

Testimony of Tim Eichenberg
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Before the

Subcommittee on Fisheries, Wildlife and Oceans
House Committee on Natural Resources

On the

National Offshore Aquaculture Act of 2007 (H.R. 2010)

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Introduction

My name is Tim Eichenberg, Director of the Pacific Regional Office of the Ocean Conservancy. The Ocean Conservancy is a science-based advocacy, research, and public educational organization that strives to inform and empower people to conserve the oceans. Our headquarters are located in Washington D.C., and we have offices in New England, the Southeastern Atlantic, the Gulf of Mexico, the Pacific, and the Caribbean.

The Ocean Conservancy greatly appreciates the invitation to testify before the Subcommittee on an issue of such great importance to the future of the oceans. We recognize the increasing role that aquaculture is likely to play in the world food economy, and are grateful for the opportunity to respond to your request to provide recommendations to improve H.R. 2010 to ensure that the U.S. develops a sustainable offshore aquaculture program. While aquaculture is being promoted as the solution to the U.S. seafood deficit and declining ocean fisheries, recent national reports and numerous scientific studies cited below indicate that, unless carefully and sustainably managed, marine finfish aquaculture can exacerbate – not solve – declining fish stocks and ocean health.¹

I began to examine this issue in 1990 for the Marine Law Institute at the University of Maine School of Law, where I authored several reports on marine finfish aquaculture in Maine.² More recently, I worked on two studies for 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 offered a set of detailed recommendations for a sustainable and precautionary program for planning, siting, zoning, leasing, permitting, monitoring, mitigating, and enforcing offshore aquaculture operations.³

Last year the Ocean Conservancy sponsored legislation to provide comprehensive standards for leasing California 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, and was signed by Governor Schwarzenegger

on May 26, 2006.⁵ I am submitting a copy of SB 201 for the record, and urge the Subcommittee to regard California's new law as a good starting point for federal offshore aquaculture legislation.

The following testimony discusses the risks associated with marine finfish aquaculture; describes how the new California law specifically addresses those risks; and provides comments and recommendations on how H.R. 2010 can be improved to better address the potential adverse impacts of marine finfish aquaculture.

Risks Associated with Marine Finfish Aquaculture

The aquaculture industry is the fastest growing sector of the global food economy, and currently provides more than 40% of all fish products worldwide.⁶ Although still comparatively small, the U.S. aquaculture industry is being promoted as the solution to the U.S. seafood trade deficit, and the growing demand for healthy seafood and declining ocean fisheries. The federal government has called for a five-fold increase in aquaculture production by the year 2025, and seeks to create a \$5 billion industry.⁷ If much of this new growth occurs in the marine environment, it could put tremendous stress on ocean ecosystems.

While seafood provides an important and healthy source of protein, if marine finfish aquaculture is not properly regulated it poses significant risks that could exacerbate the decline of marine ecosystems. These risks have been recognized by the National Oceanic and Atmospheric Administration (NOAA) as well as numerous studies and reports described in more detail below.⁸ The following testimony focuses on the impacts from marine finfish aquaculture rather than the cultivation of shellfish species, which do not pose many of the same adverse impacts.

Fish Escapement: One of the greatest ecological and economic threats associated with the growth of marine aquaculture is the impact of escaped fish to the surrounding ecosystem and 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 the U.S. Fish & Wildlife Service (FWS), escapes result in harmful interactions with native fish, including competition with wild stocks for food, habitat and mates; transfer of potentially deadly diseases and parasites to wild stocks; and genetic modification of wild stocks through inter-breeding. Even with the prohibition of nonnative species, native farmed fish can weaken the genetic makeup of wild fish populations upon escape unless properly managed.⁹

While some escapes may be inevitable, federal legislation should seek to reduce the risks of escapes to wild fish stocks by prohibiting the cultivation of nonnative and genetically modified fish species, requiring the use of local genotypes of native fish stocks, and requiring facilities to be designed to prevent escapes to the maximum extent possible.

Pollution: Both the U.S. and Pew Oceans Commissions cite nutrient pollution as the most important ocean pollution threat. The excreta from an average ocean fish farm can

produce nutrients and fecal matter equal to a city of 20,000-65,000.¹⁰ The potential wastes of a \$5 billion U.S. industry – called for by NOAA – would discharge annually the nitrogen equivalent of the untreated sewage of 17 million people.¹¹ Fish farms can change the chemical and biological structure of the sediment under net pens, and in severe cases cause “dead zones.”¹²

EPA effluent guidelines for aquaculture are extremely weak.¹³ The guidelines ignore key issues such as escapes, nonnative and genetically modified species, do not establish numeric limits on pollutant discharges such as total suspended solids, fecal coliform, nitrates, phosphates, biological oxygen demand, metals, drugs or pesticides, and do not require water quality monitoring or testing for toxic substances. Instead, the guidelines rely on operational BMPs to minimize feed and chemical inputs. Moreover, EPA ocean discharge standards do not contain qualitative standards for determining whether a discharge causes “unreasonable degradation” of the marine environment, and EPA has not established water quality standards for the EEZ under which degradation can be judged.¹⁴ Additional water quality protection is therefore needed. H.R. 2010 should provide standards to prevent pollution to the maximum extent possible, and should consider alternative methods for eliminating the release of untreated sewage into the marine environment.

Threat of Disease and Parasites: Outbreaks of diseases and parasites are a constant risk because the density of fish in aquaculture operations is much higher than in nature. Disease, pathogens, and parasites multiply rapidly in crowded pens and can spread from cultured organisms, including shellfish, to wild species.¹⁵ Recent studies from British Columbia show that salmon migrating near fish farms are 73 times more likely to be infected with sea lice than ambient levels; that fish farms affect infestation rates as far away as 75 kilometers;¹⁶ that the rise of salmon farming has coincided with the emergence of native sea lice infestations among wild fish in Ireland, Canada, Norway, and Scotland; and that farm-origin lice can induce mortality levels of wild fish from 9% to 95%.¹⁷ Sea lice have also been found to transfer highly virulent infectious salmon anemia between fish.¹⁸ Infectious haematopoietic necrosis has spread from steelhead raised in Idaho to wild salmonid populations in the Columbia River, and escapement of farmed salmonids is implicated in the spread of whirling disease. Furunculosis, a virulent bacterial disease that affects salmon and trout, can be devastating in densely populated waters and can spread from infected salmon escapees to wild stocks.¹⁹

To control these diseases and infestations, fish farms use a wide variety of antibiotics, pesticides, parasiticides, anesthetics and other chemicals that can enter the marine environment.²⁰ Vaccines to prevent disease can end up in the environment and must also be carefully managed.²¹

Because of the risks posed to wild fish populations (particularly migrating juvenile and adult salmonids) from disease, parasites and pollution, it is particularly important for federal legislation to identify ocean areas where marine aquaculture facilities are inappropriate such as spawning and feeding areas, migration routes, marine reserves and other marine protected areas. Fish densities should be limited to reduce disease,

pollution, and the impacts of chemical and biological wastes, alternative treatments should be considered in place of harmful drugs and chemicals, and research should be conducted on environmentally friendly methods of pesticide and disease control.

Impacts on Marine Wildlife: Seals, sea lions and other marine wildlife are attracted to the dense concentration of farmed fish and are targets for predator controls. Recently, fifty-one California sea lions were found dead, trapped in fish farm nets in British Columbia.²² Acoustic deterrents such as seal bombs and intense underwater loud speakers cause disorientation, pain or hearing loss, and alter the behavior of marine species.²³ 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. Federal legislation should contain standards to minimize or eliminate impacts on marine mammals, seabirds and other marine life.

Ecosystem and Public Health Impacts from Fish Meal and Oils: The use of fish products to feed farmed carnivorous fish species can reduce wild fish populations, change the distribution and reproductive success of other species throughout the marine ecosystem, and result in a net loss of fish protein. It can take from 4-10 pounds of wild fish (and even more in the case of bluefin tuna) to produce one pound of some farmed fish species.²⁴ The food conversion ratio for ocean “ranching” is even greater, where high-value species like tuna are captured and fattened in ocean pens. 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).²⁵ Much of this fishmeal is produced from ecologically important forage fish such as sardines, anchovies, squid and mackerel. In addition, much of it is not harvested in an ecologically sustainable manner, globally or domestically, with grave implications on other wild fish populations, marine mammals and seabirds.²⁶ For example, the sardine fishery off Baja and Southern California is being pressured by the growing demand from Mexican bluefin tuna ranching operations which require 20kg of wild fish to produce 1 kg of tuna.²⁷ Moreover, many of the fish taken for the production of fish meal and oil are food sources themselves for human populations – in many instances important protein sources in the coastal areas of developing nations. Increased demand for fish meal and oil can therefore exacerbate food security problems for coastal nations in the developing world.

Although it may not be possible to eliminate entirely the use of fish meal and oil at this time, federal legislation should require the use of fish meal and oil to be minimized, ensure that fish meal and oil comes from sustainable sources, identify sustainable alternatives to fish protein and oil for feeds, and set goals and milestones for reducing the amount of fish meal and oil in feeds to the maximum extent possible.

Farmed species, depending upon species and diet, can also present increased public health risks to people who consume them. Concentrations of polychlorinated biphenyls (PCBs) and dioxins have been found to be significantly greater in farmed salmon species than in wild species due to the use of fish meal and oils that contain high levels of contaminants.²⁸ Wild fish near fish farms also can accumulate higher amounts of mercury,²⁹ and drugs can select for resistant bacteria, sometimes even in wild fish consumed by humans.³⁰

Impacts on Traditional Maritime Uses and Sensitive Habitats: Ocean aquaculture operations can adversely impact traditional maritime uses, such as fishing, recreational boating, diving, wildlife observations (e.g., whale, seabird watching) and maritime shipping. These impacts include threats to vessel traffic safety, navigation hazards, and access to fishing grounds. Impacts may also occur to areas currently or historically important for commercial or recreational fishing such as essential fish habitat (EFH) and habitat areas of particular concern (HAPC) designated by the Fishery Management Councils,³¹ as well as environmentally sensitive areas such as National Marine Sanctuaries, National Parks, wildlife refuges, and marine protected areas. Federal legislation should ensure that impacts to such areas are avoided.

The Sustainable Oceans Act

The Sustainable Ocean Act (SB 201)³² was enacted in 2006 to ensure that commercial ocean fish farming operations in California ocean waters are sustainable. California banned raising salmonid, non-native, or genetically modified fish species in state marine waters 2003. However it lacked any standards for reviewing and leasing ocean waters for marine finfish aquaculture. Sponsors of SB 201 worked with stakeholders, industry, and government officials for more than a year to develop comprehensive standards for leasing state waters for marine finfish aquaculture in a way that protects marine life, water quality, consumers, and fishing communities, and provides regulatory certainty to the industry. We believe that SB 201 provides a good starting point for legislation to authorize fish farming in federal waters.

SB 201 requires standards for the preparation of a comprehensive Programmatic Environmental Impact Report (PEIR).³³ The PEIR provides an opportunity to address specifically and comprehensively the potentially serious risks of offshore aquaculture to marine ecosystems, fisheries, consumers and fishing communities. The standards for preparing the PEIR are one of the key provisions of SB 201 and were added at the request of the state to address inadequate previous efforts to draft the PEIR. The PEIR is required to evaluate appropriate locations for marine finfish aquaculture operations, consider alternatives to ocean fish farming, assess the risks and impacts of different farming methods and species, and address gaps in current state regulatory programs. It provides a framework for managing aquaculture in an environmentally sustainable manner that, at a minimum, must consider the following factors:

- Appropriate areas for siting fish farming to avoid and minimize adverse impacts.
- Effects on sensitive habitats, marine ecosystems, commercial and recreational fishing, and other ocean uses;
- Effects on plants, animals and protected species;
- Effects of wastes, chemical and biological products on human health and the marine environment;
- Effects of interactions with marine mammals and birds;
- Cumulative effects of multiple projects on the ability of the marine environment to support ecologically significant flora and fauna;

- Effects of the use of feed, fish meal and fish oil on marine ecosystems;
- Effects of escapes on wild fish stocks and the marine environment; and
- The design of facilities and farming practices to avoid and minimize adverse impacts.³⁴

SB 201 also requires finfish aquaculture leases from the California Fish & Game Commission (Commission) to meet a number of specific standards to minimize harmful effects on human health and the marine environment:³⁵

- Leases are only issued on sites considered appropriate in the PEIR.
- Leases cannot interfere with fishing or other public trust uses, disrupt or harm wildlife and habitats, or otherwise harm the marine environment.
- Operations must minimize the use of fish oil and fish meal, and alternatives must be used where possible.
- Best management practices must include regular monitoring and reporting, and site inspections. Fish stocks must be removed, and facilities closed and terminated, if operations are not in compliance with best management practices or are damaging the marine environment.
- Lessees must conduct baseline assessments of the site prior to undertaking operations, and monitor habitat during operation.
- The numbers and densities of finfish raised must be limited to what can be safely raised without harming the marine environment.
- 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 & Drug Administration for marine finfish aquaculture.
- All farmed fish must be marked, tagged or otherwise identified as belonging to the operator.
- Facilities must be designed to prevent the escape of farmed fish into the wild, and to withstand severe weather and accidents.
- 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.
- Operators must provide financial assurances in the form of bonds or other devices to ensure that sites are restored to its original condition upon termination of the lease.³⁶
- Lessees are responsible for damages caused by their operations.³⁷

Comments and Recommendations on H.R. 2010

H.R. 2010 was introduced by Chairman Rahall on April 24, 2007 by request, and represents an improvement from legislation introduced in the Senate in 2005 (S. 1195). For example, it includes mandatory rulemaking, requirements to prevent disease and escapes, and a limitation to raising native species only. However, the effect of these provisions is limited by qualifying language, and the bill still lacks a number of significant environmental safeguards. For this reason, the Ocean Conservancy joined 30

other fishing, conservation, consumer safety and farming organizations in opposing H.R. 2010.³⁸ The deficiencies of HR 2010 are described in detail below.

Section 2. Findings. Subsection (a) states that it is U.S. policy to promote offshore aquaculture, but it lacks a strong and clear statement that the legislation is intended to take a precautionary and transparent approach to minimize and eliminate environmental risks and impacts. This approach is reflected in the NMFS Code of Conduct for Responsible Aquaculture Development in the U.S. Exclusive Economic Zone (“NMFS Code of Conduct”) which calls for adoption of the precautionary approach as a guiding principle to the development of marine aquaculture.³⁹ Similar language should be included in H.R. 2010.

Section 4. Offshore Aquaculture Permits.

Rulemaking: Subsection (a)(1) mandates rulemaking but does not specifically require rulemaking to be completed before permits are issued. Moreover, this subsection fails to contain clear and specific statutory standards to limit potential environmental impacts such as those contained in SB 201. Instead, it defers addressing many impacts to the rulemaking process without clear requirements that the rules prevent, minimize and avoid impacts. H.R. 2010 should stipulate that permits may not be issued before regulations are promulgated and the PEIS is completed. It should also require that environmental impacts be minimized or eliminated, and such requirements should be included as permit conditions.

Public Notice and Comment: Subsection (a)(1)(D) requires public notice and opportunity for comment prior to issuance of aquaculture permits. However, it lacks requisite details regarding the type and manner of public involvement to help protect the public interest. H.R. 2010 should include a requirement for a 45-day comment period and the availability to the public of all pertinent agency materials prior to the hearing.

Confidential Business Information: The bill also fails to address the issue of “confidential business information” (CBI), which could be used to deny public access to important information about the potential environmental impacts of proposed operations. H.R. 2010 should require any declaration of CBI to provide upfront substantiation explaining why the information should be held confidential and should include a process for NOAA to make a CBI determination.

Programmatic Environmental Impact Statement: Subsection (a)(2) requires NOAA to “prepare an analysis” for issuing permits under NEPA. However, it is not clear that a Programmatic Environmental Impact Statement (PEIS) is required, what standards are required for a PEIS (as provided in SB 201), or whether individual permits will also be subject to NEPA review. A PEIS for the entire offshore aquaculture program should be required to identify coastal locations best suited for fish farming, and areas to be avoided like sensitive habitats and marine protected areas; to consider effects on marine ecosystems, commercial and recreational fishing and other ocean uses, plant and animal species, protected species, and human health and the marine environment; to consider

effects of the use of fish meal oil on marine ecosystems; the effects of escaped fish; cumulative effects; design and farming practices; and the impacts of ocean ranching, where juvenile fish like tuna and other species are captured and raised to market size. The latter issue has been raised as a major concern by the recreational fishing industry.

General Environmental Requirements: Subsection (a)(4) requires the Secretary to establish through rulemaking additional environmental requirements “to address” environmental risks and impacts “to the extent necessary.” The use of rulemaking to establish these requirements creates uncertainty with respect to what will be required. H.R 2010 should establish clear and explicit standards (such as those provided in SB 201) to ensure that permits and regulations address the specific impacts from marine finfish aquaculture. Earlier drafts of the bill required environmental risks and impacts to be “minimized.” However, H.R. 2010 currently requires only that risks be “addressed to the extent necessary.” The bill should require specific environmental impacts to be “prevented” or “minimized” such as provided in subsection (a)(4)(A) with respect to the transmission of disease and escapes. However, we suggest deleting the phrase “that may cause significant environmental harm” because all escapes should be prevented to the maximum extent possible.

Local Genotypes and Genetically Modified Species: We support the requirement in subsection (a)(4)(E) that only native species be raised in offshore facilities. But we urge that language be added requiring the use of local genotypes of native species and wild broodstock -- as recommended by the Woods Hole Oceanographic Institution’s Marine Aquaculture Task Force (MATF).⁴⁰ We also recommend that genetically modified organisms (GMOs) be expressly banned from marine aquaculture, as they are in California, and that the subsection be redrafted to apply to all marine species “held” in offshore aquaculture facilities, not just those “propagated and reared.”

Marking and Tagging Farmed Fish: Subsection (a)(4)(F) requires marking or tagging fish only “if necessary.” Marking creates accountability for escapes and, at least for finfish, can be accomplished simply as it is in Alaskan salmon hatcheries. Marking or tagging should therefore be required unless it is clearly impractical.

Monitoring: Subsection (a)(5)(B) requires monitoring, but does not specifically require baseline assessments to which monitoring data may be compared. Before issuance of an offshore aquaculture permit the operator should provide baseline benthic habitat and community assessments of existing environmental conditions at the proposed site as determined appropriate by the Secretary.

Permit Duration: Subsection (b)(2)(C) allows 20-year permits. The experimental nature of offshore fish farming, and emerging scientific findings about the impacts of fish farming, suggest a 20-year permit is excessive. A permit duration of 10 years, as provided in California⁴¹ and Maine,⁴² is more appropriate for marine finfish aquaculture.

Fees, Bonds and Payments: Subsection (c) authorizes the Secretary to establish application and permit fees and bonds. However there is no requirement that these fees or payments cover the cost of the permit application process, monitoring the facilities, and enforcement of permit conditions. These costs should be internalized by the fish farming industry to avoid taxpayers subsidizing aquaculture operations. H.R. 2010 should also require offshore aquaculture companies to pay back to the public a fair return for use of public trust resources as provided by the MMS in the Draft PEIS for Alternative Energy and Alternative Use Program (which requires royalties, fees, rentals, bonuses or other payment to ensure a fair return for any lease, easement, or right-of-way).⁴³

State Opt-Out: Subsection (d)(2) allows states to “opt-out” of offshore aquaculture operations within 12 miles of their coastline. We recommend that the “opt-out” provisions be extended to the full 200-mile EEZ as provided by Senator Stevens’ amendment to S. 1195 in 2006, and suggest that the “opt-out” apply to pending permit applications to prevent a race to the “courthouse” while coastal states consider “opt-out” actions.

Liability: H.R. 2010 should address the issue of liability in a manner similar to SB 201 which requires “lessees shall be responsible for any damages caused by their operations ... including but not limited to reimbursement for any costs for natural resource damage assessment.”⁴⁴

Sensitive habitats and Marine Protected Areas: H.R. 2010 should provide specific protections for essential fish habitat (EFH), habitat areas of particular concern (HAPC), national marine sanctuaries and other MPAs.

Pollution and Management Practices: While the details of pollution and management practices may be developed in rulemaking, Congress should provide directives to limit finfish numbers and densities to protect the marine environment, similar to the provisions in SB 201. H.R. 2010 should also contain other provisions similar to SB 201 to minimize or where feasible eliminate the use of drugs, chemicals and antibiotics, to prevent the discharge of pollutants to the maximum extent possible, to consider the use of alternative treatments in place of harmful drugs and chemicals, and to conduct research to develop environmentally friendly methods of pesticide and disease control.

Section 5. Research and Development.

Fish Feed: Section 5 requires research to reduce use of fish meal and oil in fish feeds. In contrast, SB 201 requires fish meal and oil use to be minimized to prevent offshore aquaculture from increasing pressure on wild fisheries.⁴⁵ The MATF makes a number of recommendations concerning the use of fish products in feeds, including the addition of “milestones” to the permit process. We urge that the bill require the use of fish meal and oils to be “minimized,” and require the use of alternative seafood processing byproducts where feasible to help drive the production of alternative feeds

taking into account the nutritional needs of the fish being raised and the availability of alternative ingredients. Fish meal and fish oil should not be sourced from any fishery known to be “overexploited,” “overfished,” “depleted,” or similarly classified, from fisheries with unsustainable rates of bycatch, or from fisheries utilizing destructive fishing gear. We also suggest including milestones or conditions in offshore permits to limit the use of fishery resources as feed to help address the issue of fish ranching that capture carnivorous species that have extremely inefficient feed conversion ratios.

Section 10. Civil Enforcement and Permit Sanctions.

Citizen Suits: Many federal environmental statutes contain provisions to enable the public to enforce violations where federal enforcement actions are not taken. We suggest inclusion of citizen suit provisions similar to Section 505 of the Clean Water Act and Section 11 of the Endangered Species Act to help enforce the statute.

We believe that these and other provisions are necessary for the development of a sustainable marine finfish aquaculture industry that protects marine ecosystems and fishing communities, and look forward to working with the Subcommittee to strengthen H.R. 2010.

Thank you for the opportunity to present the views of the Ocean Conservancy.

¹ Pew Oceans Commission, *America’s Living Oceans* (2003); U.S. Commission on Ocean Policy, *An Ocean Blueprint for the 21st Century* (2004); Report of the Marine Aquaculture Task Force, *Sustainable Marine Aquaculture: Fulfilling the Promise; Managing the Risks* (January, 2007).

² Eichenberg, T., *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); Eichenberg, T., *Improving the Legal Framework for Marine Aquaculture: The Role of Water Quality Laws and the Public Trust Doctrine*, 2 Territorial Sea Journal 339 (1992); Eichenberg, T., *Growing Pains in Maine’s Salmon Aquaculture Industry*, 6:1 National Coastal Resources Institute News (1991).

³ Cicin-Sain, B., et al., *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 SB 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 (attached).

⁵ SB 201 was sponsored by the Ocean Conservancy and supported by 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 The Economist, “Fish farming: The promise of a blue revolution.” August 7, 2003.

⁷ U.S. Department of Commerce Aquaculture Policy, http://www.nmfs.noaa.gov/mediacenter/aquaculture/docs/15_DOC%20Aq%20Policy.pdf (viewed March 18, 2007).

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- ⁸ Nash, C.E., P.R. Burbridge, and J.K. Volkman (2005), *Guidelines for Ecological Risk Assessment of Marine Fish Aquaculture*. U.S. Department of Commerce, NOAAAS Tech. Memo. NMFS-NWFSC-71. National Marine Fisheries Service, *A Code of Conduct for Responsible Aquaculture Development in the U.S. Exclusive Economic Zone*. Available at: www.nmfs.noaa.gov/trade/AQ/AQCode.pdf. The Code calls for best management practices, site evaluations, consideration of effects on local communities, adoption of the precautionary approach, escape prevention and tracking, and predator protection.
- ⁹ 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).
- ¹⁰ 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.
- ¹¹ Goldburg, R. and R. Naylor, *Transformed seascapes, fishing, and fish farming*, Frontiers in Ecology and the Environment, 3:21-28 (2005).
- ¹² 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).
- ¹³ 69 Fed. Reg. 51891-51930 (August 23, 2004).
- ¹⁴ 40 CFR §125.122.
- ¹⁵ Report of the Marine Aquaculture Task Force, *Sustainable Marine Aquaculture: Fulfilling the Promise; Managing the Risks* (January, 2007) at 60. available at: http://www.pewtrusts.org/pdf/Sustainable_Marine_Aquaculture_final_1_07.pdf.
- ¹⁶ Krkosek, M., et al., *Transmission dynamics of parasitic sea lice from farm to wild salmon*. Pro. R. Soc. B (2005) 272, 689-696.
- ¹⁷ http://www.math.ualberta.ca/~mkrkosek/Salmon_mortality_paper.pdf (visited March 18, 2007).
- ¹⁸ Naylor R, et al, *Fugitive Salmon: Assessing the Risks of Escaped Fish from Net-Pen Aquaculture*. BioScience: 55: 427-437 (2005).
- ¹⁹ Naylor, R. et al, *Effect of Aquaculture on World Fish Supplies*, Nature, 405:1017-1024 (2002).
- ²⁰ Id.
- ²¹ Report of the Marine Aquaculture Task Force, supra note 15, at 64.
- ²² Sandra McCulloch, CanWest News Service, April 21, 2007.
- ²³ 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, *Effect of Aquaculture on World Fish Supplies*, Nature, 405:1017-1024 (2002).
- ²⁴ Naylor, R. et al, *Effect of Aquaculture on World Fish Supplies*, Nature, 405:1017-1024 (2002).
- ²⁵ 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).
- ²⁶ Naylor, R. et al, *Effect of Aquaculture on World Fish Supplies*, Nature, 405:1017-1024 (2002).
- ²⁷ Naylor, R. and Burke, *Aquaculture and ocean resources: Raising tigers of the sea*, Annual Review of Environment and Resources, 30: 185-213 (2005).
- ²⁸ See Hites, et. al, *Global Assessment of Organic Contaminants in Farmed Salmon*, 303 SCIENCE at 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).
- ²⁹ deBruyn, A.. et al., *Ecosystemic Effects of Salmon Farming Increase Mercury Contamination in Wild Fish*, Environment Science and Technology, 40(11): 3489 – 3493 (2006).
- ³⁰ 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).

³¹ 71 Fed. Reg. 27406 (2006).

³² SB 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. A copy of the legislation is attached for the record.

³³ CA Fish and Game Code §15008(b)(1)-(10).

³⁴ Id. §15008(b)(1)-(10).

³⁵ Id. §15400(b)(1)-(10).

³⁶ Id. §15409(b).

³⁷ Id. §15409(c).

³⁸ Letter to The Honorable Madeleine Z. Bordallo, Chairwoman, Subcommittee on Fisheries, Wildlife and Oceans, dated April 24, 2007, from the Institute for Fisheries Resources, Ocean Conservancy, Environmental Defense, Alaska Independent Fishermen's Marketing Association, Alaska Marine Conservation Council, Alaska Trollers Association, Cape Cod Commercial Hook Fishermen's Association, Center For Food Safety Clean Catch, Columbia River Crab Fishermen's Association, Environment Matters, Fishing Vessel Owners' Association, Food and Water Watch, Go Wild Campaign, Gulf Restoration Network, Kenai Peninsula Fishermen's Association, Mangrove Action Project, Monterey Bay Aquarium, National Coalition for Marine Conservation, National Farmers Union, Northcoast Environmental Center, Oceana, Pacific Coast Federation of Fishermen's Associations, Pacific Marine Conservation Council, Puget Sound Harvester's Association, Sierra Club, Small Boat Commercial Salmon Fishermen's Association, Southeast Alaska Regional Dive Fisheries Association, Southern Shrimp Alliance, and the United Fishermen of Alaska.

³⁹ "Aquaculture development in the EEZ will adopt the guiding principle of a precautionary approach combined with adaptive management to achieve sustainable development in offshore waters." *NMFS Code of Conduct*, supra note 8, at 17.

⁴⁰ Report of the Marine Aquaculture Task Force, supra note 15.

⁴¹ CA Fish and Game Code §15405(b).

⁴² 12 MRSA §6072(2)(A).

⁴³ See, <http://ocsenergy.anl.gov/eis/guide/index.cfm>

⁴⁴ CA Fish and Game Code §15406.5.

⁴⁵ Id. §15400(b)(3).