THE CENTER FOR
FOOD SAFETY

September 20, 2002

Colin Nash
NMFS/WASC
P.O. Box 130
Manchester, WA 98353
VIA FAX (206) 842-8364

RE: Comments on the National Marine Fisheries Service Draft Code of Conduct for Responsible Aquaculture in the U.S. Exclusive Economic Zone

Dear Mr. Nash:

The Center for Food Safety ("CFS") submits the following comments in response to the National Marine Fisheries Service ("NMFS") publication of the Draft Code of Conduct for Responsible Aquaculture in the U.S. Exclusive Economic Zone (hereinafter "Draft Code").[1] CFS encourages NMFS to issue a final Code of Conduct incorporating conservation and human health management provisions as directed by the FAO Code of Conduct for Responsible Fisheries.[2]

In order to strengthen NMFS' Code, CFS recommends that the agency adopt specific standards for the aquaculture industry on protecting the environment and human health. Subsequently, to adequately protect the environment and human health, it is essential that the agency use the Code as a model for developing mandatory regulations. CFS agrees that NMFS should be the lead agency for regulating aquaculture in the exclusive economic zone ("EEZ") and strongly advocates for the establishment of a transparent regulatory framework that is open to public comment. CFS' comments for specific industry standards are discussed below along with a legal analysis supporting NMFS' promulgation of mandatory regulations.

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[1] 67 Fed. Reg. 54644 (2002).

[2] FAO, Code of Conduct for Responsible Fisheries, available at http://www.fao.org/fi/agreem/codecond/ficonde.asp (last visited at Aug. 27, 2002)(hereinafter "FAO Code").

I. Protecting the Environment

A. Non-native and Genetically Engineered Fish

Recognizing the severe environmental damage that can be caused by non-native and genetically engineered fish ("GE") species, NMFS' Draft Code states that these aquatic organisms should be regulated to "prevent threats to the diversity and abundance of native species, and to the ecosystems on which they depend."[3] CFS recommends that the Draft Code go further by unequivocally prohibiting the use of non-native (at the very least, the use of reproductively viable non-native fish species should be prohibited) and GE aquatic organisms in the EEZ.

The scientific evidence shows that non-native and GE fish are harmful exotic species. Escapes of exotic species create "biological pollution" which results in irreversible and unpredictable impacts to the ecosystem.[4] Over the years, aquaculture has caused numerous injurious introductions of pests, including seaweed that smother Hawaii's coral reefs, bighead and silver carps from Asia that compete with native fish in rivers throughout the Mississippi Basin, and Japanese cultured oysters that are now established on almost all Northern Hemisphere coasts.[5] Exotic species are implicated as one of the causes for the listing of 42 percent of the species on the Endangered Species Act.[6] Also, it is estimated that the introduction of exotic species costs the U.S. an estimated hundreds of millions of dollars every year.[7] Even the National Research Council has ranked invasive species as one of the most serious threats to native marine biodiversity.[8] Recognizing the harmful impacts caused by exotic species, an Office of Technology Assessment report recommends avoiding the use of exotic species in offshore aquaculture.[9]

NMFS should heed the warnings of experts and prohibit the use of exotic species. If NFMS does not prohibit the use of non-native and GE aquatic organisms in the EEZ, these fish will undoubtedly escape and threaten the genetic integrity of wild fish.

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[3] NMFS, A Code of Conduct for Responsible Aquaculture Development in the U.S. Exclusive Economic Zone (August 2002) [hereinafter "Draft Code"].

[4] Rosamond L. Naylor, Susan L. Williams, & Donald R. Strong, Aquaculture--A Gateway for Exotic Species, 294 Science 1655 (Nov. 2001)[hereinafter "Gateway for Exotic Species].

[5] Id.

[6] Alaska Department of Fish & Game, Atlantic Salmon: A White Paper 6 (March 5, 2002), at http://www.ak.gov/adfg/ (last visited April 14, 2002) [hereinafter "Alaska White Paper"].

[7] James T. Carlton, Introduced Species In U.S. Coastal Waters, Pew Oceans Commission 3 (2001)[hereinafter, "Introduced Species"].

[8] Gateway for Exotic Species, supra note 4, at 1656; See also Introduced Species, supra note 7, at 3,6 (explaining that the rate of introduced species has continually risen over the years and shows no signs of slowing).

[9] Center for the Study of Marine Policy, University of Delaware, Development Of A Policy Framework For Offshore Marine Aquaculture In The 3-200 Mile U.S. Ocean Zone, 40 (July 2001)[hereinafter "University of Delaware Report"].

The Use of Non-Native Fish Species and GE Fish will Threaten the Genetic Integrity of Wild Fish

Examples of Interbreeding

Off the coast of Maine, there is now "substantial evidence that escaped farmed salmon . . . interbreed with wild salmon."[10] In fact, a primary factor that compelled the recent decision to list the remaining runs of Atlantic salmon in Maine as endangered was the "continued use of non-native American salmon and detection of aquaculture escapes in Maine rivers, with the potential for interbreeding . . ."[11] Atlantic salmon populations in Maine are "particularly susceptible to genetic perturbations because of their very low abundance levels."[12] To illustrate, the 100,000 salmon that escaped from a single aquaculture facility in Maine in December 2000, was "more than 1,000 times the number of documented wild adult salmon."[13]

In the Pacific Northwest, the tens of thousands of Atlantic salmon that are released into the Pacific Coast ecosystem annually pose an enormous threat to wild Pacific salmon."[14] As a result of these frequent farmed fish escapes, "the number of Atlantic salmon seen returning to rivers and streams on the west coast is increasing, and Atlantic salmon are now successfully reproducing in British Columbia rivers."[15] The possibility of interbreeding between Atlantic and Pacific salmon also remains a serious threat since research demonstrates that it is possible for Atlantic and Pacific salmon to produce hybrid progeny.[16]

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[10] Letter from Michael Bartlett, Supervisor, New England Office, FWS, and Patricia Kurkul, Regional Administrator, Northeast Region, NMFS, to Stephen Silva, Maine State Program, EPA, 17 (January 12, 2001)(discussing Final Biological Opinion Concerning the EPA's Proposed Approval of Maine's Application to Administer the NPDES Permit Program, and its Effects on the Endangered Gulf of Maine Distinct Population Segment of Atlantic Salmon) [hereinafter "Services Final Biological Opinion"].

[11] USFWS/NMFS, Guide to the Listing of a Distinct Population Segment of Atlantic Salmon as Endangered (Nov. 2000).

[12] Rebecca J. Goldburg, et al., Marine Aquaculture in the U.S.: Environmental Impacts and Policy Options., Pew Oceans Commission 7 (2001)[hereinafter "Marine Aquaculture in the U.S."].

[13] Id., citing B. Daley, Escaped Farm Salmon Raise Alarm in Maine, Boston Globe (Feb. 23, 2001).

[14] Alaska White Paper, supra note 6, at 2 (explaining that these introductions "have frequently resulted in unexpected and often catastrophic consequences from habitat destruction, disease or parasites, hybridization, reproductive proliferation, and predation and competition."). See also Marine Aquaculture in the U.S., supra note 15, at 12 (noting that escaped Atlantic salmon are "compet[ing] with wild Pacific salmon stocks for food, habitat, and spawning grounds").

[15] Marine Aquaculture in the United States, supra note 12, at 7.

[16] See Canada Environmental Assessment Office, Impacts of Farmed Salmon Escaping Net Pens, at http://www.eao.gov.bc.ca/project/aquacult/salmon/escape.htm (last updated Feb. 25, 1997).

Genetic-variability of wild fish must be maintained to preserve biological diversity
In order to ensure the long-term sustainability and evolutionary potential of fish, the maintenance of sufficient levels of genetic variation, both within and between populations, is essential.[17] It is crucial that wild populations be protected "because they harbor coevolved gene complexes capable of continually responding to evolutionary forces on the planet."[18]

"Don't put all your eggs in one basket" is an old adage that rings true with the evolutionary "bet-hedging" strategy of maintaining genetic differences between naturally reproducing populations of a species.[19] "The 'eggs' are the different alleles (total genetic variation) harbored within each species. The 'basket' is each distinct population."[20] In other words, "as initially distinct populations become genetically homogenized, they develop the same vulnerability to stressful environmental conditions."[21] If a new disease is introduced, for example, to which most genetically homogenized members of a species is susceptible, "the disease would jeopardize all populations and therefore the entire species."[22] However, if the species is permitted to maintain genetic differences between local populations, then "it is likely that some populations would have a higher frequency of genetically resistant individuals and thus would be relatively unaffected by the disease."[23]

Interbreeding will disrupt the genetic-variability of wild fish
The continued escapement of farmed fish will lead to decreased production and fitness of wild populations due to outbreeding depression. Outbreeding depression is "a loss of fitness in the offspring produced as a result of interbreeding between two groups because the parents are too distantly related."[24] If enough wild and escaped farmed fish mate, "outbreeding depression could cause a decline in abundance of the wild population. . ." in a relatively short amount of time.[25]

Some argue that natural selection can purge wild populations of maladaptive genetic traits introduced by farmed escapees, but the evidence indicates that this is unlikely due to the significant and reoccurring fish escapes. The Services confirm that "regularly-occurring interaction between aquaculture fish and wild salmon makes [the ability of natural selection to purge maladaptive genetic traits] considerably less likely."[26] In addition, because "virtually no aquacultural

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[17] A.R. Kapuscinski & D.J. Brister, Genetic Impacts of Aquaculture, Environmental Impacts of Aquaculture 128 (Black, ed. 2001)[hereinafter "Genetic Impacts of Aquaculture"].
[18] Id.
[19] Id at 138-9.
[20] Id. at 139.
[21] Id.
[22] Genetic Impacts of Aquaculture, supra note 17, at 139.
[23] Id.
[24] Id. at 139.
[25] Id. at 140.
[26] Services Final Biological Opinion, supra note 10, at 22.

broodstocks have become so intensely domesticated as to assure a high death rate in the wild," there can be no guarantee of "rapid purging of maladaptive genes."[27] The research shows that the number of generations required for the process of natural selection is very large.[28] The process, therefore, cannot be relied upon to protect endangered species such as Atlantic salmon that do not have generations to spare. In sum, the argument that natural selection can purge wild populations of maladaptive genetic traits introduced by farmed escapees should not be relied upon to protect wild fish populations.

Looking specifically at GE fish, the National Academy of Sciences ("NAS") recently released a report warning about the use of GE fish and shellfish because of the environmental hazards these organisms pose. NAS explained that the "ability of certain GE organisms to escape, disperse, and to become feral in diverse communities is of high concern."[29] GE fish and shellfish were identified as examples of organisms that become feral easily and are highly mobile.[30] In addition, a Purdue University study shows that GE fish will attract more mates than wild fish but their offspring will be less fit and less likely to survive leading to the extinction of an entire fish population.[31] Thus, to prevent the extinction of an entire fish population, it is crucial that GE fish are not grown in the EEZ . In addition, NMFS should flatly prohibit the use of GE fish even if these fish are sterilized. GE fish will undoubtedly escape and once these fish are in the marine environment, the scientific evidence shows: (1) sterilization is not guaranteed 100 percent of the time and thus interbreeding is still a risk factor and (2) the NAS findings explains that GE fish may have increased fitness and thus may out-compete wild fish species. [32]

The Aquaculture Industry's Interest in preventing genetic-erosion

It is within the aquaculture industry's own interest to prevent genetic erosion and loss among wild fish populations. Aquaculture "depends on [the] critical role of genetic variation to sustain productivity, prevent inbreeding depression and keep the door open for new products and increased yields."[33] If the aquaculture industry fails to take immediate measures to prevent genetic erosion, then this inaction is tantamount to shooting itself in the foot. Strict standards aimed to prevent genetic erosion cannot possibly be overly burdensome for an industry that depends on their implementation. In short, as stated by fishery biologists

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[27] Genetic Impacts of Aquaculture, supra note 17, at 143.

[28] Id.

[29] National Academy of Sciences, Animal Biotechnology: Science-Based Concerns 10-11(National Academy Press, Washington, DC, Aug. 2002)[hereinafter NAS Report"].

[30] Id.

[31] William M. Muir and Richard D. Howard, Possible ecological risks of transgenic organism release when transgenes affect mating success; Sexual selection and the Trojan gene hypothesis, 96 PNAS 13853-13856 (Nov. 23, 1999)

[32] Case Study No. I, Growth-Enhanced Salmon, in CEQ and OSTP Assessment: Case Studies of Environmental Regulations for Biotechnology, 1,31 (admitting that none of the sterilization techniques are 100% effective); NAS Report, supra note 29 at 11.

[33] Genetic Impacts of Aquaculture, supra note 17, at 128.

Anne Kapuscinski and D.J. Brister, "making the genetic conservation of wild aquatic populations a primary goal of sustainable aquaculture would be an act of enlightened self-interest and of responsible global citizenship" for the industry.[34]

CFS Recommendation
To prevent the disruption of the genetic integrity of wild fish populations, NMFS' Code should include a prohibition on raising non-native (and at the very least prohibit the use of reproductively viable non-native fish) and GE aquatic organisms in the EEZ. The genetic impacts of interbreeding between farmed and wild fish must be avoided to protect against the endangerment /extinction of wild fish stocks. Combining CFS' recommendations with the Draft Code's guidance on preventing the escape of farmed fish will serve as critical steps to meeting this goal.

B. Siting of Net Pens

NMFS' Draft Code states that criteria should be established for minimizing negative impacts from the siting of net pens.[35] CFS recommends that this section specifically include criteria for preventing harm to marine life. If net pens are poorly placed, escaped farmed fish may gain access to sensitive marine areas. For example, farmed fish that escape from net pens placed near spawning grounds may affect the breeding of wild fish. Poorly placed net pens may also obstruct wild fish by impeding their migration route. Finally, placing net pens near the habitat of predators will lure these animals to the pens, which will lead to massive fish escapes.[36] Therefore, it is essential that net pens are placed in an area that will not provoke fish escapes or harm marine life if fish do escape.

CFS Recommendation
CFS recommends that the NMFS Code include criteria for the placement of net pens to prevent fish escapes and eliminate harm to marine life if fish do escape.

C. Environmental Assessment/Environmental Impact Statements

One noticeably absent provision from the Draft Code is a section requiring the managing agency to conduct an environmental assessment ("EA") or environmental impact statement ("EIS"). CFS believes that it is essential that (1) an EA/EIS be conducted before each permit is issued for raising fish in the EEZ and (2) a programmatic environmental impact statement be conducted before issuing mandatory regulations.

Under the National Environmental Policy Act ("NEPA"), all federal agencies are required to prepare a "detailed statement" regarding all "major federal actions

[34] Id. at 129.
[35] Draft Code, supra note 3, at 15-16.
[36] See Marine Aquaculture in the U.S., supra note 12, at 17.

significantly affecting the quality of the human environment . . ."[37] This statement - - known as an EIS - - must describe (1) the "environmental impacts of the proposed action," (2) any "adverse environmental effects which cannot be avoided should the proposal be implemented," (3) "alternatives to the proposed action." (4) "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity," and (5) any "irreversible or irretrievable commitment of resources which would be involved in the proposed action should it be implemented."[38] To determine whether an EIS is required, federal agencies must prepare an EA that provides sufficient evidence and analysis to support the agency's determination on whether a proposed action will significantly affect the environment.

By growing fish in the EEZ, there are numerous environmental impacts to consider. The offshore aquaculture report conducted for NMFS by the University of Delaware stated the following:

> Aquaculture practices can generate environmental impacts as a function of (1) the technique applied, (2) site location, (3) size of the production, (4) capacity of the receiving body of water (citation omitted), and (5) type of species raised (citation omitted). These can include impacts on water quality, the benthic layer, the native gene pool, other fisheries and the ecosystem as a whole, as well as impacts from non-native species, disease, and chemicals.[39]

Those interested in raising fish in the EEZ need to be aware that these environmental impacts and other potential impacts, including impacts on the social economic affects on fishermen, need to be considered by the reviewing agency before a permit is issued. Moreover, a programmatic EIS must be conducted before an agency adopts new regulations.[40] These action are not only consistent with the requirements of NEPA, but also is consistent with the precautionary approach advanced by the FAO Code of Conduct for Responsible Fisheries.[41]

CFS Recommendation
CFS recommends that NMFS' Code state that an EA/EIS will be conducted by NMFS before each permit is issued in the EEZ and a programmatic EIS will be conducted prior to issuing mandatory regulations over aquaculture in the EEZ.

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[37] 42 U.S.C. § 4332 (C).
[38] Id.
[39] University of Delaware Report, supra note 9, at 18.
[40] 40 C.F.R. §§ 1502.4(b), 1508.18(b)(1).
[41] FAO Code, supra note 2, at 9.1.2, 9.1.3.

II. Protecting Human Health

The Draft Code discusses measures to assure that aquaculture grown in the EEZ is safe for human consumption.[42] This section of the Draft Code refers the aquaculture industry to the United Nations Codex Alimentarius, Hazard Analysis Critical Control Point methods for handling, processing, and transporting seafood, and FDA regulations. CFS recommends that this section go further to ensure the safety of seafood grown in the EEZ by stating that the use of drugs and chemical should be minimized. There are strong scientific arguments for minimizing the use of drugs and chemicals in aquaculture. In advising the aquaculture industry, NMFS should be aware of these studies.

A. The Use of Antibiotics

First, the overuse of antibiotics in fish feed can cause serious public health problems. Antibiotics are used in aquaculture to treat and prevent disease, control parasites, and affect reproduction and growth.[43] The most common method of distributing antibiotics to farmed fish is through fish feed, however, not all of the feed is retained by the fish. As a result, antibiotics enter the environment through uneaten fish feed and feces. It is predicted that 75% of most antibiotics are lost in the environment.[44] Consequently, these antibiotics accumulate in wild fish and shellfish that feed on the food and feces of farmed fish.[45] By eating farmed fish treated with antibiotics or even wild fish exposed to the antibiotics, humans will be ingesting antibiotics that may be harmful.[46] Indeed, some antibiotics are toxic and can even cause fatal allergic reactions.[47]

The use of antibiotics in aquaculture also exacerbates the significant problem of antibiotic resistant bacteria. Bacteria that are resistant to antibiotics can harm human health by preventing the effective treatment of illness. The American Society of Microbiology warns that the use of antibiotics in aquaculture is potentially one of the most important factors creating the evolution of antibiotic-resistant bacteria.[48]

The Centers for Disease Control ("CDC") found that bacteria from aquaculture ecosystems can be transferred directly to humans by handling the fish.[49] Even if someone is not exposed to the aquaculture operation, FDA acknowledges that

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[42] Draft Code, supra note 3, at 21-22.
[43] Dr. Charles M. Brenbrook, Antibiotic Drug Use in U.S. Aquaculture, The Northwest Science and Environmental Policy Center 5 (Feb. 2002).
[44] Rebecca Goldberg and Tracy Triplett, Murky Waters: Environmental Effects of Aquaculture in the U.S., Environmental Defense Fund at 44 (1997).
[45] Id.
[46] Id.
[47] Id. (explaining that newborns can be harmed by chloramphenicol and betalactam compounds can cause fatal allergic reactions).
[48] Id. at 45.
[49] Memorandum from Frederick Angulo, D.V.M., Ph.D. to the record (Oct. 18, 1999).

"[b]acteria on fish may also be transmitted to humans when the aquaculture fish are eaten, or when other foods, which have been cross-contaminated by bacteria from fish, are eaten."[50] Accordingly, there are potential human health concerns connected with the use of antibiotics in aquaculture.

B. The Use of Chemicals

The use of chemicals in aquaculture also poses a risk to human health. For example, many salmon farmers use color additives to give the salmon its pink hue similar to wild fish, however, it should not be assumed that these chemicals are safe. There are human health safety issues connected with the color additive canthaxanthin. Research has already found that this additive "can cause deposits of yellow particles on the human retina, which children's eyes thought to be particularly vulnerable." [51]

Other chemicals such as PCB's, pesticides, and dioxins are found in farmed fish feed. As a result, there are high levels of chemicals in farmed fish leading researchers to report that there are food safety concerns in consuming farmed fish regularly.[52]

In light of the harmful human health effects from consuming farmed fish with antibiotics and chemicals, it is critical that NMFS' Draft Code include a statement alerting the aquaculture industry that they should minimize the use of antibiotics and chemicals when growing fish in the EEZ. Moreover, this statement is consistent with the FAO Code which provides that states should promote the minimal use of drugs and chemicals.[53]

CFS Recommendation
CFS recommends that NMFS' Draft Code include a human health safety provision directing the aquaculture industry to minimize the use of antibiotics and chemicals when growing fish in the EEZ.

III. Mandatory Regulations

CFS strongly suggests that NMFS incorporate CFS' suggestions for specific guidelines as discussed above and then use the Draft Code as a model to establish mandatory regulations. The Draft Code's precautionary approach to fish farming in the EEZ is important for notifying the aquaculture industry of

[50] Id.
[51] How the King of Fish is being farmed to death, Observer, available at www.intl-ecogen.com/newspaper.html (Jan. 7, 2001).
[52] M.D.L. Easton et al., Preliminary examination of contaminant loadings in farmed salmon, wild salmon and commercial salmon feed 46 Chemosphere 1053 (2002).
[53] FAO Code, supra note 2, at 9.4.4.

proper fish farming conduct, however, to adequately protect the environment and public health, the Draft Code must be transformed into mandatory regulations.

Under the Draft Code, compliance with the guidelines are only voluntary. There is no legal obligation for the industry to comply with these provisions and thus, the Draft Code provides no guarantee to consumer or environmentalist that fish farming in the EEZ will not harm the environment or human health.

To ensure that fish farming in the EEZ is conducted in an environmentally sustainable manner, it is essential that NMFS establish mandatory regulations for aquaculture in the EEZ. NMFS has the statutory authority under the Magnuson-Stevens Fishery Conservation and Management Act (hereinafter "Magnuson-Stevens Act") to be the lead agency in issuing mandatory regulations over aquaculture in the EEZ.[54]

Congress provides NMFS with broad authority under the Magnuson-Stevens Act to regulate "fishing" activities in the EEZ. One of the purposes of this Act is to "promote domestic commercial and recreational fishing under sound conservation and management principles."[55] As for the term "fishing," Congress broadly defined this activity to include:

> (A) the catching, taking, or harvesting of fish;
> (B) the attempted catching, taking, or harvesting of fish
> (C) any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or
> (D) any operations at sea in support of, or in preparation for, any activity described in subparagraphs (A) through (C).
> Such term does not include any scientific research activity which is conducted by scientific research vessel.[56]

This broad definition of "fishing" covers the harvesting of fish and thus encompasses aquaculture. Interpreting the term "fishing" to include aquaculture has also been recognized by NOAA's Office of General Counsel legal council.[57]

It is evident from the Magnuson-Stevens Act that NMFS has the authority to regulate aquaculture in the EEZ. NMFS should use this authority to develop mandatory regulations to require approval of ocean aquaculture by NMFS through Fishery Management Plans ("FMPs").[58]

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[54] 16 U.S.C. § 1801 et seq. Although CFS recommends that NMFS take the lead role in the regulatory permitting of aquaculture in the EEZ, CFS cautions NMFS from impeding upon the other agency's statutory mandates, such as EPA's authority under the Clean Water Act.

[55] Id. § 1801(b)(3).

[56] 16 U.S.C. § 1802(15).

[57] University of Delaware Report, supra note 9, at 78.

[58] See Id. (explaining that already two regional fishery management councils have developed aquaculture policies).

Once NMFS issues a proposed rule to regulate aquaculture in the EEZ, CFS strongly advocates for a transparent regulatory framework open to the public for comment. As NMFS is well aware, aquaculture, including the public marketing of GE fish, is a major issue of interest and concern among the American public. Petitioners request that NMFS' regulatory process involving aquaculture in the EEZ fully engage public comment prior to any decision making.

Under Executive Order No. 12,866, each federal agency is directed "to provide the public with meaningful participation in the regulatory process."[59] This meaningful opportunity to comment on regulatory proposals in most cases "should include a comment period of not less than 60 days."[60] Before NMFS issues regulations and/or permits for growing fish in the EEZ, it is imperative that the public be given a meaningful opportunity to comment.

Recommendation
CFS strongly urges NMFS to take the lead role in regulating aquaculture in the EEZ by issuing mandatory regulations. CFS also encourages NMFS to develop a transparent regulatory framework open to public comment.

Sincerely,

Tracie Letterman
Fish Program Director
Center for Food Safety

Attachment: Comments to EPA sent via mail

[59] Exec. Order No. 12,866, 58 Fed. Reg. 51735 (1993).
[60] Id.