed from the site at the permittee's expense upon termination of operations, and that the area be restored to its original condition, if necessary. NOAA should be required to obtain financial assurances from each permittee to ensure that structures are removed and any necessary restoration is performed.

Legislation should make operators of aquaculture facilities in federal waters liable for environmental damage, including damage from escaped fish, as well as costs for natural resource damage assessment caused by their operations. A citizen suit provision should be included as an additional means to enforce violations should federal agencies fail to do so.

ROLE OF REGIONAL FISHERY MANAGEMENT BODIES

Legislation should require NOAA and other federal agencies to consult with the regional fishery management councils, interstate fishery commissions, and First Nations on all matters related to open-ocean aquaculture. No commercial aquaculture facility should be permitted without approval from the fishery management body with jurisdiction in the area in which the aquaculture facility would be located. Where more than one fishery management body has authority, both bodies should be required to work together to resolve how to proceed with open ocean aquaculture. Aquaculture development should not interfere with access to traditional fishing grounds or access to recreational or commercial fish stocks.

FEDERAL AND STATE CONSISTENCY

Legislation must give states and territories the authority to “opt out” of aquaculture development in federal waters adjacent to their state waters. If one state decides to “opt out” but a neighboring state does not, states should be required to work together to resolve how to proceed. There should be a requirement that any resulting permits be consistent with authorized Coastal Zone Management Plans. Finally, permitting of offshore aquaculture facilities should be integrated with any federal marine spatial planning efforts.

CONCLUSION

Now is the time for strong leadership from Congress on the future of open-ocean aquaculture in the United States. If Congress fails to act, an unregulated industry is likely to develop, and the environmental consequences could be severe. But with bold action, this committee can play a central role in crafting the legislative framework that will ensure strong protection of U.S. federal waters, and an environmentally and economically responsible industry.

Congress has a unique opportunity – and a public responsibility - to craft a national vision that will foster “a race to the top,” precisely at a time when past missteps by other countries have created a “race to the bottom” that they have come to regret. This is no more evident than in Chile, a country that until recently was the world’s largest producer of farmed salmon.²⁷ Without a sufficiently precautionary national plan, Chile increased its production of farmed Atlantic salmon by 2,200% from 1991 to 2006. But by 2007, with too many farms located too close together, disease began to spread rapidly through the industry. Just two years later, there has been over a 50% decline in salmon production and revenue for the industry and over 7,500 direct jobs have been lost. Only after the salmon industry was decimated by the spread of this disease did Chilean authorities take the first steps toward developing a national framework to manage farms via “neighborhoods” to break the disease cycle by limiting both farm-level and regional fish production.²⁸ If they had approached the development of the salmon farming industry more cautiously *from the beginning* they may have averted this calamity.

Here in the United States, Congress must articulate a precautionary national framework now, *before* industry development, to ensure protection of the ocean, ocean users - and fish farming businesses - from the ravages that Chile has experienced.

Doing anything less is a gamble with our oceans that we simply should not take.

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- ²⁸ Patagonia Times. 2009. No end in sight for the salmon industry's ongoing slide (July 14). Retrieved July 15, 2009 from: <http://royalfoodimport.blogspot.com/2009/07/chilean-salmon-industry-update.html>