S. HRG. 109–1118

OFFSHORE AQUACULTURE: CHALLENGES OF FISH FARMING IN FEDERAL WATERS

HEARING

BEFORE THE

SUBCOMMITTEE ON NATIONAL OCEAN POLICY STUDY

OF THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

JUNE 8, 2006

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OFFSHORE AQUACULTURE: CHALLENGES OF FISH FARMING IN FEDERAL WATERS

THURSDAY, JUNE 8, 2006

U.S. SENATE,
SUBCOMMITTEE ON NATIONAL OCEAN POLICY STUDY,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Subcommittee met, pursuant to notice, at 10 a.m. in room SD–562, Dirksen Senate Office Building, Hon. John E. Sununu, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF HON. JOHN E. SUNUNU, U.S. SENATOR FROM NEW HAMPSHIRE

Senator SUNUNU. Good morning. We're going to begin on time this morning. For those members that may be joining us later in this hearing, we do have a vote scheduled for 10:45 or 11, so I am going to move forward with a very brief opening statement but then move directly to the witness testimony so we have much time as possible for your statements and for questions as well.

This is the second hearing of the National Ocean Policy Study dealing with offshore aquaculture. I'll note that today is the 13th Annual World Oceans' Day which was marked by events all across the world. In April we heard from our panel of experts on the potential and the challenges of allowing deepwater fish farming operations in Federal waters.

Today we will focus on the regulatory steps that are necessary to ensure that such operations take place in an environmentally sustainable matter. International fish farming accounts for a very significant and growing portion of the seafood that Americans consume every day. These fish and shellfish are raised and harvested overseas far from the reach of American environmental standards, but we do not have a functional method here in this country for American companies to meet the growing demand in our own Federal waters.

The early results from deepwater aquaculture around the country have been excellent. Small scale and research operations off the coasts of New Hampshire, Hawaii and Puerto Rico are raising high-quality products with little if any detectable impact on water quality, wild fish stocks or human health. This Subcommittee is exploring the best approach to expanding these operations in the future and we ask today's witnesses to help us identify the standards required to ensure that water quality, wild fish stocks and human health remain protected.

I will ask that the all of the witnesses submitted testimony and any supplemental materials be made part of the record and that the record will remain open for 2 weeks for additional questions that members might want submit. I also ask consent to place in the record a statement from Professor Thomas McIlwain who is Director Emeritus of the University of Southern Mississippi Gulf Coast Research Laboratory.

[The information referred to follows:]

PREPARED STATEMENT OF THOMAS D. MCILWAIN, DIRECTOR EMERITUS, UNIVERSITY OF SOUTHERN MISSISSIPPI, GULF COAST RESEARCH LABORATORY

First I would like to thank you for introducing "The National Offshore Aquaculture Act of 2005" and for this and the previous hearing held in April on this most important legislation. It is important legislation that will, when enacted, contribute to a stable and sustainable domestic food supply. It is also important that all of the issues involved in developing this new industry be fully discussed. Seafood and the seafood industry are integral to the culture and economy of the Northern Gulf of Mexico region (NGOM). Here as in other places, fish stocks are under pressure and aquaculture is perhaps one more approach to both meet the growing demand for fish and fish products and to rebuild the seafood industry in the post-Katrina era.

Global production of wild-caught seafood is generally considered to be at maximum capacity and unsustainable over the long term. As demand for seafood continues to increase over the years, aquaculture production has become the fastest growing sector of worldwide food production. This increased production worldwide has lead in part to a U.S. trade deficit in fishery products of over $7 billion. Worldwide, cage or net pen culture including offshore, open ocean cage culture has contributed a significant and growing portion of production. In the United States, however, the growth has elicited concerns and anxieties that include competition for space and resources with industrial and recreational user groups, the use of non-indigenous species, impacts on genetic diversity of wild stocks, disease, and environmental issues such as exposure to human-induced pollution and the impact of waste feed, chemicals, and excretory effluent. This legislation will address these concerns and speed the development of the industry, especially the permitting process. It is imperative that we develop information to address these concerns as well as to designate one agency as the lead agency responsible for the development of this new industry. The legislation will allow the building of a foundation for sustainable economic development of aquaculture that will contribute to the redevelopment of the seafood industry along the NGOM following Hurricane Katrina and contribute to the development of a more stable domestic food supply for the U.S. and contribute to a reduction in our fishery trade deficit.

At this time, I am going to introduce each of the panelists and let me just check the order. We will take the statements in the order that I introduce you.

Let me go through all of the introductions and I do appreciate the time you have all taken to be here.

Tim Keeney is the Deputy Assistant Secretary of Commerce for Oceans and Atmosphere. Mr. Keeney is responsible for environmental policies, strategic planning and program analysis for a number of ocean issues ranging from invasive species to ocean observations, and I welcome him here once again.

Tim Eichenberg is the Director of the Ocean Conservancy's Pacific Regional Office in San Francisco. He also teaches ocean and coastal law at Vermont Law School.

Dr. Randy MacMillan is President of the National Aquaculture Association. That's the largest national trade association representing a very diverse group of aquatic animal species producers. He also serves as a member of the National Agricultural Research Extension's Education and Economics Advisory Board.

Marianne Cufone. Did I pronounce that right? Marianne Cufone is the Managing Partner of Environment Matters, an environmental consulting firm based in Tampa and David Bedford is Deputy Commissioner of Fisheries for the Alaska Department of Fish and Game. That's a lot of fish and a lot of game. He brings to this hearing great experience in government but also as an owner and operator of a commercial fishing vessel and is past director of the Southeast Alaska Seiners Association.

Welcome of all of you and we will begin with the testimony of Mr. Keeney.

STATEMENT OF TIMOTHY R.E. KEENEY, DEPUTY ASSISTANT SECRETARY FOR OCEANS AND ATMOSPHERE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Mr. KEENEY. Good morning and thank you for inviting me to testify on behalf of the Administration on S. 1195, the National Offshore Aquaculture Act of 2005. My name is Tim Keeney. I'm Deputy Assistant Secretary of Commerce for Oceans and Atmosphere at the National Oceanic and Atmospheric Administration within the Department of Commerce.

My testimony today will address the opportunities and challenges by offshore aquaculture and the Federal Government's role in setting the stage for more robust commercial production of cultured seafood. We believe the development of the domestic marine aquaculture industry in the United States is essential to meet the growing demand for seafood.

Right now, the U.S. imports over 70 percent of our seafood and half of those imports are products of aquaculture. This bill presents a rare opportunity for the United States to become more self-sufficient in the production of health seafood by growing more of it here at home. This bill also lays the foundation for creating more jobs in coastal communities, and for reducing our nearly eight billion dollar seafood trade deficit. In terms of where aquaculture fits with commercial fishing, we believe the U.S. must develop aquaculture as a complement to commercial fishing because both are needed to produce seafood to meet growing demand.

Now is the time for us to be bold and decisive, to look into the future, to develop offshore aquaculture.

On April 6th, Dr. Bill Hogarth, NOAA's Fisheries Administrator, emphasized that NOAA considers S. 1195 to be a starting point. I want to underscore that point again today. The Administration believes that S. 1195 maps out a careful and inclusive process to establish a regulatory structure for offshore aquaculture.

Our goal is to work with you and our stakeholders to create an opportunity for aquaculture in Federal waters so we can ensure that the industry develops in a predictable and environmentally compatible and sustainable manner in conjunction with our wild harvest. We also want to ensure that our other top priorities, including the protection of the marine environment, the rights of other users of the marine resources, and human health and safety. However, we also acknowledge that there are concerns about the bill and we would like to work with the Subcommittee to address those concerns.

We want to assist in developing clarifying language regarding environmental requirements, including the need to provide for public comment and to consider risks and impacts including cumulative impacts.

I'd also like to stress that the U.S. is prepared to take this step forward toward offshore aquaculture. The socio-economic issues and environmental impacts associated with marine aquaculture are not new. NOAA and the Federal agencies have been working to address this for over 30 years by funding cutting-edge research and technology development. In addition to this work, NOAA has been preparing specifically for offshore aquaculture for the past 10 years.

Thirty years of improvements to marine finfish and shellfish aquaculture practices in the United States and abroad have shown that many problems can be prevented by continuous technological innovation, best management practices, careful species selection, aquaculture animal health programs, proper site selection and development of alternatives to fish meal and fish oils in feed.

I would like to give a brief overview of these environmental safeguards. First best management practices have been developed and refined over the years to ensure that aquaculture operations minimize risk and operate safely and securely. Some standard management practices used today to reduce risk associated with aquaculture include regular inspection by divers to ensure the integrity of nets and net infrastructure; cameras and surveillance to monitor efficient use of feed; regular health inspections to prevent disease and comprehensive sanitary and bio-security programs to prevent the introduction and/or spread of pests and diseases.

Another key environmental safeguard is species selection which is one of the most effective techniques available to reduce the impact of escapes. NOAA and other agencies have over 30 years of experience in stock enhancement research and programs to support commercial and recreational fishing.

Another key safeguard for protecting wild stocks is aquatic animal health. Good aquatic animal health practices and programs are well established in the U.S. More important, these practices further reduce the possibility of negative health impacts on wild resources from cultured aquatic animals.

Another important issue that NOAA continues to advocate is careful site selection as a key factor in minimizing environmental risk and maximizing the environmental benefits of aquaculture—no matter what organism is being cultured. That means that operators and NOAA will seek to provide the maximum benefit with the smallest ecological footprint.

Another area of aquaculture where advancements are being made is the development of alternatives to fishmeal and fish oil for feed. It is a fact that overall the reliance on fishmeal and fish oil for aquaculture has been significantly reduced based on research advances using plant-based alternatives in feed.

NOAA plays a vital role in that research. Groundbreaking research includes using soybeans, barley, rice, peas and other crops as alternatives is expanding in the U.S. and across the globe. Further development of plant-based feeds also represents a huge economic opportunity for American agriculture.

Finally, I would like to address a vexing issue related to both wild and cultured seafood that is the misinformation related to the health and safety of seafood products. Inaccurate information about the safety of our seafood supply hurts all of us. In light of this, NOAA will take every opportunity to address and underscore seafood safety based on the latest, fact-based information from leading scientists, nutritionists and medical and health care professionals. It's clear based on the facts that the health benefits of eating seafood far outweigh the risks due to trace-level contaminant exposure.

In fact, recent studies link seafood consumption to higher intelligence in babies and children, lower heart rates in adults, lower cholesterol, lower blood pressure and lower body weight, and seafood has been scientifically shown to fight cardiovascular disease, cancer, Alzheimer's disease and other major illnesses. So the bottom line here is eat seafood, both wild and cultured. It is good for your mind and good for your heart. This again was confirmed by an FDA advisory to consumers 2 days ago.

So in conclusion, the Department is looking forward to working with you, the public, the fishing and aquaculture industries, and the environmental community to craft a regulatory framework for offshore aquaculture. In the long run, U.S. fish communities will be harmed more by foreign competition than by a robust domestic aquaculture industry. The challenge is to find ways for our domestic fishing industry and coastal communities to benefit from the use of aquaculture technologies to produce additional seafood as fisherman are doing in some parts of the U.S. and other countries. Offshore aquaculture has great potential to make a significant contribution to our seafood supply and our Nation's economy, but this potential will be realized in the U.S. only if we can provide the regulatory certainty for businesses to make sound investment decisions. S. 1195 will give the Department the authority it needs to provide the regulatory certainty. I appreciate the opportunity to testify today in support of advancing the National Offshore Aquaculture Act of 2005.

I would be happy to answer any questions.

[The prepared statement of Mr. Keeney follows:]

PREPARED STATEMENT OF TIMOTHY R.E. KEENEY, DEPUTY ASSISTANT SECRETARY FOR OCEANS AND ATMOSPHERE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

Chairman Sununu and Members of the Subcommittee, good morning and thank you for the invitation to testify on behalf of the Administration on S. 1195, the National Offshore Aquaculture Act of 2005. My name is Tim Keeney, and I am the Deputy Assistant Secretary for Oceans and Atmosphere at the National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce.

My testimony today will address the opportunities and challenges posed by offshore aquaculture and the Federal Government's role in setting the stage for more robust commercial production of cultured seafood. We believe the development of the domestic marine aquaculture industry in the United States is essential to meet the growing demand for seafood.

Right now, the United States imports over 70 percent of our seafood and half of those imports are products of aquaculture. This bill presents a rare opportunity for the United States to become more self-sufficient in the production of healthy seafood by growing more of it here at home. This bill will also lay the foundation for creating more jobs in coastal communities, and for reducing our nearly $8 billion seafood trade deficit. The United States must develop aquaculture as a complement to

commercial fishing because both are needed to produce seafood to meet the growing demand. Now is the time for us to be bold and decisive, to look to the future and to develop offshore aquaculture.

The National Offshore Aquaculture Act is a Starting Point

On April 6th, Dr. Bill Hogarth, the Assistant Administrator for Fisheries at NOAA, testified before this Subcommittee and emphasized that NOAA considers S. 1195 to be a starting point. I want to underscore that point again today. The Administration believes that S. 1195 maps out a careful and inclusive process to establish a regulatory structure for offshore aquaculture. NOAA would like to work with the Committee to address the amendments and concerns about the bill. We want to help clarify language regarding environmental requirements, including the need to provide for public comment and to consider risks and impacts, including cumulative impacts. Our goal is to work with you and our stakeholders to create an opportunity for aquaculture in Federal waters so we can ensure that the industry develops in a predictable, environmentally compatible, and sustainable manner in conjunction with our wild harvest. We also want to ensure other top priorities, including the protection of the marine environment, the rights of other users of marine resources, and human health and safety.

Of the many challenges faced, regulatory uncertainty is widely acknowledged as the major barrier to the development of offshore aquaculture in the United States. S. 1195 will provide regulatory certainty, which is important to the offshore aquaculture industry as well as to those who are concerned about the potential impacts of offshore aquaculture. Business needs regulatory certainty to make sound investment decisions and obtain financing. Those concerned about the impacts of offshore aquaculture need to know the industry will be held to strict environmental standards.

Enactment of S. 1195 would authorize the Department of Commerce to directly regulate aquaculture in Federal waters, and to establish a coordinated permitting process among Federal agencies. We envision a one-stop regulatory shop, coordinated by NOAA, and integrated into NOAA's environmental stewardship responsibilities. Action on S. 1195 will allow us to begin a public rulemaking process to produce a comprehensive, environmentally sound permitting and regulatory program for aquaculture in Federal waters, as we committed to do as part of the *U.S. Ocean Action Plan*.

S. 1195 will:

- Authorize the Secretary of Commerce to issue offshore aquaculture permits and to establish environmental requirements where existing requirements under current law are inadequate;
- Stipulate that aquaculture will not be subject to fishing regulations that restrict size, season, and harvest methods;
- Require the Secretary of Commerce to work with other Federal agencies to develop and implement a coordinated permitting process for aquaculture in Federal waters. This includes the authority to require that development proceeds in an environmentally responsible manner that protects wild stocks and the quality of offshore ecosystems and is compatible with other uses;
- Establish a research and development program in support of offshore aquaculture; and
- Provide for enforcement of the Act, its implementing regulations, and the terms and conditions of any permits issued under the Act.

The bill will not supersede existing laws such as those concerning navigation, offshore structures, management of fisheries, environmental quality, protected resources, and coastal zone management. The implementation of the offshore aquaculture bill will complement NOAA's management and research responsibilities over wild fisheries and resolve some of the challenges the agency has faced trying to manage existing aquaculture under laws, regulations, and fishery management plans written for wild harvest fisheries.

Once a bill is enacted, NOAA envisions that a substantial role for the Regional Fishery Management Councils will evolve as part of the rulemaking process. A well-defined consultation process for the Councils will be integral to the success of the permitting process for aquaculture in Federal waters.

Under S. 1195, NOAA would consult with the Councils in the development of regulations, in the establishment of environmental and other requirements (especially as they relate to interactions with wild stocks managed by the Councils), and in the review of individual permit applications. Councils may also help identify areas of

the U.S. Exclusive Economic Zone (EEZ) where offshore aquaculture would be least likely to interfere with known fishing activities and other managed areas offshore.

Aquaculture is an Important Opportunity for U.S. Coastal Communities

By enacting legislation to allow the development of an offshore aquaculture industry in the United States, we are creating opportunities for coastal communities struggling with issues of overcapitalization and limited harvests in commercial fishing. With a more robust domestic aquaculture industry, boats used for fishing could also service aquaculture operations. Similarly, seafood industry infrastructure could process and distribute both cultured and wild harvest fishery products. Domestic aquaculture could provide a steady, year-round source of product and, in some locations, it could prevent processing facilities from closing down altogether due to insufficient harvest from wild fisheries.

Aquaculture, like agriculture, requires inputs of goods and services from many sources, while its outputs are processed into value-added offerings. Beneficiaries include owners and employees of aquaculture businesses, equipment suppliers, boat owners and operators, feed ingredient suppliers (e.g., soybean farmers and fishermen who supply fishmeal), feed manufacturers, seafood processors, and transportation and distribution companies. Other opportunities include sales, marketing, and accounting services. In turn, these activities benefit the coastal communities in which these businesses operate. And, of course, the public will eat seafood and benefit from its health attributes.

The successes of aquaculture-related businesses to date have demonstrated direct economic benefits from an increase in domestic aquaculture production, including offshore. More and more communities are recognizing that aquaculture presents a sustainable alternative for areas hit hard by job losses, natural disasters, or other challenges. As interest grows, these communities are beginning to integrate aquaculture into their economies. For example, NOAA research and technology on the culture of oysters, mussels, clams, hybrid striped bass, offshore shrimp, abalone, moi, cobia, salmon, and crayfish has helped build annual aquaculture production in the United States to an industry worth over $150 million a year. One highlight is the Hawaiian Islands, where Sea Grant estimates the number of aquaculture enterprises is up to 126 farms valued at $25.2 million supporting approximately 630 jobs.

Preliminary NOAA economic assessments indicate that the development and expansion of offshore aquaculture in the United States Federal waters could also significantly contribute to job creation. Preliminary production estimates indicate that domestic aquaculture production of all species could increase to 1 million tons per year by 2025. The additional production could include 760,000 tons from finfish aquaculture, 47,000 tons from crustacean production, and 245,000 tons from mollusk production. Of the 760,000 tons of finfish aquaculture, 590,000 tons could come from marine finfish aquaculture.

Aquaculture and Commercial and Recreational Marine Fisheries

NOAA is currently studying the economics of offshore aquaculture as it relates to commercial and sport fishing, market opportunities, global trends, underused processing capabilities, value-added niche markets, and coastal job development. The report, which will be available in late 2006, is the next step toward anticipating and then designing a strategy to address the socioeconomic questions associated with aquaculture production.

Although NOAA is certain benefits will result from the bill, the agency must consider its potential impacts as well, including the impact on our Nation's commercial fisheries. Some have expressed concern that offshore aquaculture will hurt wild harvest in the United States. If aquaculture is managed correctly, we do not believe wild harvest will be affected.

Aquaculture products, whether imported or domestic, compete with wild-caught fisheries. And this competition will exist with or without domestic aquaculture. We live in a global market and demand for seafood products is growing. The United States cannot meet that demand through wild-caught fishing activities alone. Seafood imports and other forms of protein, such as beef and chicken, already provide significant competition. Over 70 percent of the seafood Americans consume annually is imported, and half of those imports come from foreign aquaculture operations. The challenge is to integrate aquaculture into domestic seafood production so that our boat owners, fishermen, processors, and marketing companies can benefit directly.

Recreational and commercial fishing will also benefit from hatcheries and stock enhancement techniques developed for offshore aquaculture. Currently, U.S. hatcheries grow finfish and shellfish to enhance recreational and commercial fishing stocks with great success. For example, recreational fishermen in Southern Cali-

fornia and the Hubbs-SeaWorld Research Institute are cooperating on a white seabass restocking program. This excellent program helped rebuild and sustain the valuable recreational fishery for seabass in California.

The United States needs a strong commercial fishing industry *and* a robust aquaculture industry to meet projected seafood demand and supply the Nation's stock enhancement needs. While we look for aquaculture to help meet demand, NOAA will continue to assist wild-capture fisheries with management programs, stock enhancement, and marketing to channel wild-capture products to high-valued premium market outlets. But we also need to supply that vast middle market that demands a year-round supply of affordable, healthy, and safe seafood. We can do this through domestic aquaculture.

Preparing for Offshore Aquaculture in the United States

The socioeconomic issues and environmental impacts associated with aquaculture are not new. NOAA and other Federal agency partners have been working to address them for the past 30 years by funding cutting-edge research and technology development. In addition to this work, NOAA has been preparing for offshore aquaculture for the past 10 years. NOAA is currently:

- Designing environmental risk management guidelines for aquaculture, as highlighted in a recently published NOAA technical memo (Guidelines for Ecological Risk Assessment of Offshore Fish Aquaculture [NOAA Technical Memorandum NMFS–NWFSC–71]);
- Analyzing the economics of offshore aquaculture;
- Outlining regulatory steps to be taken if legislation is passed;
- Consulting with communities and businesses; and
- Examining aquaculture's role in ecosystem management with an international group of experts.

With leadership and foresight provided by NOAA through the National Marine Aquaculture Initiative's competitive grants program, the United States has invested over $10 million in offshore aquaculture research. The resulting technology is in use in commercial applications in Hawaii, Puerto Rico, and New Hampshire. All of these operations involve some combination of U.S. investors, including coastal fishermen, university scientists, and local processing, hatchery, feed, and equipment supply companies.

Environmental Standards

Also central to the National Offshore Aquaculture Act is the authority to establish rigorous environmental standards. For example, S. 1195 authorizes regulations or permit conditions to avoid, minimize, or mitigate unacceptable impacts. The bill also authorizes emergency actions to address unanticipated impacts in a timely manner. S. 1195 does not override or preempt existing laws to protect the offshore environment, wild stocks, endangered species, marine mammals, and habitat.

Thirty years of improvements to marine finfish aquaculture practices in the United States and abroad have shown that many problems can be prevented by continuous technological innovation, best management practices, careful species selection, and proper site selection.

Today's aquaculture cages, pens, and anchoring systems are more durable and have dramatically reduced the number of escaped fish. We expect these types of technological innovations will continue to develop.

Best Management Practices

Best management practices have also been developed and refined over time to ensure that aquaculture operations minimize risk and operate safely and securely. Some standard management practices used today to reduce or mitigate the risks associated with aquaculture include:

- Regular inspections by divers to ensure the integrity of nets and net infrastructure;
- Cameras and surveillance to monitor efficient use of feed, which reduces discharges of uneaten feed into the marine environment;
- Regular health inspections to prevent disease; and
- Comprehensive sanitary and bio-security programs to prevent the introduction and/or spread of pests or diseases from one farm site or cage to another or into the marine environment.

Species Selection

Another key environmental safeguard is species selection, which is one of the most effective techniques available to reduce the impact of escapes. NOAA and other agencies have over 30 years of experience in stock enhancement research and programs to support commercial and recreational fisheries. The knowledge gained from these programs will allow managers to design safeguards for conserving wild stocks.

All of the open ocean aquaculture efforts currently in the United States involve species native to the region in which the demonstration project or commercial operation is located. For example, the University of New Hampshire's Open Ocean Aquaculture project raises blue mussels, cod, haddock, and halibut—all native to the Northeast. The open ocean operations in Hawaii raise Pacific threadfin and yellowtail, both native to the islands. With careful broodstock management, selective breeding protocols and technologies, and good management practices to prevent escapes, the culture of indigenous species should present few, if any, risks to wild stocks. Scientific protocols for considering and testing the use of non-native species are also well-established.

Aquaculture operations in coastal waters in the United States have never raised genetically modified fish—another concern often raised in the context of non-native species. The knowledge NOAA and other agencies have gained from existing stock enhancement programs for commercial and recreational fishing—which include deliberate releases of finfish, oysters, and crabs for replenishment—will allow managers to design appropriate safeguards for conserving wild stocks.

Aquatic Animal Health

Comprehensive aquatic animal health programs that include health experts administering vaccines and monitoring aquatic species are also well-established. These programs further reduce the possibility of negative impacts on wild resources by cultured aquatic animals. Because aquatic animal pathogens occur naturally in open waters, and wild marine organisms serve as natural reservoirs for these disease-causing agents, disease outbreaks may occur in both wild and cultured aquatic animals. There is little scientific evidence to link disease episodes in wild populations of fish, caused by endemic pathogens, to cultured animals.

In its work with the U.S. Departments of Agriculture and the Interior and with other Federal agencies, NOAA is developing a National Aquatic Animal Health Plan that will provide for safe national and international commerce of aquatic animals and the protection of cultured and wild aquatic animals from foreign pests and diseases. Technological and scientific advances also continue to refine aquatic animal health practices. For example, as a result of scientific advances, the offshore aquaculture industry has largely replaced antibiotics with vaccinations administered before fish are stocked into cages.

Site Selection

NOAA continues to advocate careful site selection as one of the keys to minimizing environmental risk and maximizing environmental benefits of aquaculture—no matter what organism is under culture. Local site characteristics will dictate the proper organism or mix for that site, as all areas do not have the same environmental conditions and concerns. In some cases, it may be important to encourage a mix of organism types, including cultured finfish, filter feeding mollusks, marine algae, and other species. Applicants and NOAA will seek to provide the maximum benefit with the smallest ecological footprint.

Alternatives to Fishmeal and Fish Oil Developing Quickly

Another area of aquaculture where advancements are being made is in developing alternatives to fishmeal and fish oil for feeds. From a purely economic perspective, feed is a major component of the cost of production in an aquaculture operation. Typically, the cost of feed accounts for over 60 percent of operating costs, so there are strong economic incentives for the industry to help develop suitable alternative ingredients for feed formulas, and to become more efficient in converting feed into product.

Overall, the reliance on fishmeal and fish oil for aquaculture has been significantly reduced based on research advances using plant-based alternatives to fishmeal and fish oil. NOAA plays a vital role in that research. For example, scientists at NOAA's Northwest Fisheries Science Center, along with scientists from other agencies and industry, are developing alternative feed ingredients for cultured species, including finfish. This groundbreaking research—using soybeans, barley, rice, peas, and other crops as alternatives—is expanding in the United States and across the globe.

Other meals such as canola, lupine, wheat gluten, corn gluten, and various plant protein concentrates—many of them grown in the United States—have already been shown to be highly palatable and digestible for fish. As the price of alternative ingredients drops below that of fishmeal, those ingredients will be substituted for fishmeal and fish oil.

Further development of plant-based feeds also represents a huge opportunity for American agriculture, as the United States produces an abundance of high-quality proteins and fats that could be used in fish production. Increased production of high-protein by-products from bio-diesel production, and high-protein and high-fat by-products from ethanol and bio-plastics production, are likely in the future. Feed experts believe these by-product meals will be ideal for fish production.

Although the amount of fishmeal and fish oil in feeds will be reduced as alternative ingredients come online and the cost drops, they likely will not disappear from feed altogether. Research on plant-based oils has found that maintaining some fish oil in fish feed is important to maintain the health benefits to humans of eating marine fish, including the long-chain Omega-3 fatty acids.

Scientists are most concerned about two healthy fatty acids—decosahexinoic acid (DHA) and ecospentanoic acid (EPA). These fatty acids are not produced by fish, but fish concentrate them in their fats from the prey they eat. DHA and EPA are made by algae and microorganisms and are passed up the food chain. These organisms can be cultured directly to produce concentrated DHA and EPA. In fact, all the DHA currently used in baby formula in the United States comes from production of micro-algae, not from fish oil. Although it is costly, experiments have shown that a small amount of this concentrated algae oil can be added to vegetable oil to restore the healthy fatty acids in the final product. In addition, other healthy fats, such as the shorter chain Omega-3 fatty acids found in olive and flax oil, can also be incorporated into the cultured fish. NOAA and other Federal agencies are working with industry on research to develop lipid substitutes, such as marine micro-algae production, to reduce reliance on fish and fish oil. The agencies, research institutions, and others will continue to work with grain and feed companies and with feed researchers to find suitable alternatives for fishmeal and fish oil.

Seafood and Human Health

A vexing issue related to seafood, both wild and cultured, is the misinformation related to the health and safety of seafood products. NOAA's mission includes a focus on human health and safety, and NOAA seeks to maintain a positive connection between human health and seafood. Misinformation about the safety of our seafood supply includes published research that has been shown to be inadequate, flawed, or biased. This research continues to be cited, especially by critics of aquaculture. NOAA will take every opportunity to address seafood safety based on the latest, fact-based information from leading scientists, nutritionists, and medical and healthcare professionals.

Peer-reviewed studies, including those presented at the international Seafood & Health Conference co-sponsored by NOAA in December 2005, link seafood consumption to higher intelligence in babies and children, lower heart rates in adults, lower cholesterol, lower blood pressure, and lower body weight. It is clear, based on the facts, that the health benefits of eating seafood far outweigh the risks due to trace-level contaminant exposure. Seafood has been scientifically shown to fight cardiovascular disease, cancer, Alzheimer's disease, and other major illnesses.

Conclusion

Mr. Chairman and Members of the Subcommittee, the Department is looking forward to working with you, the public, the fishing and aquaculture industries, and the environmental community to craft a regulatory framework for offshore aquaculture. The U.S. Exclusive Economic Zone is 3.4 million square miles and NOAA is confident there are appropriate sites where aquaculture facilities could operate without compromising the protection of wild stocks, environmental quality, or people's livelihoods. In the long run, U.S. fishing communities will be harmed more by foreign competition than by a robust domestic aquaculture industry. The challenge is to find ways for our domestic fishing industry to benefit from the use of aquaculture technologies to produce additional seafood—as fishermen are doing in some parts of the United States and in other countries.

Offshore aquaculture has great potential to make a significant contribution to our seafood supply and the economy, but this potential will be realized in the United States only if we can provide the regulatory certainty for businesses to make sound investment decisions. S. 1195 will give NOAA the authority it needs to provide that regulatory certainty. I appreciate the opportunity to present the National Offshore Aquaculture Act of 2005 to you today, and I will be happy to answer any questions.

Senator SUNUNU. Thank you, Mr. Keeney.
Mr. Eichenberg.

STATEMENT OF TIM EICHENBERG, DIRECTOR, PACIFIC REGIONAL OFFICE, THE OCEAN CONSERVANCY

Mr. EICHENBERG. Good morning Mr. Chairman, Senator Boxer. My name is Tim Eichenberg, and I am the Director of the Pacific Regional Office of The Ocean Conservancy. Thank you for inviting me to testify before your Committee today.

I commend you for carefully considering an issue of great importance for the future of the oceans. Some may view offshore aquaculture as the solution to the U.S. seafood deficit and declining ocean fisheries. But two recent national ocean commissions and numerous studies have noted that, unless carefully and sustainably managed, marine finfish aquaculture can exacerbate, not redress declining fisheries and ocean health.

I first examined this issue in the early 1990s for the Marine Law Institute at the University of Maine School of Law, just as the salmon farming industry was taking off in Maine. In Maine I first saw salmon infested with sea lice, and realized the promise of aquaculture was accompanied by certain risks and impacts.

More recently, I worked on two studies by the Center for Marine Policy at the University of Delaware that examined the lack of a coherent policy framework for offshore marine aquaculture in the EEZ, and developed a set of very detailed recommendations fashioned by stakeholders for a sustainable and precautionary program for planning, siting, zoning, leasing, permitting, monitoring, mitigating, and enforcing offshore aquaculture operations.

And just last month, I completed work on legislation in California that was signed by Governor Schwarzenegger on May 26, sponsored by the Ocean Conservancy and California Senator Joe Simitian, that provides comprehensive standards for leasing state waters for marine finfish aquaculture. The bill was supported by more than 30 business, academic, conservation, and fishing organizations, and I'm submitting a copy of this legislation for the record.

These experiences have led me to conclude that our oceans are public trust that require the sustainable and precautionary management of commercial fish farming operations to address the potentially serious risks to marine ecosystems, consumer health, fisheries and fishing communities described to this Committee at its April 6th hearing by Dr. Goldberg and in numerous scientific studies cited in our written testimony.

Briefly these risks fall into the following categories: Competition with and genetic alteration of wild fish stocks; the spread of disease pathogens and parasites; the use of antibiotics, pesticides, parasiticides, hormones and other chemicals; the degradation of water quality and benthic habitat from fish wastes; harmful interactions with marine mammals and other wildlife near fish pens; the adverse ecosystem impacts and the loss of ocean protein from the consumption of about 12 percent of the world's catch and 40 percent of the world's fish meal supply used for fish feed; and high levels of toxic chemicals found in some farmed salmon and in wild fish near fish pens.

After carefully reviewing the bill before your Committee (S. 1195), I regretfully conclude that it does not meet the high standards needed to protect the public trust, or address these potentially serious impacts, nor has NOAA answered key questions on how this legislation will prevent offshore fish farming from exacerbating the serious problems that already face the oceans. We're submitting a copy of these questions for the record.

Congress can be very specific when it wants to be and deferring to NOAA regulations to address these concerns is not sufficient. Congress is abdicating its public trust responsibilities over the EEZ if it does not provide specific standards to ensure that any regulations promulgated meaningfully address a number of critical issues, many of which were addressed by Mr. Keeney in his testimony.

I'd like to list some of the standards in the California bill and suggest they be incorporated into this Federal bill: All leases and permits for offshore aquaculture should be issued through a transparent process to resolve conflicting uses, provide a fair return to the public and generate sufficient funds to pay for administering the program; environmental analyses under NEPA should be conducted both at a programmatic or legislative level, as well as the project level to address planning and siting issues and individual and cumulative impacts; non-native and genetically modified species should not be farmed in ocean waters and strict broodstock controls on farmed native species should be required; sites should not be leased that conflict with fishing and other public trust uses, or are located within special ocean areas such as marine sanctuaries, marine protected areas or essential fish habitat; pollution should be prevented to the maximum extent possible through discharge limits, husbandry, siting, density controls and species integration; alternatives to drugs and chemicals should be required whenever available and permitted only if minimized to the maximum extent possible to provide both safe and healthy seafood through these kinds of controls; alternatives to feeds produced from wild caught fish should be required whenever available and only sustainably harvested ingredients should be utilized; baseline assessments should be conducted prior to issuing permits and all sites should be monitored regularly; lessees must be held responsible for damages to the marine environment and for restoring sites to pre-leased conditions; fish should be removed, leases terminated and the facilities closed if operations pose a danger to the marine environment; and all facilities and operations must be designed to prevent the escape of farmed fish, all escapes should be reported immediately, and all fish should be tagged or marked so farms are accountable for escapes.

Legislation that contains standards such as these, recently enacted in the bipartisan bill in California, can guide the development of a sustainable offshore aquaculture industry and the promulgation of comprehensive regulations to protect the marine environment, resolve conflicts with ocean uses and prevent further decline in fisheries and ocean health. I urge the Committee to consider such an approach.

Thank you again for the opportunity to address the Committee and I welcome any questions you might have.

[The prepared statement of Mr. Eichenberg follows:]

PREPARED STATEMENT OF TIM EICHENBERG, DIRECTOR, PACIFIC REGIONAL OFFICE, THE OCEAN CONSERVANCY

Introduction

Good morning Mr. Chairman and Members of the Subcommittee. My name is Tim Eichenberg, and I am the Director of the Pacific Regional Office of The Ocean Conservancy. Thank you for inviting me to testify before your Subcommittee.

The Ocean Conservancy strives to be the world's foremost advocate for the oceans. Through science-based advocacy, research, and public education, we inform, inspire, and empower people to speak and act for the oceans. The Ocean Conservancy is the largest and oldest nonprofit conservation organization dedicated solely to protecting the marine environment. Headquartered in Washington, D.C., The Ocean Conservancy has offices throughout the United States, including New England, the Southeastern Atlantic, the Gulf of Mexico, the Pacific, and the Caribbean.

I congratulate you for carefully examining an issue of great importance for the future of our oceans. Some may view offshore aquaculture as the solution to the U.S. seafood deficit and declining ocean fisheries. But two recent national ocean commissions and numerous scientific studies have noted that, unless carefully and sustainably managed, marine finfish aquaculture can exacerbate—not solve—declining ocean health.[1]

I first examined this issue in the early 1990s for the Marine Law Institute at the University of Maine School of Law, just as the salmon farming industry was taking off in Maine.[2] At that time the industry was viewed with great promise for its potential to revive sagging local economies hit hard by decades of overfishing, a vision that has been only partially realized, due in part to stiff competition from inexpensive imports. Maine is where I first encountered farmed salmon teeming with sea lice, and realized that the industry's potential is tempered by risks that need to be addressed.

More recently, I worked on two studies by the Center for Marine Policy at the University of Delaware that examined the lack of a coherent policy framework for offshore marine aquaculture in the U.S. Exclusive Economic Zone (EEZ), and developed a set of very detailed recommendations fashioned by stakeholders for a sustainable and precautionary program for planning, siting, zoning, leasing, permitting, monitoring, mitigating, and enforcing offshore aquaculture operations.[3]

And just last month, I completed work on legislation in California signed by Governor Arnold Schwarzenegger on May 26th, sponsored by The Ocean Conservancy and California Senator Joe Simitian, that provides comprehensive standards for leasing state waters for marine finfish aquaculture (SB 201, The Sustainable Oceans Act).[4] The bill was supported by more than 30 business, fishing, academic and conservation organizations.[5]

The following testimony discusses the risks associated with marine finfish aquaculture; describes the California bill, which the Subcommittee should consider in developing an appropriate Federal regulatory regime; comments on the Administration's proposal, introduced by Senators Ted Stevens and Daniel Inouye as S. 1195, which unfortunately in my view is still insufficient to safeguard our ocean resources; and suggests ways to better protect our oceans from the potential adverse effects of marine finfish aquaculture.

Risks Associated with Marine Finfish Aquaculture

Open ocean aquaculture is promoted as a solution to the ocean's diminishing resources. However, it also poses significant risks, including escapement of fish, damage to the surrounding environment, harmful effects on native fish populations, and pollution. These risks, and their consequences, are largely dependent upon the location of the operation, its size or scope, the management practices, the capacity of the receiving water body, and the choice of species to be raised in a particular area.

Fish Escapement: Perhaps the single greatest ecological and economic threat associated with the growth of offshore aquaculture is the potential to introduce invasive species to the surrounding ecosystem and nearby coastal communities. Millions of farmed fish escape from fish farms because of storms, human error, and predators. According to the National Marine Fisheries Service (NMFS) and many other authorities, escapes result in harmful interactions with native fish, including competition with wild stock for food, habitat and mates; transfer of potentially deadly diseases and parasites to wild stocks; and genetic modification of wild stocks through inter-breeding.[6] Farmed fish are vastly different and can weaken the genetic makeup of wild populations.[7]

Threat of Disease and Pollution: Offshore aquaculture also presents numerous additional biological threats to ocean ecosystems. Fish farms, like animal feed lots, produce enormous pollution. The excreta from an average floating cage farm can produce nutrients and fecal matter equal to a city of 20,000–65,000,[8] and the potential wastes for a $5 billion U.S. industry—called for by NOAA—would discharge annually the nitrogen equivalent of the untreated sewage of 17 million people.[9] Depending upon pollutant composition and the cumulative effects of similar cages in a particular area, discharges may cause harmful effects on the surrounding environment. Fish farms can change the chemical and biological structure of the sediment under net pens, and in severe cases cause "dead zones." [10]

Additionally, outbreaks of diseases and parasites are a constant risk because the density of fish in aquaculture operations is so much higher than in nature. Disease, pathogens, and parasites multiply rapidly in crowded pens and can spread to wild fish stocks. Farmed species, depending upon species and diet, can even present increased public health risks to the people who consume them. Concentrations of Polychlorinated Biphenyls (PCBs), toxaphene, and dieldrine have been found to be significantly greater in farmed salmon species than in wild species.[11]

Fish farms also use a wide variety of antibiotics, pesticides, parasiticides, hormones, anesthetics and other chemicals that enter the marine environment.[12] Wild fish near fish farms accumulate higher amounts of mercury,[13] and drugs can select for resistant bacteria, sometimes even in wild fish consumed by humans.[14]

Harmful Ecosystem and Marine Wildlife Effects: Seals, sea lions and other marine wildlife prey on farmed fish and are targets for predator controls and, in some cases, are shot. Acoustic deterrents such as seal bombs and intense underwater loud speakers cause disorientation, pain or hearing loss, and alter the behavior of marine species.[15] Aquaculture operations also may require dredging, drilling, the use of large heavy anchors, and other disturbances to sediment and bottom habitats, which can displace ocean wildlife, smother bottom-dwelling animals, destroy hiding places for young fish, and cause other ecological changes to the sea floor.

The use of fish meal to feed farmed carnivorous fish produces a net loss of fish protein, reduces wild fish populations, and can change the distribution and reproductive success of other species throughout the marine ecosystem. It can take from 2–5 pounds of wild fish to produce one pound of some farmed fish species.[16] Farmed fish are fed 12 percent of the world's catch, and consume about 40 percent of the world's fishmeal supply (20 billion pounds of fish).[17]

California's "Sustainable Oceans Act"

Our oceans are a public trust, and any commercial farming of them must be done sustainably and with precaution. Unfortunately, current regulations and mitigation strategies at the Federal level are inadequate to guide the aquaculture industry or manage its risks. Regulatory agencies with overlapping and conflicting authority have caused significant confusion regarding environmental requirements, siting considerations, leasing procedures and jurisdictional responsibility.[18]

Without careful legislative coordination of NOAA's jurisdiction and responsibilities with those of other agencies, we believe problems will persist, with potentially serious environmental consequences. Moreover, it is imperative that any management regime address specifically and comprehensively the potentially serious risks of offshore aquaculture to marine ecosystems, consumer health and safety, fisheries, and fishing communities.

It was with this in mind that The Ocean Conservancy sponsored the "Sustainable Oceans Act," recently passed by the California legislature, and signed by Governor Schwarzenegger on May 26. I am submitting a copy of this legislation for the record. Sponsors of this new law worked with stakeholders and government agency officials for more than a year to develop the most comprehensive standards in the Nation for marine finfish aquaculture. We believe the standards developed for the State of California could serve as a good model for any legislation to manage offshore aquaculture within waters under Federal jurisdiction.

The Sustainable Oceans Act establishes a process for leasing state marine areas for offshore finfish aquaculture, and does so in a way that aims to protect marine life, water quality, and consumers.

The Act requires finfish farmers to obtain a lease from the California Fish and Game Commission (Commission) in order to conduct marine finfish aquaculture. It also requires that a programmatic environmental impact report (PEIR) for commercial aquaculture operations be prepared to provide a framework for managing aquaculture in an environmentally sustainable manner throughout the State. In addition to identifying coastal locations best suited for finfish farming, the PEIR must consider: the effects on human health and the marine environment from the chemical and biological products used in fish farming; the effects of fish farming on mam-

mals, birds and sensitive habitats; the effects of the use of fish meal; and the threat of escaped fish on the environment. In addition to the PEIR, the California Environmental Quality Act also requires that a separate environmental analysis be conducted for each lease to determine if an individual environmental impact report (EIR) must also be prepared.[19]

Under the Act, the Fish and Game Commission may lease marine areas for aquaculture only after consultation with affected stakeholders through a fair and transparent public process that includes notice and comment. In addition, the Commission may only issue leases that meet a comprehensive list of standards, all of which are designed and are essential to minimize harmful effects on human health and the marine environment. These standards include, but are not limited to, the following:

1. Leases may only be adopted by the Fish and Game Commission for commercial finfish aquaculture if the site has been considered appropriate in a programmatic EIR.

2. Leases cannot interfere with fishing or other public trust uses, disrupt or harm wildlife and habitats, or otherwise harm the marine environment.

3. Operations must minimize the use of fish oil and fish meal, due to their adverse affects on ocean ecosystems, and alternatives must be used where possible.

4. Finfish farmers must establish "best management practices" that include regular monitoring and reporting, and site inspections. The state Fish and Game Commission can remove fish stocks, close facilities, or terminate a lease if the operations are not in compliance with best management practices or are damaging the marine environment.

5. Lessees must conduct baseline assessments of the site prior to undertaking operations, and must monitor the habitat during operation.

6. The numbers of finfish raised and their density within the site must remain limited to what can be safely raised without harming the marine environment.

7. Lessees must minimize the use of chemicals and drugs, and may only use drugs, therapeutic substances and antibiotics as approved by the U.S. Food and Drug Administration for marine finfish aquaculture.

8. The Commission must require in a lease that all farmed fish are marked, tagged or otherwise identified as belonging to the operator of the operation.

9. Facilities must be designed to prevent the escape of farmed fish into the wild, and to withstand severe weather and accidents.

10. Aquaculture operators must prevent discharges of pollutants to the maximum extent possible, and must meet all the water quality requirements of the State Water Resources Control Board and the applicable regional water quality control board.

11. Lessees must restore an area to its original condition upon termination of the lease, and are responsible for any damages caused by their operations.

The standards and requirements established by the Sustainable Oceans Act represent an innovative yet common-sense approach toward minimizing the risks posed by this emerging industry. California has long led the way in protecting the oceans, and once again has set an example that Congress can follow to protect our Federal marine areas.

S. 1195: The National Offshore Aquaculture Act of 2005

In light of the foundation laid by the Sustainable Oceans Act, and after carefully reviewing the bill before your Subcommittee, I regretfully conclude that it does not meet the high standards needed to address the impacts of offshore aquaculture for a number of reasons briefly summarized below. Nor has NOAA addressed key questions on how the legislation will prevent offshore fish farming from exacerbating the serious problems that face the oceans. We are submitting a copy of these questions for the record.[20]

Findings: As currently drafted, the findings of Congressional policy in section 2 generally promote the development of aquaculture with little acknowledgement of its risks or effects on other ocean uses. While the findings acknowledge "wild stocks" and "marine ecosystems," we recommend the findings be expanded to ensure the policy reflects a more balanced perspective on the development of a new ocean use and its potential risks to other ocean uses and the marine environment.

Definitions: Section 3 defines "demonstration" to include both pilot scale-testing of aquaculture science and technologies, or farm-scale research. This definition is too vague to give sufficient guidance. "Pilot scale," "science," "technologies," and "farm-

scale research" are subjective terms not defined further in the bill. We recommend that you clarify these terms to ensure that demonstration projects are conducted in an ecologically protective manner.

Offshore Aquaculture Permits: Section 4 should be amended to provide a stronger framework to ensure offshore aquaculture is well coordinated with other ocean uses and protects the public trust. This section directs the Secretary of Commerce to establish a site and operating permit process to make areas of the U.S. EEZ available to persons to develop and operate offshore aquaculture facilities. However, it leaves too much agency discretion to the particular procedures that will be followed in granting permits, including timing of regulatory processes, and the necessary criteria for permitting aquaculture operations.

The bill requires the Secretary to specify the size and location of an offshore aquaculture facility in individual site permits, and requires consultation with other Federal agencies to ensure that a specific offshore aquaculture facility is compatible with other uses of the EEZ. The bill lacks, however, a mechanism to determine, in advance of individual siting decisions, where offshore aquaculture is, and is not, generally appropriate within the EEZ. Similar to the PEIR in the California bill, Federal legislation should include a process that would clearly articulate criteria and a process for NOAA to follow in establishing zones appropriate for development of offshore aquaculture operations and areas that are inappropriate such as marine sanctuaries, marine protected areas, and essential fish habitat.

The bill should also include language prohibiting the issuance of any aquaculture permits under this section until the agency has promulgated comprehensive regulations to guide its decision-making, including a process for including the public in the permitting process. The timely establishment of clear, consistent, and enforceable regulations is critical for both the public and industry.

Section 4 should also ensure that permitting fees are adequate to pay for the costs of administering the program, and that lease or royalty payments adequately compensate for the use of public resources consistent with the government's public trust responsibilities and other Federal laws (such as oil and gas extraction).

Finally, section 4 should prohibit the use of non-native and transgenic species in marine aquaculture operations. States like California have already implemented such prohibitions in legislation to protect state waters.

Environmental Requirements: We are concerned that S. 1195 establishes few parameters to guide agency consideration of the ecological impacts of aquaculture facilities. Although subsection (4)(c) authorizes the Secretary to issue operating permits under "such terms and conditions as the Secretary shall prescribe" and subsection (4)(d) directs the Secretary to "consult as appropriate" with other Federal agencies to ensure that offshore aquaculture facilities meet the environmental requirements established under section 5(a) of the bill, section 5(a) does not establish any new requirements. Instead, it simply directs the Secretary to consult with other Federal agencies to identify the environmental requirements applicable to offshore aquaculture under *existing* laws and regulations,

While the bill authorizes the Secretary to establish additional environmental requirements, the process for consultation with other stakeholders as well as the content of any such additional requirements is left to the discretion of the Secretary. Furthermore, paragraph (d)(6) requires only that the Secretary "periodically review" the criteria for issuance of site and operating permits. Given the unique risks posed by the burgeoning aquaculture industry, we recommend that the bill include standards for siting and operating permits that are precautionary, comprehensive, clear, and legally binding, based on NOAA's own "2002 Code of Conduct for Responsible Aquaculture," the standards for siting, cultured species, pollution control, monitoring and leasing in California's Sustainable Oceans Act listed above, and on the principles set forth in The Ocean Conservancy's November 1, 2005, letter to Senators Stevens and Inouye, submitted for the record.

Research and Development: S. 1195 allows the Secretary to conduct research and development to advance technologies that are compatible with the protection of marine ecosystems. This work should be carried out in close coordination with other relevant agencies. The bill should direct NMFS to develop and publish such research in time to help guide development and promulgation of regulations under section 4 of the bill.

Administration: S. 1195 should establish reasonable timelines and deadlines for the promulgation of regulations necessary to administer this program. As outlined earlier, we believe that the bill should make clear that permitting for commercial aquaculture facilities may not proceed until the National Marine Fisheries Service has promulgated those regulations.

Additionally, we recommend amendments to subsection 4(c) to detail processes for resolving disputes that may that arise in decisionmaking. Other than requirements

that the Secretary consult with other relevant agencies "as appropriate" (paragraph 4(d)(1)) and the requirement to obtain "concurrence" (paragraph 4(a)(2)) from the Department of Interior on some decisions, the bill currently does not articulate a process for resolving interagency disputes.

Despite the language of subsection 5(f), subsection 5(g) takes the highly unusual step of authorizing the Secretary to apply the provisions of any other Federal statute to offshore aquaculture facilities if the Secretary determines that it is in the public interest. In our view, Congress, and not the Secretary, should determine in the first instance whether those laws apply to offshore aquaculture facilities.

Authorization of Appropriations: Section 8 authorizes to be appropriated to the Secretary such sums as are necessary to carry out the Act. Although this section gives the appropriators wide latitude, an authorization for a specific dollar amount in each of the Fiscal Years authorized by the bill would give the members of the appropriations committee and the public some indication of the resources needed to fully and effectively implement this program. We suggest that this section also include specific authorizations for research and the promulgation of regulations.

Enforcement: Section 10 of the bill should further clarify the circumstances and use of available enforcement authority and incorporate a citizen suit provision, similar to those utilized in other Federal statutes regulating biological pollution. In addition, we believe section 11 should be amended to include a liability in rem provision, and that section 13 should include language ensuring that forfeited resources made available for sale do not endanger public health.

Conclusion

Thank you again for the opportunity to address the Subcommittee. The Ocean Conservancy looks forward to working with you to develop an effective and efficient management regime that safeguards the environment and protects the public trust.

ENDNOTES

[1] Pew Oceans Commission, *America's Living Oceans* (2003); U.S. Commission on Ocean Policy, *An Ocean Blueprint for the 21st Century* (2004).

[2] Tim Eichenberg, *Legal Methods for Promoting Local Salmon Farming in Down East Maine, and An Assessment of the Regulatory Framework for Finfish Aquaculture in Marine Waters,* Marine Law Institute (1992); *Improving the Legal Framework for Marine Aquaculture: The Role of Water Quality Laws and the Public Trust Doctrine,* 2 Territorial Sea Journal 339 (1992); *Growing Pains in Maine's Salmon Aquaculture Industry,* 6:1 National Coastal Resources Institute News (1991).

[3] *An Operational Framework for Offshore Marine Aquaculture in U.S. Federal Waters,* The Mangone Center for Marine Policy, University of Delaware (October 2005); *Development of a Policy Framework for Offshore Aquaculture in the 3–200 Mile U.S. Ocean Zone,* Center for the Study of Marine Policy, University of Delaware (2001).

[4] S. 201, Chapter 36, Statutes of 2006. An act to amend Sections 15400, 5405, 15406, 15406.5, and 15409 of, and to add Sections 54.5 and 15008 to, the Fish and Game Code, and to amend Section 30411 of the Public Resources Code, relating to aquaculture.

[5] S. 201 was supported by The Ocean Conservancy (sponsor), Bluewater Network, California Coastkeeper Alliance, California Coastal Protection Network, California League of Conservation Voters, CalTrout, Coastside Fishing Club, Center for Food Safety, Defenders of Wildlife, Environment California, Environmental Center of San Luis Obispo, Environmental Defense, Environmental Defense Center, Environmental Entrepreneurs, Institute of Marine Sciences—US Santa Cruz, Monterey Bay Aquarium—Center for the Future of the Oceans, Natural Resources Defense Council, Oceana, O'Neil Sea Odyssey, Orange County Coastkeeper, Pacific Coast Federation of Fishermen's Associations, Planning and Conservation League, Santa Barbara Channelkeeper, San Diego Baykeeper, San Luis Obispo Coastkeeper, Santa Monica Baykeeper, Save Our Shores, Seaflow, Sierra Club California, The Nature Conservancy, University of California Marine Council.

[6] NOAA Technical Memorandum NMFS–NWFSC–71, Guidelines for Ecological Risk Assessment of Marine Aquaculture (December 2005); Goldburg, R., Elliott and Naylor, Marine Aquaculture in the United States: Environmental Impacts and Policy Options, Pew Oceans Commission (2001).

[7] Hindar, K., *Interactions of cultured and wild species* (draft). Marine aquaculture and the environment: a meeting for stakeholders in the Northeast, University of Massachusetts, Boston. 11–13. January 2001; McGinnity et al., Genetic impact of escape farmed Atlantic salmon on native populations: use of DNA profiling to assess freshwater performance of wild farmed and hybrid progeny in a natural river environment, ICES Journal of Marine Science, 54:998–1008 (1997); Naylor, R and

Burke, Aquaculture and ocean resources: Raising tigers of the sea, Annual Review of Environment and Resources, 30: 185–213 (2005).

[8] Hardy, R.W., *Fish, feeds and nutrition in the new millennium, Aquaculture Magazine,* 26(1):85–89; *See also, What's Behind That Farmed Salmon Steak?* Salmon Nation (2002) at *http://www.salmonnation.com/farmed.html*, citing David Suzuki Foundation, (2002) *Ocean Pollution from Salmon Farming, http://www.davidsuzuki.org/Oceans/Fish—Farming/Salmon/Pollution.asp*.

[9] Goldburg, R and Naylor, *Transformed seascapes, fishing, and fish farming,* Frontiers in Ecology and the Environment, 3:21–28 (2005).

[10] Beveridge, M.C.M, *Cage Aquaculture,* 2d ed. Fishing News Books, Edinburgh, Scotland, 346 (1996); EAO, British Columbia Environmental Assessment Office, *The Salmon Aquaculture Review Final Report,* April 8, 2001, *http://www.eao.gov.bc.ca/project/aquacult/salmon/report/toc.htm;* Folke C., Kautsky and Troell, *The costs of eutrophication from salmon farming: Implications for management,* Journal of Environmental Management, 40: 173–182 (1994).

[11] *See* Hites, et. al, *Global Assessment of Organic Contaminants in Farmed Salmon,* 203 Science at 226.

[12] Naylor, R. et al, *Effect of Aquaculture on World Fish Supplies,* Nature, 405:1017–1024 (2002).

[13] deBruyn, A. et al., *Ecosystemic Effects of Salmon Farming Increase Mercury Contamination in Wild Fish,* Environment Science and Technology, 40(11): 3489–3493 (2006).

[14] Evrik, A. et al, *Impact of administering antibacterial agents on wild fish and blue mussels in the vicinity of fish farms,* Diseases of Aquatic Organisms, 18:45–51 (1994); Krosek, M, Lewis and Volpe, Transmission dynamics of parasitic sea lice from farm to wild salmon, Proc. Royal Society B., 272:689–696 (2005).

[15] Hastings M.C., et al, *Effects of low-frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish,* Journal of the Acoustical Society of America, 99(3):1759–1766 (1996); Natural Resources Defense Council, *Sounding the Depths: Supertankers, Sonar and the Rise of Undersea Noise* (1999); Naylor, R. et al., *supra* note 11.

[16] Goldburg and Naylor, *supra* note 9; Naylor, R, et al., *Id.;* Naylor and Burke, *supra* note 7.

[17] Tacon, A.G.J. and Forster, *Global trends and challenges to aquaculture and aquafeed development in the new millennium,* International Aquafeed-Director and Buyers Guide, 2001:4–25 (2000)

[18] *See, An Operational Framework, supra* note 3.

[19] California Public Resources Code §§2100–21177.

[20] Letter to Susan Bunsick, NOAA Fisheries, from Anne Mosness, Go Wild Campaign, August 25, 2005.

BILL NUMBER: S. 201

FEBRUARY 10, 2005

An act to amend Sections 15400, 15405, 15406, 15406.5, and 15409 of, and to add Sections 54.5 and 15008 to, the Fish and Game Code, and to amend Section 30411 of the Public Resources Code, relating to aquaculture.

Legislative Counsel's Digest

S. 201, Simitian Marine finfish aquaculture: leases.

(1) Existing law authorizes the Fish and Game Commission to lease state water bottoms to any person for aquaculture, and authorizes the commission to adopt regulations governing the terms of the leases. Existing law prohibits state water bottoms from being leased, unless the commission determines that the lease is in the public interest.

This bill would prohibit a person from engaging in marine finfish aquaculture, as defined, in state waters without a lease from the commission. The bill would require leases and regulations adopted by the commission for marine finfish aquaculture to meet certain standards. The bill would establish maximum initial and renewal terms for those leases.

(2) Existing law requires the restoration of an aquaculture lease site upon the termination of the lease.

The bill would require the commission to require financial assurances of each lessee to ensure that restoration is performed, and would make marine finfish aquaculture lessees responsible for damage caused by their operations, as determined by the commission.

(3) The California Coastal Act requires the Department of Fish and Game, in consultation with the Aquaculture Development Committee, to prepare programmatic environmental impact reports for existing and potential commercial aquaculture operations in both coastal and inland areas of the state if certain conditions are met.

This bill would delete that requirement from the act, and, instead, modify provisions relating to aquaculture to include that requirement. The bill would further require that if a final programmatic environmental impact report is prepared pursuant to that requirement for coastal marine finfish aquaculture projects approved by the commission, the report provide a framework for managing marine finfish aquaculture in a sustainable manner that adequately considers specified environmental factors.

(4) The provisions of the bill would be known as the Sustainable Oceans Act.

(5) Because this bill creates a new crime, it would impose a state-mandated local program.

(6) The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

The People of the State of California Do Enact as Follows

SECTION 1. This bill shall be known, and may be cited, as the Sustainable Oceans Act.

SEC. 2. Section 54.5 is added to the Fish and Game Code, to read:

54.5. "Marine finfish aquaculture" means the propagation, cultivation, or maintenance of finfish species in the waters of the Pacific Ocean that are regulated by this state.

SEC. 3. Section 15008 is added to the Fish and Game Code, to read:

15008. (a) The department shall, in consultation with the Aquaculture Development Committee, prepare programmatic environmental impact reports for existing and potential commercial aquaculture operations in both coastal and inland areas of the state if both of the following conditions are met:

(1) Funds are appropriated to the department for this purpose.

(2) Matching funds are provided by the aquaculture industry. For the purpose of this section, "matching funds" include, but are not limited to, any funds expended by the aquaculture industry before January 1, 2006, for the preparation of a programmatic environmental impact report.

(b) If the final programmatic environmental impact report is prepared pursuant to subdivision (a) for coastal marine finfish aquaculture projects and approved by the commission under the California Environmental Quality Act set forth in Division 13 (commencing with Section 21000) of the Public Resources Code, the report shall provide a framework for managing marine finfish aquaculture in an environmentally sustainable manner that, at a minimum, adequately considers all of the following factors:

(1) Appropriate areas for siting marine finfish aquaculture operations to avoid adverse impacts, and minimize any unavoidable impacts, on user groups, public trust values, and the marine environment.

(2) The effects on sensitive ocean and coastal habitats.

(3) The effects on marine ecosystems, commercial and recreational fishing, and other important ocean uses.

(4) The effects on other plant and animal species, especially species protected or recovering under state and Federal law.

(5) The effects of the use of chemical and biological products and pollutants and nutrient wastes on human health and the marine environment.

(6) The effects of interactions with marine mammals and birds.

(7) The cumulative effects of a number of similar finfish aquaculture projects on the ability of the marine environment to support ecologically significant flora and fauna.

(8) The effects of feed, fish meal, and fish oil on marine ecosystems.

(9) The effects of escaped fish on wild fish stocks and the marine environment.

(10) The design of facilities and farming practices so as to avoid adverse environmental impacts, and to minimize any unavoidable impacts.

SEC. 4. Section 15400 of the Fish and Game Code is amended to read:

15400. (a) Except as prohibited by Section 15007, the commission may lease state water bottoms or the water column to any person for aquaculture, including, but

not limited to, marine finfish aquaculture. Upon appropriation of funds for that purpose, or if funds are otherwise available, the commission shall adopt regulations governing the terms of the leases, after consulting with affected stakeholders in a public process. No state leases shall be issued, unless the commission determines that the lease is in the public interest in a public hearing conducted in a fair and transparent manner, with notice and comment, in accordance with commission procedures. Leases issued, and regulations adopted, pursuant to this section shall not be construed to be fishery management plans.

(b) A person shall not engage in marine finfish aquaculture in ocean waters within the jurisdiction of the state without a lease from the commission. Leases and regulations adopted by the commission for marine finfish aquaculture shall meet, but are not limited to, all of the following standards:

(1) The lease site is considered appropriate for marine finfish aquaculture in the programmatic environmental impact report if prepared and approved by the commission pursuant to Section 15008.

(2) A lease shall not unreasonably interfere with fishing or other uses or public trust values, unreasonably disrupt wildlife and marine habitats, or unreasonably harm the ability of the marine environment to support ecologically significant flora and fauna. A lease shall not have significant adverse cumulative impacts.

(3) To reduce adverse effects on global ocean ecosystems, the use of fish meal and fish oil shall be minimized. Where feasible, alternatives to fish meal and fish oil, or fish meal and fish oil made from seafood harvesting byproducts, shall be utilized, taking into account factors that include, but need not be limited to, the nutritional needs of the fish being raised and the availability of alternative ingredients.

(4) Lessees shall establish best management practices, approved by the commission, for each lease site. Approved best management practices shall include a regular monitoring, reporting, and site inspection program that requires at least annual monitoring of lease sites to ensure that the operations are in compliance with best management practices related to fish disease, escapement, and environmental stewardship, and that operations are meeting the requirements of this section. The commission may remove fish stocks, close facilities, or terminate the lease if it finds that the lessee is not in compliance with best management practices, that the lessee's activities have damaged or are damaging the marine environment, or that the lessee is not in compliance with this section. The commission shall take immediate remedial action to avoid or eliminate significant damage, or the threat of significant damage, to the marine environment.

(5) Before issuance of the lease, the lessee shall provide baseline benthic habitat and community assessments of the proposed lease site to the applicable regional water quality control board or the State Water Resources Control Board, and shall monitor the benthic habitat and community during the operation of the lease in a manner determined by the regional board or the State Water Resources Control Board. The regional board and the State Water Resources Control Board may establish and impose reasonable permit fees to pay for the costs of administering and conducting the assessment and monitoring program.

(6) Finfish numbers and density shall be limited to what can be safely raised while protecting the marine environment, as specified by the terms of the lease, subject to review and amendment by the commission.

(7) The use of all drugs, chemicals, and antibiotics, and amounts used and applied, shall be minimized. All drugs, therapeutic substances, and antibiotics shall be used and applied only as approved by the United States Food and Drug Administration for marine finfish aquaculture. The lessee shall report that use and application to the commission on a regular schedule, as determined by the commission, but no less than annually, that shall be included in the terms of the lease. The commission shall review those reports on a regular basis and at least annually.

(8) The commission shall require all farmed fish to be marked, tagged, or otherwise identified as belonging to the lessee in a manner determined appropriate by the commission, unless the commission determines that identifying farmed fish is unnecessary for protecting wild fish stocks, the marine environment, or other ocean uses.

(9) All facilities and operations shall be designed to prevent the escape of farmed fish into the marine environment and to withstand severe weather conditions and marine accidents. The lessee shall maintain records on all escapes in a manner determined by the commission. In the event of more than de minimis escapement, the number of escaped fish and the circumstances surrounding the incident shall be reported immediately to the commission, and the lessee shall be responsible for damages to the marine environment caused by those escaped fish, as determined by the commission.

(10) The lessee shall, at a minimum, meet all applicable requirements imposed by the State Water Resources Control Board and the regional water quality control boards, and shall prevent discharges to the maximum extent possible. Monitoring and testing of water quality shall be required on a regular basis as deemed appropriate by the State Water Resources Control Board or the regional water quality control boards. All inspection and monitoring reports and other records, and all data on the discharge of chemical and biological pollutants shall be kept on file and available for public review.

(c) If a restoration or enhancement plan is submitted to, and approved by, the commission, and that plan, among other things, provides for monitoring and protecting the benthic habitat, the prevention of pollution, and the prevention of adverse impacts on wild fish stocks from disease, parasites, and genetic alterations, subdivision (b) shall not apply to any of the following:

(1) Artificial propagation, rearing, and stocking projects for the purpose of recovery, restoration, or enhancement of native fish stocks carried out under either of the following:

(A) A scientific collecting or research permit issued by the department.

(B) The California Ocean Resources Enhancement and Hatchery Program, as set forth in Article 8 (commencing with Section 6590) of Chapter 5 of Part 1 of Division 6, for the enhancement of white sea bass.

(2) Nonprofit hatcheries and nonprofit artificial propagation projects operated by, or on behalf of, licensed commercial or sport fishermen and fisherwomen for the purpose of recovery, restoration, or enhancement of California's native marine fish populations, pursuant to Chapter 8 (commencing with Section 6900) of Part 1 of Division 6.

(d) Nothing in this section shall be construed to limit or expand the application of any other state law or regulation pertaining to marine finfish aquaculture conducted within the ocean waters under the jurisdiction of this state.

SEC. 5. Section 15405 of the Fish and Game Code is amended to read:

15405. (a) Except as specified in subdivision (b), no initial term of a state water bottom lease shall exceed 25 years.

(b) The initial term of a state water bottom lease for marine finfish aquaculture shall not exceed 10 years.

SEC. 6. Section 15406 of the Fish and Game Code is amended to read:

15406. (a) Each state water bottom lease shall specify a period prior to expiration when renewal of the lease may be requested by the lessee. If during this period the lessee is still actively engaged in aquaculture, as determined by the commission, the lessee shall have a prior right to renew the lease on terms agreed upon between the commission and the lessee. If terms are not agreed upon, the commission shall advertise for bids on the lease. If a request for renewal is not made by the lessee, the commission shall advertise for bids on the lease. The commission shall consider bids only from aquaculturists registered pursuant to Section 15101.

(b) Notwithstanding subdivision (a), with respect to any lease of state water bottoms in effect on January 1, 1983, the lessee shall have a prior right to renew the lease. If the lessee does not renew the lease, the commission shall advertise for bids on the lease. The commission shall consider bids only from aquaculturists registered pursuant to Section 15101.

(c) Except as specified in subdivision (d), a lease may be renewed for additional periods not to exceed 25 years each.

(d) A lease for marine finfish aquaculture may be renewed for additional periods not to exceed 5 years each.

SEC. 7. Section 15406.5 of the Fish and Game Code is amended to read:

15406.5. (a) Except as specified in subdivision (b), the commission shall award water bottom leases to the highest responsible bidder, if the bid meets or exceeds the minimum annual rent established by the commission, which shall not be less than two dollars ($2) per acre, for all species cultivated, unless the acreage applied for is 10 acres or less, in which case the minimum acceptable rent shall be ten dollars ($10) per acre. The annual rent for any lease in effect on January 1, 1983, for the cultivation of oysters shall be one dollar ($1) per acre until the expiration thereof. The commission may reject any or all bids for the lease of state water bottoms if it deems the rejection to be in the public interest.

(b) Fees for marine finfish aquaculture leases shall, at a minimum, be sufficient to pay for the costs of administering the marine finfish leasing program, and for monitoring and enforcing the terms of the leases.

SEC. 8. Section 15409 of the Fish and Game Code is amended to read:

15409. (a) Upon termination of a lease, for any reason, all structures shall be removed at the lessee's expense from the leasehold, and the area shall be restored to its original condition. If the lessee fails to remove the structures, the state may remove them and the lessee shall pay the removal costs incurred.

(b) The commission shall require financial assurances of each marine finfish aquaculture lessee to ensure that restoration is performed to the satisfaction of the commission. Financial assurances may take the form of surety bonds executed by an admitted surety insurer, irrevocable letters of credit, trust funds, or other forms of financial assurances specified by the commission, as it determines are available and adequate to ensure the lease site is restored pursuant to this section.

(c) Marine finfish aquaculture lessees shall be responsible for any damages caused by their operations, as determined by the commission, including, but not limited to, reimbursement for any costs for natural resource damage assessment.

(d) Nothing in this section limits the state in pursuing additional remedies authorized by law.

SEC. 9. Section 30411 of the Public Resources Code is amended to read:

30411. (a) The Department of Fish and Game and the Fish and Game Commission are the principal state agencies responsible for the establishment and control of wildlife and fishery management programs and the commission shall not establish or impose any controls with respect thereto that duplicate or exceed regulatory controls established by these agencies pursuant to specific statutory requirements or authorization.

(b) The Department of Fish and Game, in consultation with the commission and the Department of Boating and Waterways, may study degraded wetlands and identify those which can most feasibly be restored in conjunction with development of a boating facility as provided in subdivision (a) of Section 30233. Any study conducted under this subdivision shall include consideration of all of the following:

(1) Whether the wetland is so severely degraded and its natural processes so substantially impaired that it is not capable of recovering and maintaining a high level of biological productivity without major restoration activities.

(2) Whether a substantial portion of the degraded wetland, but in no event less than 75 percent, can be restored and maintained as a highly productive wetland in conjunction with a boating facilities project.

(3) Whether restoration of the wetland's natural values, including its biological productivity and wildlife habitat features, can most feasibly be achieved and maintained in conjunction with a boating facility or whether there are other feasible ways to achieve these values.

(c) The Legislature finds and declares that salt water or brackish water aquaculture is a coastal-dependent use which should be encouraged to augment food supplies and to further the policies set forth in Chapter 4 (commencing with Section 825) of Division 1. The Department of Fish and Game may identify coastal sites it determines to be appropriate for aquaculture facilities. If the department identifies these sites, it shall transmit information identifying the sites to the commission and the relevant local government agency. The commission, and where appropriate, local governments, shall, consistent with the coastal planning requirements of this division, provide for as many coastal sites identified by the Department of Fish and Game for any uses that are consistent with the policies of Chapter 3 (commencing with Section 30200) of this division.

(d) Any agency of the state owning or managing land in the coastal zone for public purposes shall be an active participant in the selection of suitable sites for aquaculture facilities and shall make the land available for use in aquaculture when feasible and consistent with other policies of this division and other provisions of law.

SEC. 10. No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because the only costs that may be incurred by a local agency or school district will be incurred because this act creates a new crime or infraction, eliminates a crime or infraction, or changes the penalty for a crime or infraction, within the meaning of Section 17556 of the Government Code, or changes the definition of a crime within the meaning of Section 6 of Article XIII B of the California Constitution.

GO WILD CAMPAIGN
Bellingham, WA, August 25, 2005

Ms. SUSAN BUNSICK,
Policy Analyst,
NOAA Aquaculture Program/National Marine Fisheries Service.

Dear Ms. Bunsick,

This letter constitutes a formal request for NOAA to:

1. Immediately prepare the required LEIS on S. 1195, National Aquaculture Act of 2005.

2. Enlist the Science Advisory Board and other knowledgeable scientists, and finance appropriate research to fully analyze the issues surrounding open ocean fish farming; and,

3. Provide written response to the questions outlined in this letter.

At NOAA's Science Advisory Board meeting in Seattle, August 8 and 9, 2005, many questions were raised following your presentation about "NOAA's Role in Open Ocean Aquaculture: Legislation and Research".

The "National Aquaculture Act of 2005" (S. 1195), developed in secrecy and introduced on June 7, vastly changes management and utilization of the U.S. Exclusive Economic Zone, 3–200 miles offshore. Many citizens, elected officials and members of the scientific community are losing confidence in NOAA's stewardship of our ocean commons, while the agency is aggressively promoting private, even foreign owned fish farms in our waters.

You stated several times that NOAA recognizes the importance of science, yet it is apparent that substantial scientific assessment of impacts and risks of open ocean aquaculture (OOA) have not been conducted.

NOAA has thus far declined to prepare a legislative environmental impact statement (LEIS) which is required by the National Environmental Policy Act (NEPA) *prior* to Congress voting on legislation that significantly affects the quality of the human environment. Several Members of Congress, including two from Washington State where the recent SAB meeting was held, have requested that NOAA prepare the LEIS.

On NOAA's Science Advisory Board website, their stated mission is to ensure NOAA's science programs "are of the highest quality and provide optimal support to resource management, and environmental assessment and prediction" and they can assist "NOAA in maintaining a complete and accurate understanding of scientific issues critical to the agency's missions."

To that end, the following are some of the analysis that must be conducted:

1. *A detailed economic impact study of effects of aquaculture of all economically valuable marine species on existing fishing dependent businesses and employment* (i.e. commercial, recreational, tribal), under several assumed levels of offshore commercial aquaculture and given existing and predicted net pen and alternative containment technologies.

2. *A detailed analysis of the full range of economic and environmental impacts that could result from the escape of various levels of farmed native or exotic species and genetically modified fish into the open ocean and nearshore environments.* This analysis should consider several different scenarios based on various production models, quantities, and methodologies utilizing current and predicted net pen and alternative containment technologies.

3. *An analysis of the potential impact to the environment and human health from potential fish diseases, bacteria, viruses, and parasites resulting from offshore aquaculture,* under several assumed levels of offshore commercial aquaculture and given existing and predicted net pen and alternative containment technologies.

4. *An analysis of the impacts on human health* from consuming offshore farmed fish, including an analysis of the impacts of: (a) antibiotics, (b) other cleaning and algal growth prohibiting chemicals, and, (c) mercury and hydrocarbons in facilities located on or adjacent to offshore oil and gas facilities, under several assumed levels of offshore commercial aquaculture and given existing and predicted use of these chemicals in marine aquaculture.

5. *A detailed analysis of the impacts on water quality* and the environment resulting from the use of various cage materials under several assumed levels of offshore commercial aquaculture and various proximities for aquaculture facilities, given existing and predicted net pen and alternative containment technologies. Such analysis should describe in detail how the farms will meet the

terms of relevant state and Federal fisheries and environmental law (e.g. Clean Water Act, ESA, MMPA).

6. *An analysis detailing the potential impact of dredging, drilling, and other sediment and bottom habitat disturbances* from aquaculture, including potential harms to seagrass, coral die-off, survival rates and displacement of ocean wildlife, as well as impacts from resuspension of any persistent, bioaccumulative toxicants already in the sediments, given existing and predicted net pen and alternative containment technologies.

7. *An identification of the areas of the ocean where aquaculture could compete with other uses* that are of significant social or economic value to the public or nation including: (a) fishing grounds and routes to those fishing grounds, (b) vessel traffic lanes, (c) military sites and areas of concern regarding national security, (d) national marine sanctuaries, marine reserves and other marine protected areas, (e) areas used for public recreational purposes, like boating, diving, and recreational fishing, and (f) other multiple use areas.

8. *An analysis of the likely impacts from the use of fish feed in offshore aquaculture*—including an analysis of any changes in pelagic fish populations and resulting impact on various predator fish species and endangered seabirds and mammals, and the economic impact to fishing communities—under several assumed levels of offshore commercial aquaculture and given existing and predicted feed technologies and rates.

9. *An analysis of the expected increase/decrease in the net amount of marine protein* available for human consumption under various types of offshore aquaculture utilizing various species of fish and shellfish.

10. *A detailed analysis of the amount of fossil fuel and other energy resources* used for ocean production of fish and the resulting impact on the economy under several assumed levels of offshore commercial aquaculture.

11. *The "Code of Conduct for Responsible Aquaculture Development in the U.S. Exclusive Economic Zone", prepared by the National Marine Fisheries Service in 2002 states, "The Code adheres to the spirit and intent of the FAO Code of Conduct for Responsible Fisheries (CCRF) to which the United States is a signatory and strong supporter, and does not in any way contradict its principles".*

Several articles of the FAO Code of Conduct for Responsible Fisheries are significant:

"States should apply the precautionary approach widely to conservation, management and exploitation of living aquatic resources in order to protect them and preserve the aquatic environment. The absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures." (Article 7.5.1) "States should ensure that the livelihoods of local communities, and their access to fishing grounds, are not negatively affected by aquaculture developments." (Article 9.1.4) "States should protect transboundary aquatic ecosystems" (Article 9.2.1). "States should conserve genetic diversity and maintain integrity of aquatic communities and ecosystems by appropriate management. In particular, efforts should be undertaken to minimize the harmful effects of introducing nonnative species or genetically altered stocks . . . States should, whenever possible, promote steps to minimize adverse genetic, disease and other effects of escaped farmed fish on wild stocks" (Article 9.3.1). "States should regulate the use of chemical inputs in aquaculture which are hazardous to human health and the environment" (Article 9.4.5). "States should require that the disposal of wastes such as offal, sludge, dead or diseased fish, excess veterinary drugs and other hazardous chemical inputs does not constitute a hazard to human health and the environment" (Article 9.4.6).

Please respond with detailed descriptions of how NOAA, in the face of expansive aquaculture development, intends to comply with the precautionary approach and uphold the principals of the FAO Code of Conduct for Responsible Fisheries.

Thank you for responding to these questions and concerns. This letter will be available to Members of Congress, NOAA's Science Advisory Board, as well as other interested parties. NOAA's timely response is appreciated.

Sincerely,

ANNE MOSNESS.

cc: Dr. Leonard J. Pietrafesa; Dr. Michael Uhart; The NOAA Science Advisory Board; Members of Congress; Coastal Governors and State Legislators; and Fishing, consumer advocacy and conservation organizations.

THE OCEAN CONSERVANCY
Washington DC, November 1, 2005

Hon. TED STEVENS,
Chairman,
Hon. DANIEL K. INOUYE,
Co-Chairman,
Senate Committee on Commerce, Science, and Transportation,
Washington, DC.

Dear Senators Stevens and Inouye:

We are writing to register The Ocean Conservancy's (TOC) concerns regarding the National Offshore Aquaculture Act of 2005 (S. 1195) as introduced, and to offer recommendations for improving the bill. While the development of offshore aquaculture may have significant potential, it also has significant risks. To protect human health, native fish and wildlife populations, and ocean ecosystems, TOC believes that aquaculture in ocean waters must be accompanied by a stringent statutory and regulatory framework.

We appreciate your efforts, as well as those of many of your colleagues, to ensure environmental standards are developed to accompany any legislative authorization of this new ocean use. As it stands, S. 1195 is strongly weighted toward the promotion of commerce. It fails to provide adequate criteria and standards to guide NOAA in accounting for other interests, such as the protection of wild stocks, protection of the environment, and coordination of other uses. In fact, without your amendment upon introduction, even the duty to develop standards would have been left solely to the discretion of the agency.

In this context, we would appreciate your consideration of our comments on the bill as introduced. We look forward to working with you to develop a more effective and efficient management regime that will safeguard the environment and the public trust.

Sincerely,

CATHERINE HAZLEWOOD,
Legislative Program Manager.
TIM EICHENBERG,
Pacific Regional Director.

cc: Members of the Senate Commerce Committee; Members of the House Resources Committee; and Members of the House Oceans Caucus.

COMMENTS OF THE OCEAN CONSERVANCY ON S. 1195: THE NATIONAL OFFSHORE AQUACULTURE ACT OF 2005

Background

The potential of open ocean aquaculture is promoted as a solution to the ocean's diminishing resources. However, it also poses significant risks, including escapement of fish, damage to the surrounding environment, harmful effects on native fish populations, and pollution. These risks, and their consequences, are largely dependent upon the location of the operation, its size or scope, the stringency and comprehensiveness of the management practices, the capacity of the receiving water body, and the choice of species to be raised in a particular area.

Both the Pew Oceans Commission and the U.S. Commission on Ocean Policy recommended that Congress improve the governance framework to address the many challenges and risks associated with the development of offshore aquaculture.

Risk of Escapement of Potentially Invasive Species

In our view, the single greatest ecological and economic threat associated with a rise in offshore aquaculture is the potential to introduce potentially invasive species to the surrounding ecosystem and nearby coastal communities. According to the National Marine Fisheries Service (NMFS) and the Fish and U.S. Wildlife Service (FWS), escapes are resulting in harmful interactions with native fish. These interactions include competition with wild stock for food, habitat and mates, genetic modification of wild stocks through inter-breeding, and transfer of potentially deadly diseases and parasites to wild stocks.

The potential for escapement of farmed fish is greater in facilities sited further offshore, where containment structures face increased exposure to wind and wave power as well as to predators. Offshore structures pose unique challenges for monitoring as well as rapid response in the event of escapement. Additionally, many of

the species favored for offshore aquaculture use are highly pelagic, and consequently, once they escape, are capable of traveling thousands of miles.

Moreover, we currently have no way of determining in advance which species that escape into the wild are likely to cause harm. No common statutory definition of invasive species exists; nor has the Federal Government implemented comprehensive screening protocols to discern which non-native or genetically modified species have the potential to become invasive upon introduction into a given environment. Therefore, the utilization of non-native species in offshore aquaculture facilities is dangerously premature.

Additional Biological Threats

Offshore aquaculture presents numerous additional biological threats to ocean ecosystems. The excreta from an average floating cage farm can produce nutrients equal to a city of 7,500.[1] Depending upon pollutant composition and the cumulative effects of similar cages in a particular area, discharges may present harmful effects on the surrounding environment. Additionally, outbreaks of diseases and parasites are a constant risk because the density of fish in aquaculture operations is so much higher than in nature. Diseases in farmed salmon have been found to significantly threaten the health and vitality of nearby migrating wild stocks. Farmed species, depending upon species and diet, can even present increased public health risks to the people who consume them.[2]

Aquaculture operations also may require dredging, drilling, the use of large heavy anchors, and other disturbances to sediment and bottom habitats, which can displace ocean wildlife, smother bottom-dwelling animals, destroy hiding places for young fish, and cause other ecological changes to the sea floor. Finally, aquaculture may create an incentive to overexploit targeted wild fish populations to provide inexpensive feed for farmed fish.[3] Farming carnivorous marine fish such as salmon currently represents a net loss of fish protein.[4]

Lack of Capacity of Regulatory Regime to Address Risks

Unfortunately, current regulations and mitigation strategies are simply inadequate to guide the aquaculture industry or manage its risks. Regulatory agencies with overlapping and conflicting authority have thus far demonstrated significant confusion regarding environmental requirements, siting considerations, leasing procedures and jurisdictional responsibility. Without careful legislative coordination of NOAA's jurisdiction and responsibilities with those of other agencies, we believe problems will persist, with potentially serious environmental consequences.

For these reasons, clear, coordinated and comprehensive standards must accompany the development of this new ocean use. This is especially critical given the projected growth of the industry: the U.S. Department of Commerce has called for aquaculture production in the United States to increase fivefold by 2025.[5] In this context, the remainder of our comments will address our specific concerns with the bill as introduced, organized section-by-section.

Section 2. Findings

As currently drafted, the findings of Congressional policy in this section generally promote the development of aquaculture while incorporating too little acknowledgement of either its risks or its effects on other ocean uses. We encourage the Committee to ensure this policy reflects a more balanced perspective on the development of a new ocean use and its relationship to other ocean uses and the marine environment.

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[1] *See What's Behind That Farmed Salmon Steak?* Salmon Nation (2002) at *http://www.salmonnation.com/farmed.html,* citing David Suzuki Foundation, (2002) *Ocean Pollution from Salmon Farming, http://www.davidsuzuki.org/Oceans/Fish__Farming/Salmon/Pollution.asp*.

[2] *See* Hites, et. al, *Global Assessment of Organic Contaminants in Farmed Salmon,* 203 *Science* at 226 (concentrations of PCBs, toxaphene, and dieldrine have been found to be significantly greater in farmed salmon species than in wild species, and applications of risk indicates risks may detract from beneficial effects of consumption).

[3] "An annual production of 1 million mt of farm fish may require 1–5 million mt of compounded feed, depending upon its formula and conversion rates [. . .] For carnivorous fish, like most marine species, feeds contain proteins mostly of animal origin, particularly high quality fish meal and fish oil." *Achieving policy objectives to increase the value of the seafood industry in the United States: the technical feasibility and associated constraints,* C.E. Nash, 29 FOOD POLICY 621–641 (2004).

[4] "[A]bout two to five times more wild-caught fish are used in feeds than are harvested from aquaculture," Future seascapes, fishing, and fish farming, R. Goldburg and R. Naylor, 3(1) *Front. Ecol Environ*, 21–28, p. 23 (2005).

[5] *See,* Biliana Cicin-Sain and Robert W. Knecht, *Development of a Policy Framework for Offshore Marine Aquaculture in the 3–200 Mile U.S. Ocean Zone* (2001).

Section 3. Definitions

Section 3(1) defines "demonstration" to include both pilot scale-testing of aquaculture science and technologies, or farm-scale research. We believe generally this definition is too vague to give sufficient guidance. "[P]ilot scale," "science," "technologies," and "farm-scale research" are potentially subjective terms not defined further in the bill. We would encourage you to clarify these terms to ensure even demonstration projects are conducted in an ecologically protective manner.

Section 4. Offshore Aquaculture Permits

Generally speaking, we would like to see section 4 amended to provide a framework to ensure offshore aquaculture is well coordinated with other ocean uses and protects the public trust. This section directs the Secretary of Commerce to establish a site and operating permit process to make areas of the U.S. Exclusive Economic Zone (EEZ) available to persons to develop and operate offshore aquaculture facilities. However, it leaves to agency discretion particular procedures to be followed, including timing of regulatory processes, and scope and criteria for decisions.

Legislation Should Include a Method for Initially Determining Suitable Areas for Aquaculture

We recommend that the Committee include a more comprehensive siting process than the proposed lease-by-lease, operation-by-operation approach. Although subsection (b) requires the Secretary to specify in a site permit the size and location of an offshore aquaculture facility and, under subsection (d), to consult with other Federal agencies to ensure that an offshore aquaculture facility is compatible with other uses of the EEZ, the bill lacks a mechanism to determine, in advance of individual operation-by-operation siting decisions, where offshore aquaculture is, and is not, appropriate. The process we envision would clearly articulate criteria and a process for NOAA to follow in establishing zones appropriate for development of aquaculture leases and operations that also would not interfere with other ocean uses, such as shipping channels and commercial fisheries.

Legislation Should Prohibit the Permitting of Commercial Operations Until NOAA has Promulgated Necessary Regulations

We also urge you to include language prohibiting the issuance of any aquaculture permits under this section until the agency has promulgated comprehensive regulations to guide its decision-making. The timely establishment of clear, consistent, and enforceable regulations is critical for both the public and industry.

Legislation Should Ban the Use of Non-native or Genetically Modified Species in Offshore Aquaculture

For the reasons articulated in the background section to these comments, we oppose the use of non-native or transgenic species in offshore aquaculture. Some states, including Maine, California, Washington and Oregon have already implemented such prohibitions in legislation to protect state waters, while other states such as Alaska more broadly prohibit the development of offshore aquaculture in state waters. We urge you to amend section 4 to prohibit the use of non-native species and transgenic species in section 4 of S. 1195.

Section 5. Environmental Requirements

Legislation Must Include Strong, Clear Operational and Site Permitting Requirements

We are concerned that S. 1195 establishes few parameters to guide agency consideration of the ecological impacts of aquaculture facilities. Although subsection (4)(c) authorizes the Secretary to issue operating permits under "such terms and conditions as the Secretary shall prescribe" and subsection (4)(d) directs the Secretary to "consult as appropriate" with other Federal agencies to ensure that offshore aquaculture facilities meet the environmental requirements established under section 5(a) of the bill, section 5(a) does not establish any new requirements. Instead, it simply directs the Secretary to consult with other Federal agencies to identify the environmental requirements applicable to offshore aquaculture under *existing* laws and regulations. Although the bill authorizes the Secretary to establish additional environmental requirements, the process for consultation with other stakeholders as well as the content of any such additional requirements is left to the discretion of the Secretary. Furthermore, subparagraph (d)(6) requires only that the Secretary "periodically review" the criteria for issuance of site and operating permits.

We recommend that the Committee include standards in the bill for siting and operating permits that are precautionary, comprehensive, clear, and legally binding.

Specifically, we recommend that such standards address the following general issues:

Siting

- Description of site characteristics, and proximity to other ocean uses;
- Consideration of cumulative effects of similar facilities in an ecosystem;
- Prioritization of ocean uses such that aquaculture does not unreasonably interfere with other ocean uses, such as the protection of a sensitive marine environment, popular recreational fishery, or vessel lane used in commercial fishing;
- Requirements that facilities be designed and operated to prevent escapes and interactions with wild species.

Cultured Species

- Proposed sources for organisms to be grown at the site;
- Procedures for the introduction of fish stocks to stock facilities, including brood stock quarantine, limited introduction of first-generation progeny to assess interactions with native species in open waters, and continued study of the introduced organisms in their new environment;
- Maximum allowed density, numbers and biomass of fish allowed in a particular type of structure;
- Minimization of the use of fishmeal and fish oils in feeds.

Pollution Standards

- An analysis of the quality of the receiving waters (with bioassays, as appropriate). Analysis of the potential for pollutant transport by biological, physical or chemical processes, and availability of alternatives to pollutant discharge from the facility;
- Development and application of water quality criteria and pollutant effluent limits established by the Environmental Protection Agency under the Clean Water Act;
- Requirements that the use of drugs and chemicals be minimized and that detailed records be kept on all drugs and chemicals used in an aquaculture facility, including the amounts used and frequency applied. Drugs, pesticides, and other chemicals not authorized and registered by the Food and Drug Administration and the Environmental Protection Agency for the particular use should be specifically prohibited. In addition, drug and chemical records should be available to the public at all times;
- A detailed plan in the event of escapement to rapidly respond, including tagging and notification procedures.

Monitoring and Permitting

- Minimum standards for record keeping, including records of the total number of each species grown and harvested, and specific maintenance and inspection procedures carried out;
- Ongoing monitoring of benthic habitat and water quality both in and immediately surrounding the containment structure;
- Limitations on the duration of permits and a specific timeframe for review of criteria for the issuance of site and operating permits. Specifically, the legislation should provide for an initial period for an operating period that is economically and environmentally reasonable, not to exceed 8 years. Once that initial period has elapsed, operating permits should be reviewed and renewed at least every 5 years. Similarly, criteria for the issuance of site and operating permits should be reviewed not less than once every 4 years;
- Bonding procedures to ensure restoration of the site and financial liability of the owner/operator of the facility.

In sum, given the risks associated with offshore aquaculture, we believe it should be carefully regulated from its inception to ensure its economic and environmental success.

Section 6. Research and Development

S. 1195 allows the Secretary to conduct research and development to advance technologies that are compatible with the protection of marine ecosystems. We believe this work should be carried out in close coordination with other relevant agencies. We also note that while many international, national and state governments

have implemented recommended management measures drawing upon existing science, NMFS has not yet promulgated best management practices under existing law. We urge the Committee to direct NMFS to develop and publish such research in time to help guide development and promulgation of regulations under section 4 of the bill.

Section 7. Administration

We believe S. 1195 should establish reasonable timelines and deadlines for the promulgation of regulations necessary to administer this program. As outlined earlier, we believe that the bill should make clear that permitting for commercial aquaculture facilities may not proceed until NMFS has promulgated those regulations.

Additionally, we request that the Committee amend subsection (c) to detail processes for resolving disputes that may that arise in decisionmaking. Other than requirements that the Secretary consult with other relevant agencies "as appropriate" (section 4(d)(1)) and the requirement to obtain "concurrence" (section 4(a)(2)) from the Department of Interior on some decisions, the bill currently does not articulate a process for resolving interagency disputes.

Despite the language of subsection (f), subsection (g) takes the highly unusual step of authorizing the Secretary to apply the provisions of any other Federal statute to offshore aquaculture facilities if the Secretary determines that it is in the public interest. In our view, Congress, and not the Secretary, should determine in the first instance whether those laws apply to offshore aquaculture facilities.

Similarly, subsection (h) would Federalize the law of the nearest adjacent coastal states even for state laws that have not yet been adopted. Although we appreciate that state resources may be adversely affected by aquaculture operations in Federal waters, and support states' ability to adopt more stringent laws governing such facilities, subsection (h) is not an adequate substitute for a sufficiently comprehensive and stringent Federal program.

Section 8. Authorization of Appropriations

Section 8 authorizes to be appropriated to the Secretary such sums as are necessary to carry out the Act. Although this section gives the appropriators wide latitude, an authorization for a specific dollar amount in each of the Fiscal Years authorized by the Act would give the members of the appropriations committee and the public some indication of the resources needed to fully and effectively implement this program. We suggest that this section also include specific authorizations for research and the promulgation of regulations.

Section 10. Enforcement Provisions

We urge the Committee to clarify the circumstances and use of available enforcement authority. We urge the Committee to incorporate a citizen suit provision, similar to those utilized in other Federal statutes regulating biological pollution.

Section 11. Civil Enforcement and Permit Sanctions

We urge the Committee to consider including a liability in rem provision.

Section 13. Forfeitures

We urge the Committee to include language ensuring that forfeited resources made available for sale do not endanger public health.

Conclusion

Thank you for your efforts to ensure that offshore aquaculture is guided by strong environmental standards. We look forward to working with you to advance legislation that would ensure prudent, consistent, and responsible controls on the siting and operations of open ocean aquaculture facilities.

Senator SUNUNU. Thank you.
Dr. MacMillan.

STATEMENT OF JOHN R. "RANDY" MACMILLAN, PH.D., PRESIDENT, NATIONAL AQUACULTURE ASSOCIATION

Dr. MACMILLAN. Thank you Mr. Chairman. My name is Randy MacMillan. I'm the President of the National Aquaculture Association. My testimony will focus on the importance of ensuring the Senate Bill 1195 strikes a reasonable environmental protection bal-

ance if the goal of Congress is to create an open ocean aquaculture program.

I want to emphasize three principal issues. Number one, for any aquaculture program to succeed it must be profitable for business.

Number two, current U.S. environmental protection fishery management and public health and safety programs already ensure domestic ocean aquaculture practices will be ecologically sustainable, and number three, Senate bill 1195 should resolve the fundamental legal issues of authority of the states and Federal waters and resolve limits on the lease periods. Development of specific operating standards should be left to the transparency of rulemaking which should be based on objective scientific research findings.

Today foreign imports have created a seafood deficit of $8.3 billion and 40 to 50 percent of those imports are farm-raised seafood. Well documented human health benefits of farm-raised seafood consumption taste and price drive seafood consumption in the United States. The significant driver for increased consumption of imported farm-raised seafood is their comparatively low priced, low production costs. These lower costs occur because of low labor costs and far less stringent and environmental expectations. This threatens the economic viability of our existing domestic aquaculture sectors.

Senate Bill 1195 contemplates development of aquaculture in Federal open ocean waters. If that is indeed the objective of congress, then you must guard against a bill that is overly prescriptive and anti-competitive or burdensome. The legal system created must provide a reasonable expectation of commercial viability. Legislation that leads to uncertainty, excessive operating costs, litigation over broadly defined legislative standards, short permit periods or potential revocation of permits by states will not justify investment. Investment risks will have to fall within acceptable ranges if we're to produce marine aquaculture products in U.S. waters.

In 2004, the U.S. EPA completed 4 years of investigations into the primary methods of aquaculture production, including coastal marine net pen operations and developed new effluent guidelines for incorporation in Federal discharge permits. The Clean Water Act and its regulations also include ocean discharge standards that supplement the recently adopted aquaculture effluent regulations and provide an adaptive process to ensure protection of ocean water quality. The ocean discharge criteria require assessment of location, design, proposed stock species and receiving water characteristics to establish appropriate safeguards. Because current protective Federal scientifically based requirements exist, we should guard against efforts to create redundant new requirements, or use political motivations to mandate revision of current standards. Congress should simply confirm that aquaculture in Federal waters must comply with the requirements of the Federal Clean Water Act.

There is much discussion of the use of fish meal and fish oil in feeds for cattle, swine, poultry and fish. The debate centers on whether the harvest of pelagic fishes used to make fish meal and fish oil is ecologically sustainable.

The domestic aquaculture use of fish meal and fish oil even with potential open ocean aquaculture scenarios is and will only have a minor share of the global market. Other countries, notably China, are far greater users and even now are contracting for future production volume from the major global producers of fish meal and fish oil.

Legislation dictating minimized use of these products will only penalize American farmers. I urge you not to submit to calls for silver bullet solutions regarding management of fish feed, stocks. Comprehensive domestic and international fisheries management programs should address this issue. Management of this resource cannot be effectively conducted by simply restricting the potential use of fish feed at offshore U.S. production sites.

The pending legislation should not attempt to set new policy for drug use in marine aquaculture. A rigorous program of Federal regulations is already well-established under authority of the U.S. FDA. Policy statements that mandate minimized use of such materials are not science-based and provide no additional measure of protection to human health or the environment and for the record, there are no approved hormones for use in domestic food fish aquaculture.

Efforts to develop a domestic offshore aquaculture program are not occurring in a vacuum. Several well-established Federal regulatory program standards can be used to protect water quality, animal health and natural resources in this context. The offshore legislation should rely on such established standards and the integration of the new offshore program details such existing standards through the rulemaking process. This approach could provide a better coordinated and efficient program that is more likely lead to actual investment and production in U.S. marine aquaculture.

Thank you again for the opportunity for me to present my testimony.

[The prepared statement of Dr. MacMillan follows:]

PREPARED STATEMENT OF JOHN R. "RANDY" MACMILLAN, PH.D., PRESIDENT, NATIONAL AQUACULTURE ASSOCIATION

Introduction

I am honored to testify today about the opportunities Senate Bill 1195 could create to improve availability of wholesome, competitively priced seafood for U.S. consumers while creating jobs for people living in coastal fishing communities. My name is John R. MacMillan. I am the President of the National Aquaculture Association, the NAA. The NAA is a U.S. trade association primarily representing producers of domestic fish and shellfish aquaculture. Our members produce a variety of food fish, recreational fishing stock and baitfish, aquarium ornamental fish and shellfish. The NAA mission is to foster development of environmentally sustainable aquaculture in the United States. To do this, we strive to partner with various Federal agencies to develop policies and regulations that are protective of the environment and public health, practical and cost-effective, and based on credible scientific information. The focus of my testimony is environmental issues. Several issues regarding offshore aquaculture were also presented in written comments previously submitted to the Subcommittee by the NAA. The NAA supports S. 1195 because it creates opportunity for further, environmentally sustainable U.S. aquaculture development.

In addition to serving as President of the NAA, I am the Vice President of Research and Environmental Affairs for Clear Springs Foods in south-central Idaho. In this capacity, I serve as an officer of the company addressing various research, natural resource and quality assurance issues. I also serve as the chairman of the Idaho Board of Environmental Quality. Prior to my current position, I was an Asso-

ciate Professor of Veterinary and Aquatic Animal Medicine at the Mississippi State University College of Veterinary Medicine. I have authored or co-authored over 75 scientific publications dealing with cellular senescence, aquatic animal diseases and their treatments, environmental stewardship and aquatic animal production practices. I have a Ph.D. in fishery biology and was a Senior Research Fellow in the School of Medicine at the University of Washington in Seattle. In 2005, I received the U.S. Food and Drug Administration (FDA) Commissioner's Special Citation and recently (2006) was selected by the United Nations FAO/WHO/OIE as a world expert on antibiotics and antimicrobial resistance issues to participate in an expert consultation.

My testimony will focus on the importance of ensuring that Federal legislation strikes a reasonable environmental protection balance if the goal of Congress is to successfully create an open ocean aquaculture program. My conclusion will be to encourage Congress to support offshore aquaculture development in the Exclusive Economic Zone (EEZ) by ensuring S. 1195 is not overly burdensome or prescriptive.

I will make three primary points as follows:

1. For any aquaculture program to succeed, whether in the EEZ or anyplace else, it must be profitable for businesses.

2. Current U.S. environmental protection, fishery management and public safety programs provide the means to ensure domestic aquaculture practices are ecologically sustainable.

3. S. 1195 should resolve the fundamental legal issues of authority of the states in Federal waters, and limits on the lease periods. Development of specific operating standards should be left to the transparency of rulemaking which should be based on objective scientific research findings.

Globalization, Domestic Aquaculture and Economics

Consumer demand for seafood in the United States continues to rise at an increasing rate. In 2005, U.S. per capita consumption of seafood had increased to 16.6 lbs, an increase of 11 percent from 5 years ago. This increased consumption is due to widespread consumer recognition of the health benefits of seafood consumption and because seafood represents good value to U.S. consumers. At this time, foreign imports overwhelmingly dominate the U.S. seafood market. In 2005, our seafood deficit reached $8.3 billion.

Increasingly, this seafood is coming from aquaculture. The United Nations Food and Agriculture Organization (FAO) estimates that in 2002, 35.2 percent of the world's 145.9 million metric tons of fisheries landings came from aquaculture. Imports of various farm raised fishes such as salmon, shrimp and tilapia have increased 20 to 200 percent over the past 5 years. Worldwide, the aquaculture sector has grown an average of 9 percent per year since 1970 compared with only a 1.2 percent growth of capture fisheries and 2.8 percent for terrestrial farmed meat production over the same period. Besides the well-documented health benefits of seafood consumption, including consumption of farm raised species, consumers purchase seafood because of taste and because of price competitiveness. The significant increase in consumption of imported seafood over time is attributed to their competitive consumer prices. Imported products are often of lower cost because of significant production advantages due to reduced labor costs and reduced environmental stringency, and other reduced regulatory obligations compared to those in the U.S.

In the U.S., seafood aquaculture production of freshwater finfish is currently dominated by channel catfish, rainbow trout, salmon, hybrid striped bass and tilapia. However, cost competitive domestic production of these products is being severely challenged by international competition. In fact, there is already a significant reduction of production in some domestic freshwater species sectors because of the tremendous volume of imported seafood. Marine products captured in U.S. waters, even when combined with domestic farm raised freshwater species, cannot be expected to satisfy the U.S. seafood market demand. Marine aquaculture production could be an important component of domestic efforts to meet consumer demand, but only if the offshore legislation creates a commercially viable legal framework.

If the objective of Congress is to indeed create opportunity to produce food fish and other products in U.S. Federal waters, then your success should not be defined by passage of Senate Bill 1195. Success can only be measured by your success in attracting private investment in the creation of U.S. marine aquaculture facilities and the production of products for domestic and potentially for export markets.

The legal system created must provide a reasonable expectation of commercial viability. In part, such viability will be dependent on the legal standards and operating requirements ultimately established. Legislation that leads to uncertainty, excessive operating costs, litigation over broadly-defined legislative standards, short

permit periods or potential revocation by states will not justify investment. Investment risks will have to fall within acceptable ranges if we are to produce marine aquaculture products in U.S. waters. [1]

Environmental Sustainability

Protection of Water Quality

In one respect, the development of offshore aquaculture in the United States enjoys what could be a demonstrable benefit over several other potential international development locations. In the US, we have legally enforceable environmental standards that have been developed through transparent, rulemaking procedures under the Federal Clean Water Act. Existing standards offer a measure of predictability in designing offshore operations. To attract investors, we should emphasize this predictability as an advantage. Frankly, this may be the best we can make of this issue because other countries are reportedly attracting investors and facility operators with public financing, less stringent regulatory standards and expedited permit application review procedures. We also should guard against efforts to create redundant new requirements, or mandate revision of current standards; as such steps will undermine any existing advantages. Congress should simply confirm that aquaculture in Federal waters must comply with the requirements of the Federal Clean Water Act.

Maintaining good water quality is a first priority for all successful aquaculturists. Without good water quality, animal husbandry challenges are dramatically increased and these increase fish production costs. There is no reason to believe this will not be the case in offshore production facilities as well. Current information indicates that marine locations offer favorable characteristics because of their assimilative capacity (waters beneath prospective sites are up to 500 feet deep) and the retention of good water quality. But offshore aquaculture facilities are unlikely to be built simply to take advantage of these characteristics.

In aquaculture facilities, the effluent constituents represent lost investment dollars and product. This is in contrast to constituents of wastewater effluent discharges in other types of industries where the discharge represents non-usable production waste. The principle wastes of concern from aquaculture operations are excess feed and fish excretions. Excess feed is money wasted by producers; so great care is exercised to ensure over-feeding does not occur. Recent technological advancements provide encouragement that feed wastage can be readily prevented. Fish excretions are necessary elements of biomass production by fish. In the husbandry of many farmed fish species, feed to flesh conversions of nearly 1:1 have been achieved. It is reasonable to anticipate similar feed to fish flesh efficiencies in marine waters. Practices that limit waste discharge from freshwater and marine aquaculture facilities have been the subject of considerable scientific research. This research ultimately resulted in development of cost-effective and environmentally protective fish farming practices. The U.S. Environmental Protection Agency (US EPA) has a great deal of information regarding this topic. As you have heard in other testimony, feed management is a focus of marine aquaculture research, and includes development of technologies for video monitoring, and evaluation of environmental impacts of excess feed use.

We should avoid creating new, potentially conflicting legislative standards for issues already addressed through detailed rulemaking under well-developed programs, such as existing standards created under the Clean Water Act. In 2004, the U.S. EPA completed 4 years of investigations into the primary methods of aquaculture production (including coastal marine net pen operations), and developed discharge permit regulations. The U.S. EPA regulations created enforceable permit standards for aquaculture operations. Aquaculture facilities are required to meet these standards as elements of permits issued under the Clean Water Act. The U.S. EPA relied heavily upon scientifically credible information collected from throughout the World to craft these standards.

In addition, the Clean Water Act and its regulations include ocean discharge standards that supplement the recently-adopted aquaculture effluent regulations, and provide an adaptive process to ensure protection of ocean water quality. The ocean discharge criteria require an assessment of discharge impacts to biological community resources including human health risks. The U.S. EPA's review of a proposed ocean discharge project considers the effects on the receiving water ecosystems, and specifically ensures that there is no "unreasonable degradation" of the

[1] The NAA submitted written comments to the Subcommittee dated April 19, 2006. In part, we opined that a viable commercial program would require long term renewable leases (25+ years), must avoid unpredictable state veto authorities and extraterritorial application of the CZMA, and should modify the role of the regional fishery management councils.

marine environment. The operating conditions necessary to meet this requirement are developed in the permit application process, where the project factors such as location, design, proposed stock species and receiving water characteristics are taken into account in order to establish appropriate safeguards. Existing Federal regulations require an evaluation of ten criteria to determine whether an unreasonable degradation of the marine environment will occur. Permits cannot be issued when there is insufficient information to determine that no unreasonable degradation will occur, unless the applicant can demonstrate that: (a) the discharge will not result in irreparable harm; (b) no reasonable alternatives to the discharge exist; and, (c) the applicant complies with other permit conditions.

Legislation that creates new performance standards using non-scientific superlative language such as "maximum extent possible" will only lead to debate, not greater protection. Such mandates also create a greater risk that investors and producers will not undertake projects given this level of new uncertainty, and the costs of protracted debates through the rulemaking or judicial review processes that would have to interpret such legislation.

A valid regulatory permit program is already available to regulate offshore ocean discharges from aquaculture facilities. The proposed legislation need not duplicate this program, and efforts to do so will only create potential conflicts and unnecessary additional regulation.

Restrictions on Fish Feed

The potential for development of U.S. offshore aquaculture would be greatly hampered if American fish farmers must also shoulder the burden of international policy disputes. There is much discussion of the use of fish meal and fish oil in aquaculture circles. The debate centers on whether the harvest of pelagic fishes used to make fish meal and fish oil is ecologically sustainable. Fish meal and fish oil is the most expensive component of feed. Typically, feed is the single greatest operating cost for aquaculture facilities. Farmers go to great lengths to ensure that feed is not wasted.

Legislative mandates regarding the use of such feeds will not address the issue of whether fish meal resources are properly managed on a national or international basis. Domestically, regulations concerning the management of fish stocks used to produce fish meal and oil is where such protective efforts should be directed. Mandates to minimize U.S. farm use of these products are unlikely to have any measurable effects.

Fish meal and fish oil are used in feeds for fish, cattle, swine and poultry. But the domestic aquaculture use of fish meal and fish oil is only a minor share of the global market. Other countries, notably China, are far greater users, and even now are contracting for future production volumes from the major global producers of fish meal and fish oil. Legislation dictating minimized use of these products will only penalize American farmers. Ironically, American farmers are more likely to efficiently use these products by application of technology. In addition, by burdening the fledgling U.S. offshore industry with feed restrictions, we inhibit the potential for developing alternative feed formulas that may be available with greater operating experience in U.S. waters.

Recent scientific reports present a compelling argument that pelagic fishes harvested for fish meal and fish oil production are ecologically and socioeconomically sustainable. Various national and international government agencies manage pelagic fish stock through total allowable catch limits. These international agencies include the Instituto del Mar del Peru (IMARPE), Institute of Fisheries Research (IFOP) in Chile, and the International Council for the Exploration of the Sea (ICES) in Europe. The fish meal industry itself supports government-led stock management and supports the FAO's Code of Conduct for Responsible Fisheries. Data from the FAO over the past 20 years indicate landings of industrial or feed fish have remained fairly stable at around 20 to 25 million tons per year since 1984. While total catch has remained stable, the portion of total fish meal used in aquaculture feeds has increased. Competition for fish meal and fish oil amongst various consumers has increased fish meal and fish oil costs, thereby making production of carnivorous fishes more expensive. Consequently, research priorities have shifted to discovering alternatives to fish meal and fish oil use while maintaining proper animal nutrition and ensuring the positive nutritional benefits of seafood consumption by people is maintained (e.g. omega 3 fatty acid composition).

I urge you not to submit to calls for "silver bullet" solutions regarding proper management of fish feed stocks. Comprehensive domestic and international fisheries management programs should address this issue. Management of this resource cannot be effectively conducted by simply restricting the potential use of fish feed at offshore U.S. production sites.

The Regulation of Antibiotics and Other Drugs

The pending legislation should not attempt to set new policy for drug and antibiotic use in marine aquaculture. A program of Federal regulation is already well established under authority of the U.S. Food and Drug Administration (FDA). Policy statements that mandate minimized use of such materials are not science-based, and provide no additional measure of protection to human health or the environment.

Opponents of aquaculture often allege rampant misuse of antibiotics by producers. Such opponents speculate that antibiotic misuse will be a standard practice if we create a domestic marine aquaculture system. Aquaculture opponents never discuss the various Federal programs designed to ensure that public health and environmental safety are maintained when the few available antibiotics are used. Critics also fail to recognize the scientifically rigorous FDA drug approval process for drugs and antibiotics used in agriculture, including aquaculture.

There are very few drugs approved for use in aquatic animal farming in the United States and the three approved antibiotics are only available for a few specific fish species. Ongoing efforts to develop vaccines will dramatically reduce the need for antibiotics. The use of hormones as growth promoters is of questionable merit and none are approved for such use in aquaculture in the U.S. New drugs are strictly regulated, and must pass rigorous evaluation for their potential environmental impacts under the FDA-Center for Veterinary Medicine Investigational New Animal Drug (INAD) approval process. Existing laws set public health and environmental standards for management of drug use and quality assurance requirements that would apply in marine aquaculture.

Conclusion

Efforts to develop an offshore aquaculture program are not occurring in a vacuum. Several well-established Federal regulatory program standards can be used to protect water quality, animal health and natural resources in this context. The offshore legislation should rely on such established standards, and the integration of the new offshore program details with such existing standards through the rulemaking process. This approach could provide a better coordinated and efficient program that is more likely to lead to actual investment and production in U.S. marine aquaculture.

Thank you again for the opportunity to present my testimony. I would be pleased to answer any questions regarding these issues.

Senator SUNUNU. Thank you, Dr. MacMillan.

Ms. Cufone.

STATEMENT OF MARIANNE CUFONE, ESQ., MANAGING PARTNER, ENVIRONMENT MATTERS

Ms. CUFONE. My name is Marianne Cufone. I am an environmental attorney and advocate in Tampa, Florida. I work with a wide variety of groups and individuals on fishery issues, including open ocean aquaculture. It is very unusual to find an issue where various user groups can come together and speak with almost one voice and offshore aquaculture is one.

I am honored to be here today on behalf of not just one particular organization, but rather many in the Gulf of Mexico—groups like Center for Food Safety, the Gulf Restoration Network, the Institute for Fisheries Resources, the Southeastern Fisheries Association and the Southern Shrimp Alliance. These are fishing conservation consumer organizations all concerned about potential negative impacts associated with open ocean aquaculture.

There are currently many concerns about commercial development of offshore aquaculture in the United States. Two of the primary ones are pollution, both of wild fish populations and the environment and user conflicts. Pollution of wild fish populations is the intermixing of aquacultured fish with wild fish. Offshore aquaculture of finfish utilizes cages or net pens to contain fish, and some fish will escape from these structures into the open ocean due

to severe weather, predators tearing at netting, failed equipment, human error and more. Because these fish are captive and bred for profit, they are often different from wild fish. They can be exotic species mutated in captivity for unknown reasons, inbred, genetically modified to create faster growing and larger fish or continually selectively bred to achieve similar results. Some fish behaviors are learned from communal interactions, so even unaltered captive fish can have different behaviors than wild fish.

Escape of these fish that are different from wild fish can change the ecosystem and natural fish populations permanently. There are ways to help assure minimal intermixing. Requiring best available technology for cages and pens and preventing use of non-native and genetically modified organisms are important.

We also should evaluate the scientific merit of requiring only first generation fish or hyper-domesticated fish in open water facilities.

Pollution of the environment occurs when substances come out of aquaculture facilities into the waters like excess food, fish waste, parasites and other diseases, excessive algal growth, dislodged cage or other facility materials and antibiotics or other chemicals. These all can destroy important habitat like corals and sea grass, even far from facilities, carried by currents. Debris and other wastes can contaminate water and can cause safety hazards for boaters, fishermen and divers, and of course harm wildlife.

A stringent program to guard against releases and quickly alleviate any damage is critical. We also need to establish strict environmental requirements with detailed pollution prevention and mitigation plans as conditions of operation before any permits issue and then condition annual permit renewal on environmental performance.

Also regular removal of bio-fouling and mortalities, preventing use of antibiotics or other chemicals, requiring efficient feed usage, and minimal habitat disturbances are important.

Various user conflicts are expected between offshore aquaculture and other ocean uses. Likely conflicts involve known fishing grounds and routes to those fishing grounds, other vessel traffic lanes, military sites, sites of national security, marine reserves, sanctuaries and otherwise protected or vulnerable sites. Essentially, S. 1195 as is will re-allocate public resources for private gain without protecting existing uses. This is troubling.

Rather than creating buffer zones just around the aquaculture facilities, we should create buffer zones around areas of current significant competing economic use or public value, and also ban the use of such areas for open ocean aquaculture.

The composition of aquacultured fish feed creates a conflict issue. Cultured species are also often directly fed wild caught species or products that contain wild species. This is an inefficient use of available protein. Lower level species are critical to the ecosystem, serving as prey for marine mammals, birds and fish. Use of wild fish in creating feed for captive fish creates a very real food shortage problem for wild fisheries and other marine wildlife.

Additionally, use of wild fish to feed captive ones may increase fishing pressure on wild fish populations as demand and prices rise for aquacultured fish. Some limitations on use of wild caught spe-

cies as food for captive species should be established. Also, requiring best available technology will ensure that adequate food supply for natural wildlife remains.

There are serious issues nationwide, but particularly in the Gulf of Mexico, because there is dependence on ocean and coastal areas for food, recreation, financial stability through tourism, recreational, commercial fishing and so many other things. Additionally, the severe hurricanes for the past 2 years make the Gulf of Mexico very vulnerable to any further alterations.

Use of oil rigs as sites for aquaculture facilities is a very real concern for us. During recent hurricanes, oil rigs were destroyed, some carried miles to shore. Had aquaculture existed on these rigs, there would have been massive fish escapes and likely other severe problems.

In sum, it seems that we're rushing into development of offshore aquaculture in the United States without really considering the consequences. If we want commercial development of offshore aquaculture to benefit the United States, these matters that I have mentioned and many others first must be fully addressed. Expanded commercial development of offshore aquaculture may be a benefit in the future, but it should not proceed until after the implementation of stringent guidelines. This isn't only about economics and increased food, it's also about a net benefit to the United States and so we do need to look at these very serious issues first to ensure we don't hurt other existing assets.

I very much appreciate the opportunity to be here today, and I look forward to working with you and others on these very important matters.

[The prepared statement of Ms. Cufone follows:]

PREPARED STATEMENT OF MARIANNE CUFONE, ESQ., MANAGING PARTNER, ENVIRONMENT MATTERS

Introduction

Good morning. I greatly appreciate the opportunity to testify today about the very important issues associated with offshore aquaculture. My name is Marianne Cufone. I am an environmental attorney and advocate in Tampa, Florida. I work with a wide variety of groups and individuals on fisheries issues, including open ocean aquaculture. I am the Vice Chair of the Gulf of Mexico Fishery Management Council Advisory Panel on Offshore Aquaculture, a member of the Florida Department of Agriculture and Consumer Services Task Force on open water aquaculture and I have been helping to coordinate a broad-based regional coalition to collaboratively engage on marine aquaculture matters.

Through years of environmental advocacy, I have seen very few issues that most users groups can come together and speak on with almost one voice. Open water aquaculture is one such anomaly.[1] I am honored to be here today on behalf of not just one particular organization, but rather many in the Gulf of Mexico region, including the Center for Food Safety,[2] the Gulf Restoration Network,[3] the Institute

[1] Attached, please see the letter dated May 24, 2005, regarding offshore aquaculture. This letter had a wide range of signatories, many of which are from or work in the Gulf of Mexico region.

[2] *The Center for Food Safety* (CFS) is a non-profit public interest and environmental advocacy membership organization established in 1997 by its sister organization, International Center for Technology Assessment, for the purpose of challenging harmful food production technologies and promoting sustainable alternatives. CFS has offices in Washington, DC and San Francisco, CA and engages in work throughout the United States.

[3] *The Gulf Restoration Network* (GRN) is a 501(c)(3) non-profit alliance of over fifty groups and individuals committed to uniting and empowering people to protect and restore the resources of the Gulf of Mexico region. GRN has members in all five Gulf of Mexico States.

for Fisheries Resources,[4] the Southeastern Fisheries Association,[5] and the Southern Shrimp Alliance,[6] to highlight a few of the coalition members. These are conservation, fishing and consumer organizations . . . all concerned by potential negative impacts associated with open ocean aquaculture.

There are currently many concerns about commercial development of offshore aquaculture in United States waters, far more than I can cover in a few minutes or pages. I will therefore concentrate on the issues I and those I work with find most pressing regarding S. 1195. The first is pollution: both of wild fish populations and the environment. The second is user conflicts.

Pollution

Pollution of wild fish populations occurs when there is intermixing of aquacultured fish with wild fish. Offshore aquaculture of finfish currently utilizes a cage or pen to contain the fish. Even well engineered and strategically placed cages and pens will have some escape of fish from these containers into the open ocean from various complications like severe weather, predators tearing at netting, failed equipment, human error and a number of other possibilities. Because these fish are captive and bred for profit, they are often different from wild fish. The captive fish may be exotic species, from a different area entirely to introduce a new product to a local market. Aquacultured fish can mutate in captivity for unknown reasons, or because of continued inbreeding. Some fish behaviors are learned from natural communal interactions, so even unaltered captive fish can have different behaviors than wild fish and if released, the aquacultured fish can change natural behaviors in the wild. Perhaps most disturbing, fish used for aquaculture might be intentionally genetically modified to create faster growing and larger fish or might be continually selectively bred to achieve similar results. Escape of fish that are different from wild fish could change the ecosystem and natural fish populations permanently.

There are ways to help assure minimal escapement and intermixing of wild fish with different captive fish: requiring use of best available technology for cages and pens and preventing use of non-native species and genetically modified organisms are important standards. Additionally, other methods of minimizing intermixing in the event of an escape should be reviewed and evaluated, for example the scientific merit of requiring only use of first generation fish or alternatively hyper-domestication of animals in open water facilities.

Pollution of the environment occurs when there are substances coming out of the aquaculture facility into our waters, like excess food, fish waste, parasites and other diseases, excessive algal growth, dislodged cage or other facility materials and antibiotics or other chemicals. These all can destroy important habitat, like corals and seagrass, even far from the facilities, carried by currents. Debris and other wastes can contaminate our water and cause safety hazards for boaters, fishermen and divers and of course, harm wildlife.

Because there are numerous pollution concerns associated with open water aquaculture, a stringent program to first guard against releases and then quickly alleviate any damage is most critical. Establishing strict environmental requirements with detailed pollution prevention and mitigation plans as conditions of operation before any permits issue and then conditioning annual permit renewal on environmental performance could promote more careful processes and rapid recovery time. Some specific measures include: regular removal of biofouling and mortalities, preventing use of antibiotics or other chemicals, requiring efficient feed usage, careful placement of anchors, cable and other structure, current mapping, and disease control.

User Conflicts

Because offshore aquaculture facilities will take up real space in the marine environment, various user conflicts are expected between offshore aquaculture and other

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[4] *The Institute for Fisheries Resources* (IFR) is a 501(c)(3) non-profit organization dedicated to the protection and restoration of fish resources and the human economies that depend on them. By establishing alliances among fishing men and women, government agencies, and concerned citizens, IFR *unites* resource stakeholders, *protects* fish populations, and *restores* aquatic habitats.

[5] *Southeastern Fisheries Association* (SFA) is a 501(c)(6) not-for-profit fisheries trade association founded in Florida in 1952. SFA represents seafood dealers that handle eighty-five percent of the pink shrimp landed in the state and the majority of spiny lobster, stone crab, grouper and oysters in the state of Florida. SFA has members in all segments and sectors of the fishing industry, including importers, exporters and aquaculturists.

[6] *Southern Shrimp Alliance* (SSA) is a non-profit network of members of the shrimp industry in eight states. SSA serves as the national voice for the shrimp fishermen and processors in Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, and Texas.

ocean uses. Contributing to this is the express provision in S. 1195 that allows creation of buffer zones around aquaculture areas in which no activities will be permitted other than those relative to the aquaculture facility. Some of the most likely and troubling conflicts are those regarding known fishing grounds and routes to those fishing grounds, other vessel traffic lanes, military sites and areas of concern regarding national security, marine reserves, sanctuaries and otherwise protected or vulnerable areas and areas of significant multiple use, for example where there are boating, diving, water sports and swimming. Essentially S. 1195 will re-allocate public resources for private gains without protecting existing uses.

Rather than establishing buffer zones only around aquaculture facilities, buffer zones should be created around areas of current significant competing economic use or public value, especially including known fishing grounds and routes to those fishing grounds, vessel traffic lanes, military sites and areas of concern regarding national security, marine reserves, sanctuaries and otherwise protected or fragile areas. Additionally, the use of areas of significant multiple use and/or public value for open water aquaculture should be completely prevented.

Another area of significant conflict involves composition of aquacultured fish feed. Cultured species are often directly fed wild caught species or products that contain wild species, in the form of fish meal or fish oil. This is an inefficient use of the available natural protein resources. The resulting net loss of fish protein means that offshore fish farming is not a good alternative to wild capture fishing, though often touted as being such, and may actually increase fishing pressure on wild fish populations as demand and prices rise for fish meal and fish oil to feed captive fish.

Lower trophic level species like krill, squid, and other small fish are a crucial part of the marine ecosystem, serving as prey for marine mammals, birds and fish yet are still used to make captive fish feed. Many commercially and recreationally important fish species depend directly on the availability and abundance of such prey species for their survival and recovery. Prey species also support several species of endangered marine mammals and seabirds. In order to effectively protect and restore our natural ocean resources, it is critical to protect the health and availability of prey species. Wild fish populations and other threatened and endangered species can only recover and thrive if the ecosystem upon which they depend is intact. Use of wild fish in creating feed for captive fish creates a very real problem for wild fisheries and other marine life.

Some limitations on use of wild caught species in as food for captive species should be established. There is ongoing research into alternative food sources for captive fish and best available technology should be required to ensure adequate food supply for natural wildlife.

Regional Matters

These are all serious issues nationwide, but particularly in the Gulf of Mexico, many people are very concerned about expanded development of offshore aquaculture. Historically, we are coastal people known for our commercial and recreational fisheries including shrimp, crab, lobster snapper, grouper and many more. Tourism, based on our environment, is a key economic factor and so many of us live around the Gulf of Mexico to enjoy the benefits of a coastal lifestyle: relaxing on white sand beaches, swimming in clear blue waters, boating and countless water sports. Also, the severe hurricanes of the past 2 years make us very vulnerable to any further alterations in our marine world.

One matter in particular that became very troubling to many Gulf residents after assessing damage from the catastrophic storms is the use of oil rigs as sites for aquaculture facilities. During the hurricanes, oil rigs were destroyed, some even being carried miles to shore. Had offshore aquaculture existed on these rigs at the time of the storms, there would have been massive releases of captive fish, feed and other pollutants directly into Gulf of Mexico waters.

Oil rigs are erected for a purposes and when that purpose is completed, they should be removed as originally contemplated, not transitioned into other uses that might cause serious long term negative consequences. There are open water net pens and cages better designed to withstand storm activity and other disturbances far better suited for use in open ocean aquaculture than oil rig structures initially created for something entirely different. In general, recycling and re-use of materials is something I strongly support, but the consequences potentially far outweigh the benefit in this particular instance. Oil rigs, active or decommissioned, should not be substituted for best available technology in open water aquaculture.

Our region has been taking steps to protect unique local resources because S. 1195 in its current form does not sufficiently do so. The Gulf of Mexico Fishery Management Council is developing an amendment to the fishery management plans for the Gulf of Mexico to manage offshore aquaculture while they still have a meaning-

ful regulatory role. Under S. 1195, regional Councils would be ambiguously demoted to a consulting or perhaps consenting entity, though they are in the best position to understand local needs. Currently, these draft Council regulations contain provisions to deal with many of the concerns I previously mentioned associated with offshore aquaculture.

Similarly, the Florida Department of Agriculture and Consumer Services developed open water aquaculture best management practices through a cooperative task force of various interest representatives. These guidelines also address many of the potential threats to our environment and the people that rely on it associated with open water aquaculture.

These documents could be used as guidance for specific matters to include in S. 1195, which currently does not provide adequate protections.

Conclusion

It seems we are rushing into development of offshore aquaculture in United States waters without really considering the consequences.

S. 1195 in current form does not adequately protect our valuable marine resources and the many individuals and communities that rely on them, though we have better means to do so.

Expanded commercial development of offshore aquaculture in United States waters may be a benefit in the future, but it should not proceed until after the development of stringent guidelines. S. 1195 does not yet provide these.

Thank you for your time and attention. I look forward to working with you and others on these important matters.

ATTACHMENT

ALASKA LONGLINE FISHERMEN'S ASSOCIATION; CENTER FOR FOOD SAFETY; COOK INLET KEEPER; ENVIRONMENT MAINE; ENVIRONMENT MATTERS; ENVIRONMENTAL DEFENSE; ENVIRONMENTAL DEFENSE CENTER; FLORIDA FISHERMEN'S FEDERATION; FRIENDS OF CASCO BAY; GO WILD CAMPAIGN; GRACE PUBLIC FUND; GREENPEACE; GULF RESTORATION NETWORK; HAWAII AUDUBON SOCIETY; INSTITUTE FOR AGRICULTURE AND TRADE POLICY; KAHEA; MANGROVE ACTION PROJECT; MARYLAND CONSERVATION COUNCIL; NATIONAL ENVIRONMENTAL TRUST; NATURAL RESOURCES DEFENSE COUNCIL; THE OCEAN CONSERVANCY; OCEANA; PACIFIC COAST FEDERATION OF FISHERMEN'S ASSOCIATIONS; PCC NATURAL MARKETS/SOUND CONSUMER; PUBLIC CITIZEN; SIERRA CLUB; REEF RELIEF; SOUTHEASTERN FISHERIES ASSOCIATION; SOUTHERN OFFSHORE FISHING ASSOCIATION; UNITED ANGLERS OF CALIFORNIA; U.S. SALMON NETWORK; UNITED SOUTHEAST ALASKA GILLNETTERS; VERSAGGI SHRIMP CORPORATION; WHALE CENTER OF NEW ENGLAND

May 24, 2005

Hon. TED STEVENS,
Hon. DANIEL INOUYE,
Hon. OLYMPIA SNOWE,
Hon. MARIA CANTWELL,
U.S. Senate,
Washington, DC.

Hon. RICHARD POMBO,
Hon. NICK RAHALL,
Hon. WAYNE GILCHREST,
Hon. FRANK PALLONE, JR.,
House of Representatives,
Washington, DC.

RE: PROTECT OCEAN HEALTH AND ENSURE RESPONSIBLE GOVERNANCE, DO NOT SUPPORT NOAA'S OFFSHORE AQUACULTURE BILL

Dear Chairs and Ranking Members,

To protect our oceans, native fish populations, and human health and livelihoods, the above groups urge your leadership to ensure legislation to promote aquaculture in offshore ocean waters is governed by a strict regime of scientifically sound regulations. The National Oceanic and Atmospheric Administration (NOAA) has drafted legislation that it intends to soon transmit to Capitol Hill to promote offshore aquaculture in the U.S. Exclusive Economic Zone. We are concerned that this legislation is not adequately protective of our oceans, including fisheries and other ocean uses. We hope you will work with us to ensure that any offshore aquaculture legislation introduced protects all ocean interests.

Fish farming and other forms of aquaculture have received widespread attention, including as posited as a solution to dwindling wild stocks and the growing U.S. seafood trade deficit. The Department of Commerce has called for a five-fold increase in domestic aquaculture production by 2025. We recognize that some types of aquaculture offer potential benefits. However, without comprehensive Federal permitting requirements, offshore aquaculture poses numerous serious risks to marine ecosystems, native fish stocks, and public health. Offshore finfish farms are vulnerable to the escape of farmed fish, which may interbreed with and alter the genetic makeup of local fish populations. Fish farms concentrate parasites and diseases, which can spread to other fish. Antibiotics and other chemicals used to treat or prevent these diseases can bring unintended consequences. Large quantities of uneaten fish feed and wastes are discharged from farms directly into ocean waters and may pollute the surrounding ecosystems.

Moreover, we question claims that offshore aquaculture supplements dwindling fish stocks and will reduce the Nation's "seafood deficit." Most marine finfish are carnivores and currently require large quantities of fisheries products, made largely from wild-caught fish, in their diets. Farming these marine finfish actually reduces the net supply of fish. In this way, aquaculture diminishes rather than adds to fish supplies, and although it might reduce the U.S. seafood deficit in monetary terms, it does not reduce it in ecological terms. Moreover, NOAA has not justified its economic claims for reducing the U.S. seafood trade deficit.

Significantly, NOAA's proposal does not provide adequate safeguards to ensure our oceans, fisheries, ecosystems and public health are protected. NOAA has rejected Congressional and stakeholder comments to include specific precautions and provide further necessary study in conjunction with its legislation, including requests that the Agency comply with the National Environmental Policy Act (NEPA) by completing a Legislative Environmental Impact Statement before submitting its legislation to Congress. Rather than comply with NEPA, NOAA has ignored these requests dating from late 2003.

Based on our understanding of NOAA's proposed legislation, specific concerns shared by our groups include:

- Almost total discretion given to NOAA regarding permits and conditions;
- No coordination with other offshore uses such as navigation, recreation, defense, or fishing except "to the extent practicable;"
- Lack of baseline environmental protections for incorporation within permits;
- Allowance of genetically modified and non-native fish species that may compete with and cause harm to native populations;
- No clear process for public or state government participation in the consideration of permits;
- Lack of detailed provisions as required of other offshore industries making the permittee responsible for the life of the offshore structures, and providing for general financial and environmental risks, including bankruptcy;
- Lack of critical implementation language regarding enforcement and no provisions for citizen suits;
- Absence of rapid response provisions for known risks, such as disease outbreaks.

Two recent national commissions, the U.S. Commission on Ocean Policy and the Pew Oceans Commission, recommended that ocean uses be better managed and coordinated. NOAA's bill does not accomplish such coordination, nor does it adequately protect our oceans. For these reasons, we urge you to forgo sponsorship of NOAA's proposal at this time, and to only support legislation which provides sufficient parameters to ensure our oceans and fisheries are protected, and to ensure that any aquaculture facilities in public waters enhance, not diminish, our food supply.

Sincerely,

Catherine Hazlewood, *The Ocean Conservancy, Washington, DC.*
Tracie Letterman, *Center for Food Safety, Washington, DC.*
Becky Goldburg, Ph.D., *Environmental Defense, Boston, MA.*
Zeke Grader, *Pacific Coast Federation of Fishermen's Associations, San Francisco, CA.*
Marianne Cufone, *Environment Matters, Tampa, FL.*
Andrianna Natsoulas, *Public Citizen, Washington, DC.*
Bob Jones, *Southeastern Fisheries Association, Tallahassee, FL.*
Robert Spaeth, *Southern Offshore Fishing Association, Madeira Beach, FL.*
Cyn Sarthou, *Gulf Restoration Network, New Orleans, LA.*

Mark Ritchie, *Institute for Agriculture & Trade Policy, U.S. Salmon Network, Minneapolis, MN.*
Sal Versaggi, *Versaggi Shrimp Corporation, Tampa, FL.*
Kate Wing, *Natural Resources Defense Council, San Francisco, CA.*
Mike Hirshfield Ph.D., *Oceana, Washington, DC.*
Anne Mosness, *Go Wild Campaign, Bellingham, WA.*
Linda Behnken, *Alaska Longline Fishermen's Association, Sitka, AK.*
Linda Paul, *Hawaii Audubon Society, Honolulu, HI.*
Eric Wickham, *Canadian Sablefish Association, Vancouver, BC Canada.*
Caroline Karp, *Sierra Club, Exeter, RI.*
Kenneth Duckett, *United Southeast Alaska Gillnetters, Ketchikan, AK.*
Matthew Davis, *Environment Maine, Portland, ME.*
Bob Shavelson, *Cook Inlet Keeper, Homer, AK.*
Tracy Wolpert, Randy Lee, Trudy Bialic, *PCC Natural Markets/Sound Consumer, Seattle, WA.*
Andrea Kavanagh, *National Environmental Trust, Washington, DC.*
Ray Pringle, *Florida Fishermen's Federation, Panacea, FL.*
Cha Smith, *KAHEA, The Hawaiian Environmental Alliance, Honolulu, HI.*
Joseph E. Payne, *Casco Baykeeper, Friends of Casco Bay, South Portland, ME.*
Alfredo Quarto, *Mangrove Action Project, Port Angeles, WA.*
Alice Slater, *GRACE Public Fund, New York, NY.*
Paul G. Johnson, *Reef Relief, Crawfordville, FL.*
Mason Weinrich, *Whale Center of New England, Gloucester, MA.*
Bob Strickland, *United Anglers of California, San Jose, CA.*
Mary P. Marsh, *Maryland Conservation Council, Annapolis, MD.*
Brian Trautwein, *Environmental Defense Center, Santa Barbara, CA.*
John Hocevar, *Greenpeace, Washington, DC.*

Senator SUNUNU. Thank you Ms. Cufone. I hope you don't mind if I use the net benefit pun in the future. I have additional hearings on this.

[Laughter.]

Senator SUNUNU. Mr. Bedford.

STATEMENT OF DAVID BEDFORD, DEPUTY COMMISSIONER, ALASKA DEPARTMENT OF FISH AND GAME

Mr. BEDFORD. Good morning Chairman Sununu and Members of the Committee. For the record, my name is David Bedford. I serve as Deputy Commissioner as the Alaska Department of Fish and Game and I focus my portfolio on fisheries issues. I also serve as the Commissioner for the State of Alaska on the Pacific Salmon Commission, the body responsible for developing conservation and harvest sharing agreements for Pacific salmon under a treaty between the United States and Canada.

I have been asked to speak today about the importance of coordinating Federal regulation of offshore aquaculture with state regulatory programs, and I thank you for the opportunity to present these remarks.

I would start by noting a few of Alaska's general recommendations for management of offshore aquaculture that are derived from our experience with management of marine fisheries. We believe that the legislation authorizing offshore aquaculture should first allow states to determine what kind of aquaculture activity would take place in the Federal waters off their coastlines. Local control is from our perspective and in our experience key to long-term conservation of resources and public acceptance of any development that takes place.

Second, we should include an initial 5-year moratorium on new aquaculture operations to ensure that we develop an adequate sci-

entific foundation and socio-economic analyses to have a good grasp of what the implications of our actions would be.

Third, we believe that the Regional Fishery Management Councils should be given jurisdiction over aquaculture operations. The Regional Counsils are an effective means to provide for public participation and for scientific review.

Fourth, we believe that legislation should prohibit farming of specific species, particularly salmon, halibut, and black cod. The economic and biological implications of farming these species are profound.

As you consider legislation that would authorize the development of aquaculture off the coast of the United States, I would note a couple of important facts: First, there is no natural division between state waters and Federal waters that the proposed legislation would regulate. While we can draw jurisdictional boundaries, in the natural world there are no such distinctions, and many species of fish spend important stages of development in near shore waters then move to offshore waters for later stages of development. Some species pass between state and Federal waters innumerable times in the course of their lives.

Second, the states have been in the business of regulating marine fishery resources for some time. Consequently, management of new aquaculture development off our coast should be consistent with existing state policies and practices.

Alaskan fishery management is grounded on obligations set in the State Constitution that require management of fish and wildlife to provide for sustained yield. Alaska has developed a number of strategies in resource management which enable the state to provide for sustained yield. First in our management, the resource comes first and second and third and always. To ensure long-term use, sustained yield management must begin by setting conservation objectives and controlling any kind of human use to ensure these objectives are met.

Second, management must be based on science. Fishery resources in our management program are studied to determine long-term conservation requirements. State management includes strict policies to preserve genetic integrity, control the spread of disease, control transport of fish products and live fish, and prevent introduction of non-native species.

Third, where possible, management is adaptive and uses current information. In instances where we do not have a good source of current information, we're very conservative in the way that we manage.

Fourth, harvest allocation and science-based resource management are distinct processes. We have separate agencies for handling those two.

And finally, the public has a meaningful role in allocation and management decisions. Meaningful public involvement in resource management engenders support for conservation and helps in planning that increases efficient use. There have been a number of lessons learned from Alaska's experience that would be helpful to a nascent aquaculture industry. First to assure long-term conservation of marine resources, management should be local. It should not be an exercise of a distant national regulatory agency.

Second, development should be based on sound science which can specify the impacts of proposed development on the local environment, on the resources and on human communities.

Third, decisionmaking that provides for the economic well-being of the industry should be separated from the scientific evaluation of impacts of those developments.

And finally, the public should be involved in the regulatory process. Where people have a meaningful role agencies will be motivated to manage effectively, cautiously and in a conservative fashion.

Thank you again for the opportunity to testify. I welcome any questions you may have.

[The prepared statement of Mr. Bedford follows:]

PREPARED STATEMENT OF DAVID BEDFORD, DEPUTY COMMISSIONER, ALASKA DEPARTMENT OF FISH AND GAME

Good morning Mr. Chairman and Members of the Committee. For the record, my name is David Bedford. I serve as Deputy Commissioner of the Alaska Department of Fish and Game focusing on fishery issues. I also serve as the Commissioner for the State of Alaska on the Pacific Salmon Commission, the body responsible for developing conservation and harvest sharing agreements for Pacific salmon under a treaty between the United States and Canada. I am appearing on behalf of Fish and Game Commissioner McKie Campbell. He appreciates your invitation but is participating in a meeting of the North Pacific Fisheries Management Council, on which he serves as a voting member.

The Committee has asked that I focus my testimony on Alaska's effective fishery management and conservation of its marine fishery resources. Alaska developed sustained yield management of its fishery resources as a matter of necessity. Alaska's people depend on our fisheries for their livelihood, recreation and as a source of nutrition. Alaskans take advantage of our fishery resources in subsistence, commercial, sport and personal use fisheries. Over half of the total harvest of fish in the United States is taken from the waters off Alaska. Our fisheries support half of the jobs in Alaska fully or in part. With a total economic output of more than 4.6 billion dollars per year, Alaska's seafood industry is one its largest private sector employers, and is the largest employer in a number of fishery-dependent coastal communities.

Given the interests of Alaska and other states in marine resources and fisheries it is vital that any effort to develop off shore aquaculture coordinate with and utilize the expertise of state management programs.

Alaska Fisheries Management

Alaskan fishery management is grounded on obligations set in the state constitution requiring management of fish and wildlife to provide for sustained yield and reserving fish and wildlife for the common use of the people. Thus, the constitution sets the standard for conservation of the resource with the objective of allowing for human use of that resource in perpetuity. We provide a healthy resource for fishing families while ensuring environmental protections. Alaska has developed a number of strategies employed in resource management which enable the state to achieve these ends:

- *The resource comes first.* To assure long-term use and sustained yield, management must begin by setting conservation objectives and controlling harvest to ensure that these objectives are met. Unique amongst state constitutions, Alaska's actually requires sustainable management of its renewable natural resources.
- *Management is based on science.* Fishery resources are studied to determine life history; long-term conservation requirements are determined and harvests are permitted only on the resource that is surplus. Long-term conservation management includes strict policies to preserve genetic integrity, control spread of disease, control transport of fish, and prevent introduction of non-native species.
- *Where possible, management is adaptive and uses current information.* Alaskan managers monitor the fishery and respond with fishery openings and closures or other modifications as new information becomes available. If there is no source of current information, the harvest is set at conservative levels.

- *Harvest allocation and resource management are distinct.* The managers responsible for monitoring the fishery resource and making decisions on when and where the public can harvest must make objective decisions based on science and dictated by resource status. Decisions on allocating the available harvest among various uses should be, and are, made by another body, the Alaska Board of Fisheries.
- *The public has a meaningful role in allocation and management decisions.* Alaskans have a stake in, and responsibility for, the conservation of their resources. The resource allocation process conducted by the Alaska Board of Fisheries is open to the public with the issues debated and decisions made in public session. In addition, the Department of Fish and Game has established 82 local advisory committees comprised of resource users to help develop strategies to implement fishery management plans. Meaningful public involvement in resource management engenders support for resource conservation and helps in the development of harvest plans that increase efficient use.

Offshore aquaculture would be a new industry. To assure effective development of the industry it should be coordinated with existing resource uses and management programs. There are a number of the lessons learned by Alaska that would be helpful to a nascent aquaculture industry.

- To assure long-term conservation of marine resources, management should be local, not an exercise by a distant national regulatory agency.
- Development should be based on sound science which can specify the impact of proposed development on the local environment, resources, and human communities.
- Decision making that provides for the economic well-being of the industry should be separated from the scientific evaluation of the impact of any development.
- The public should be involved in the regulatory process. Where people have a meaningful role agencies will be motivated to manage effectively.

The Effects of Fish Farming

Alaska has some experience with marine finfish aquaculture both from the introduction of an invasive species into Alaskan waters with the escape of Atlantic salmon from marine aquaculture facilities in British Columbia and from the effect on world salmon markets caused by the growth of the salmon farming industry. These experiences lead us to sound a cautionary note regarding the development of offshore aquaculture in the United States.

Finfish farming is illegal in Alaska, and has been since statehood. Fish farms, whether in Alaskan waters, in the Exclusive Economic Zone or in Canada, pose a potential threat to the health of Alaska's fisheries, our economy and our way of life.

Fish farms in British Columbia and the Pacific Northwest cultivate Atlantic salmon, a species not native to the North Pacific. For a variety of reasons, some of these fish escape the farms and mingle with wild salmon populations. Despite the efforts of fish farmers, there is no technology that can prevent these escapes. Since 1994, Atlantic salmon have been found in Alaska's waters, including freshwater systems such as the Copper and Situk rivers.

Farmed Atlantic salmon, when released into Alaska's fresh and marine waters, are an invasive species. These invasions raise serious ecological and economic concerns. The Atlantic salmon can compete with our abundant salmon stocks and threaten them with disease.

We are also concerned about ensuring the genetic diversity and viability of our wild salmon stocks. In hatchery operations and in all management decisions, we have strict guidelines:

- Live salmonids, including gametes, will not be imported from sources outside the state;
- Stocks will not be transported between major geographic areas;
- Stocks cannot be introduced to sites where significant negative interaction or impact on wild stocks will occur; and
- Genetic diversity is stressed with a single wild donor stock contributing to more than three hatchery stocks.

Invasive species can introduce new disease organisms, including pathogens that are new to Alaska, and might be resistant to antibiotics. They can promote the spread of existing pathogens, such as sea lice. We also have concerns that new species could be cultured, with the potential for introducing new pathogens.

The growth and development of the global salmon industry caused a severe decline in the value of Alaska salmon over the last fifteen years. The value of the Alaskan salmon harvest averaged $500 million at first point of sale from 1990—1995, but fell below $200 million in 2001 and 2002. Increased production of farmed salmon was the primary reason for the collapse.

Although farmed salmon are treated with heavy doses of antibiotics and artificial coloring agents, farmed salmon raised in Chile compete directly in market places around the world with wild Alaska salmon. Farmed salmon have provided a cheaper alternative to wild Alaska salmon, and as a result, has depressed salmon prices around the globe. This is not surprising given the low cost of labor and minimal environmental standards for the Chilean salmon farming industry.

In the face of off shore competition, Alaskan fishermen and the State of Alaska have been working diligently to promote the benefits of eating wild Alaskan salmon, focusing on industry restructuring to improve product quality, and new product development. Our promotional efforts are yielding impressive results.

We pride ourselves on the high quality of our wild seafood, and Governor Frank Murkowski has been leading a concerted effort in recent years to establish "Wild Alaska Salmon" as a successful brand. This is a key component of the state's efforts to counter the painful effect that fish farming elsewhere in the world has had on the domestic salmon production in the last fifteen years.

Should offshore aquaculture develop there are concerns that it could be less stringently regulated than the Alaska standards would call for. It has the potential to detrimentally impact Alaska wild stocks and their markets, and may undermine the state regulatory program if state input is not included.

Recommendations

Therefore, Alaska urges that any offshore aquaculture legislation include several components:

- *Governors and state management agencies should determine* what types of aquaculture activities, if any, occur in the waters off their states' coastlines.
- *A five-year moratorium on new aquaculture operations* to ensure that adequate scientific and socio-economic analyses of the impacts of aquaculture can be done: Some structured studies have been conducted on the scientific and socio-economic impacts of aquaculture, in addition to the multitudes of anecdotal evidence that have been compiled in recent years. The State believes that a comprehensive study should be undertaken to understand how aquaculture would affect the ecology of American waters as well as the socio-economic impacts it would have on coastal communities. A moratorium on new operations should be enforced for at least five years while this study is being conducted and results evaluated.
- *Regional Fishery Management Councils must have jurisdiction over aquaculture operations:* Success in managing the Federal fisheries off of Alaska's coasts can, in large measure, be attributed to the strong role of the North Pacific Fisheries Management Council (NPFMC). The NPFMC, like its counterparts around the country, has developed expertise and the necessary judgment for dealing with issues of biological, economic, and social importance to the region's fisheries. The current draft of aquaculture legislation leaves it to the Secretary to determine whether aquaculture will interfere with other fisheries and only recommends consultation between the Secretary and relevant Federal agencies before permitting an aquaculture facility. The amendment proposed by Senator Inouye requiring consultation between the Secretary and the regional fishery management councils on environmental regulations is a good beginning; however, the State would prefer more council oversight and decision-making over all parts of offshore aquaculture management.
- *Statutory prohibitions of aquaculture for certain species:* Prohibitions on farming of certain species, particularly salmon, halibut, and black cod, would prevent the tainting of the wild Alaska branding image and impacts to the consequent recent increases in commodity value. Moreover, the introduction of mass-produced, farmed fish has already severely impacted economies of rural Alaska communities. Species-specific prohibitions on aquaculture would allow these communities to survive and maintain traditional lifestyles.
- *As the Federal Government works to develop aquaculture as a competing interest to wild fisheries, it should develop programs to maintain the economic vitality of wild capture fisheries.* Fish farming around the world has caused a significant downfall in the value of Alaska's salmon. To mitigate impacts on the other Alaska fisheries, worth an estimated $700 to $800 million harvest value, programs should be set in place that focus on market and product diversification

for wild capture fisheries, with an emphasis on highlighting the important characteristics of wild seafood. These types of programs may provide improvement to harvesting and processing infrastructure, quality improvement investments, value-added equipment, and marketing funds. Programs could also be put in place that limit the growth of farm fish production to a scale that does not flood the market with product in a manner that leads to excessive downward prices in both the aquaculture and wild capture fishery industries.

Senator SUNUNU. Thank you very much. We are going to begin the discussion with Senator Boxer.

STATEMENT OF HON. BARBARA BOXER,
U.S. SENATOR FROM CALIFORNIA

Senator BOXER. Mr. Chairman, thank you so much for this hearing and for your focus on this very important issue which is so key in my state. I want to say that all of the witnesses have been very clear and personally I think we're getting a good road map here toward some resolution.

At the last hearing on offshore aquaculture, we learned from the witnesses about some of the challenges and potential problems of expanding aquaculture. We heard from Dr. Goldberg who testified how demand for fish feed and oil for offshore aquaculture can contribute to over fishing which is a big issue. He also talked about how offshore aquaculture could cause significant harm to marine ecosystems and fisheries whether it is from water pollution or escape farm fish, disease or the use of antibiotics.

We learned how high levels of PCBs in farm fish could threaten human health, and I think those people who try to brush all of this to the side are absolutely not being real because these things aren't made up. They are provable, and we know that, so the question is how do we solve these problems? What do we do so that we can achieve everything we all want to achieve?

And I am very proud to say and Mr. Eichenberg discussed this and alluded to this that my home state of California, on this and so many environmental issues, is leading the way and 2 weeks ago our governor signed the sustainable oceans act, a law that creates strong standards and protection for aquaculture off of our coast and it took a long time. It brought everybody together. It is kind of like what Ms. Cufone said in her statement which this is an issue that you can really get some consensus on. You don't have to take a strong side of us against them. It can bring everybody to the table, and I am very pleased that happened and I am glad that Mr. Eichenberg put the law into the record and I am going to give my copy to my chairman to take a look at.

Specifically, the law sets out standards to ensure that aquaculture lease conditions minimize marine aquaculture's potential environmental and socio-economic problems. For example, it requires that the use of all drugs, chemicals and antibiotics be minimized. It limits the use of fish meal and fish oil. The law also requires public hearings on potential leases before the State Fish and Game Commission can grant the lease. This ensures the community and public input is taken into account before any new projects are approved, so it's not—it doesn't go as far as Alaska's recommendation here for a moratorium, it actually says we can look at applications, but we need to make sure they are solid. Again, we brought together in California the environmental groups, the fish-

ing groups, and I believe we laid out a very strong, sound and sensible approach. It's a bipartisan bill. I believe it should serve as a model for this Committee, and quite obviously, if we come up with something less than this and we don't have an exemption for those states that want to do more, I think we're going to run into trouble quite frankly, Mr. Chairman. You know, I don't mind setting a floor, but not a ceiling. I don't think that is our job. I don't think that we should tell the states you can't be any more concerned, or you don't know how to do this any better.

So I know states like California and Alaska are very strong about the way we feel and I think other states may come forward as well. However, we may yet come up with something that is so solid and strong based on something like the California bill that we can get tremendous accolades rather than start a whole big argument. Now unfortunately, I don't think the Administration bill does it and so I would ask Mr. Eichenberg in my time here, do you feel it is important that we write at least a strong Federal law as California has and what would the practical effect be if we had a Federal law that was weaker on farm—fish farm pollution in Federal waters four miles offshore than in California state waters three miles out? What would happen if we had that kind and perhaps others could answer that?

Mr. EICHENBERG. Thank you, Senator Boxer. Yes, I think adopting a law such as the one adopted in California is feasible. As you said, it was done through a stakeholder process. We had everybody at the table talking about these specific standards. The standards are not prescriptive. But they do provide general guidance for the development of regulations, and give some instruction to the Department of Fish and Game and the Fish and Game Commission which will be adopting the regulations, to do the things that you mentioned—minimize pollution, prevent escapes and so forth.

Right now, the Federal bill has nothing. It just basically turns all this over to the agency that developed the regulations. And if the Federal Government adopts a regime without strict environmental controls to ensure that these impacts don't occur, then the efforts of the states like the states of California and Alaska will be undermined. You will have weak Federal legislation that allows projects just beyond the three-mile limit. Fish swim in the ocean for long distances as you know, and there is nothing to prevent either the pollution or the fish from entering state waters and undermining the best efforts of states to protect their own waters from these kinds of impacts.

Senator BOXER. Does anybody else want to answer that question? It is my only question.

Mr. KEENEY. Senator Boxer, as far as the Administration is concerned and NOAA that we are frankly very pleased that California has recognized there is a need for a program and is helping to meet the growing demand for safe seafood and healthy seafood.

We think the California legislation is a good start and many of the requirements in that bill are being considered by NOAA in its deliberations. NOAA has a program where we anticipate over the next 2 to 3 years, we will work closely with other fellow partners, including the Environmental Protection Agency, U.S. Department of Agriculture and the Corps of Engineers, as well as industry,

states, fishing management counsels, the public, NGOs in developing and drafting permanent requirements through the Federal Register process, and we disagree with very little of what I have heard today. It is right on point. We are very supportive. This is not new to NOAA. We have been involved in aquaculture for over 30 years and we are very interested in meeting the concerns expressed today.

Senator BOXER. Well, that is very encouraging.

Senator SUNUNU. Dr. MacMillan.

Dr. MACMILLAN. Thank you Mr. Chairman, Senator Boxer. With all due respect, we do take issue with a number of things that you said, Senator Boxer.

Senator BOXER. It is all right. It won't be the first time anyone has had issues.

Dr. MACMILLAN. We don't agree with your statement about the questionable health of farm-raised products. We think there is ample scientific evidence that farm-raised fishes are just as nutritious and wholesome as wild caught fish and in many cases better. The wonderful thing about aquaculture is there is opportunity to control the environment and what farm-raised species eat. With regard to statements about the fishmeal industry or the industrial feed, you referenced Dr. Goldberg's statements from a previous hearing. Much of what she has promoted is not supported by the scientific evidence, by the data collected by the UN's FAO, the Food and Agriculture Organization. That data indicates that pelagic fish harvests, used to make fish meal, is sustainable and has been so for the past 20 years or so.

During times of El Niño the harvest of the pelagic fishes that constitute the bulk of the fishmeal industry does drop off, but there are management agencies, Federal management agency programs, not only in the United States, but elsewhere that monitor the population of pelagic fishes and work to ensure that that fishery is sustainable.

The economic situation is such that the California bill is a dead end for aquaculture. There will be no offshore aquaculture off the coast of California. Business is not going to invest in offshore aquaculture if a state can remove the aquaculture operation at will, without due process. The language in the California bill is very, what I would call, mushy. There is no definition to many of the items identified. An industry or business would have to be crazy to attempt to develop an offshore aquaculture program off the coast of California.

We do support the state's rights to opt out of offshore aquaculture but before a business has invested in an offshore operation.

Senator BOXER. I just need to respond, Mr. Chairman, since we are engaging here. I just want to say to you I quoted a scientist who you didn't agree with. I didn't quote a——

Dr. MACMILLAN. OK, I am sorry.

Senator BOXER. OK, number one, so since you took issue with her, let me just read you one sentence each from two publications—one of the publications is *Science*. The people who wrote this article I'll give you their last names—Hites, Foran, Carpenter, Hamilton, Knuth, Schwager, and I'll just read you. "We show that concentrations of these contaminants are significantly higher in farmed

salmon than in wild." And they are talking about a whole group of contaminants.

In another publication, Environmental Health Perspectives, May 2005, this one written by Foran, Carpenter, Hamilton, Knuth, Schwager, so it's the same. It is one name different. They say, "health risks (based on quantitative cancer risk assessment) associated with consumption of farmed salmon contaminated with PCBs, toxaphene and dieldrin were higher than risks associated with exposure to the same contaminants in wild salmon." So, I would ask that these publications be placed in the record, not in their entirety, but just those paragraphs if I might, Mr. Chairman?

[The previously referred to information follows:]

Science, January 9, 2004, Vol. 303. no. 5655, pp. 226–229

GLOBAL ASSESSMENT OF ORGANIC CONTAMINANTS IN FARMED SALMON

by Ronald A. Hites,[1] Jeffery A. Foran,[2] David O. Carpenter,[3] M. Coreen Hamilton,[4] Barbara A. Knuth,[5] and Steven J. Schwager[6]

Abstract

The annual global production of farmed salmon has increased by a factor of 40 during the past two decades. Salmon from farms in northern Europe, North America, and Chile are now available widely year-round at relatively low prices. Salmon farms have been criticized for their ecological effects, but the potential human health risks of farmed salmon consumption have not been examined rigorously. Having analyzed over 2 metric tons of farmed and wild salmon from around the world for organochlorine contaminants, we show that concentrations of these contaminants are significantly higher in farmed salmon than in wild. European-raised salmon have significantly greater contaminant loads than those raised in North and South America, indicating the need for further investigation into the sources of contamination. Risk analysis indicates that consumption of farmed Atlantic salmon may pose health risks that detract from the beneficial effects of fish consumption.

Environmental Health Perspectives, May 2005; 113(5): 552–556.

RISK-BASED CONSUMPTION ADVICE FOR FARMED ATLANTIC AND WILD PACIFIC SALMON CONTAMINATED WITH DIOXINS AND DIOXIN-LIKE COMPOUNDS

by Jeffery A. Foran, David O. Carpenter, M. Coreen Hamilton, Barbara A. Knuth, and Steven J. Schwager

Abstract

We reported recently that several organic contaminants occurred at elevated concentrations in farmed Atlantic salmon compared with concentrations of the same contaminants in wild Pacific salmon [Hites et al. Science 303:226–229 (2004)]. We also found that polychlorinated biphenyls (PCBs), toxaphene, dieldrin, dioxins, and polybrominated diphenyl ethers occurred at higher concentrations in European farm-raised salmon than in farmed salmon from North and South America. Health risks (based on a quantitative cancer risk assessment) associated with consumption of farmed salmon contaminated with PCBs, toxaphene, and dieldrin were higher than risks associated with exposure to the same contaminants in wild salmon. Here we present information on cancer and noncancer health risks of exposure to dioxins in farmed and wild salmon. The analysis is based on a tolerable intake level for dioxin-like compounds established by the World Health Organization and on risk estimates for human exposure to dioxins developed by the U.S. Environmental Protection Agency. Consumption of farmed salmon at relatively low frequencies results in

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elevated exposure to dioxins and dioxin-like compounds with commensurate elevation in estimates of health risk.

Senator BOXER. And to say that I know you represent the industry sir, but it doesn't help us when you take such a position that you say there are zero problems or something. There is a problem with everything in life. It can't be that there are no problems, so why not just come here and address the ones that we know exist. Let's fix them. So I am just glad that NOAA, here contradicted you sir in looking at the California law and I am excited about that. I want to see your industry move forward, but I want to see it move forward in a way that is responsible.

Dr. MACMILLAN. Mr. Chairman, Senator Boxer, if I could respond to that. I didn't say there were no problems. There certainly are some issues out there that need to be dealt with, but what we are promoting is the use of good scientifically credible data in our statements. The reports that you are identifying, one in *Science* and I don't know recall where the other one was from, those are disputed studies and the significance is highly disputed.

A Harvard study just recently published indicates that—as Mr. Keeney stated, farm-raised seafood and wild catch seafood is extremely healthy for you and that the benefits outweigh the risks by a lot.

I know in California the issue of mercury is an issue. The FDA and EPA are dealing with the issue and whether mercury is a hazard or not, remains to be seen at the concentrations that occur in some marine fishes. We are here to promote good sound science and the references Senator Boxer provides, while there is some science, whether it is sufficient for the agency or for FDA to change their position on the health benefits of seafood is questionable. Thank you.

Senator SUNUNU. Thank you. Mr. Keeney, let me go back to you and reference your testimony where you described the S. 1195 as a starting point and I think that is something that is generally recognized. This is the first introduction of legislation intended to establish a Federal regulatory structure for offshore aquaculture. It is the first significant step since the passage of the general act back in 1980. You described it as a starting point. I am curious to know if there are any specific points raised today, or specific issues that you've looked at over the last few months that you would consider important to add to the legislation as it moves forward. Is there anything you want to bring to the visibility of the Subcommittee that you think is essential to consider adding to the bill in its current form?

Mr. KEENEY. Mr. Chairman, I would like to say that NOAA will make itself available to work with the Committee and Committee staff to address any concerns with regard to specific language and leave it at that. I think that—as I said already today, many of the issues already raised today are also concerns of ours. We think they can all be addressed. We think there are tremendous opportunities in the—economic opportunities, food value opportunities to the American public and opportunities for competing with foreign interests who are clearly moving ahead with their production. In fact, Secretary Gutierrez—I was reminded this morning has publicly stated; his concern is that we are missing out on a big eco-

nomic opportunity here. We are leaving on the table the future demand for offshore—for aquaculture products to other countries by not pursuing our own domestic operations.

Thank you.

Senator SUNUNU. Thank you and I think that is a point that is worth repeating. You know the question isn't whether aquaculture is going to take place around the world, or whether farm-raised fish products are going to be consumed in the United States. They are. They are now. They will be in the future and the percentages will only grow, so I think it is really a question of whether we are going to establish some kind of regulatory regime that allows it to be done in a sustainable way in the United States' EEZ.

Mr. Eichenberg, you talked about—you used the phrase and I think it is used very commonly, "best management practices." I don't know if that you reference that was used as a specific part of the California legislation, but that strikes me as a very general statement. I am curious to know what that means to you in a legal sense, and how is it determined and how is such a standard enforced?

Mr. EICHENBERG. Thank you, Senator. In the California legislation, we refer to best management practices in a specific context. It can mean different things to different people just like sustainable development.

Senator SUNUNU. That is what makes it a potentially dangerous phrase.

Mr. EICHENBERG. Exactly, and we had a long discussion about this with the aquaculture industry and the Fish and Game Department in California.

Incidentally, the California Aquaculture Association which is a member of Mr. MacMillan's association, removed their objections to our bill after working with us extensively on this, so they did not believe it would be as Mr. MacMillan says, legislation that would kill aquaculture development in California. But best management practices in the context that we were using it in California is a subjective term meant to be developed through regulations by the Department of Fish and Game. It is not something that we wanted to prescribe in the legislation itself.

Senator SUNUNU. So to be clear, the final regulations associated with the inshore state water aquaculture in California haven't been determined yet?

Mr. EICHENBERG. That is correct, but we did provide guidance to tell the agency that is developing those regulations what the California legislature wanted to see in those regulations, and specifically, prescribes some things like minimizing pollution and utilizing alternatives to fish meal for example.

Senator SUNUNU. But what does that mean? Does minimize mean zero?

Mr. EICHENBERG. No, it doesn't mean zero because we discussed this and we realize that it is impossible to have zero pollution in these kinds of situations. So at least the legislature gave some direction that it was their intent to minimize it as much as possible and that is really all you can do.

Senator SUNUNU. So hypothetically, the Department of Fish and Game in now promulgating final regulations has at least the power

to determine what a standard could be that meets the minimized pollution reference.

Mr. EICHENBERG. Exactly.

Senator SUNUNU. Is that correct?

Mr. EICHENBERG. Yes. There is one other point that I would like to make about best management practices if I could and that is that we recognize that there may be different management practices for different kinds of offshore aquaculture operations, but the Fish and Game wanted to have the aquaculturist come back and explain to them how they are going to do things like minimize pollution, prevent escapes and those kinds of things and then the Fish and Game Department would approve those based on the standards that were provided in the legislation. So they had some guidance on approving that, but the practices would be developed with the assistance of the industry itself as it deals with that particular development. Then it would be looked at through the lens of the guidelines and standards in the legislation.

Senator SUNUNU. I appreciate that clarification and it certainly sounds like there has been an effort to drive a consensus process in California, but the devil is always in the details and I think there is an important discussion that needs to take place here as to what standards Congress establishes and specifies and what standards we leave to regulators like NOAA to establish. But I am very concerned about that kind of language and intent has a lot to do with it and I certainly think that the intent of those in California is the right one, but to call for best management practices, best available technology, that would seem to take us down the road of mandating certain technologies and I think that is less effective and can be counterproductive when compared to simply mandating and legislating performance standards. A performance standard for water quality. A performance standard for contaminants in the food we eat. A performance standard for a number of releases that is acceptable. You set that standard. You set it in a clear, definable way and then monitor performance, of course, and continue to monitor those participating in the industry or meeting the standard. And as a result, technology and management practices will continue to evolve and improve and as they evolve and improve, we might see opportunities to further strengthen those standards. Whereas if you just regulate the practices, if you tell someone here is the kind of nets you have to use, here is the kind of filters you have to use, then you almost condemn yourself to today's performance standards—no better, no worse—and that might be undesirable.

I just make that general statement because I would much rather have Congress step forward and say here is what we deem to be an acceptable water-quality standard and if we find out later we got that wrong, then we can clearly and efficiently and effectively take steps to make it right. Whereas if we get into the game of regulating exactly how someone should operate, what technology they should use, what management practices they should use, we run the risk of stifling innovation and new product development in an area where those issues and those questions are very important because there is still a lot of development going on here.

I would like to turn it over now to Chairman Stevens who has joined us and was indicated earlier, has come from a state with a great fishing history. Mr. Chairman.

STATEMENT OF HON. TED STEVENS,
U.S. SENATOR FROM ALASKA

The CHAIRMAN. [presiding] A great fishing future, Mr. Chairman. I am sorry to say I was in another meeting. Dave, I am pleased you would take the time to come all the way down here to appear before our Committee. I have summaries of all of your statements given to me by our staff last evening, but I am still worried about one thing. I believe that a state should have the right to determine what happens in terms of the areas off its shores, and I am really worried about the problem of not having the right to veto a Federal plan to develop beyond the state's three mile jurisdiction if an operation of a hatchery or some sort of fish farm or whatever it might be would pose a threat to the survival of the wild species that that state has.

You know, we have half the coastline in the United States and I think my colleagues get tired of me telling them that, but it makes a great difference to us what happens in the Federal waters offshore of Alaska. Have you taken a position with regard to the state veto?

Mr. MACMILLAN. Mr. Chairman, we have. We believe a state should have the opportunity to opt out of an offshore aquaculture program. Where we have difficulty is if an investor starts the process and maybe even builds a facility, installs it, and starts operating it and the state decides for whatever reason that it is a no go, why then would a business want to make that initial investment? There is no probable certainty of success.

The CHAIRMAN. That is why we have the Magnuson-Stevens Act. We have control out there yet we have a management plan which involves both the state and the Federal Government operated by a regional council. Now I don't believe anything should take place in the area of that council without the council's approval. If a state goes to that council and says, "we do not want this kind of species off our shores," the council ought to have the right to say you can't do it. Where do you end up on that?

Dr. MACMILLAN. Well, we think that species selection is an important issue and one that NOAA should have authority to deal with when they determine what species should be allowed to be farmed at offshore aquaculture locations.

The CHAIRMAN. I am involved in this battle right now. It is on the Coast Guard bill, and you may know about it. It involves a wind farm proposed in Nantucket Sound Bay and there is a process underway that says that Department of Interior will decide whether or not that wind farm can be located in Federal waters off that state. Now if you take the same circumstance and apply it to the Cook Inlet, you will have an enormous portion of Cook Inlet and land on both sides that is primarily owned by the Federal Government. Matter of fact, managed by the Department of Interior and along comes someone from Britain or Holland who wants to build a wind farm in the Cook Inlet. Today, under the law, what would happen is he goes to the Department of Interior and the Depart-

ment of Interior says, "fine, you've got a good plan." He goes to the Energy Department and says, "we would like to have that additional energy" and what happens? The State has no say about what goes on in Federal waters under the current legislation.

Now, I am saying in terms of Nantucket Sound, the Coast Guard ought to make a determination as to safety of navigation at both air and sea and determine impacts on communications, and the state ought to have some say about where the facility is sited. I am not saying you can't put it off there, but it ought to be sited where it will not do any harm to the economy of the area or to the creatures of the sea.

Now you put that into this concept of and say someone goes out there and builds it, in my opinion, they have no right to build in the 200-mile limit without regional council's agreement, and if that is not clear, we will make it clear. What do you say to that?

Dr. MACMILLAN. Mr. Chairman, I think it is a good idea to make things very, very clear to potential investors. They need to no upfront what the state or Federal rules are so they can make informed decisions. That is the key for the National Aquaculture Association. We want certainty to whatever the legislation is, and in the rules or regulations that are developed by NOAA. If a business doesn't have confidence environmental rules will be relatively constant and consistently applied, which would be a problem as Senator Sununu mentioned, if definitions are rather nebulous, then the investment risk gets escalated. Considering that, offshore aquaculture is going to be very expensive compared to fresh water aquaculture. You are talking about major dollars perhaps millions of dollars of investment, of risk, then mushy definitions and regulations only increase the risk. That is why we have concerns about a state deciding once the investment has been made, to pull the plug.

Senator SUNUNU. I think that clarification here is that Dr. MacMillan, what you are talking about is the situation where a state chooses to participate and a facility is licensed whether or not that license duly issued because the state did not opt out, can then be revoked after the fact.

Dr. MACMILLAN. That is correct.

Senator SUNUNU. And we talked about this licensing issue and there is an important question—is a 10-year license enough? Should it be a 20-year or 30-year because you do want to create some certainty and in the same way, if a state chooses to participate and a facility is licensed, then the Federal standards should apply to that case? If a state chooses not to participate, the license can't be issued and clearly those concerns do not come into effect, but I think the concern would be the retroactive elimination of a license that was issued when a state chose to participate.

The CHAIRMAN. Mr. Chairman, I don't disagree with that, but I hope the panel—we have about 3 minutes until we have to vote and we won't be coming back, but the concept I see is that there is not going to be any money invested in any offshore aquaculture until there is an application and it's reviewed by the state and by the Federal Government or regional council for—whatever the area decides. I think the regional council ought to make some decisions about what the process is. Very clearly, the dollars aren't going to

be spent until it is determined that the state does approve and if the state doesn't approve then I don't think the Federal Government or the regional council ought to allow that process to go forward.

Mr. Keeney.

Mr. KEENEY. Mr. Chairman, Mr. Stevens, the Administration agrees that offshore aquaculture should only develop in areas where it is welcomed and we would like to work with the Committee staff to develop the language to provide for appropriate mechanisms where this can take place, as well as mechanisms that can revert an opt-out decision.

Now when we are talking about space, there are 3.4 million square miles in the exclusive economic zone. When we are looking at the demands for aquaculture over the next 20 years, we think that there may be demands for as much as lets say a million metric tons which would take up no more space than the Pentagon and its parking lot.

So there is plenty of space out there. Siting is a critical issue.

The CHAIRMAN. Poison in the parking lot is still poison so let's keep that straight. Dave, we have aquaculture now in Prince William Sound right? That was approved by the state before it was put in there right?

Mr. BEDFORD. That is correct, Senator.

The CHAIRMAN. And that is our state law. What is wrong with that? No investment without prior approval as to the siting and process.

Mr. KEENEY. I have no problem with that.

Dr. MACMILLAN. I agree.

The CHAIRMAN. Anyone else? Ms. Cufone?

Ms. CUFONE. I think that is exactly right.

The CHAIRMAN. Mr. Eichenberg?

Mr. EICHENBERG. I agree as well, Mr. Chairman.

The CHAIRMAN. That is essential. Dave, do you have something to say? We really have to go and vote.

Mr. BEDFORD. Senator, just one moment if I could. One of the things that we recognize in managing dynamic natural systems in the State of Alaska when dealing with these kinds of resources, is that we can do the best planning that we can and get the best information that we can but in our own aquaculture permitting process, we recognize that things may change and we may find things out tomorrow that we don't know today. So whereas we would all like certainty, Mother Nature doesn't provide us with much of it. Thank you.

The CHAIRMAN. I will never forget the salmon pens in Puget Sound. I am sure you remember them. A big storm came up and they were all spread around and I am not sure we ever really knew the final result of that, but very clearly they were not a species that was indigenous to that area as I understood it. So that is the fear we have, I have and I think our wild fish—I think that most people back there don't know how far we've gone in utilizing even annual hatcheries, the system to enhance a particular population. I do believe that we should have this Committee come up some time and go look at some of those things we've done and understand them, because I think there are some places in the country

that could enhance their population and when I was in the State legislature we put up $40,000. We took fingerlings from Alaska silver salmon to the Great Lakes as the population now as salmon in the Great Lakes came from little initiative from a new state.

Senator SUNUNU. I thank you, Mr. Chairman, for your insights, for your participation. We do have a vote on the floor, so I want to thank the panelists and New Hampshire may only have 13 miles of coastline, but we are very proud of it and we certainly value the rights of our people, our legislature in the state to participate actively in the questions of ocean management. I think we've put together a good record so far on this issue. I think there is also a lot of consensus on this issue about the importance of having some regulatory framework, the importance of clarity and consistency in that regulatory framework, the economic value and the recognition that this already an industry that is global in its scope, that it affects our consumers and that has great economic value, so I think it would be an opportunity lost if we delayed unnecessarily in the creating process, moving forward in the process to address the issue.

Thank you to our panelists and to Members of the Subcommittee.

Senator STEVENS. Let me just add this. There are 2.5 million acres of Federal waters in just the Cook Inlet. Beyond state jurisdiction there is 2.5 million acres there and I think that is the area where people are looking at to think about aquaculture in our state. It is going to be a long time before that happens.

Senator SUNUNU. Thank you, the hearing is adjourned.

[Whereupon, at 11:12 a.m., the hearing was adjourned.]

A P P E N D I X

PREPARED STATEMENT OF JIM AYERS, VICE PRESIDENT, OCEANA

Chairman Stevens, we appreciate all that you do to protect America's oceans, and we agree with you that we can have healthy biodiverse ocean ecosystems with vibrant and productive fisheries. To that end we hope to work with you on the National Offshore Aquaculture Act (S. 1195). It is our understanding that your intent is to protect States from being negatively impacted by the expansion of aquaculture into Federal waters by providing a State Opt-Out Amendment (S. Amdt. 769) provision. In order for that provision to be effective, states will need protection authorities that prevent other states and Federal authorities from "polluting" their waters with aquaculture spills, in particular escapements. We request you allow us to work with you by developing language in the State Opt-Out Amendment with the goal of protecting the environmental interests of states such as Alaska.

Offshore fin-fish aquaculture will likely affect areas far away from where fish are being raised because the ocean lacks natural barriers and fish regularly traverse great distances. For example, farmed Atlantic salmon have been found in the Bering Sea, thousands of miles away from the closest salmon aquaculture facilities.[1] Potential impacts to Alaska's environment from offshore aquaculture along the U.S. west coast include:

1. *Disease Transmission*—A few escaped farmed fish carrying a novel or exotic pathogen could cause severe mortality in wild fish populations.[2] The high densities of fish in aquaculture operations lead to disease outbreaks and a higher prevalence of disease overall.[3]

2. *Invasive Species*—Approximately 40 percent of documented marine species introductions are the result of aquaculture operations.[4] In the Pacific Ocean, Atlantic salmon have already been found breeding in both British Columbia,[5] and South America.[6] Increased salmon aquaculture will result in an increased risk of Atlantic salmon becoming established in Alaska streams. Recent development of other Atlantic aquaculture species, such as Atlantic cod and Atlantic halibut, could be devastating to Alaska's fisheries if aquaculture of these species is allowed in Pacific waters.

3. *Genetic Pollution*—Aquaculture of native species can decrease the fitness of wild populations when interbreeding occurs,[7] a risk that is magnified when transgenics are considered.[2] An expansion of farming Pacific salmon species increases the likelihood of an adverse impact to Alaska salmon stocks. Development of other native aquaculture species in the Pacific, such as sablefish (black cod), may pose an even greater risk of genetic pollution to Alaska's fisheries. Unlike salmon, most other species of fish are likely capable of reproducing in-

[1] Brodeur, R. D., and M. S Busby. 1998. Occurrence of an Atlantic Salmon *Salmo salar* in the Bering Sea. Alaska Fishery Research Bulletin 5:64–66.

[2] Naylor, R., K. Hindar, I. A. Fleming, R. Goldburg, S. Williams, J. Volpe, F. Whoriskey, J. Eagle, D. Kelso, and M. Mangel. 2005. Fugitive salmon: assessing the risks of escaped fish from net-pen aquaculture. Bioscience 55:427437.

[3] Jones, S. R., A. H. MacKinnon, D. B. Gorman. 1999. Virulence and pathogenicity of infectious salmon anemia virus isolated from farmed salmon in Atlantic Canada. Journal of Aquatic Animal Health 11:400–405.

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side net pens and have eggs and larvae much smaller than the mesh of a net pen.

4. *Competition for Resources*—Escaped fish can compete with wild stocks for resources such as food, habitat and mates. [2]

Given these problems, we strongly encourage you to strengthen the State Opt-Out Amendment to better protect the fisheries and other biological resources important to coastal states. We suggest making the following changes to S. Amdt. 769 that will allow Alaska and other coastal states to object to offshore aquaculture that may harm their biological resources:

- Change subsection (b) to (c) and insert new subsection (b) as follows—

(b) PROTECTION OF STATE RESOURCES. Notwithstanding any other provision of this Act, if the Secretary receives notice in writing from the chief executive officer of a coastal State that implementation of this Act may harm or may put at risk of harm a biological resource of that state when this Act is applied to areas that are outside the State's seaward portion of the Exclusive Economic Zone, then—

(1) the provisions of sections 4 shall not apply to such areas that are outside the State's seaward portion of the Exclusive Economic Zone more than 30 days after the date on which the Secretary receives the notice;

(2) no permit issued under this Act shall be valid in that portion of the Exclusive Economic Zone more than 30 days after the date on which the Secretary receives the notice; and

Insert new definition (d)(3)

(3) BIOLOGICAL RESOURCE.—the term "biological resource" means a living component of the ecosystem.

This language was drafted with the intent to mirror the scope of the language in S. Amdt.769. If changes are made to the amendment, for example making the opt-out species or type of aquaculture specific, we would be happy to work with you to make similar changes in the scope of the language we are proposing.

While we focus on the State Opt-Out Amendment here, we are also concerned with S. 1195 in general. Both the U.S. Commission on Ocean Policy and the Pew Oceans Commission highlighted the real and significant problems that marine finfish aquaculture poses to our marine resources and ecosystems. S. 1195 would expand aquaculture offshore before we know what the consequences of this expansion will be and without ensuring protection and likely bringing harm to our ocean resources. Before addressing S. 1195 further, we strongly encourage you to make sure the economic impacts, threats to wild fish stocks, effects on water quality and ocean habitats, access and transportation concerns, and human health risks of offshore aquaculture are scientifically examined, as called for in the Natural Stock Conservation Act of 2005 (S. 796). These studies would allow us to look before we leap offshore with aquaculture, and make sure that proper standards are put in place that will ensure our marine resources are not harmed.

We appreciate your efforts to protect Alaska's and other coastal states' biological resources and urge you to strengthen the State Opt-Out Amendment to ensure states can choose a healthy biodiverse ocean ecosystem with vibrant and productive fisheries. Please contact me if you have any questions or would like to discuss further.

PREPARED STATEMENT OF WENONAH HAUTER, EXECUTIVE DIRECTOR, FOOD & WATER WATCH

Food & Water Watch, a nonprofit consumer rights organization that challenges corporate control and abuse of our food supply and freshwater and ocean resources, wishes to thank you for the June 8th National Ocean Policy Study subcommittee hearing on offshore aquaculture. We are pleased to submit these comments for the record in order to highlight some of the very productive discussions at the hearing about necessary safeguards to protect the environment and local fishing communities. We also hope to highlight some of the issues that have yet to be examined by this Subcommittee. We urge the Subcommittee not to move forward on legislation to permit offshore aquaculture in the Exclusive Economic Zone (EEZ) until NOAA provides a detailed assessment of all the potential negative impacts of offshore aquaculture and how these problems can best be addressed.

As we discussed in our previous comments, offshore aquaculture involves the raising of carnivorous finfish, such as cod, halibut, and red snapper, in often large,

crowded cages where fish waste and chemicals flush straight into the open ocean. We are very concerned that offshore fish farming in the U.S. EEZ may pose many of the same problems for marine ecosystems, consumer health, and the economic livelihoods of fishing businesses and communities, as largescale industrial farming of carnivorous finfish has in other countries.

We were pleased that two witnesses at the June 8th hearing, Mr. Tim Eichenberg from The Ocean Conservancy, and Mr. David Bedford of the Alaska Department of Fish and Game, discussed the safeguards that their states have implemented in order to protect the environment and local fishing communities from the possible negative impacts of offshore aquaculture. As Mr. Eichenberg pointed out, if Federal law were to entail fewer safeguards than provided by state law, these state protections would be severely undermined. Neither fish farm's pollution nor its economic effects will likely adhere to state and national political boundaries.

One of the very important safeguards of both Alaska and California's policies on marine aquaculture is a required comprehensive analysis of the environmental and socioeconomic impacts of marine aquaculture. Alaska's position states that a five-year moratorium should be in place for all new aquaculture operations so that a comprehensive study can be undertaken to understand how aquaculture would affect the ecology of American waters as well as the socioeconomic impacts on coastal communities.

Likewise, California's new Sustainable Oceans Act requires the Department of Fish and Game to issue a programmatic environmental impact statement that analyzes:

- appropriate areas for siting of marine finfish aquaculture operations to avoid adverse impacts and minimize any unavoidable impacts;
- the effects on sensitive ocean and coastal habitats;
- the effects on marine ecosystems, commercial and recreational fishing, and other important ocean uses;
- the effects on other plant and animal species, especially protected species;
- the effects of the use of chemical and biological products and pollutants and nutrient wastes on human health and the marine environment;
- the effects of interactions with marine mammals and birds;
- the cumulative effects of a number of similar finfish aquaculture projects on the ability of the marine environment to support ecologically significant flora and fauna;
- the effects of feed, fish meal, and fish oil on marine ecosystems;
- the effects of escaped fish on wild fish stocks and the marine environment; and
- the design of facilities and farming practices so as to avoid adverse environmental impacts, and to minimize any unavoidable impacts.

Another witness, Ms. Marianne Cufone from Environment Matters, discussed how the Gulf of Mexico Fishery Management Council and the Florida Department of Agriculture and Consumer Services are also considering steps to protect unique local resources because S. 1195 in its current form does not sufficiently do so. As she attested and as was confirmed in Mr. Tim Keeney of NOAA's testimony, under S. 1195 regional councils would be demoted to a consulting or consenting role on offshore aquaculture. States would have little to no role whatsoever. Ms. Cufone's testimony further discussed how various user conflicts are expected between offshore aquaculture and other ocean uses, such as those regarding known fishing grounds and routes to those fishing grounds, other vessel traffic lanes, military sites, marine reserves, sanctuaries, and other protected or vulnerable areas. Ms. Cufone called for buffer zones around these areas. To have such buffer zones would require NOAA to perform comprehensive mapping and analysis.

Whether it is the analysis needed to establish buffer zones, or the analysis prescribed in California and Alaska's state policy, it is clear that comprehensive analyses should be required before commercial aquaculture is allowed in Federal waters. A deliberative and precautionary approach is consistent with the Pew Oceans Commission recommendation that there be a moratorium on offshore fish farming until environmental concerns are addressed. At this time, there has been very little study of the likely environmental and socioeconomic impacts of offshore aquaculture in Federal waters. Our recent report, Seas of Doubt, details the lack of published research on the environmental impacts of four marine aquaculture projects currently operating in U.S. waters and highlights the significant discrepancies in what research does exist. Additionally, the report notes the insufficiency of these four projects as viable economic demonstrations for a full-scale industry given their lim-

ited capacities and the lack of true freemarket conditions surrounding their current operations.

Unfortunately, instead of providing a comprehensive analysis of the likely environmental and socioeconomic impacts of offshore aquaculture and manner in which it plans to address these impacts, NOAA continues to promote S. 1195, which allows for the fast-track permitting of fish farming in Federal waters with little analysis and few safeguards necessary to protect marine ecosystems, including marine fisheries. It is amazing to us that NOAA officials can in one breath talk about the agency's 30 years of experience in dealing with some of aquaculture's potential negative impacts, and in the next, fail to detail, with any specificity, how the agency plans to address these issues.

While we were pleased that Mr. Keeney testified that the administration would be willing to work with the Senate to alter S. 1195, much more is needed than simply the "clarifying language," that he offered the Subcommittee. As a primary step, NOAA should provide the following information and make it subject to public scrutiny and further legislative hearings:

- NOAA has not provided any analysis of the likely individual and cumulative environmental and socioeconomic effects of offshore aquaculture due to, for example, chemical and nutrient pollution, escaped fish, or diseases and parasites transmitted to wild fish populations.
- NOAA has not detailed the agency's plans, if any, to minimize the discharge of wastes and chemicals and cumulative impacts from offshore fish farms into the ocean environment. More information is needed on how best to limit wastes and why closed containment systems are not a better option for aquaculture than offshore cages.
- NOAA has not provided much detail about the agency's plans, if any, to engage in planning, zoning, or the development of siting criteria for offshore aquaculture. NOAA officials have not discussed whether NOAA plans to assess and maintain environmental carrying capacities of each region where offshore aquaculture is planned.
- NOAA has not discussed whether NOAA would prohibit the siting of offshore fish farms in National Marine Sanctuaries or other protected areas. Nothing in S. 1195 currently prohibits such siting.
- NOAA has not discussed whether NOAA is opposed to prohibiting non-native or genetically modified species in offshore fish farms. There are no such prohibitions in S. 1195.
- While Dr. Hogarth's testimony stated that "technological innovation, best management practices, and careful species selection" can limit fish escapes, he did not discuss whether NOAA would support requiring offshore aquaculture facilities to adopt these measures and, if so, the level of mitigation anticipated using different technologies and practices. He did not discuss whether offshore aquaculture facilities would be required to tag or track farmed fish or whether NOAA was opposed to such measures.
- While Mr. Keeney and Dr. Hogarth's testimony indicated that NOAA believes that offshore aquaculture could benefit coastal communities, they have yet to provide a detailed analysis of the likely impacts of offshore aquaculture on commercial fish prices and employment.
- NOAA has failed to adequately detail how it plans to adequately fund its new offshore aquaculture program. In his April 6th testimony, Dr. Hogarth testified that establishing an offshore aquaculture program would cost approximately $3 million per year and that the continuing costs of running the program would be about $7 million per year. He could not answer the question, however, of how NOAA would secure these funds. Just this year, NOAA requested a 65 percent decrease in funding for its Marine Aquaculture Program—a decrease from $4.5 million it received in appropriations in FY 2006 to $1.6 million requested for FY 2007.
- NOAA has failed to provide a Legislative Environmental Impact Statement (LEIS), which is required by the National Environmental Policy Act. An adequate LEIS would enable the Subcommittee and the public to thoroughly evaluate all of the risks of offshore aquaculture, possible alternatives, measures that NOAA would recommend to mitigate these risks, and any unavoidable consequences of offshore aquaculture.

This information will only help the Senate in assessing S. 1195 or any other offshore aquaculture permitting bill. We urge the Subcommittee to not move forward on legislation to permit offshore aquaculture in the EEZ until NOAA adequately as-

sesses all the potential problems of offshore aquaculture and how these can best be mitigated.

We would be happy to discuss our concerns further and look forward to working with you to protect our oceans and America's fisheries.

JOINT PREPARED STATEMENT OF THE UNITED STATES OFFSHORE AQUACULTURE COMMUNITY

Dear Committee Members,

We, the undersigned, represent a group of U.S.-based small businesses, academic institutions, and market interests who wish to tender support for the passage of the National Offshore Aquaculture Act (S. 1195). The passage of this Act is a critical step toward securing an economically viable and environmentally sound domestic source of healthy seafood for American consumers.

In contrast to those who oppose S. 1195, we do not believe its passage will result in the rapid, unfettered, and environmentally harmful development of aquaculture in the U.S. Exclusive Economic Zone (EEZ). Our beliefs rest on direct experience and peer-reviewed scientific research. Ongoing commercial, demonstration, and research projects in the U.S. have proven that, with current technology, we can safely farm a number of species in open ocean waters of up to 200 feet in depth. The water and sediment quality monitoring programs under which these projects operate demonstrate that the environmental impacts of offshore finfish culture operations are typically negligible when sited and managed appropriately. This is well documented in technical reports that are regularly submitted to the state and Federal environmental agencies, and are a matter of public record.

The accomplishments of these projects and others in the U.S. indicate that, given the proper regulatory environment, the U.S. is well positioned to meet and overcome the challenges of establishing commercially viable farming operations in distant and deep offshore waters. For that to occur, however, S. 1195 must pass into law.

How that law defines compliance with environmental standards is of paramount importance to all stakeholders. We believe that effective environmental regulation is based on performance. The a-priori adoption of prescribed technologies and management practices that do not assure minimal environmental impact is neither sustainable nor cost-effective.

As with any emerging industry, offshore aquaculture is continually evolving. Technical and methods-based innovations that result in greater production efficiency and enhanced environmental performance must not be precluded because they do not fit a preordained and untested set of regulations. A regulatory structure that forces companies to adopt specific technologies and practices rather than setting strict environmental impact goals will stifle innovation and hamper a sustainable approach to offshore aquaculture.

Current state and Federal regulations already insure environmental protection for operations in state waters. The most compelling need addressed by S. 1195 is the creation of a Federal permitting process in the EEZ. The absence of a formal process and lead agency make it virtually impossible for a small business, and in some cases, research projects to obtain permits in waters under Federal jurisdiction. With NOAA to coordinate existing regulatory processes with the U.S. Army Corps of Engineers, the Environmental Protection Agency, and other agencies, we can build a regulatory system that protects the environment and provides appropriate and attainable environmental standards for industry.

We believe that NOAA is well suited to the task of coordinating and managing such an industry. NOAA has been actively involved in the field of offshore aquaculture for decades, and it continues to play a pivotal role in related research and development. Site visits by NOAA personnel to key U.S. projects, NOAA's review of production records and environmental reports, and its engagement in an ongoing, constructive dialogue with stakeholders has provided the Administration with a solid understanding of the scientific, technological, environmental, economic, and social aspects of this emerging industry.

We also believe that for S. 1195 to move forward, open and sincere dialogue among stakeholders is necessary. Unfortunately, opposition to offshore aquaculture is often based on false, dated, incomplete, or out-of-context information. Opponents routinely use conjecture and speculation—rather than sound science—to misinform media and inflame public fear. U.S. companies and university researchers welcome a constructive dialogue on environmental issues, however, many opposition groups resist meaningful discussion. Rarely has a conversation between members of these groups and the principals of aquaculture projects had a fruitful outcome. Instead, statements made by company affiliates and university researchers in the aqua-

culture field have been grossly misquoted in advocacy-based "reports" and, ultimately, the media. In their sweeping condemnation of all of our efforts, they also malign the ability of U.S. companies to lead this industry toward a sustainable, environmentally sound and healthful future. They would seem to prefer that we remain forever reliant on seafood imported from elsewhere.

We ask that in your deliberations, you please consider the source of the information presented to your Committee, and make your decisions based on information backed by credible science. You have a tremendous amount of influence on the future of offshore aquaculture in this country. Please consider the facts, not the misconceptions when evaluating S. 1195.

Sincerely,

Businesses

Brian O'Hanlon, President/Founder, Snapperfarm, Inc.

Neil Anthony Sims, President/Co-Founder, Kona Blue, Inc.

John "Randy" Cates, President/Founder, Cates International, Inc.

Stephen Page, CEO/Founder, Ocean Farm Technologies Inc.

Gary F. Loverich, Chairman/Founder, OceanSpar LLC.

Joe Hendrix, Seafish Mariculture.

Dr. J.E. Jack Rensel, Rensel Associates Aquatic Sciences.

Jose A. Rivera, Biologist/Contractor, Boqueron, Puerto Rico.

Christopher Duffy, Great Bay Aquaculture, LLC.

George Nardi, Great Bay Aquaculture, LLC.

Universities and Research Organizations

Dr. Richard Langan, Director, Open Ocean Aquaculture Program, University of New Hampshire.

Clifford Goudey, Center for Fisheries Engineering Research, Massachusetts Institute of Technology.

Dr. Daniel D. Benetti, Rosenstiel School of Marine and Atmospheric Science, University of Miami.

Dr. Sandra Shumway, Department of Marine Science, University of Connecticut.

Dr. Barry Costa-Pierce, Director, Rhode Island Sea Grant College Program, University of Rhode Island.

Dr. La Don Swan, Director, Mississippi-Alabama Sea Grant Consortium.

Dr. Robert R. Stickney, Department of Oceanography, Texas A&M University.

Dr. Dale Kiefer, Department of Biological Sciences, University of Southern California.

Dr. Albert Tacon, Aquaculture Coordinator, University of Hawaii.

Dr. Kevin D. Hopkins, Professor, College of Agriculture, Forestry & Natural Resource Management, University of Hawaii at Hilo.

Dr. Bruce S. Anderson, President, Oceanic Institute, Waimanalo, Hawaii.

Glen Rice, Ocean Engineering, University of New Hampshire.

Michael Chambers, Ocean Engineering, University of New Hampshire.

Scott Lindell, Marine Resources Center, Marine Biological Laboratory, Woods Hole, MA.

Bruno Sardenberg, Rosenstiel School of Marine and Atmospheric Science, Marine Affairs and Policy, University of Miami.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN E. SUNUNU TO TIMOTHY R.E. KEENEY

Question 1. Senator Boxer referred to an article in the magazine Science outlining concerns with the levels of toxins in farmed salmon. Did this study find any toxin levels beyond acceptable limits from the Food and Drug Administration, the World Health Organization, or the Environmental Protection Agency?

Answer. The study Senator Boxer referred to at the June 8, 2006, subcommittee hearing on offshore aquaculture is titled "Global Assessment of Organic Contaminants in Farmed Salmon" (Hites et al., 2004. *Science* 303:226–229). In that study, the authors compared the levels of organic contaminants in wild Pacific salmon, pri-

marily from Alaska, with cultured Atlantic salmon from Europe, North America, and Chile. They found the levels of organic contaminants to be significantly higher in cultured salmon than in wild Alaskan salmon. However, the actual amounts of polychlorinated biphenyls (PCBs) found in the skin-on cultured salmon used in the study ranged from .02 to .05 parts per million (20–50 parts per billion), which is within acceptable limits of PCB contaminants in seafood set by the Food and Drug Administration, the World Health Organization, and guidance issued by the Environmental Protection Agency.

Specifically, the U.S. Food and Drug Administration has established a tolerance of 2 parts per million (ppm) for PCBs for fish and shellfish (edible portion). The levels of PCBs in farmed Atlantic salmon in the Hites study ranged from about .02 to .05 ppm, well below the FDA allowable amount (US FDA, 21 C.F.R. 109.30).

The World Health Organization (WHO), in collaboration with the Food and Agriculture Organization of the United Nations (FAO), has considered dioxins and dioxin-like compounds such as PCBs on several occasions. Most recently, in June 2001 the Joint FAO/WHO Expert Committee on Food Additives examined new evidence on the toxicity of these chemicals and established a Provisional Tolerable Monthly Intake (PTMI) of 70 picograms of dioxins and dioxin-like PCBs. Based on the mean contamination levels reported in the Hites study, eating one or two portions per week of cultured salmon would result in a monthly intake below the PTMI levels set by the FAO/WHO committee. (World Health Organization. PCBs and Dioxins in Salmon; Organochloride Contamination of Salmon; January 20, 2004.)

The U.S. Environmental Protection Agency (EPA) regulates the discharge of organic contaminants, including PCBs, into the environment and sets acceptable amounts in drinking water. The EPA gives guidance on consumption of seafood products that contain contaminants such as PCBs. The EPA does not give guidance on consumption of terrestrial animals that contain PCBs. The time period EPA uses in assessing health risk for humans is the entire life span of the consumer. For pollutants with carcinogenic properties, EPA currently assumes there is no threshold below which the risk is zero. The limits for carcinogens set by the EPA are based on the assumption that consumption over a human's lifetime, at the monthly rate provided, would yield a lifetime cancer risk no greater than an acceptable risk of 1 in 100,000. In making its recommendations, EPA assumes the adult is 70 kilograms in weight and the serving portion of fish is 8 ounces. For fish tissue concentrations of >0.023–0.047 ppm for PCBs, wet weight (roughly the range of values from the Hites study for cultured salmon), EPA's risk-based consumption limit is not more than four meals per month for "non-cancer health endpoints" and one meal per month for "cancer health endpoints." (US EPA, Guidance for assessing chemical contaminant data for use in fish advisories. Vol. 2: Risk assessment and fish consumption limits, third edition. See Table 4–24 for Monthly Fish Consumption Limits, PCBs). In other words, EPA's risk-based consumption limit of eating no more than one portion of fish per month with more than .05 ppm PCB (on a continuing monthly basis) is based on the assumption that consumption over a lifetime would yield a lifetime cancer risk no greater than an acceptable risk of 1 in 100,000.

In the Hites study, the authors examined levels of contaminants in many species of Pacific salmon that are primarily plankton eaters. Because these salmon (chum, pink, and sockeye) consume little or no contaminated baitfish, the level of organic contaminants in these fish would be relatively low. In comparison, Chinook salmon (which are fish eaters) residing their entire lives in Puget Sound, Washington, have levels of contaminants equal to or higher than cultured Atlantic salmon. (O'Neill et al., 1998. Spatial trends in the concentrated PCBs in Chinook and Coho salmon in Puget Sound and factors affecting PCB accumulation: Results from the Puget Sound Ambient Monitoring Program. *Puget Sound Research* 312–328).

Organic contaminants in the environment, such as PCBs, are associated with industrial development. PCBs are found in chickens, eggs, and dairy products at levels comparable to those found in some salmon. For example, the FDA allowable levels of PCBs in some common food products are as follows: 1.5 ppm for milk, 3 ppm for poultry, 2 ppm for fish, and 0.3 ppm for chicken eggs. PCBs are found in a variety of marine fishes, including baitfish such as anchovies, herring, and sardines. Because baitfish are used to make fish meal—a component in feeds for poultry, swine, and fish—organic contaminants in baitfish can be transferred up the food chain to any farmed animal or their products. Because Alaska has experienced little industrial development, there are relatively low levels of organic contaminants in its waters and, subsequently, in the baitfish.

Question 2. We've heard calls for a moratorium, in order to allow full scale demonstration projects before proceeding to commercial operations. How many permits would you envision NOAA granting in the first few years of this program?

Answer. Prospects for future growth of offshore aquaculture in the United States depend on many factors, including the details of the regulatory structure that would be developed under the National Offshore Aquaculture Act of 2005. The industry will be operating and competing in a global market, where a range of economic factors (e.g., consumer demand and the costs of labor, capital, and competing products) will determine the commercial viability of U.S. operations and drive the demand for offshore permits.

Question 3. How would Fisheries Management Councils be involved in the decision of whether or not to approve an offshore aquaculture application?

Answer. NOAA has a longstanding working relationship with the Regional Fishery Management Councils established under the Magnuson-Stevens Fishery Conservation and Management Act. The National Offshore Aquaculture Act of 2005 requires NOAA to consult with the Councils in developing and implementing the regulatory regime for offshore aquaculture. NOAA would consult with the Councils when drafting implementing regulations, establishing environmental and other requirements (especially as they relate to interactions with wild stocks managed by the Councils), and reviewing individual permit applications. NOAA intends to use the rulemaking process to define the Councils' role in permitting individual sites once the bill is enacted. In the meantime, NOAA has identified opportunities to begin discussing the consultation process with the Councils on an informal basis.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO TIMOTHY R.E. KEENEY

Hawaii and California Aquaculture Legislation

Question 1. In 1999, the Hawaii Legislature amended existing law and allowed the long term leasing of State marine waters for commercial aquaculture. This action opened up the opportunity for farming the ocean using modern surface and submerged cage culture technologies and economically important local species. California just passed comprehensive legislation for permitting and regulating aquaculture in state waters. Both laws have environmental regulations regarding issues of concern for each state.

How will environmental safeguards in existing state legislation, such as in Hawaii and California, be respected in Federal regulations?

Answer. Environmental safeguards in existing state legislation, such as in Hawaii and California, provide a good starting point for the development of Federal regulations. NOAA will be looking closely at these existing standards, and encouraging the full participation of coastal states in the rulemaking process, as we implement the National Offshore Aquaculture Act of 2005. In addition, current law already requires that offshore aquaculture operations obtain a state consistency certification under the Coastal Zone Management Act and a state water quality certification under the Clean Water Act.

NOAA has already begun to compile information on environmental safeguards, not only in U.S. coastal states but also in other countries with more established marine aquaculture industries. We are finding general agreement across a range of jurisdictions on the major issues that need to be addressed, and there is great similarity among the standards that have been developed.

Question 2. In what ways are the Hawaii and California aquaculture laws and programs similar? In what ways are they different?

Answer. In Hawaii, more than 100 aquafarms are in operation. More than 50 aquatic plant and animal species are being raised for research or commercial production in Hawaii, including shellfish (marine shrimp, freshwater prawns, and abalone); finfish (Pacific threadfin/moi, tilapia, catfish, carp, flounder, sturgeon, amberjack, snappers, mahi-mahi, and grouper); algae (seaweeds and microalgae); and other products such as broodstock shrimp, oyster and clam seed, pearl oysters, and various freshwater and marine aquarium fish and invertebrates. Current open ocean marine aquaculture leases include two commercial cage culture operations that produce Pacific threadfin and greater amberjack.

Regarding regulation, the Hawaii Department of Land and Natural Resources (DLNR) issues and administers aquaculture leases. The state's Department of Agriculture, through its Aquaculture Development Program (ADP), serves as liaison with potential lessees and provides technical support to aquaculture businesses.

In Hawaii, the stated goal is to increase aquaculture production by providing a variety of support services to help businesses get started. And once a business is established, the state continues to provide support services and offer technical assistance. For example, the ADP provides business counseling, planning and coordi-

nation, informational services, marketing, animal health management, and research and extension services. The business counseling services include preparation and review of business plans; advice on Federal, state, and local permit requirements, and on sources of financing and suitable sites; and technical assistance to improve farm operational efficiency and profitability. The ADP also provides a wide variety of current information to aquaculture businesses, including species identification and culture technologies, product and service markets, regulations, and the cost of doing business in Hawaii. The ADP employs an aquaculture veterinary medical officer and technical staff. The program also provides health certification services to aquatic livestock exporters and serves as a technical resource to state officials in charge of aquatic species importation permitting. The ADP also encourages short-term applied research. California does not have a program similar to the Hawaii ADP.

Aquaculture is found in almost every county in California. But unlike Hawaii, the majority of aquaculture production consists of pond culture of freshwater fish. Coastal marine aquaculture activities in California include farming of oysters, abalone, mussels, clams, and scallops. Unlike Hawaii, there are no open ocean operations in state waters. As far as aquaculture in Federal waters in California is concerned, Hubbs-SeaWorld Research Institute is in the permitting process to operate an aquaculture facility at the Grace oil platform.

Regarding regulatory programs, California's aquaculture industry operates under the jurisdiction of a number of state agencies. The primary agencies are the California Departments of Fish & Game (CDFG) and the California Department of Health Services (CDHS). CDFG is the lead agency, and CDHS has regulatory authority over all health and sanitation aspects of the shellfish industry, including growing waters, harvesting, processing, and shipping of products.

The chart below compares the approaches to regulation in California and Hawaii.

Comparison of Approaches to Aquaculture

	California	Hawaii
Environmental Assessments	Environmental assessment if funds are appropriated to the department and matching funds from aquaculture industry..	—Environmental assessment under rules of Chapter 343 of the code. —Cannot lease in marine life conservation district, shoreline fisheries management area, or natural area reserve program.
Prior to Lease	—Basic benthic habitat and community assessment by lessee to Control Board.. —Lessee must establish best management practices approved by Commission..	Must submit environmental assessment or environmental impact statement.
Escapes	—All farmed fish must be marked or tagged.. —Site designed to prevent escapes and lessee responsible for damages..	—Escapes that are not identifiable may become common property. —Lessee may be responsible for retrieving escapes if demanded by Board.
Collected Funds	Remaining funds go to Fish and Game Fund..	Revenues deposited in special land development fund for aquaculture industry after portion deposited in public land trust.
Lease Periods	Lease for a period of 10 years—renewable every 5 years at discretion of Commission..	Term specified in lease issued by Board of Land and Natural Resources (first commercial lease was for 15 years).

Comparison of Approaches to Aquaculture—Continued

	California	Hawaii
Fees Collected	Fees sufficient to pay for administering the program and enforcement..	Annual rent set by Board.

State vs. Federal Permitting

Question 3. Any legislation should address how the permitting process will include states and other stakeholders in the development of permitting and siting criteria. Enhanced coordination is needed to provide consistency and to adequately manage potential impacts that cross jurisdictional lines, such as the spread of disease. Significant state participation and input to guidelines to ensure they are complementary at both state and Federal levels is important. Without such Federal-state coordination, states have placed limitations on aquaculture facilities in their waters. Alaska, for example, has a constitutional provision banning finfish aquaculture, and several states prohibit the cultivation of genetically-modified species. Can minimum national standards avoid "bad actors," who undermine environmentally sensitive operations?

Answer. NOAA agrees that minimum national standards are needed to ensure that offshore aquaculture develops in an environmentally responsible and sustainable manner, and these standards need to be legally enforceable. The National Offshore Aquaculture Act of 2005 provides the authority to (1) establish these standards, (2) include appropriate terms and conditions on offshore aquaculture site and operating permits requiring permit holders to comply with these standards, (3) monitor operations, (4) enforce the terms and conditions of offshore aquaculture permits, and (5) penalize permit holders who violate the terms and conditions of their permits. Under the National Offshore Aquaculture Act of 2005, permit holders who violate the terms and conditions of their permits may be fined or imprisoned, their property may be seized, and their permits may be suspended or revoked. The Act further provides that permit holders must post a bond or other form of financial guarantee as added insurance against "bad actors."

In addition, since the Act does not preempt existing laws and regulations, "bad actors" should expect the full force of applicable criminal and civil remedies beyond those in the Act—for example, those under applicable fish and wildlife statutes.

Question 4. What role should states play in helping set these minimum standards?

Answer. NOAA will encourage the full participation of coastal states in the rulemaking process to implement the National Offshore Aquaculture Act of 2005. In particular, NOAA will look to the states to share their experience and insights on the rationale for the standards they have adopted, as well as their experience in implementing state legislation and enforcing environmental standards. Information from the states about what does and does not work in terms of their regulatory approach will be valuable to NOAA in establishing and enforcing national standards.

Question 5. How can we avoid inconsistency with state standards, including forum shopping for areas with weaker standards?

Answer. Current law already provides mechanisms for ensuring consistency with state standards. The Clean Water Act requires state certification that an offshore aquaculture operation meets water quality standards, and the Coastal Zone Management Act requires state certification that issuance of an offshore aquaculture permit is consistent with state coastal management plans.

NOAA's rulemaking process to establish environmental requirements will draw heavily on state experience in regulating coastal marine aquaculture operations. Based on the information NOAA has already compiled on environmental safeguards in U.S. coastal states, there is general agreement across a range of jurisdictions on the major issues that need to be addressed, and there is tremendous similarity among the standards that have been developed. This is also true with respect to environmental safeguards in other countries with established aquaculture industries. So it is reasonable to expect that Federal standards developed under the National Offshore Aquaculture Act of 2005 will be consistent with existing state standards and will not provide incentives for forum shopping. NOAA expects aquaculture businesses to choose sites for new marine aquaculture operations based primarily on the suitability of the site for the specific species and systems in which they want to invest. For example, businesses are likely to consider site characteristics such as water depth, bottom type, salinity levels, currents, proximity to land-based support facilities and markets, and potential conflicts with other uses.

Question 6. As recommended by the Ocean Commission, aquaculture legislation should specify how the permitting regime will contribute to Federal coordination of existing regimes, including facilities established under the Deepwater Ports Act, as well as offshore alternative energy facilities and offshore oil and gas drilling permitted under the Outer Continental Shelf Lands Act.

An offshore management regime should provide for effective coordination of all ocean activities such as offshore aquaculture and alternative energy development. How should aquaculture programs coordinate with other agencies of jurisdiction to prioritize activities, minimize conflicts, protect resources, and ensure that uses are compatible?

Answer. The National Offshore Aquaculture Act of 2005 specifically provides for the establishment of a coordinated permit process that will include other agencies with jurisdiction over activities that occur in Federal waters of the Exclusive Economic Zone. The bill includes specific provisions detailing the role of the Department of the Interior with respect to offshore aquaculture facilities located on or near facilities permitted under the Outer Continental Shelf Lands Act.

With respect to interagency coordination, NOAA is already an active participant in existing institutional structures, including the Committee on Ocean Policy and the Joint Subcommittee on Aquaculture, that provide good communication channels for working with Federal agency partners to develop the coordinated permit process called for under the National Offshore Aquaculture Act of 2005. In addition, NOAA is already working with the Army Corps of Engineers, the Environmental Protection Agency, the Fish and Wildlife Service, and other agencies of jurisdiction to address aquaculture permitting issues under current law.

Some issues will need to be addressed through internal NOAA processes, as NOAA has major stewardship and management responsibilities under the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, Marine Mammal Protection Act, Coastal Zone Management Act, and other statutes. NOAA is already working to improve coordination between the aquaculture program and other NOAA programs that have primary responsibility for implementing these statutes.

Question 7. Will any agency be empowered to reject a proposed facility based on safety or environmental standards? Please explain.

Answer. The National Offshore Aquaculture Act of 2005 specifically requires Department of the Interior (DOI) concurrence on permits for offshore aquaculture facilities located on or near facilities permitted by DOI under the Outer Continental Shelf Lands Act. The bill includes specific provisions detailing DOI's continuing role with respect to maintenance and safety on existing facilities such as oil and gas platforms.

Because the bill does not supersede any existing statutes, offshore aquaculture facilities and operations will need to comply with all existing requirements and standards. Therefore, even though there is no explicit concurrence requirement for other Federal agencies such as the Environmental Protection Agency or the Army Corps of Engineers, an offshore aquaculture facility will not be able to operate without the proper permits from these other agencies—e.g., a National Pollutant Discharge Elimination System permit from EPA and a Section 10 permit from the Army Corps of Engineers pursuant to the Rivers and Harbors Act. Other requirements, such as Coast Guard rules governing marking of a site, would also apply.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO TIM EICHENBERG AND MARIANNE CUFONE, ESQ.

Hawaii and California Aquaculture Legislation

Question 1. In 1999, the Hawaii Legislature amended existing law and allowed the long term leasing of State marine waters for commercial aquaculture. This action opened up the opportunity for farming the ocean using modern surface and submerged cage culture technologies and economically important local species. California just passed comprehensive legislation for permitting and regulating aquaculture in state waters. Both laws have environmental regulations regarding issues of concern for each state.

How will environmental safeguards in existing state legislation, such as in Hawaii and California, be respected in Federal regulations?

Answer. S. 1195 currently contains no safeguards to ensure that Federal regulations protect state environmental standards, such as those adopted in California and Hawaii, and likely soon to be finalized in Florida. In fact, as currently proposed, nothing in S. 1195 would prevent fish farms located in the EEZ—just beyond state waters—from seriously undermining efforts in state waters to protect water quality,

prevent the spread of disease, pathogens and parasites, or protect the genetic make-up of wild fish stocks from escaped farmed fish.

Senators Stevens and Inouye have proposed an amendment that would allow states to prevent the approval of Federal aquaculture projects under S. 1195 in the EEZ adjacent to state ocean waters. This "opt-out" provision could prevent impacts on some state marine fisheries and wildlife from fish farms in nearby Federal waters. However, it will not prevent impacts on states that do not elect to opt-out, or prevent impacts on states near states that do not elect to opt-out. [1] Some provision for authorizing these nearby states to object to Federal aquaculture projects also needs to be included in S. 1195. It is also uncertain if it will prevent impacts from aquaculture operations authorized under other Federal laws in the EEZ (such as if the Minerals Management Service were to assume such authority either under the 2005 amendments to the Outer Continental Shelf Lands Act or under new authority provided by the Deep Oceans Energy Resources Act, H.R. 4761, which the House passed on June 29, 2006). For this reason the proposed opt-out amendment, even if approved, is no substitute for minimum national standards to ensure that Federal aquaculture operations are conducted sustainably, and do not undermine state environmental safeguards.

Question 2. In what ways are the Hawaii and California aquaculture laws and programs similar? In what ways are they different?

Answer. Both Hawaii and California prohibit the farming of non-native species. California Fish and Game Code Section 15007 also prohibits marine fish farms from raising salmon and genetically-modified species. Requiring native fish species and the use of wild broodstock can help minimize the genetic consequences of escaped farmed fish. However, additional standards are needed to address potentially significant impacts of farming native fish species on the marine environment.

Both Hawaii and California utilize an aquaculture leasing system which allows environmental requirements to be imposed on the lease itself rather than just the operating permit. Possible termination of a lease may provide a stronger incentive for compliance than suspending an operating permit.

Hawaii's approach is derived from land-use zoning policy, and submerged lands are broadly zoned for "resource uses." Typically land use decisions respond to applications for permits instead of proactively assessing and designating areas for aquaculture. As a result, some operations in Hawaii have been permitted in relatively shallow water, and published research shows this is having significant impacts on the benthos in the vicinity of the cages. [2]

California has taken a different and more proactive approach. The Sustainable Oceans Act (SB 201) provides for the preparation of a programmatic environmental impact report (PEIR) to consider, among other things, appropriate areas for siting marine fish farms to avoid adverse impacts. Lease sites must be considered appropriate for fish farms in the PEIR before aquaculture leases can be issued. This will help to avoid siting marine finfish aquaculture operations in areas that are inappropriate because they may be too shallow, conflict with fishing and other uses, are located in sensitive habitats such as marine protected areas, or would impact essential fish habitat or spawning grounds.

S. 201 also contains a number of other provisions for farming native fish species that should be considered as starting point for Federal standards:

- Sites can not be leased that conflict with fishing and other public trust uses, disrupt or harm wildlife and habitats, or otherwise harm the marine environment.
- Pollution must be prevented to the maximum extent possible.
- Alternatives to drugs and chemicals must be required whenever available, and permitted only if minimized to the maximum extent possible.
- Alternatives to feeds produced from wild-caught fisheries are required where available, and only sustainably harvested ingredients can be utilized.
- Baseline assessments must be conducted prior to issuing permits, and all sites must be monitored regularly.

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[1] For example, it was recently reported by the Alaska Department of Fish and Game that a salmon caught in Cook Inlet was farmed Atlantic salmon even though farming salmon is banned in Alaska. Kohl. "Testing proves fish was farmed." Peninsula Clarion, July 16, 2006. According to the report, about one of every 100 Atlantic salmon raised on farms in British Columbia and Washington escapes.

[2] Lee, Han W. et al. "Temporal changes in the polychaete infaunal community surrounding a Hawaiian mariculture operation." Marine Ecology Progress Series, Vol. 307, pp. 175–185, January 2006.

- Lessees are held responsible for damages to the marine environment, and for restoring sites to pre-leased condition.
- Fish must be removed, leases terminated, and facilities closed if operations pose a danger to the marine environment.
- All facilities and operations must be designed to prevent the escape of farmed fish, escapes must be reported immediately, and fish must be tagged or marked.

Any Federal offshore aquaculture program should also consider the socio-economic effects of farmed species on fishing communities.

State vs. Federal Permitting

Question 3. Any legislation should address how the permitting process will include states and other stakeholders in the development of permitting and siting criteria. Enhanced coordination is needed to provide consistency and to adequately manage potential impacts that cross jurisdictional lines, such as the spread of disease. Significant state participation and input to guidelines to ensure they are complementary at both state and Federal levels is important. Without such Federal-state coordination, states have placed limitations on aquaculture facilities in their waters. Alaska, for example, has a constitutional provision banning finfish aquaculture, and several states prohibit the cultivation of genetically-modified species.

Can minimum national standards avoid "bad actors" who undermine environmentally sensitive operations?

Answer. Yes. For example, minimum national standards under the Clean Water Act have improved water quality nationwide. Strong national aquaculture standards can do the same.

However, EPA's current effluent guidelines for aquaculture are weak and ignore key issues such as escapes, and impacts from non-native and genetically modified species. EPA guidelines do not establish enforceable numeric limits on pollutants discharged from offshore aquaculture operations such as total suspended solids, fecal coliform, nitrates, phosphates, biological oxygen demand, metals, drugs or pesticides; nor do they require water quality monitoring or testing for toxic substances. Instead the guidelines rely on operational BMPs to minimize feed and chemical inputs. 69 *Fed. Reg.* 51891–51930 (August 23, 2004). Moreover, ocean discharge standards under the Clean Water Act require certain ocean resources to be "considered," but do not contain qualitative standards for determining whether a discharge causes "unreasonable degradation" of the marine environment; nor has EPA established water quality standards for the EEZ under which degradation can be judged. 40 CFR § 125.122. Thus, minimum national standards could, but do not currently, provide adequate protection for the marine environment against "bad actors. Nor does S. 1195 currently ensure that adequate minimum standards will be adopted.

For S. 1195 to establish a national policy for sustainable marine aquaculture, the bill must direct NOAA to implement specific national standards enumerated in the bill to ensure there are no gaps in Federal environmental protection, such as from escapes. Congress should adopt very specific measures for NOAA to ensure that marine ecosystems are not harmed by offshore aquaculture, and that cumulative and secondary impacts are adequately considered in evaluating Federal proposals.

Question 4. What role should states play in helping set these minimum standards?

Answer. Clearly aquaculture activities in Federal waters can impact state assets, and therefore states should play a key role in setting Federal environmental standards. However, existing mechanisms do not provide an adequate role for states. Under the Coastal Zone Management Act (CZMA) Federal consistency requirements, state's with approved coastal management programs may object to Federal and federally permitted activities, such as Federal aquaculture leases and permits. However, some states will be unable to object to Federal aquaculture permits because they lack enforceable state aquaculture policies, and state objections can be overridden by the Secretary of Commerce under Section 307(c)(1) and (3) of the CZMA. Under Section 401 of the Clean Water Act, Federal licenses and permits must be consistent with state water quality standards. However, section 401 certifications may not be applicable to permits or licenses issued in the EEZ. Therefore, the CZMA and Clean Water Act do not ensure an adequate role for the states, and additional provisions are needed in S. 1195 for state input, including the proposed "opt-out" amendment, to ensure that aquaculture operations in Federal waters do not undermine state environmental safeguards and meet stringent minimum environmental standards.

Moreover, states are already participating on regional fisheries management councils. These bodies should be integrally involved with development of environmental standards and approval of siting permits to ensure that aquaculture operations do

not conflict with fishing operations, essential fish habitat and other fishery management concerns.

Question 5. How can we avoid inconsistency with state standards, including forum shopping for areas with weaker standards?

Answer. Strong national standards for aquaculture activities in the EEZ should provide a floor—but not a ceiling—for standards in adjacent state waters to ensure that state standards meet minimum environmental requirements, and that state standards are essentially consistent with one another. States should be permitted to adopt regulatory programs that exceed but are not weaker than these Federal standards. This will prevent forum shopping for states with weak environmental standards, and ensure that the Nation's ocean waters are adequately and consistently protected.

Conflicting Uses

Question 6. As recommended by the Ocean Commission, aquaculture legislation should specify how the permitting regime will contribute to Federal coordination of existing regimes, including facilities established under the Deepwater Ports Act, as well as offshore alternative energy facilities and offshore oil and gas drilling permitted under the Outer Continental Shelf Lands Act.

An offshore management regime should provide for effective coordination of all ocean activities such as offshore aquaculture and alternative energy development. How should aquaculture programs coordinate with other agencies of jurisdiction to prioritize activities, minimize conflicts, protect resources, and ensure that uses are compatible?

Answer. Congress should ensure that NOAA prepares a legislative or programmatic EIS and a comprehensive offshore aquaculture plan for the Federal aquaculture program to provide adequate public participation and determine how other Federal agency reviews and permits should be coordinated with offshore aquaculture leasing program under S. 1195. Interagency reviews and permits for individual aquaculture permits and leases can also be coordinated through the National Environmental Policy Act review process. A legislative EIS would also greatly assist the Committee comprehensively evaluate the likely individual and cumulative environmental and socio-economic effects, possible alternatives and mitigation measures, and any unavoidable consequences of offshore aquaculture. A legislative or programmatic EIS can also help develop other measures such as planning, zoning, siting criteria and environmental carrying capacity as recommended in a recent Sea Grant study by the University of Delaware. [3]

Question 7. Will any agency be empowered to reject a proposed facility based on safety or environmental standards? Please explain.

Answer. As the lead agency for offshore aquaculture, NOAA should be given a clear mandate—not just authority—to protect the marine environment and minimize adverse environmental effects from offshore aquaculture activities. To be meaningful, this authority must include the ability to deny permits. Moreover, other Federal agencies with permitting authority over offshore aquaculture projects also have the authority to reject proposed facilities that do not meet standards related to their jurisdictional authority even if NOAA is designated as the lead agency for offshore aquaculture leases. Thus, for example, EPA and the Corps have the authority to deny a project that has adverse water quality or navigational impacts. The Sea Grant study by the University of Delaware cited earlier also noted that these are important checks and balances for offshore aquaculture. [4]

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. JOHN E. SUNUNU TO TIM EICHENBERG

Question. The Omega-3 acids in fish oil are largely responsible for the superior nutritional value of seafood. Have you determined the minimum amount of fish meal and oil necessary in order to preserve these nutritional benefits?

Answer. Scottish research suggests that if salmon are fed a vegetable based diet for most of their grow-out period, followed by a "finishing diet" containing fish meal and oil, fish flesh is high in omega 3 fatty acids. It is therefore possible to drastically reduce levels of fisheries products in fish diets, and still obtain fish high in

[3] Cicin-Sain, et al. "Recommendations for an Operational Framework for Offshore Aquaculture in U.S. Federal Waters." Mangone Center for Marine Policy, University of Delaware, October 2005.

[4] Id.

omega 3 fatty acids.[1] In the future, fish high in omega 3 fatty acids may be obtained with little or no use of fish meal and oil in feeds, since feeds with high levels of omega 3 fatty acids from marine algae are now in research and development in the U.S. and abroad.

David Higgs, head of the fish nutrition program at the DFO/UBC Centre for Aquaculture and Environmental Research in West Vancouver, Canada, presented a study at the Society for Experimental Biology Annual Meeting in Canterbury, England in 2006, in which farm-raised salmon were fed diets high in vegetable oil. The study found that up to 75 percent of the dietary fat in farm-raised salmon can come from canola oil without fish suffering any negative health effects or significant loss in omega-3 fatty acids. The seven-month feeding trial on more than 7,000 spring Chinook salmon investigated four different diets, with the canola oil diet providing optimal results.

Some farmed fish contain high levels of contaminants including PCBs and dioxins from fishmeal and oil derived from wild marine fish such as anchovies.[2] The Canadian and Scottish research cited above shows that levels of contaminants in farmed fish can be reduced without sacrificing omega-3s by using substitutes to fishmeal. Fishmeal substitutes can also help address concerns about the ecosystem impacts of using wild fish stocks for fish meal which, if current trends continue, could use the total global fish catch for fish feed by 2010.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN E. SUNUNU TO DAVID BEDFORD

Question 1. Alaska has had great success with its salmon hatcheries. Do you think this success can provide lessons for raising other species with a less complex life cycle?

Answer. Alaska's ocean ranching program for salmon differs significantly from fish or shellfish farming because it is designed to improve survival of salmon in the natural environment rather than put the fish under positive control throughout development. Our hatchery program involves human intervention only at the earlier life stages with the intent of improving survival of immature salmon at time in which immature salmon have the highest levels of natural mortality. For the great majority of their development Alaska hatchery salmon share the same natural environment that the wild stocks use.

Hatchery production in Alaska supplements natural production. The hatchery salmon are not completely segregated from the wild stock because they share the marine environment in significant life stages. Furthermore some hatchery fish may stray into streams that are habitat for wild stocks. To minimize potential impact on wild stocks our hatchery regulatory program implements strict genetic and pathology policies and tracks the transport of brood stock and harvested product. Similar policies for aquaculture would seem prudent.

Ocean ranching of salmon, complex as it may be, is in significant respects an easy case. Salmon have been subject to intense scientific scrutiny for over a century. Salmon hatcheries have been in operation for a similar period. Perhaps most pertinent salmon spend important parts of their development in fresh water and are consequently relatively easy to observe. Aquaculture of species for which the level of knowledge is insufficient to fully assess the potential impact of cultivation should be preceded by comprehensive research.

Question 2. Do you see any potential for hatchery programs to enhance other wild fish populations while also providing stock for aquaculture?

Answer. Alaska's salmon hatchery program produces additional salmon for harvest in the common property fisheries. We are exploring the potential for enhancing the productivity of some marine populations. The Alaska Department of Fish and Game is in the early phases of developing strategies for ocean ranching of king crab. This would follow the basic pattern of salmon hatchery production involving holding juveniles for a period of time to control sources of natural mortality then releasing them into the natural environment to mature and finally be harvested in the fisheries. At present we are permitting research that looks at the potential for and ef-

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[1] Bell, et al. Replacement of Dietary Oil with Increasing Levels of Linseed Oil: Modification of Flesh Fatty Acid Composition in Atlantic Salmon (Salmo salar) Using a Fish Oil Finishing Diet. *Lipids* 39, 1–10 (2004).

[2] 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).

fects of hatchery production of juveniles. There are significant genetic, pathology and wild stock interaction issues yet to be addressed.

We are also permitting an experimental project that would plant a species of clams and study the potential for using this approach to increase local populations of the species that would be available for harvest.

In both instances we take a precautionary approach. We enjoyed some advantages with salmon enhancement. Salmon have been the subject of intense scientific scrutiny for over a century. Furthermore we benefit in our study of salmon as compared to marine species because the salmon reproduce in fresh water and are consequently more susceptible to observation at crucial life stages. In addition, we were able to look at the experiences of other states with salmon production and incorporate the lessons of these programs in the development of our own. With other marine species we do not enjoy theses same advantages and hence will be cautious.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO DAVID BEDFORD

Question 1. Any legislation should address how the permitting process will include states and other stakeholders in the development of permitting and siting criteria. Enhanced coordination is needed to provide consistency and to adequately manage potential impacts that cross jurisdictional lines, such as the spread of disease. Significant state participation and input to guidelines to ensure they are complementary at both state and Federal levels is important. Without such Federal-state coordination, states have placed limitations on aquaculture facilities in their waters. Alaska, for example, has a constitutional statutory provisions banning finfish aquaculture, and several states prohibit the cultivation of genetically-modified species.

Can minimum national standards avoid "bad actors," who undermine environmentally sensitive operations?

Answer. The aquaculture program should be implemented through the regional council system created by the Magnuson-Stevens Fishery Conservation and Management act. The Council process provides for effective scientific review by scientific and technical committees and thorough public review in the council process and the advisory panels. Magnuson-Stevens incorporates national standards for fishery conservation and management. These provide important policy guidance to the councils and also allow sufficient flexibility to enable the councils to develop management plans that are appropriate for the specific region, fisheries and resources at issue. National standards for implementing off-shore aquaculture would be useful and important guidelines for decisionmaking. The kind of rigorous review undertaken by the regional councils would be the first step in preventing abuse by reviewing applications and developing permit conditions and oversight.

Question 2. What role should states play in helping set these minimum standards?

Answer. The minimum standards for implementing the national standards and other provisions in statute should be developed by the regional councils and would be expected reflect the policy perspectives of the states represented on each council. States nominate the majority of the members on the councils and participate substantially on the scientific and technical committees. The advisory panels would provide opportunity for additional review by members of the public and interest groups.

Question 3. How can we avoid inconsistency with state standards, including forum shopping for areas with weaker standards?

Answer. By working through the existing regional councils, state participation is ensured and consequently the states could ensure that their standards were reflected in the decisions of the council. It would likely be necessary to expand the scientific and technical committees to add expertise specific to aquaculture. It might also be useful to empanel additional advisory panels that focus on aquaculture and include some interests not presently engaged in the council process.

We might expect councils in different regions of the country to develop different approaches to aquaculture. Operating under the national standards we should expect effective but not uniform application of the law. It would fall within a council's authority to implement national standards in a more rigorous fashion than that adopted in another region. This could well create an environment more conducive to aquaculture development on some regions however this would be consistent with the national standards and reflect the policy choices of the states in that region.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. JOHN E. SUNUNU TO JOHN R. "RANDY", MACMILLAN, PH.D.

Question 1. Many of the critics of offshore aquaculture point to the early problems of near-shore aquaculture operations in the U.S. How has your industry learned from the challenges it faced with escapes and disease?

Answer. The loss of animals from any aquaculture operation whether off-shore or on-shore is a concern economically for the owner and potentially of concern ecologically. Economic concern arises because of lost product for market. Depending upon how close to harvest the loss occurs, financial loses can be significant. Potential ecologic damage arises because non-indigenous species may have potential to displace native species or otherwise change an ecosystem. Development of predictive science to enable wise decisions in this regard is ongoing. Because of escapement concerns producers in near shore operations have successfully sought ways to minimize potential for escape. In addition to changes in cage (net pent) material to better withstand efforts of piscivors (e.g. seals and otters), producers utilize predator exclusion devices and double cage the rearing environment. Improved facility siting has also further minimized escapes caused by marine mammal destruction of cages and has concomitantly significantly reduced environmental impacts. Some recent theories offered for escape events indicate intentional tampering with aquaculture stocks and equipment by those who oppose the industry may have occurred. Such occurrence presents significant adverse financial impacts on aquaculture operations. One tool to deter such tampering may be amendment of the pending aquaculture legislation to include criminal penalties and civil liability for damages resulting from tampering with offshore aquaculture facilities.

Claims of more disease in wild species as a consequence of near-shore aquaculture operations is disputed by various Federal and fish health management experts (e.g. LaPatra, S. 2003. The lack of scientific evidence to support the development of effluent limitations guidelines for aquatic animal pathogens. Aquaculture 226: 191–199). It is well established principle that fish disease occurs as a consequence of interaction between host, environment and pathogen. Due to careful management by fish farmers, and Federal and state regulatory authorities, introduction of new pathogens by aquaculturists is very rare and unintentional. In open water aquaculture as envisioned in an off-shore aquaculture operation, pathogens are more likely to occur as a consequence of wild fish carrying pathogens and exposing farmed fish. Pathogen amplification on a fish farm can theoretically occur but its impact on wild fish has never been scientifically demonstrated. Much of the rhetoric concerning near shore aquaculture operations and fish disease has focused on sea lice. NOAA fisheries experts report (NOAA Technical Memorandum NMFS–NWFSC–71) that "contrary to some circumstantial reports, there is no basis for expecting an increase in wild fish infections in the immediate vicinity of any source of lice larvae, including those hatched from lice at fish farms." Existing Federal and state regulatory programs already ensure introduction of exotic fish pathogens is unlikely. (The LaPatra article is appended for inclusion in the record).

Question 2. How has the aquaculture industry used alternative feeds to reduce its reliance on fish meal and fish oil?

Answer. The use of fish meal and fish oil is not inherently detrimental to marine ecosystems and ecologic sustainability as long as the fisheries supplying the fish meal and oil are properly managed. The species most used for reduction fish meal and oils are the small shoaling pelagic fish (anchovy and menhaden) harvested from surface waters feeding at the lowest trophic level above or near to nutrient-rich oceanic upwellings (NOAA Technical Memorandum NMFS–NWFSC–71). These populations are volatile and are dependent on ocean productivity which depends on seasonal movement of some deep ocean currently. While the fish meal and oils are well-suited for human consumption, they are used globally by terrestrial animal and poultry industries as well as for aquaculture. Because of the economic and social importance of the pelagic industrial fisheries, their population dynamics are routinely monitored and assessed by fisheries managers and scientists worldwide. Fisheries managers predict each year the strength of the target population and manage to ensure sustainability of the population.

While the pelagic fisheries are regarded as sustainable, the resource is nevertheless limited. Global capture has remained stable over the past 20 years but demand for fishmeal and oil has increased. Increasing demand has caused substantial price increase which has encouraged a search for alternative protein and oil sources. Fish processing wastes (trimmings) are increasingly used in fish meal as are direct protein substitutions (e.g. terrestrial animal, poultry, trimmings). Most importantly there is research to substitute grains and oilseed meals for fish meal as sources of protein and energy (NOAA Technical Memorandum NMFS–NWFSC–71). The chal-

lenge is to find suitable fish meal substitutes for carnivorous animals such that their physiologic homeostasis is maintained, and cost-effective feeds that maximize growth rate and reduce or eliminate feed wastage occurs.

Question 3. Senator Boxer referred to an article in the magazine Science outlining concerns with the levels of toxins in farmed salmon. Did this study find any toxin levels beyond acceptable limits from the Food and Drug Administration, the World Health Organization, or the Environmental Protection Agency?

Answer. The study Senator Boxer referred to did not find any contaminant levels beyond acceptable limits established by the Food and Drug Administration, the World Health Organization, or the U.S. Environmental Protection Agency. A recent (July 11, 2006) National Academy of Science review of EPA's 2003 dioxin risk assessment concludes that EPA overstates dioxin cancer risks further calling into question the Science article referred to by Senator Boxer.

Question 4. What new information has been gathered in recent years to counter the claims of this article?

Answer. The most recent germane scientific analysis was conducted by scientists and physicians at the Harvard School of Public Health, Harvard University. These researchers developed a clear, scientifically sound argument that consumption of wild and farm raised fish, including salmon, is essential for good health (Teutsch SM and Cohen JT. Health trade-offs from polices to alter fish consumption. Am J Prev Med 2005; 29: 324; Cohen JT, Belinger DC, Connor WE., et al. A quantitative risk-benefit analysis of changes in population fish consumption. Am J Prev Med 2005; 29: 325–334; Konig A, Bouzan C, Cohen JT et al. A quantitative analysis of fish consumption and coronary heart disease mortality. Am J Prev Med 2005; 29: 335–346; Bouzan C, Cohen JT, Connor WE, et al. A quantitative analysis of fish consumption and stroke risk. Am J Prev Med 2005; 29: 347–352; Cohne JT, Bellinger DC, Shaywitz BA. A quantitative analysis of prenatal methyl mercury exposure and cognitive development. Am J Prev Med 2005; 29: 353–365; and Cohen JT, Bellinger DC, Connor WE, Shaywitz BA. A quantitative analysis of prenatal intake of n–3 polyunsaturated fatty acids and cognitive development. Am J Prev Med 2005; 29: 366–374).

Willet (Willet WC. 2005. Fish: Balancing Health Risk and Benefits. Am. J. Preventive Medicine 29 (4): 320–321), in introducing the above studies, suggests the Science article (Hites RA., Foran J.A., Carpenter D.O., Hamilton MC, Knuth BA, and Schwager SJ. 2004. Global assessment of organic contaminants in farmed salmon. Science 303: 226–229) was "particularly troublesome, perhaps even irresponsible, because the implied health consequences (sic. of farmed salmon consumption) were based on hypothetical calculations and very small lifetime risks." Willet also states the Hites et al publication "likely caused substantial numbers of premature deaths" because of the reduction in fish consumption that occurred as a consequence. The conclusion of course is that wild and farmed raised seafood consumption is an important component of a healthy diet and lifestyle, for all ages. (The 2005 Willet article is appended for inclusion in the record).

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO JOHN R. "RANDY", MACMILLAN, PH.D.

Question 1. Any legislation should address how the permitting process will include states and other stakeholders in the development of permitting and siting criteria. Enhanced coordination is needed to provide consistency and to adequately manage potential impacts that cross jurisdictional lines, such as the spread of disease. Significant state participation and input to guidelines to ensure they are complementary at both state and Federal levels is important. Without such Federal-state coordination, states have placed limitations on aquaculture facilities in their waters. Alaska, for example, has a constitutional provision banning finfish aquaculture, and several states prohibit the cultivation of genetically-modified species.

Can minimum national standards avoid "bad actors," who undermine environmentally sensitive operations?

Answer. There is no distinction likely between the effectiveness of national or state standards when it comes to the prevention of prohibited actions by individuals who may be characterized as "bad actors." By definition, such persons have no regard for operating standards regardless of the source of authority, or for the legitimate goals of laws established to protect sensitive environmental resources.

Question 2. What role should states play in helping set these minimum standards?

Answer. The responsibility for creation of Federal aquaculture standards established by legislation or regulation lies with the Congress and Federal agencies, respectively. Some potential environmental impacts of aquaculture in Federal waters are analogous to the "trans-boundary pollution" aspects of matters regulated by the Clean Air Act and Clean Water Act in terms of the state-Federal boundary and state-state boundary issues. In such cases, state standards must be taken into consideration. In addition, just as is the case in these well-established programs, States may choose to take part in creation of Federal standards by participating in the rulemaking that will be conducted to create the Federal aquaculture program. Participation of the states in the rulemaking process provides them with appropriate input in the development of Federal standards and also provides the Federal agencies with the benefit of state experiences in oversight of state aquaculture programs.

Question 3. How can we avoid inconsistency with state standards, including forum shopping for areas with weaker standards?

Answer. Neither Congress nor Federal agency rule-makers should be tasked with the burden of forging a coherent Federal program into an amalgam of differing state standards. The Federal program should be developed to meet the legislative objectives established by a Congressional vision of national goals.

There is no compelling reason why Federal standards must be made "consistent" with existing (or future) state standards. Indeed, from the perspective of the states, some state legislators may find the Federal program attractive, and use it as a model for aquaculture in state waters. Other states may determine that distinctions are needed to meet the unique local circumstances of their state's natural environment or the demands of their constituents. In either such instances, there should be no negative inference attached to an aquaculturist choosing a location in a particular state simply because the standards differ from other states or the Federal program.

In examples of other Federal environmental legislation, the states have been free to choose to apply more stringent standards not inconsistent with Federal programs. States also have sometimes been the "laboratories" in which differing experimental approaches have been pursued, and successful approaches later adopted elsewhere. Similar flexibility would appear to be a reasonable and useful option in the context of state aquaculture programs.

However, it would be wholly inconsistent with the prerogative afforded Federal legislators, if those crafting the national program were thought to be bound by state standards when it comes to the regulation of Federal waters. This is especially true if we were simply to follow the path of those who engaged in a "race to legislate" at the state level and thereby presumed to set the terms of Federal legislation. The worst case scenario would be for Congress to feel compelled to follow the legislative example of a state where substantial influences actually opposed development of a viable marine finfish aquaculture industry in either their state waters or nearby Federal waters, and as a result created hollow legislation intended to suit such purposes.

Question 4. As recommended by the Ocean Commission, aquaculture legislation should specify how the permitting regime will contribute to Federal coordination of existing regimes, including facilities established under the Deepwater Ports Act, as well as offshore alternative energy facilities and offshore oil and gas drilling permitted under the Outer Continental Shelf Lands Act.

Answer. An offshore management regime should provide for effective coordination of all ocean activities such as offshore aquaculture and alternative energy development. How should aquaculture programs coordinate with other agencies of jurisdiction to prioritize activities, minimize conflicts, protect resources, and ensure that uses are compatible?

Answer. There are steps that could be taken by Federal authorities immediately to efficiently coordinate the development of a commercial aquaculture industry in Federal waters once Federal legislation is passed.

Creation of an Information Data base

Readily available, accurate information would be of considerable assistance to sound and efficient decision-making by both project proponents and regulators. The agency charged with oversight of the Federal offshore aquaculture program should create a data base of information relevant to the proper siting of aquaculture operations and avoidance of ocean-user conflicts and conflicts with other agency programs. This information should include: existing offshore uses (oil and gas leases, mineral leases and similar federally-established private rights and the operational restrictions relevant to proposed aquaculture activities), navigational constraints (shipping lanes, anchorages, security-sensitive areas, etc.), sensitive resource areas (marine protected areas and preserves, designated historic landmarks, marine mam-

mal migration routes, etc.), and similar potential conflict factors that can be established in advance of designing a proposed aquaculture project. This information should be Internet-based and available without charge. Last, it is important to keep in mind that while this information would facilitate efficient application proceedings, the creation of such a data base should not be a condition precedent to acceptance of permit applications for aquaculture projects.

Pre-designated Aquaculture Sites

Ongoing development of new aquaculture operations would benefit from creation of an inventory of available facility sites. The Federal agency charged with aquaculture responsibility should initiate a site selection process for various types of aquaculture operations (finfish, shellfish, other species) in different regions of the country. By conducting the various review and approval procedures required to preapprove such sites, Federal authorities would create a powerful tool to support development of U.S. production capabilities. In addition, the review process may offer a useful example of the approval process that developers with self-selected sites could anticipate following in approval of their projects.

Coordination is Appropriate; Consolidation is not Necessary

A number of Federal programs already exist for approval and management of marine structures, dredging, extraction of minerals, oil and gas, navigation and other varied offshore uses. Several different Federal agencies have jurisdiction for different activities. All Federal agencies engaged in management of offshore activities have procedures for review and approval of offshore activities, including solicitation of public comment and comment from sister Federal agencies. A similar approach is anticipated for review and approval of proposed aquaculture projects.

While coordination between agencies certainly is appropriate, offshore aquaculture should not have to wait for creation of a universal, "Ocean" agency before projects are approved. There has been some discussion of creating an overarching body to manage all uses of the Federal oceans. We have no way of knowing whether such an approach would be taken, or whether it would be advisable. But aquaculture should not be delayed in order to determine if new "ocean" agency will be created. Federal authorities certainly should be capable of appropriately reviewing proposed offshore aquaculture projects through a notice and comment application review process similar to the process used for so many other federally-approved activities.

Question 5. Will any agency be empowered to reject a proposed facility based on safety or environmental standards? Please explain.

Answer. The criteria for approval of offshore aquaculture facilities will be established by regulations. The agency with approval authority would be empowered to reject a proposed facility if the application failed to meet any applicable standards, presumably including safety or environmental standards established by new rules or existing applicable rules (such as the absence of any required discharge permit under the Clean Water Act). Sister agencies would advise the permit authority of any conflicts the proposed facility created with their rules or policies during the application review process. The permit authority would then determine if the other agency rule were controlling. In some instances, differences between standards of different agencies may need to be resolved at the Secretary-level.

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THE LACK OF SCIENTIFIC EVIDENCE TO SUPPORT THE DEVELOPMENT OF EFFLUENT LIMITATIONS GUIDELINES FOR AQUATIC ANIMAL PATHOGENS

by Scott E. LaPatra

Abstract

The biological significance of aquatic animal pathogens in effluents is unknown. In general, most of these pathogens existed in aquatic populations either prior to or in the absence of aquaculture. Huge gaps exist in our knowledge regarding pathogen distribution in the environment, the environmental fate of pathogens and host susceptibility in aquatic ecosystems. There are no reliable, standardized or validated methods for testing effluents for aquatic animal pathogens. There are internationally accepted analytical methods available to qualify and/or quantify aquatic animal pathogens in tissues. These methods are used in regulatory control programs to limit the introduction of important fish pathogens into new regions. Federal, state, and tribal pathogen control programs have existed for many years. The goal of these programs is to prevent the introduction of significant fish pathogens into the United States, specific states, regions or facilities. These regulatory control programs have

been successful at limiting the introduction of important fish pathogens. Additionally, there are health management strategies to minimize the occurrence and impact of disease if it does occur, including the use of vaccines. However, there are currently no consistently used practices to control the discharge of aquatic animal pathogens in effluents of commercial or public aquaculture facilities if pathogens do occur. The most cost-effective way to effectively limit the impact of significant aquatic animal pathogens is to prevent their introduction into facilities.

1. Introduction

In 1989, the Natural Resources Defense Council filed a lawsuit against the Environmental Protection Agency (EPA) for lack of enforcement of the Clean Water Act. The lawsuit resulted in a settlement and Consent Decree on January 31, 1992. The Consent Decree provided EPA to develop effluent limitation guidelines for certain specified industries and laid out a timetable for initiating guidelines for additional industries. EPA originally designated the Industrial Container Cleaning industry as a category for rulemaking. However, in late 1999, EPA asked the court to substitute aquaculture for the Industrial Container Cleaning industry. The reasons given by EPA for this action include the following: (1) the only relevant EPA guidance on aquaculture was over 20 years old, (2) the aquaculture industry has changed significantly in terms of the types of species raised and the industrial processes employed, and (3) aquaculture point sources appear to discharge nutrients which states regularly identify as one of the most common causes of water quality impairment in this country. EPA has also indicated that in addition to developing effluent limitation guidelines for nutrients, they would also consider effluent limitation guidelines for aquatic animal pathogens.

Huge gaps exist in our knowledge regarding pathogen distribution in the environment, the environmental fate of pathogens and host susceptibility in aquatic ecosystems. There are many misperceptions held by the public and scientific community regarding the spread of infectious agents from cultured aquatic animals to wild aquatic animals. While it is true that human activities have affected aquatic animal health through direct changes in habitat and ecosystems, these changes do not necessarily mean that the aquatic animal pathogens were, or are, actively introduced through these actions. While intensive culture may magnify the effects of these pathogens within cultured populations, it does not create or establish the association of the agent and the aquatic species. The assumption that aquacultural activities create and spread disease in the aquatic ecosystem is misleading and an erroneous inference. Infectious disease agents are an integral part of the existence of all animals, including both cultured and wild aquatic animal populations. In general, most of these pathogens existed in aquatic populations either prior to or in the absence of aquaculture. However, studies to examine the prevalence and the impacts of infection or disease on free-ranging fish populations have been limited. Detection of infected fish and the potential impacts of disease in a free-ranging population are both difficult and expensive. Issues associated with sampling free-ranging populations and the possible removal of infected fish by predators are complex. In contrast to free-ranging populations, artificial propagation of aquatic animals presents a captive population and an intensively monitored population. Captivity coupled with the routine monitoring of the health and performance of fish in aquaculture systems facilitates the identification of pathogens that have evolved with their hosts in natural environments.

One of the primary concerns of any aquaculture program is the potential introduction and transmission of pathogens in both cultured and native populations. Exposure to infectious disease agents is a continual process during the life span of any organism. However, exposure to an infectious microorganism does not necessarily result in infection or manifestation of clinical disease. The latter depends on the interaction of several factors including (1) the health and immunological status of the host, (2) the dose and virulence or contagiousness of the pathogen, and (3) the environmental conditions that affect the host and pathogen interaction. Although clinical disease is easily qualified and quantified, subclinical disease is more difficult to characterize and may only be detected with the assistance of diagnostic tests or aids. However, it must be emphasized that the presence or detection of any infectious agent does not imply the presence of disease. Simply put, *infection*—defined as invasion of a host by a pathogenic agent—is a more common event. In contrast, *disease* is defined as the condition that results in morbidity and, possibly, mortality in the individual host or population as a consequence of infection.

Significant gaps in our knowledge exist due in part to the lack of reliable, standardized or validated methods for testing effluents for aquatic animal pathogens. This is further compounded by the lack of information on pathogen amplification

when an aquatic animal host, at various life stages and under different environmental conditions, becomes infected or diseased. Additionally, many characteristics of aquatic animal pathogens are poorly described yet are required in any risk assessment. These include information on the ability of the pathogen to multiply and remain viable in water, the survival time outside the host, and the number of infectious units required to cause infection and pathogenicity.

2. Literature Review

Several reviews have been written recently that have examined the interactions between hatchery and wild salmonids and the possible spread of disease. Flagg et al. (2000) of the National Marine Fisheries Service wrote a white paper entitled "Ecological and behavioral impacts of artificial production strategies on the abundance of wild salmon populations", which included a reference list of 175 citations pertinent to the subject. In this document, the authors suggest that with the exception of the unintentional introduction of "exotic" pathogen(s) in an aquatic ecosystem, most if not all pathogenic microorganisms existed in wild aquatic animal populations before the establishment of aquaculture facilities. While cultured populations can be considered reservoirs of infectious agents because of intensive culture practices, there is little evidence to suggest that disease transmission to wild stocks is routine. Therefore, it is extremely difficult to determine the incidence of disease transmission from cultured to wild aquatic animals, as well as the impacts such transmission would have on wild stocks. To specifically determine whether a particular pathogen found in wild fish originated from a cultured fish requires the ability to distinguish different strains of a pathogen at the genetic level. While such epidemiological tracking can be done on all classes of infectious pathogens using a variety of molecular methods, these techniques have not been applied to many aquatic animals. However, a recent article by Anderson et al. (2000) illustrated the usefulness of these molecular methods in understanding how fish viruses evolve and are transmitted in aquatic ecosystems. The goal of this study was to characterize infectious hematopoietic necrosis virus (IHNV) genetic heterogeneity and viral traffic over time at a study site in the Deschutes River watershed in Oregon, USA, with an emphasis on the epidemiology of IHNV types causing epidemics in wild kokanee *Oncorhynchus nerka* between 1991 and 1995. The study site included kokanee spawning grounds in the Metolius River and Lake Billy Chinook downstream, in which the IHNV epidemics occurred in 2- and 3-year-old kokanee, and the Round Butte Fish Hatchery at the outflow of the lake. Virus isolates collected from this area between 1975 and 1995 were characterized on a genetic basis by ribonuclease protection fingerprint analyses of the virus nucleocapsid, glycoprotein, and nonvirion genes. Analysis of the genetic differences between the IHNV isolates suggested that both virus evolution and occurrence of new IHNV strains contributed to the genetic diversity that was observed. The results indicated that the 1991–1995 epidemics in wild kokanee from Lake Billy Chinook were due to a unique IHNV type that was first detected in spawning wild adult kokanee in 1988 and that this virus type was transmitted from the wild kokanee to hatchery fish downstream in 1991. This work shows that aquatic animal virus trafficking can be much more complex than was previously recognized and that pathogens are natural components of wild fish populations that can impact cultured fish.

In 1997, a symposium was held entitled "Pathogens and diseases of fish in aquatic ecosystems: implications in fisheries management" (Moffitt et al., 1998). The science of fish health has evolved primarily for captive populations and the recent attention to whirling disease in the United States provided an example of the need for a scientific approach to assess the risk of pathogens on free-ranging fish populations. One report by Reno (1998) introduced the concept that infectious diseases have been observed in both human and animal populations for millennia. However, unlike diseases of higher animals, the dispersal of disease in fish populations rarely has been studied quantitatively, but the principles that govern the spread of diseases of human and other mammals, should with modification, be applicable to the study of infectious diseases in fish. Among the factors shown to be important in other systems are the contagiousness of the pathogen, duration of infection, host population density, and development of immunity.

Foott et al. (2000) investigated the dispersal of a pathogen in fish populations. Coleman National Fish Hatchery in northern California, USA has a long history of IHN virus dating back to the 1940s and asymptomatic IHNV carrier chinook salmon *O. tshawytscha* adults and IHN epizootics in juvenile fish are commonly detected. When epizootics are detected in the hatchery, juvenile fish are released into the Sacramento River. This practice has raised concerns over potential impacts to the "natural" or wild chinook salmon juveniles. Hatchery smolts that were released after an IHN epizootic was detected and captured down river had a prevalence of infection

ranging from 9 percent to 12 percent over a 2-week period. However, viral infection was not detected in more than 500 natural chinook salmon juveniles that were tested. Uninfected, natural chinook salmon juveniles were also cohabitated with different ratios of infected hatchery chinook salmon (1:1, 1:10, 1:20) in the laboratory for either 5 min or 24 h in a flow through circular tank. Gill, liver, and kidney tissue from the natural fish were assayed for virus at 4–6-day post-exposure. No virus was detected in any natural fish from any exposure group. The authors concluded that the data indicated a low ecological risk to natural chinook salmon stocks from the release of IHNV infected hatchery chinook salmon smolts. This study illustrates the complexities of understanding pathogen transmission and dissemination of disease in fish populations but suggests that neither effluents or infected hatchery fish posed a risk to the natural populations in this particular system.

Kent et al. (1998) surveyed wild fishes captured around marine net-pen salmon farms and from open waters near British Columbia, Canada for certain salmonid pathogens. The results substantiated the recent observations of others that some pathogens thought to be restricted to salmonids have a broader host range, and it expanded the list of pathogens important to salmon farming for which wild marine fishes may act as reservoirs. There has been speculation that certain pathogens may have been introduced into free-ranging populations through the stocking of cultured animals. However, as this study illustrated, there is very little credible scientific information regarding the presence or distribution of pathogens in the wild that currently exist or may have existed prior to stocking.

A national Wild Fish Health Survey has been initiated by the U.S. Fish and Wildlife Service. A survey of this type has helped to identify where certain pathogens are known to exist and will assist in identifying the geographic range of other pathogens. Additionally, this will allow for comparisons from state to state or watershed to watershed that may help identify why a pathogen in one area has negative impacts on certain fish stocks but not in others. Most importantly, this information will provide a scientific basis for management decisions regarding stocking and fish transport activities, which has been lacking for many years. The real challenge will be to determine how to use this information in establishing new regulation and control programs or modifying existing ones.

The need for this type of survey is further supported by the work of Noakes et al. (2000). They concluded that the evidence to date with respect to the prevalence of pathogens as well as the frequency and pattern of disease outbreaks both now and in the past indicate that salmon aquaculture is not having a significant incremental impact on wild and hatchery Pacific salmon. However, it is clear that a more comprehensive review of disease issues including ongoing monitoring of wild, enhanced, and farmed salmon is required to resolve the concerns raised.

Stephen and Iwama (2000) suggest that in assessing the risks of the transmission of pathogens, the characteristics of the pathogen must be considered including its ability to multiply and remain viable in water, survival time outside the host, and the number of infectious units required to cause infections and pathogenicity. Host factors also must be considered such as susceptibility to infection, exposure to pathogens, age, health status, pre-existing conditions and culture and ecosystem conditions. Environmental considerations also must be included such as the effects of climate, hydrography and water quality. This is an extremely complex analysis that is further compounded by the lack of credible scientific information on many of these factors that vary significantly depending on the pathogen, the aquatic animal host and the type of natural ecosystem or artificial culture environment in which they reside.

In an attempt to develop the scientific information required to assess the risk(s) of the transmission of a pathogen, LaPatra et al. (2001) examined the survival of an aquatic animal virus under different environmental conditions, using IHN virus as an example. Three IHNV isolates, which exhibited antigenic differences, were diluted either in fresh water collected from a spring, after this water had passed through a fish farm, or in river water from the river, which received water from the fish farm. Each treatment was incubated at 15 jC in a water bath and samples were removed at hourly and daily intervals. Virus suspended in spring water survived longer than virus incubated in water obtained from a fish farm or the river. Virus suspended in river water exhibited a 99 percent reduction in virus concentration in 24 h. More recent studies have shown a 99.99 percent reduction in virus concentrations after 30 h in river water at 15 jC. Subsequent exposure of small (mean weight, 0.5 g), susceptible rainbow trout to the virus—seeded river water after 30 h failed to induce any clinical disease (unpublished results).

A preliminary study was also conducted to determine the genetic similarity of IHNV isolates from the state of Idaho, USA, to isolates from other areas of North America where IHNV is endemic. It has been hypothesized that rainbow trout aqua-

culture facilities on the Snake River in southern Idaho may have been the source of and/or enhanced the emergence of IHNV in salmon and trout downstream in the Columbia River basin. This was suggested by the temporal correlation between the emergence of IHNV in rainbow trout in southern Idaho between 1977 and 1980 and the increased incidence of IHNV in juvenile and adult salmonids in the lower Columbia River basin in the early 1980s (Groberg, 1983). Isolates were analyzed using the ribonuclease protection assay (RPA) and by nucleotide sequencing of reverse transcription polymerase chain reaction (RT–PCR) products of specific isolates. By RPA, a high level of genetic heterogeneity was found in Idaho compared to isolates from the other locations. A phylogenetic analysis indicated that the isolates from Idaho could be grouped separately from all other IHNV isolates from across the Pacific Northwest, USA, and Canada. The results suggested that the IHNV lineages from southern Idaho may be phylogenetically distinct. These studies illustrated the complexity of evaluating virus survival and trafficking and the importance of developing this type of information for use in risk assessment (LaPatra et al., 2001).

McAllister and Bebak (1997) monitored effluents from three fish hatcheries known to contain fish infected with infectious pancreatic necrosis virus (IPNV) for discharge and downstream distribution of IPNV. They found no virus upstream of the hatcheries or in the hatchery spring water supplies. However, virus could be detected 19.3 km (the furthest distance tested) below the hatchery discharge. Virus concentrations detected downstream were affected by stream dilution parameters. A total of 106 resident fish downstream of the hatcheries were sampled and no IPNV was detected in 61 nonsalmonid fishes. However, IPNV was detected in 3 of 11 brook trout *Salvelinus fontinalis* but not in 30 brown trout *Salmo trutta* or 4 rainbow trout which illustrates the differences in species susceptibility to infection. Of the three positive brook trout, two were adults and believed to be hatchery escapees. The third, a fingerling brook trout, captured about 5 miles downstream was believed to be the consequence of instream infection, however, no clinical signs were found in any of the positive fish. Although the sample size was limited, the results suggested that the prevalence of IPNV in stream fish captured below the hatcheries was very low. Based on the IPNV prevalence, it appeared that chronic, low-level exposure to IPNV (10–100 plaque forming units/l) in stream water did not pose a significant risk to resident salmonid and non-salmonid fish. Research by other workers supports the hypothesis that low-level virus exposure may not pose a significant risk to fish under natural conditions (Yamamoto, 1975; Yamamoto and Kilistoff, 1979). Even though the stream fish were exposed continuously to IPNV in these studies, infection might not have occurred because the virus concentration in the water was to low or because natural defense mechanisms of the fish effectively controlled low level virus exposure.

Following the outbreak of infectious salmon anemia (ISA) at salmon farms in Scotland, UK, a survey was conducted by Raynard et al. (2001) to determine the extent of infection in wild fish. Isolations of ISA virus (ISAV) were made from five sea trout *Salmo trutta* within areas where ISA affected salmon farms were located, however, there were no clinical signs. Evidence for ISAV in other sea trout was provided by ISAV RT–PCR diagnostic tests. Results from these tests revealed evidence for ISAV presence in salmon parr, adult salmon and juvenile brown trout *S. trutta* in rivers distant from the salmon farms, but again there were no clinical signs. This suggested that at the time of the survey (1998–1999) ISAV may have already been widely distributed in wild fish.

These types of studies are complex because of difficulties in reproducing aquatic animal pathogen "life cycles", determination if the agent is in fact infectious, and quantitatively assessing risk of pathogen presence and/or the presence of asymptomatically infected fish. This is further compounded by the lack of information on pathogen amplification when an aquatic animal host, at various life stages and under different environmental conditions, becomes infected and exhibits asymptomatic, subclinical or clinical manifestation of the disease. Additionally, previously mentioned characteristics of the pathogen that are poorly described and must be considered in any risk assessment include the ability to multiply and remain viable in water, the survival time outside the host, and the number of infectious units required to cause infection and pathogenicity. Currently, the biological significance of aquatic animal pathogens in effluents is unknown.

3. Conclusions

State, Federal, and tribal pathogen control programs have existed for a long time. Their goal is to prevent the introduction of significant fish pathogens into the US, specific states, regions or facilities. Pathogens are regulated that meet criteria such as (1) serious pathogens exotic to an area, (2) pathogens known to cause serious problems, (3) pathogens which are highly infectious and easily transmitted, and/or

(4) pathogens which regional watershed compacts have agreed are of concern in that region. Additionally, pathogen inspections are required before fish are brought onto an aquaculture facility and routine disease inspections may be required of fish on the facility. State resource management agencies and/or state agriculture departments oversee these programs in public and private aquaculture operations. The U.S. Fish and Wildlife Service also has an importation inspection program (Title 50) to prevent the introduction of foreign animal pathogens and the National Marine Fisheries Service and the U.S. Department of Agriculture—Animal Plant Health Inspection Service may also be involved under certain circumstances. These regulatory control programs have been successful at limiting the introduction of important fish pathogens. Regulatory control programs are also being revised and/or established to prevent the introduction of important shellfish pathogens.

There are no reliable, standardized or validated methods for testing effluents for aquatic animal pathogens. There are internationally accepted analytical methods available to qualify and/or quantify aquatic animal pathogens in tissues (Thoesen, 1994; Office International Des Epizooties (OEI), 2001). These methods are used in the regulatory control programs that have been successful at limiting the introduction of important fish pathogens into new regions. There are currently no consistently used practices to control the discharge of aquatic animal pathogens in effluents of commercial or public aquaculture facilities if pathogens do occur. The most cost-effective way to effectively limit potentially significant aquatic animal pathogens is to prevent their introduction into facilities.

The biological significance of aquatic animal pathogens in effluents is unknown. In general, most of these pathogens existed in aquatic populations either prior to or in the absence of aquaculture. There exist huge gaps in our knowledge regarding pathogen distribution in the environment, the environmental fate of pathogens and host susceptibility in aquatic ecosystems. The gaps in the available scientific information must be filled before any effluent guidelines can be established.

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FISH: BALANCING HEALTH RISKS AND BENEFITS

by Walter C. Willett, M.D., DrPH

In this issue of the *American Journal of Preventive Medicine,* Teutsch, Cohen, and their colleagues [1–6] present a detailed analysis of possible health effects from policies to alter fish consumption, which have both potential harms and benefits. As they clearly document, the results would have overall benefits under optimistic scenarios in which women who may become pregnant replace fish high in mercury with low-mercury fish, or in which there is an increase in low-mercury fish in the general population. However, the overall consequences could be adverse if fish consumption is reduced in the general population, which has apparently occurred. This analysis supports current guidelines that focus on changes in the type of fish eaten by women in the reproductive age, but also highlights concerns that educational messages and the implementation of policies must be carefully crafted to avoid unintended consequences.

The recent decreases in fish consumption have probably been influenced by not only fears about mercury, but also by a widely publicized report in a prominent journal [7] that farmed salmon contains measurable amounts of organochloride compounds. That publication was particularly troublesome, perhaps even irresponsible, because the implied health consequences were based on hypothetical calculations and very small (lifetime risks of 1:10,000). In contrast, the benefits of eating salmon are based on human data at the doses actually consumed and, as pointed out by Cohen et al. [2] in the present analysis, are likely to be at least 100-fold greater than the estimates of harm, which may not exist at all. Because the report on organochloride consumption almost certainly contributed to a reduction in fish consumption, that publication likely caused substantial numbers of premature deaths. Although the monitoring of contaminant levels in foods is an important function, reports of findings in places where widespread publicity is likely should be accompanied by at least a qualitative balancing of likely risks and benefits of changing consumption of the foods being considered. A more detailed analysis such as that by Cohen et al. [2] would be even better.

The nutritional, environmental, and policy issues surrounding consumption of fish and omega-3 fatty acids extend well beyond the scope of the analysis conducted by Cohen et al. [6] Catches of wild fish are presently near maximum, and perhaps even greater than sustainable, so further increases in fish consumption will need to be mainly from aquaculture. This method of production has many potential environmental impacts, but is worthy of careful development because conversion of feed to protein is far more efficient for fish than for land animals (because fish are cold blooded and float, no energy is needed to maintain body temperature and little is needed for movement). However, on a global basis, even large increases in aqua-

culture are unlikely to meet the needs for omega-3 fatty acids, because for a large part of the world's population, including Russia and much of Eastern Europe, per capita fish intake is extremely low. Thus, for much of the world, omega-3 fatty acids will need to be obtained from other sources. Fortunately, plant sources are many (as the 18-carbon fatty acid, alphalinoleic acid), including soybean and canola oils. However, in the United States and many other countries, the partial hydrogenation of these oils destroys the omega-3 fatty acids so that intake of these essential fatty acids is very low. In such regions, the most rapid way to increase consumption of omega-3 fatty acids is to stop the partial hydrogenation of these oils, which would also virtually eliminate the consumption of trans-fatty acids. Whether alpha-linoleic acid, through endogenous conversion to EPA and DHA, can provide all the health benefits of fish oil is a research topic of great importance. This has potential implications for the analyses of Cohen et al.,[1–6] because the background intake of alpha-linoleic acid is likely to be increasing in the United States due to reductions in partial hydrogenation of soybean oil, the benefits of fish intake may decrease. As our food supply is dynamic and human nutrition is complex, risk-benefit analyses cannot be static.

Fish consumption is but one example in human nutrition where potential competing risks and benefits exist; dairy products provide another. The recent U.S. dietary guidelines[8] recommend that all persons increase consumption of milk, or equivalent dairy products, to three glasses per day. The recommendation, if implemented, would lead to radical changes in individual diets; for example, average consumption by adult men is presently less than one serving per day. It would also result in a doubling of milk production in the United States, which would have major economic and environmental consequences. The recommendation was not based on evidence that there would be an improvement in human health if everyone consumed three glasses of milk per day, but rather on the mandate by the U.S. Department of Agriculture that the guidelines should meet the dietary reference intakes (DRIs) for calcium, potassium, and other nutrients from food sources alone. The DRIs in turn are also not usually based on health outcomes, but rather on a single metabolic criterion, such as the short-term maximal calcium retention test. The health consequences of high consumption of dairy products are complex and not fully understood. For example, although some intake of calcium is essential, high milk consumption has consistently not been associated with lower risk of fractures in large prospective studies, whereas increased risks of advanced or fatal prostate cancer have been observed in many studies. Moreover, large amounts of saturated fat would be introduced into the food supply if dairy consumption were doubled, even though the recommendation is to consume low-fat dairy products.

Interestingly, detailed economic analyses are required for government regulatory actions, but comparable analyses of health risks and benefits are not, even for the dietary guidelines, which have huge policy implications for government food programs. The field of nutrition would benefit from further work like that of Cohen et al.[1–6]

ENDNOTES

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