The Ones that Got Away: Regulating Escaped Fish and Other Pollutants from Salmon Fish Farms

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THE ONES THAT GOT AWAY: REGULATING ESCAPED FISH AND OTHER POLLUTANTS FROM SALMON FISH FARMS

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The growth in the number, size, and production capability of salmon and other fish farms in the past twenty-five years has led to demands for national regulation of fish farm effluents. Pollution from salmon and other fish farms is substantial and reuslts in numerous adverse environmental effects. Existing laws do not effectively control discharges from salmon fish farms and other aquaculture facilities. This Comment argues that the Environmental Protection Agency should promulgate aquaculture industry effluent limitations to ensure consistent regulation of fish farms. The implementation of effluent limitations will facilitate the issuance of National Pollution Discharge Elimination System permits and lead to a reduction in discharged pollutants from fish farms.

Introduction

Aquaculture, "the propagation and rearing of aquatic species in controlled or selected environments,"[1] is a relatively young industry in the United States.[2] A decline in wild fisheries and an increase in the demand for seafood have helped aquaculture develop into a major industry, beginning in the 1950s.[3] Aquaculture production has grown significantly since then and is currently the fastest-growing sector of agriculture in the United States.[4] Today, fish farms exist in every state.[5] In 1995, the aquaculture industry produced more than 400,000

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[1] 16 U.S.C. § 2802(1) (1994).

[2] *See* Rebecca Goldburg & Tracy Triplett, Environmental Defense Fund, Murky Waters: Environmental Effects of Aquaculture in the US 21 (1997).

[3] *See id.* at 19, 21.

[4] *See id.* at 7; Ronald J. Rychlak & Ellen M. Peel, *Swimming Past the Hook: Navigating Legal Obstacles in the Aquaculture Industry*, 23 Envtl. L. 837, 842 (1993) (citing David J. Harvey, U.S. Dep't of Agric., AQUA-7, Aquaculture: Situation and Outlook Report 22 (1991)).

[5] *See* Goldburg & Triplett, *supra* note 2, at 7.

metric tons of finfish and shellfish.[6] Every year over the last decade, the value of aquaculture production in the United States increased by approximately five to ten percent.[7] Specifically, Atlantic salmon production grew from zero in 1985 to more than 14,000 metric tons in 1995.[8] Salmon production constitutes 3.4% of United States aquaculture by weight and 10.4% by value.[9]

In salmon aquaculture, fish farmers raise salmon in captivity from the egg stage until the salmon are ready for consumption.[10] The eggs grow to the smolt stage in fresh water hatcheries.[11] At the smolt stage the salmon are able to make the transition from fresh to salt water, at which point they are transferred to saltwater netpens.[12]

If the aquaculture industry is to expand as projected, its operations should not adversely affect the environment so that local communities will accept aquaculture facilities.[13] Pollution from fish farms is substantial and opposition to environmental degradation may hamper the growth of the industry, as opponents believe that all they stand to receive from aquaculture facilities is pollution.[14] Salmon fish farms, most specifically, have the greatest capacity to harm the environment if their discharged wastes remain untreated.[15] Pollution from the salmon industry is a particular concern because the salmon industry will continue to grow and expand into marine waters.[16]

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[6] *See id.*

[7] *See id.*

[8] *See id.* at 22.

[9] *See id.*

[10] *See* British Columbia Environmental Assessment Office, *Salmon Aquaculture Review,* Summ. (visited Dec. 16, 1998) <http://www.eao.gov.bc.ca/PROJECT/AQUACULT/SALMON/report/> [hereinafter Environmental Assessment].

[11] *See* Marine Envtl. Consortium v. Department of Ecology, PCHG No. 96–257, 1998 WL 377649,at *8 (Wash. Pol. Control Bd. June 1, 1998); Environmental Assessment, *supra* note 10, at Summ.

[12] *See Marine Envtl. Consortium,* 1998 WL 377649, at *8.

[13] *See* Goldburg & Triplett, *supra* note 2, at 19–20.

[14] *See id.* (citing B.A. Costa-Pierce, Environmental Impacts of Nutrients Discharged from Aquaculture: Towards the Evolution of Sustainable Ecological Aquaculture Systems, Plenary Talk at the Conference on Aquaculture and Water Resource Management, Institute of Aquaculture, University of Stirling, Stirling, Scotland (1994)).

[15] *See id.* at 9.

[16] *See* D. Douglas Hopkins et al., *An Environmental Critique of Government Regulations and Policies for Open Ocean Aquaculture,* 2 Ocean & Coastal L.J. 235, 236 (1997) (stating that "[a]s the industry continues to grow, it will likely expand into the open ocean . . .").

The Environmental Protection Agency (EPA) classifies certain fish farms as point sources[17] that it may regulate under the Clean Water Act (CWA).[18] However, the EPA has not promulgated aquaculture industry effluent limitations[19] for use in setting requirements for National Pollution Discharge Elimination System (NPDES) permits.[20] This lack of federal effluent limitations has led to two undesirable outcomes.[21] First, the lack of effluent limitations discourages the EPA and states from issuing discharge permits[22] because without the limitations they have few guidelines and standards for evaluating permits.[23] Second, the lack of national effluent limitations results in discrepancies between different states' treatment of pollution from fish farms, an outcome contradictory to the general objective of the CWA, which was to establish national standards to reduce water pollution.[24]

Some states do not regulate aquaculture operations in any way, and the fish farms in these states regularly discharge large quantities of untreated fish wastes into their waterways.[25] Furthermore, a recent court case, arising in Washington State and recently brought before the Washington Pollution Control Board, suggests that the current regulations existing in that state do not regulate enough salmon fish farm pollutants, as the proponents in that case argued that escaped salmon should be treated as a pollutant.[26] This case raises two interesting legal questions: first, whether the CWA should regulate escaped

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[17] *See* 40 C.F.R. § 122.24 (1998). Point sources are detectable, single conveyances such as pipes or channels that discharge pollutants into a body of water. *See* 33 U.S.C. § 1362(14) (1994); *infra* notes 184–93 and accompanying text.

[18] *See* 33 U.S.C. § 1362(14); 40 C.F.R. § 122.24.

[19] *See* 40 C.F.R. § 122 app. A. Effluent limitations are EPA-established limits on the concentrations, amounts, and rates of substances that a point source may discharge. *See infra* notes 237–72 and accompanying text.

[20] *See* 40 C.F.R. § 122 app. A (listing industry categories which have effluent limitations that does not include aquaculture).

[21] *See* Goldburg & Triplett, *supra* note 2, at 108–10.

[22] The CWA requires discharge permits for every point source discharging pollutants into bodies of water, and these permits contain limitations on the amount of pollutants released into the water and monitoring requirements, as well as other standard requirements. *See infra* notes 232–36, 273–79 and accompanying text.

[23] *See* Goldburg & Triplett, *supra* note 2, at 108.

[24] *See id.*; 33 U.S.C. §§ 1251(a) (1994) (stating that the objective of the CWA is to revitalize and preserve the health of the Nation's waters), 1311(b)(2)(A) (stating that national effluent limitations will further this goal of healthier waters by reducing the discharge of pollutants).

[25] *See* Goldburg & Triplett, *supra* note 2, at 108–10.

[26] *See generally* Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96–257, 1998 WL 377649, at *1–6 (Wash. Pol. Control Bd. June 1, 1998).

fish, and, second, whether the EPA should set limitations on the numbers of escaped fish from fish farms.[27]

As the EPA has not yet set effluent limitations for fish farms, this Comment suggests that the EPA should draft effluent limitations for salmon fish farms and the aquaculture industry, in general, in order to set a floor to which states and the EPA must adhere in granting discharge permits. These effluent limitations will help decrease the pollution from fish farms as the numbers of such farms increase in the future. Furthermore, this Comment argues that the EPA should change its definition regarding which fish farms constitute point sources in order to regulate currently unregulated fish farms, which are sources of pollution.

This Comment focuses primarily on the salmon aquaculture industry located in coastal waters. Section I discusses the adverse environmental effects of salmon fish farms, including the impacts of waste discharges and escaped salmon. Section II then examines alternatives for reducing pollution from salmon fish farms. Section III explains the CWA and its potential role in regulating waste discharges from salmon fish farms. Section IV details the discrepancies between different states' regulation of various fish farms. Section V discusses the process of creating effluent limitations under the CWA and gives some examples of proposed effluent limitations for fish farms. The concluding section argues that the EPA should implement effluent limitations for salmon fish farms and the aquaculture industry, in general, and alter the definition of an aquaculture point source to effectively regulate pollution from the industry. These effluent limitations should include regulations on escaped salmon from fish farms. Such effluent limitations would provide standards for evaluation and would promote a level of minimum consistency for state and federal regulation of the industry.

I. Adverse Environmental Effects of Salmon Fish Farms

Concern regarding the environmental effects of salmon fish farms arises because salmon fish farms release solid wastes and discharge effluents (wastes released as liquids) directly into bodies of water.[28] This direct discharge of wastes from salmon fish farms is in contrast to land farms where discharges reach water only indirectly—

[27] *See* Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96-257, 1997 WL 394651, at *3 (Wash. Pol. Control Bd. May 27, 1997).

[28] *See* Goldburg & Triplett, *supra* note 2, at 9.

for example, through stormwater runoff.[29] A coastal salmon fish farm typically consists of a group of open mesh net-cages (or netpens) suspended from anchored metal cage frames.[30] Sea water passes freely through the cages carrying untreated wastes away.[31] The openness of floating netpen systems increases their potential for causing environmental degradation.[32] The three main categories of environmental impacts from salmon fish farms are: (1) solid waste and effluent pollution; (2) chemical pollution; and, (3) biological pollution.[33]

A. *Solid Waste and Effluent Pollution*

A salmon aquaculture operation produces solid wastes consisting of excess fish feed and fecal waste.[34] The amount of released waste depends on a number of factors such as the effectiveness of the fish-feeding program, water currents, and the positioning of the netpens.[35] Solid wastes from netpens pose the greatest threat of harm to the environment.[36] These solid wastes, made entirely of organic matter, sink to the ocean floor underneath the netpens.[37] The amount of fish feed that becomes waste in netpens ranges from one to forty percent.[38] The release of these aquaculture effluents results in three outcomes which degrade the environment surrounding the netpens: (1) oxygen depletion in surrounding waters; (2) degradation of benthic (bottom) ecosystems; and, (3) exacerbation of toxic algae blooms.[39]

1. Oxygen Depletion in Surrounding Waters

Biological oxygen demand (BOD) is the measure of the concentrations of organic material in the water that microorganisms are capable of breaking down.[40] High levels of BOD indicate large quantities of organic matter.[41] With high levels of BOD, the microorganisms

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[29] *See id.*

[30] *See* Environmental Assessment, *supra* note 10, at Summ.

[31] *See id.*; GOLDBURG & TRIPLETT, *supra* note 2, at 9.

[32] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 35 (citing Costa-Pierce).

[33] *See generally id.* at 35–62 (discussing and describing the various forms of pollution in aquaculture).

[34] *See id.* at 35.

[35] *See* Environmental Assessment, *supra* note 10, at ch. 7, sec. I.

[36] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 9.

[37] *See id.* at 36.

[38] *See id.* at 35.

[39] *See id.*

[40] *See id.* at 36.

[41] *See id.*

break down organic matter, consuming much of the oxygen in the water in the process.[42] The resulting low levels of oxygen may kill or cause stress to fish and other organisms in the water.[43]

2. Harm to Benthic Ecosystems

The build-up of wastes below the netpens enriches the bottom sediments.[44] At some point the sediment can no longer assimilate the excess nutrients and the sediment becomes oxygen-deficient.[45] Mats of a bacterial mold (*Beggiatoa*) form, indicating that the organic matter is decomposing without oxygen.[46] Sediments that can no longer assimilate nutrients if wastes are not reduced will eventually result in anoxia.[47] Anoxia is the production of hydrogen sulfide and methane gases that are toxic to fish and most organisms.[48] A study of a salmon farm in Puget Sound showed that such benthic impacts extend up to 150 meters from the site of the netpens.[49]

Solid aquaculture wastes, which increase the layers of sediment as they fall, may also result in the smothering of the natural biota.[50] Sediment recovery may occur if the site lies fallow, with fish no longer being raised there.[51] The benthic community below a netpen may recover from the impact of solid wastes in anywhere from a year to a year and a half, and the recovery times for flora may differ from those for fauna.[52] However, full recovery may not be possible for a much longer period of time as high amounts of organic matter may persist in the sediment.[53]

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42 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 36.

43 *See id.*

44 *See id.* at 40; Environmental Assessment, *supra* note 10, at ch. 7, sec. I, pt. A.

45 *See* GOLDBURG & TRIPLETT, *supra* note 1, at 40.

46 *See id.* at 157.

47 *See* Environmental Assessment, *supra* note 10, at ch. 7, sec. I, pt. A.

48 *See id.*; GOLDBURG & TRIPLETT, *supra* note 2, at 40.

49 *See* Donald P. Weston, *Quantitative Examination of Macrobenthic Community Changes Along an Organic Enrichment Gradient*, 61 MARINE ECOLOGY PROGRESS SERIES 233, 241 (1990).

50 *See* Environmental Assessment, *supra* note 10, at ch. 7, sec. I, pt. A.

51 *See id.*

52 *See* GOLDBURG & TRIPLETT, *supra* note 1, at 158; P.J. Johannessen et al., *Macrobenthos: Before, During and After a Fish Farm,* 25 AQUACULTURE AND FISHERIES MGMT. 55, 58, 61 (1994) (detailing the effects of a salmon farm on the benthic environment below the pen).

53 *See* GOLDBURG & TRIPLETT, *supra* note 1, at 158.

3. Toxic Algae Blooms

Salmon farms also discharge effluents, in the form of excess nitrogen and phosphorous excreted by fish in their urine and through their gills.[54] Discharges from the salmon farms along the coast of British Columbia pollute the waters significantly: they discharge the equivalent of the human raw sewage from a city of 500,000 people.[55] High levels of nitrogen and phosphorous in the water can cause eutrophication, the growth of blooms of algae.[56] The nutrients stimulate the growth of algae; however, the altered levels of nutrients in the algae may also make the algae less attractive to the filter-feeding animals that usually consume the algae, resulting in reduced grazing and increased levels of algae.[57] As the algae die, microorganisms use oxygen to degrade the algae resulting in reduced oxygen levels, which can kill fish and other organisms.[58] Some high nutrient concentrations can also trigger blooms of a type of plankton (dinoflagellate) that produces very potent toxins deadly to marine organisms and humans.[59] Studies show that excess nutrients from coastal netpens can stimulate the growth of these toxic blooms.[60]

B. *Chemical Pollution*

Aside from the harmful effects of solid waste and effluent pollution resulting from salmon aquaculture, chemical pollution from salmon fish farms also leads to degradation of the environment.[61] Salmon fish farmers use a variety of chemicals including: antibiotics to control disease, pesticides to control parasites and algae, hormones to commence spawning, and vitamins and minerals to enhance the growth of fish.[62] Because salmon farmers rarely use aquatic pesticides due to prohibitions on their use by the federal government, the chemical pollution most prevalent in salmon aquaculture stems from

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[54] *See id.* at 37.

[55] *See id.* at 9 (indicating that pollution from aquaculture in areas with a significant number of fish farms is of concern because the nutrient pollution, similar to that which a city might discharge, impacts water quality).

[56] *See id.* at 37.

[57] *See* Carl Folke et al., *The Costs of Eutrophication from Salmon Farming: Implications for Policy*, 40 J. ENVTL. MGMT. 173, 175 (1994).

[58] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 37.

[59] *See id.* at 39.

[60] *See* Folke et al., *supra* note 57, at 175.

[61] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 43.

[62] *See id.*

antibiotic use.[63] As with solid wastes and effluents that enter the water directly from the fish farm, distributors place these chemicals directly into the water or into fish food.[64] The chemicals then disseminate into the water and affect the surrounding organisms.[65]

Antibiotics are problematic because at least seventy-five percent of antibiotics given to fish in fish food leach into the environment.[66] The antibiotics distributed to fish eventually bind themselves to particles in the sediment.[67] The antibiotics remain in the sediment for varying amounts of time.[68] The most commonly used antibiotic, oxytetracycline, remains effective for thirty days in the water and the sediment; however, traces remain in the sediment for several months.[69] Furthermore, the antibiotics build up in native fish as the fish eat the aquaculture wastes or absorb them into their bodies.[70] Scientists found native fish with traces of antibiotics as far away as 400 meters from a fish farm site.[71] Antibiotics administered in fish farms can cause death in other aquatic organisms.[72] Other negative effects of antibiotics on aquatic organisms include: (1) adverse effects on the liver; (2) toxic effects on the central nervous system; (3) gastrointestinal irritation; (4) interference in gene transcription in mammalian cells; and, (5) the spread of resistant bacteria to other organisms.[73]

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[63] *See id.* at 43, 46.

[64] *See id.* at 43.

[65] *See id.*

[66] *See id.* at 44.

[67] *See* T.V.R. PILLAY, AQUACULTURE AND THE ENVIRONMENT 68 (1992) [hereinafter PILLAY, ENVIRONMENT].

[68] *See* Environmental Assessment, *supra* note 10, at ch. 7, sec. I (stating that antibiotics can remain in the sediment for up to several months).

[69] *See id.*

[70] *See generally* O.B. Samuelson et al., *Residues of Oxolinic Acid in Wild Fauna Following Medication in Fish Farms,* 12 DISEASES OF AQUATIC ORGANISMS 111, 111–12 (1992).

[71] *See id.* at 117. Finding antibiotic residues in fish 400 meters (approximately 1200 feet) away from a netpen site is significant because it dispels the notion that the effects of aquaculture are only seen directly below a netpen site. In the discussion of the impact of solid wastes on the benthic ecosystem in this text, the effect of solid waste pollution was only seen up to 150 meters away from the netpens, a distance significantly less than the 400 meter mark for the effect of antibiotics. *See supra* note 49 and accompanying text.

[72] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 159.

[73] *See* Samuelson, *supra* note 70, at 116–17. Antibiotics can cause the spread of bacteria to other organisms because fish initially develop resistance to certain antibiotics. This resistance to antibiotics will result in the continued growth of bacteria, and the bacteria will eventually enter the environment through fish feces at which point other organisms may become infected by the bacteria. *See id.*

The use of pesticides by fish farmers is much less frequent than the use of antibiotics.[74] In the United States, only a few antifoulant pesticides, which prevent barnacles and algae from attaching to netpens, are allowed for use in aquaculture because of the harm the pesticides cause to farmed and wild fish and to other organisms.[75] The aquaculture industry has also reduced the amount of antifoulant pesticides released directly into the environment by using netpens made with materials that incorporate antifouling chemicals.[76] However, salmon farms still use pesticides to control parasites such as sea lice.[77] Chemical pesticides are usually applied as a bath, and after the treatment the chemicals are discharged into the environment.[78] The environmental effects of many of these pesticides are largely unknown; however, many of the pesticides are known to be biologically potent at even the lowest levels.[79] One drug, cypermethrin, is toxic to crustaceans and may affect species other than just the targeted sea lice.[80]

C. *Biological Pollution*

Hundreds of genetically distinct populations of salmon make up the salmon species.[81] Each of these genetically differentiated populations adapted to the waters where they hatched and where they spawn.[82] Therefore, the introduction of non-native species of salmon through escape from fish farms causes biological pollution and environmental harm by altering species composition.[83]

Netpen aquaculture is extremely prone to fish escapes.[84] Factors contributing to escapes are poor maintenance of nets, storm damage to netpens, accidents during transfers, boat and seal damage to the nets, and vandalism.[85] In 1996, nearly 100,000 Atlantic salmon escaped from netpens in Washington State.[86] In 1997, 300,000 juvenile

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[74] *See supra* note 63 and accompanying text.

[75] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 46.

[76] *See id.*

[77] *See id.* at 47.

[78] *See id.* at 160.

[79] *See* PILLAY, ENVIRONMENT, *supra* note 67, at 66.

[80] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 145, 160 (stating that the cypermethrin contaminated the aquatic environment and caused mass mortality and sickness in a lobster pound).

[81] *See id.* at 49.

[82] *See id.*

[83] *See id.* (discussing how pollution from aquaculture can be biological in nature).

[84] *See id.* at 10.

[85] *See id.* at 54; Environmental Assessment, *supra* note 10, at ch. 5.

[86] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 10.

and adult salmon escaped from a single Washington State salmon farm.[87] The number of escaping Atlantic salmon is much larger in comparison to the small number of wild native chinook salmon in the same waters.[88] The ecological impacts of escaped salmon consist of the escaped fish feeding on native species, competing with native species for food and space resources, modifying or destroying the habitat of native species, and introducing new diseases and parasites to the native populations.[89] These occurrences may ultimately result in the extinction or displacement of native populations.[90] Scientists believe non-native fish from aquaculture provided a contributing factor in the extinction and endangerment of several native fish species, such as the bonytail and humpback chubs, the desert pupfish, the Gulf sturgeon, and the June and razorback suckers.[91]

The introduction of cultured fish also raises concerns about the genetic impact cultured fish may have on native species.[92] Atlantic and Pacific salmon bred for aquaculture are genetically uniform and exhibit traits of rapid growth, low aggressiveness, and resistance to disease.[93] On the other hand, wild salmon from each local river system are genetically distinct.[94] There is potential for both interbreeding and hybridization between wild and farm salmon.[95] Interbreeding between wild and cultured Pacific salmon alters the genetic make-up of the fish, leaving the wild stock less competitive and less adaptable to

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[87] *See Morning Edition* (National Public Radio broadcast, Feb. 24, 1998), *available in* WL 3306495.

[88] *See* Letter from Dr. Arthur Whiteley, Board Member, Marine Environmental Consortium to the Experts and Lay Witnesses Testifying in an Appeal of a NPDES Permit to Atlantic Salmon Fish Farms 3 (June 4, 1998) (on file with author).

[89] *See* Environmental Assessment, *supra* note 10, at ch. 5, sec. II, tbl. 14; C.C. Krueger & B. May, *Ecological and Genetic Effects of Salmonid Introductions in North America*, 48 (Supp. 1) CAN. J. OF FISHERIES AND AQUATIC SCI., 66, 66 (1991).

[90] *See* Krueger & May, *supra* note 89, at 67.

[91] *See* Dennis R. Lassuy, *Introduced Species as a Factor in Extinction and Endangerment of Native Fish Species*, 15 AM. FISHERIES SOC'Y SYMP., 391, 391, 393–94 (1995) (analyzing the factors cited as reasons for endangerment in the Endangered Species Act fish listings, which include habitat alteration, pollution, and introduced species).

[92] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 53; Environmental Assessment, *supra* note 10, at ch. 5, sec. II, tbl. 14.

[93] *See* D. Gausen & V. Moen, *Large-Scale Escapes of Farmed Atlantic Salmon* (Salmo salar) *into Norwegian Rivers Threaten Natural Populations*, 48 CAN. J. OF FISHERIES AND AQUATIC SCI., 426, 426 (1991).

[94] *See id.* (citing R.L. Saunders, *Atlantic Salmon* (Salmo salar) *Stocks and Management Implications in the Canadian Atlantic Provinces and New England, USA*, 38 CAN. J. OF FISHERIES AND AQUATIC SCI., 1612, 1612–25 (1981)).

[95] *See* Environmental Assessment, *supra* note 10, at ch. 5, sec. II, pt. B.

its surroundings.[96] If large numbers of escapes occur, the chance of genetic damage due to interbreeding between escaped Pacific salmon and wild stocks is high.[97]

Hybridization results from breeding between farm Atlantic salmon and wild Pacific salmon.[98] Scientists have yet to record hybridization between Atlantic salmon and native fish on the Washington coast; however, hybridization may occur in the future since non-native species often need a lengthy period of time to establish themselves and adapt to new surroundings.[99]

Even if hybridization does not occur, the escaped fish could compete with native fish.[100] In Washington, escaped Atlantic salmon have been found to swim in all the Puget Sound drainages.[101] They are learning to feed on natural foods such as salmon eggs and trout.[102] Scientists have seen an escaped Atlantic salmon eating a trout, a pair of salmon defending a site, a female spewing eggs, Atlantic smolts swimming in streams, and Atlantic salmon spawning in rivers.[103]

Scientists in British Columbia have documented escaped Atlantic salmon breeding and establishing new populations.[104] Researchers have also found juvenile naturally-reproduced Atlantic salmon from two different age classes, documenting successful reproduction of escaped salmon in two consecutive years.[105] The establishment of a natural Atlantic salmon population in Pacific waters will result in competition between non-native Atlantic salmon and native Pacific salmon for food and habitat resources, the Atlantic salmon modifying or destroying the habitat of the native Pacific salmon, and the Atlantic

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[96] *See id.* at ch. 5, sec. II, tbl. 14; Gausen & Moen, *supra* note 93, at 426, 428.

[97] *See* Environmental Assessment, *supra* note 10, at ch. 5, sec. II, pt. B.

[98] *See id.* at ch. 5, sec. II, tbl. 14.

[99] *See* Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96–257, 1997 WL 394651, at *5 (Wash. Pol. Control Bd. May 27, 1997).

[100] *See id.*

[101] *See* Letter from Dr. Arthur Whiteley, *supra* note 88, at 3.

[102] *See id.*

[103] *See id.* at 1; Telephone Interview with Dr. Arthur Whiteley, Board Member of the Marine Environmental Consortium (Jan. 8, 1999).

[104] *See* Memorandum of Points and Authorities in Support of Appellant's Motion for Reconsideration of Final Order at 3, Marine Envtl. Consortium v. Department of Ecology, 1998 WL 377649 (Wash. Pol. Control Bd. June 1, 1998) (PCHB No. 96–257) [hereinafter Memorandum of Points]; Letter from Dr. Arthur Whiteley, *supra* note 88, at 1.

[105] *See* Memorandum of Points, *supra* note 104, at 2.

salmon introducing new diseases and parasites to the native populations.[106]

Wild salmon populations also face the threat of the escape of experimental, genetically engineered fish.[107] Transgenic fish receive genes from other fish and organisms, and these alterations produce fish that grow faster and are more resistant to disease.[108] Scientists categorize transgenic fish exhibiting altered traits as non-native fish.[109] Transgenic fish have the potential to harm native populations in the same ways as traditional non-native species.[110] For example, they might win the battle against native populations for food or spawning sites if they contain growth hormone genes making them larger than wild fish.[111] Furthermore, escaped transgenic fish might transfer their genetic material to native populations through breeding, resulting in altered genetics in native populations.[112]

II. Aquaculture Alternatives for Reducing Pollution

The technology exists to reduce the amount of pollution salmon fish farms generate.[113] The most favorable approach to reducing pollution is source reduction—and preventing or reducing the production of pollutants at the farm site.[114] Other options, in decreasing order of effectiveness, consist of recycling and reusing wastes, treating wastes, and lastly disposing of wastes in the environment.[115]

A. *Alterations to Aquaculture Feed*

One source-reduction approach to reducing nutrient pollution is reducing the amount of feed not eaten in aquaculture systems.[116] Increasing the proportion of feed that fish consume and then retain in

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[106] *See supra* note 89 and accompanying text.

[107] *See* Goldburg & Triplett, *supra* note 2, at 55.

[108] *See* Elliot Entis, *Aquabiotech: A Blue Revolution?*, World Aquaculture, March 1997, at 12–15; E. Hallerman & A. Kapuscinski, *Potential Impacts of Transgenic and Genetically Manipulated Fish on Natural Populations: Addressing the Uncertainties Through Field Testing*, *in* Genetic Conservation of Salmonid Fishes 93, 95 (Joseph G. Cloud & Gary H. Thorgaard eds., 1993).

[109] *See* Goldburg & Triplett, *supra* note 2, at 11.

[110] *See id.* at 56.

[111] *See id.*

[112] *See id.*

[113] *See generally id.* at 63–84.

[114] *See id.* at 12–13.

[115] *See* Goldburg & Triplett, *supra* note 2, at 13.

[116] *See id.* at 63–64.

their bodies can significantly lessen the amount of nutrient waste.[117] Similarly, salmon farmers have reduced feed conversion ratios, the efficiency of feed to livestock product, by about fifty percent in the last two decades, which has simultaneously resulted in an eighty percent decrease in discharged solids from fish farms.[118] One way to reduce the feed conversion ratio is to reduce the amount of fishmeal in feed.[119] Fishmeal, in general, contains more phosphorous than fish can absorb, and the fish release the unused phosphorous into the environment in the form of fish wastes and fecal matter.[120] Fish require a large amount of protein in their diets, which is the reason for the frequent use of fishmeal in feed.[121] Potential high-protein substitutes for fishmeal include soybean meal; wheat and corn gluten meal; and, single-cell proteins from algae, fungi, and bacteria.[122] The use of plant proteins in feed reduces the discharge of phosphorous into the environment because plant proteins contain less phosphorous than fishmeal.[123] Using feed that contains less phosphorous has the potential to decrease the amount of phosphorous discharged as effluent by between thirty and eighty percent.[124]

The right composition of feed, characterized by optimized levels of amino acids and high levels of fat, also reduces nitrogen excreted by fish.[125] An extrusion process, whereby fish feed undergoes a treatment of high pressure and heat followed by a quick lowering of pressure, results in feed characterized by enhanced digestibility and high fat levels.[126] The extrusion process also increases the floating time of

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117 *See id.* at 64.

118 *See id.* at 29; J. Lopez Alvarado, *Aquafeeds and the Environment, in* FEEDING TOMORROW'S FISH 275, 285 (A. Tacon & B. Basurco eds., 1997).

119 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 64–65.

120 *See* Gary L. Rumsey, *Fish Meal and Alternate Sources of Protein in Fish Feeds,* 18 FISHERIES 14, 17 (1993) (citing G.H. Ketola, *Effect of Phosphorus in Trout Diets on Water Pollution,* 6 SALMONID 12, 12–15 (1982)).

121 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 64.

122 *See id.* at 64–65.

123 *See id.* at 65; Rumsey, *supra* note 120, at 17.

124 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 65 (citing G.H. Ketola & B.F. Harland, *Influence of Phosphorous in Rainbow Trout Diets on Phosphorous Discharges in Effluent Water,* 122 TRANSACTIONS OF THE AM. FISHERIES SOC'Y 1120, 1120–26 (1993)).

125 *See* Alvarado, *supra* note 118, at 286–87 (explaining that when feeds are deficient in amino acids fish will use the amino acids as a source of energy, resulting in the release of nitrogen, and the use of fat will reduce the amount of protein that fish break down for energy, again reducing the amount of nitrogen released into the environment); GOLDBURG & TRIPLETT, *supra* note 2, at 65.

126 *See* Alvarado, *supra* note 118, at 286; M. Autin, *Commercial Aquafeed Manufacture and Production, in* FEEDING TOMORROW'S FISH, *supra* note 118, at 102.

feed pellets, which wastes less feed as fish have more time to consume the feed before it sinks.[127]

A caveat to using many potential fishmeal substitutes is their high cost and consequent decreased availability.[128] However, the technology is available to produce the substitute feeds.[129] These substitutes can, furthermore, become competitive if restrictions on nutrient pollution from netpens are imposed, if fishmeal prices rise due to the continued decline of natural fisheries, and/or if the prices of plant proteins decrease.[130]

Several other technological innovations are available to reduce feed waste.[131] One example is an ultrasonic waste feed controller which uses a computer to detect when feed is reaching the bottom of a netpen and halts the feeding.[132] An air-lift pipe system is another alternative technology that collects uneaten feed from mesh nets that form the bottoms of netpens.[133]

B. *Polyculture*

Polyculture consists of raising more than one species in a single location, possibly combining fish, bivalves (shellfish), or plants.[134] Plants and bivalves effectively remove nutrients discharged by aquaculture operations.[135] The specific form of polyculture utilized in marine waters consists of seaweed, bivalves, and marine finfish.[136] The seaweed absorbs the excess nutrients from the fish, and the bivalves consume the nutrient-induced excess phytoplankton growth.[137] Fish farms in the United States are experimenting with seaweed aquaculture.[138] One commercial producer of nori seaweed observed greater

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127 *See* Charles C. Botting, *Extrusion Technology in Aquaculture Feed Processing*, *in* PROCEEDINGS OF THE AQUACULTURE FEED PROCESSING AND NUTRITION WORKSHOP 129, 130 (Dean M. Akiuama & Ronnie K.H. Tan eds., 1991).

128 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 64.

129 *See generally* Ronald W. Hardy, *Sustainable Aquaculture and Aquatic Feeds*, AQUACULTURE MAG., Mar./Apr. 1997, at 72–77 (detailing innovations in utilizing soybeans and gluten products to produce salmon feeds).

130 *See id.* at 74 (describing limiting factors on the use of substitute feeds).

131 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 66.

132 *See id.*

133 *See* Alvarado, *supra* note 118, at 283.

134 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 67–68.

135 *See id.* at 68.

136 *See id.* at 69.

137 *See id.*

138 *See id.*

growth rates of the seaweed when grown near salmon netpens.[139] Another possible polyculture combination under study is sea scallops growing together with salmon.[140]

However, barriers and disadvantages to polyculture operations exist.[141] The operation of a polyculture system necessitates extra labor and certain skills to discern the correct combinations and numbers of species that should grow together.[142] Furthermore, the market demand for each of the species in a polyculture operation may be low, thereby limiting their profitability.[143] Lastly, raising fish alone may lead to higher production rates of fish than when raising multiple species together, making polyculture a less cost-effective option for fish farmers.[144]

C. *Reducing Use of Chemicals*

The use of preventive measures such as vaccines to increase fish resistance to disease leads to decreased use of drugs to treat sickness in fish.[145] Vaccination appears to be a very satisfactory way to prevent certain diseases in aquaculture.[146] Fish receive vaccines either orally, by injection, or by absorption through the skin.[147] Many vaccines are available for salmon: the United States has licensed fourteen vaccines for use with salmon.[148] The negative aspects of vaccines are their expense and the skill required in dispensing them.[149]

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139 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 69.

140 *See id.* at 69–70 (citing NEW ENGLAND FISHERIES DEV. ASS'N, POLYCULTURE OF SEA SCALLOPS SUSPENDED FROM SALMON NET PENS (1996)).

141 *See* T.V.R. PILLAY, AQUACULTURE DEVELOPMENT: PROGRESS AND PROSPECTS 73–74 (1994).

142 *See id.*

143 *See id.* at 74.

144 *See id.*

145 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 72.

146 *See id.*

147 *See* James W. Avault, Jr., *Prevention of Disease, Some Fundamentals Reviewed,* AQUACULTURE MAG., Mar./Apr. 1997, at 81.

148 *See* OFFICE OF TECHNOLOGY ASSESSMENT, CONGRESS OF THE UNITED STATES, SELECTED TECHNOLOGY IN U.S. AQUACULTURE 10 (1995) (citing Joint Subcommittee on Aquaculture, U.S. Department of Agriculture, Guide to Drug, Vaccine, and Pesticide Use in Aquaculture (1994)).

149 *See* FRED P. MEYER, HEALTH AND DISEASE IN AQUACULTURE: SCIENCE, TECHNOLOGY, AND THE FEDERAL ROLE, 26 (citing Office of Technology Assessment, *Current Status of Federal Involvement in U.S. Aquaculture* OTA-BP-ENV-170, and *Selected Technology Issues in U.S. Aquaculture* OTA-BP-ENV-171, Oct. 1995).

Certain practices in aquaculture also reduce the use of pesticides.[150] Salmon farms may utilize netpens made from plastic with antifouling chemicals to reduce the incidence of barnacles and algae attaching to and harming the netpens.[151] Cages made with this special plastic release less antifoulant pesticides than if the farmers themselves spread the chemicals.[152]

Salmon netpen farms also have several alternatives for reducing the level of sea lice parasites without the use of chemicals.[153] Selecting sites with strong water currents and allowing the sites to lie fallow between crops can aid in reducing levels of sea lice.[154] An alternative biological control to reduce sea lice is the wrasse, a small fish that eats lice off of salmon.[155] In one study, keeping 26,000 salmon clean of lice required just 600 wrasse.[156] In the same study, the netpens not utilizing wrasse necessitated several chemical treatments to remove lice.[157] A benefit of using wrasse is that salmon raised in European fish farms that use wrasse show signs of increased growth rates in comparison to salmon treated with chemicals.[158] Although wrasse are expensive, treating cages with pesticides may be equally if not more expensive.[159] Other potential downsides to using wrasse are that they often die in the winter and that they require the use of smaller mesh nets to prevent their escaping from the salmon cages.[160]

One effective alternative to wrasse is the use of onions: one fish farmer in Britain solved his sea lice infestation problem by throwing seven kilograms of onions into his fish cage every week.[161] The reason why salmon become lice-free when onions are introduced is not yet

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150 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 73.

151 *See* ROBERT R. STICKNEY, PRINCIPLES OF AQUACULTURE 76–77 (1994) [hereinafter STICKNEY, PRINCIPLES]; GOLDBURG & TRIPLETT, *supra* note 2, at 74.

152 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 74 (citing Interview with J. McGonigle, Maine Aquaculture Association).

153 *See* Stewart C. Johnson et al., *Crustacean and Helminth Parasites of Seawater-Reared Salmonids*, AQUACULTURE MAG., Mar./Apr. 1997, at 48.

154 *See id.*

155 *See id.* at 50; OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 148, at 18, box 2–3.

156 *See* Stephanie Pain, *Salmon Farmers Put 'Cleaner Fish' on the Payroll*, NEW SCIENTIST, Oct. 21, 1989, at 35.

157 *See id.*

158 *See* Johnson, *supra* note 153, at 50.

159 *See* Pain, *supra* note 156, at 35.

160 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 74; Stephen L. Ott, *Onions May Replace Insecticides for Some British Fish Farmers*, FOODREVIEW, Oct.-Dec. 1991, at 20.

161 *See* Ott, *supra* note 160, at 20.

clear.[162] However, onions contain phenolic compounds, already known to be toxic to fungi, that might also be toxic to sea lice.[163]

D. *Reducing Biological Pollution*

The most effective way to prevent fish escapes is to avoid the use of open netpen systems.[164] Still, alterations can be made to open netpens to reduce the number of fish escapes.[165] Anchoring the netpens with heavy moorings to help prevent storm damage, for example, reduces potential escapes.[166]

An alternative technology to prevent biological and nutrient pollution is the closed circulating marine system with a closed-wall cage.[167] This system simulates the floating netpen, but instead of using nets the tank is made with an impermeable membrane.[168] The system also has a pump directing water into the cage and back out on the opposite side.[169] These closed-wall cages have the potential to include a solid waste collection component.[170] The major environmental benefits of the closed-wall system are its ability to collect solid wastes and eliminate fish escapes.[171] These closed systems are becoming technically feasible for growing salmon.[172] However, commercial feasibility is not yet determinable due to the necessity of further development and improvement of the effectiveness of the system.[173]

In addition to containment of fish, the use of reproductively sterile fish reduces the biological pollution associated with escaped fish.[174] Escaped sterile fish will not interbreed with wild fish or establish their

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162 *See id.*

163 *See id.*

164 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 76. The alternatives to using netpens that enable fish containment include using closed systems on land or using more secured systems with walls in coastal operations. *See id.*; Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96-257, 1998 WL 377649, at *2 (Wash. Pol. Control Bd. June 1, 1998); *infra* notes 167–73 and accompanying text.

165 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 76.

166 *See id.*; Gausen & Moen, *supra* note 93, at 426 (stating that cages' movement due to a loss of moorings is an accident resulting in salmon escapes).

167 *See* Environmental Assessment, *supra* note 10, at ch. 11, sec. III.

168 *See id.*

169 *See id.*

170 *See id.*

171 *See id.*

172 *See* Environmental Assessment, *supra* note 10, at ch. 11, sec. III.

173 *See id.* As this Comment focuses on coastal aquaculture, it will not explore offshore and land-based saltwater systems that constitute other alternatives to raising salmon, each with its own costs and benefits. *See id.* at ch. 11, secs. II, IV.

174 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 77.

own populations.[175] A benefit of sterile fish is that they may grow larger than non-sterile fish as they use their energy for size and weight gain rather than for sexual development.[176] The sterilization process is also inexpensive and readily available.[177] Many organizations such as the Atlantic Salmon Federation, the Conservation Council of New Brunswick, and the International Council for Exploration of the Sea's Study Group on Genetic Risks to Atlantic Salmon Stocks recommend using sterile salmon in aquaculture.[178] However, the techniques used to render fish sterile are not always 100% effective.[179]

III. The Clean Water Act

Although many alternatives exist to lessen the pollution that fish farms release, the use of these alternatives by fish farmers has remained minimal due to the limited standards for regulation of aquaculture under the Clean Water Act (CWA).[180] The primary purpose of the CWA is "to restore and maintain the chemical, physical and biological integrity of the Nation's waters."[181] Congress, responding to the nation's need for clean water supplies, passed the CWA to create a means by which to reduce the amount of water pollution nationwide.[182] In order to correct the water pollution problem, Congress prohibited the discharge of pollutants into navigable waters unless such discharges are in compliance with federal law.[183] The CWA defines the term "discharge of pollutants" to mean "any addition of any pollutant to navigable waters from any point source."[184] Federal and state permits under the National Pollution Elimination Discharge

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[175] *See id.*

[176] *See* David J. Harvey, *Aquaculture: A Diverse Industry Poised for Growth,* FOOD REVIEW, Oct.-Dec. 1991, at 23.

[177] *See* Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96–257, 1998 WL 377649, at *3 (Wash. Pol. Control Bd. June 1, 1998).

[178] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 77, 146 (citing INTERNATIONAL COUNCIL FOR EXPLORATION OF THE SEA, REPORT OF THE STUDY GROUP OF GENETIC RISKS TO ATLANTIC SALMON STOCKS (1991)).

[179] *See* OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 148, at 30 (stating that sterility in finfish appears to be 94–100% effective).

[180] *See supra* note 23 and accompanying text. Stricter regulations will propel the use of such technologies to enable compliance with the regulations. *See supra* note 130 and accompanying text.

[181] 33 U.S.C. § 1251(a) (1994).

[182] *See* Jeff L. Todd, Note, *Environmental Law: The Clean Water Act—Understanding When a Concentrated Animal Feeding Operation Should Obtain an NPDES Permit,* 49 OKLA. L. REV. 481, 482–83 (1996).

[183] *See* 33 U.S.C. § 1311(a).

[184] *Id.* § 1362(12).

System (NPDES) control point sources of pollution.[185] To determine whether a certain source requires a NPDES permit, courts use a test based on the statutory definition of "discharge of pollutants."[186] A permit is required when a pollutant is added to navigable waters[187] from a point source.[188] The "point source," "pollutant," and "added" elements of this test are explored in the sections below.

A. *Sources Requiring NPDES Permits*

1. Point and Nonpoint Sources

The CWA divides pollution sources into two categories: "point sources"[189] and "nonpoint sources."[190] The term point source signifies the dividing line categorizing those discharges that the CWA can regulate and those that it cannot.[191] The statute defines a point source as "any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged."[192] Nonpoint sources are defined as those sources not traceable to a single conveyance.[193]

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[185] *See* National Wildlife Fed'n v. Consumers Power Co., 862 F.2d 580, 582 (6th Cir. 1988) (describing the procedures for controlling pollution under the CWA).

[186] *See* National Wildlife Fed'n v. Gorsuch, 693 F.2d 156, 165 (D.C. Cir. 1982); *Consumers Power*, 862 F.2d at 583.

[187] *See* 33 U.S.C. § 1362(7) (1994). "The term 'navigable waters' means the waters of the United States including the territorial seas." *Id.* "The term 'territorial seas' means the belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending a distance of three miles." *Id.* § 1362(8). Most coastal aquaculture establishments are within this territorial seas category and thereby fall within state and federal jurisdiction. *See* Hopkins et al., *supra* note 16, at 236 (discussing the lack of regulation for aquaculture beyond the territorial seas in the open ocean).

[188] *See Gorsuch*, 693 F.2d at 165 (utilizing the test to determine whether dams are required to obtain NPDES permits); *Consumers Power*, 862 F.2d at 583.

[189] *See* 33 U.S.C. § 1362(14); *infra* note 192 and accompanying text.

[190] *See Gorsuch*, 693 F.2d at 165–66; 33 U.S.C. § 1288(b)(2)(F) (exemplifying the way in which the CWA and its corresponding regulations refer to nonpoint sources; however a definition of the term is not provided in the statute).

[191] *See* 2 SHELDON M. NOVICK ET AL., LAW OF ENVIRONMENTAL PROTECTION § 12.05[1][b] at 12–51 (1998). "If one's pollutants end up in 'navigable waters' but not by means of a 'point source,' one's activities are not regulated directly under the [CWA]." *Id.*

[192] 33 U.S.C. § 1362(14) (1994).

[193] *See* WILLIAM H. RODGERS, JR., HANDBOOK ON ENVIRONMENTAL LAW, § 4.4, at 375 (1977); S. Rep. No.92–414, at 212 (1972), reprinted in 1972 U.S.C.C.A.N. 3668, 3760. Senator Bob Dole defined a nonpoint source as "one that does not confine its polluting

The EPA has determined that certain fish farms are concentrated aquatic animal production facilities (CAAPF), which are point sources requiring NPDES permits.[194] A CAAPF includes a hatchery, a fish farm, any other facility that grows or contains aquatic organisms in a group of categories defined in the regulations, or a facility that the EPA Director designates as a CAAPF.[195] Any fish farm or facility that is a CAAPF must obtain a NPDES permit.[196] The regulations make a distinction between cold and warm water fish facilities.[197] Cold water fish facilities, including salmon fish farms, requiring a NPDES permit are those facilities that discharge pollutants at least thirty days per year, and produce at least 20,000 pounds of aquatic animals per year or feed at least 5000 pounds of food during the month with the greatest feeding.[198]

Currently all of the thirty-three salmon fish farms in the United States (eight in Washington State and twenty-five in Maine)[199] meet the requirements of a CAAPF as the average salmon fish farm continuously discharges pollutants and produces approximately twenty-five tons (50,000 pounds) of aquatic animals per year.[200] Many of the salmon fish farms in Maine applied to the EPA for the required NPDES permits, but the EPA has issued few of these permits due to the lack of standards and policy regarding salmon aquaculture.[201] Washington State has granted permits to its salmon fish farms, but the requirements of these permits are not very strict.[202] Moreover, the CAAPF categorization does not apply to all other fish farms. For example, the entire catfish industry is exempt from the provision because catfish farms do not discharge pollutants on more than thirty days per year.[203]

The Regulations also have a provision for case-by-case designation by the EPA Director of a facility as a CAAPF.[204] The Director may

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discharge to one fairly specific outlet, such as a sewer pipe, a drainage ditch or a conduit. . . ." *Id.*

[194] *See* 40 C.F.R. §§ 122.1(b)(2)(ii), 122.24 (1998).

[195] *See id.* §§ 122 app. C, 122.24(b).

[196] *See id.* § 122.24(a).

[197] *See id.* § 122 app. C(a), (b).

[198] *See id.* § 122 app. C(a).

[199] *See* John Fleischman, *Muddying the Waters: Perils of Fish Farming*, AUDUBON, Mar.-Apr. 1997, at 68.

[200] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 134.

[201] *See id.* at 156.

[202] *See infra* notes 296–98 and accompanying text.

[203] *See infra* notes 284–90 and accompanying text.

[204] *See* 40 C.F.R. § 122.24(c) (1998).

name any cold or warm water fish farm or other facility as a CAAPF if she decides that the facility adds significant amounts of pollution to waters of the United States.[205] The Director, in assessing whether to designate a facility as a CAAPF, must evaluate: (1) the location and quality of the waters receiving the pollution; (2) the numbers of organisms the facility can hold, feed, and produce; (3) the amount and characteristics of the pollutants entering the receiving waters; and, (4) any other relevant factors in making the CAAPF designation.[206] The owner of a case-by-case designated CAAPF will not need to apply for a permit until the Director has made an on-site inspection of the facility and determined that the facility requires regulation through a NPDES permit.[207]

A separate Regulation deals specifically with the discharges of chemical pollutants, such as antibiotics or pesticides, into an aquaculture project.[208] The Regulation defines an aquaculture project as "a defined managed water area which uses discharges of pollutants into that designated area for the maintenance or production of harvestable freshwater, estuarine, or marine plants or animals."[209] All aquaculture projects that discharge chemical pollutants require a NPDES permit to regulate the discharged chemicals.[210]

2. "Pollutant"

The CWA defines "pollutant" as "dredged spoil, *solid waste,* incinerator residue, sewage, garbage, sewage sludge, munitions, *chemical wastes, biological materials,* radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and *industrial,* municipal, *and agricultural waste* discharged into water."[211] The CWA extends to both animate and inanimate pollutants.[212] The statute, for example, regulates fecal coliform (living bacteria) as conventional pollutants.[213]

The chemical and solid wastes associated with fish farming appear to fall within the definition of pollutants, yet the CWA does not

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[205] *See id.* § 122.24(c)(1).

[206] *See id.* § 122.24(c)(1)(i)-(iv).

[207] *See id.* § 122.24(c)(2).

[208] *See* 33 U.S.C. § 1328 (1994); 40 C.F.R. § 122.25.

[209] 40 C.F.R. § 122.25(b).

[210] *See id.* § 122.25(a).

[211] 33 U.S.C. § 1362(6).

[212] *See* Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96-257, 1997 WL 394651, at *4 (Wash. Pol. Control Bd. May 27, 1997).

[213] *See* 33 U.S.C. § 1314(a)(4).

define "biological materials."[214] Courts have interpreted "biological materials" broadly to include "live fish, dead fish and fish remains."[215] One court stated, "[f]ish . . . constitute biological materials, and therefore clearly fall within the definition given in [the CWA]."[216] The Washington Pollution Control Board has also found that escaped salmon are "agricultural or industrial waste," another statutory example of the definition of pollutant.[217] As the federal government also considers aquaculture to be a form of agriculture, escaped salmon may similarly be treated as agricultural or industrial waste under the CWA.[218]

3. "Added"

The CWA does not define the word "added," although courts have reviewed the EPA's definition of the word.[219] A pollutant is deemed "added" when a point source "physically introduces a pollutant into water from the outside world."[220] To be added into the water, a pollutant, therefore, must be introduced into the water from outside the water.[221]

In *National Wildlife Federation v. Consumers Power Co.*, the Sixth Circuit held that a hydro-electric facility's release of dead fish and fish parts did not violate the CWA.[222] While the EPA acknowledged, in *Consumers Power*, that dead fish were pollutants, it also maintained that only a pollutant introduced into water from the outside world is "added" to the water.[223] Similarly, the defendant, Consumers Power

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214 *See Marine Envtl. Consortium*, 1997 WL 394651, at *4 (discussing the meaning of the term biological pollution and determining that salmon fall within the meaning of biological pollutant).

215 National Wildlife Fed'n v. Consumers Power Co., 862 F.2d 580, 583 (6th Cir. 1988); *see* Association of Pac. Fisheries v. EPA, 615 F.2d 794, 802 (9th Cir. 1980) (determining that fish residuals in water discharged from seafood processing plants are pollutants).

216 National Wildlife Fed'n v. Consumers Power Co., 657 F. Supp.fl989, 1007 (W.D. Mich. 1987).

217 WASH. REV. CODE ANN. § 15.85.010 (West 1998).

218 *See* ROBERT R. STICKNEY, AQUACULTURE IN THE UNITED STATES: A HISTORICAL SURVEY 228 (1996) (stating that the Department of Agriculture was involved in the aquaculture industry in the late 1970s and that it controlled the specific area of inland species which were of commercial interest) [hereinafter STICKNEY, HISTORICAL SURVEY]; 33 U.S.C. § 1362(6).

219 *See Consumers Power*, 862 F.2d at 584–87; National Wildlife Fed'n v. Gorsuch, 693 F.2d 156, 174–77 (D.C. Cir. 1982) (holding that the EPA has the discretion to define the term "added").

220 *Gorsuch*, 693 F.2d at 175; *see Consumers Power*, 862 F.2d at 584.

221 *See Consumers Power*, 862 F.2d at 588–89; *Gorsuch*, 693 F.2d at 174–75.

222 *See Consumers Power*, 862 F.2d at 581.

223 *See id.* at 585, 588–89.

Company, argued in the case that there was no addition of a pollutant because the fish were already in the water.[224] In deferring to the EPA's interpretation, the Sixth Circuit held that as the fish never left the water, the plant did not add a pollutant when it removed the water, crushed the fish, and released the fish and water back into Lake Michigan.[225]

The court in *Consumers Power* did not consider the return of dead fish and fish parts to the water by a hydro-electric facility to constitute an "addition of a pollutant."[226] By contrast, seafood processors are deemed to add pollutants to the water when they release dead fish and fish parts back into the water.[227] Fishermen first remove the fish from the water, the seafood processors then process the fish, and finally the seafood processors discharge the fish wastes into the water.[228] The EPA signified its belief that the fish wastes were pollutants added to the water by issuing effluent guidelines covering the seafood processors' discharges.[229] Thus, the contrast between the two settings reveals that the CWA has not been utilized to regulate dead fish and fish parts in one context (when discharged by hydro-electric facilities), but has been employed to regulate them in another (when discharged by seafood processors).[230] The EPA explains this seemingly artificial distinction by noting that the seafood processors actually remove the fish from the water and later introduce the dead fish and fish parts into the water as waste, whereas the hydro-electric facility never technically removes the fish from the water.[231]

B. *NPDES Permits*

The CWA reflects Congress's determination that the most effective regulation method for point source discharges was the NPDES mandatory permit program.[232] The NPDES program requires that every point source discharging pollutants into the waters of the

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[224] *See* National Wildlife Fed'n v. Consumers Power Co., 657 F. Supp. 989, 1008 (W.D. Mich. 1987).

[225] *See* National Wildlife Fed'n v. Consumers Power Co., 862 F.2d at 585 (6th Cir. 1988).

[226] *See id.*

[227] *See id.*

[228] *See id.*

[229] *See* 40 C.F.R. § 408 (1998); *see also* Association of Pac. Fisheries v. EPA, 615 F.2d 794, 801 (9th Cir. 1980) (ruling on a challenge to the seafood processors' effluent guidelines).

[230] *See Consumers Power*, 862 F.2d at 585.

[231] *See id.* at 585–86.

[232] *See* 33 U.S.C. § 1342 (1994).

United States obtain a permit.[233] The NPDES program mandates conditions and standards of quality, often in the form of effluent limitations, to insure that all point sources comply with the CWA.[234] Congress granted the EPA the authority to administer the NPDES program.[235] However, state pollution control agencies may issue NPDES permits upon approval by the EPA.[236]

1. Effluent Limitations

The CWA imposes effluent limitations through two avenues: technology-based standards and water quality-based standards.[237] Permits for discharges in certain industries must contain EPA-established limits based on uniform technology-based effluent limitation guidelines.[238] The CWA authorizes the EPA Administrator to establish effluent limitation guidelines.[239] These guidelines reflect the pollution reduction that a certain technology can attain and thereby limit the quantity of pollutants that a source may release.[240] These effluent limitations, often expressed numerically, represent exact restrictions on discharges and limit the concentrations, amounts, and rates of substances that a point source may discharge.[241] The regulations also place limits on certain pollution measurement parameters such as pH and biochemical oxygen demand (BOD).[242] BOD, for example, measures the amount of organic matter in the water, indicating the biological pollution in the water.[243]

The standards utilized to determine technology-based effluent limitations will depend on what type of pollutant is involved: toxic,

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[233] *See id.* § 1342(a)(1).

[234] *See generally* Kristy A. Niehaus, *Clean Water Act Permitting: The NPDES Program at Fifteen*, 2 NAT. RESOURCES & ENV'T 16 (1987) (explaining the NPDES permitting process and relevant terminology).

[235] *See* 33 U.S.C. § 1251(d).

[236] *See id.* § 1342(b).

[237] *See id.* §§ 1311(b)(1)(A)-(C), (b)(2)(E), 1312(a).

[238] *See* Niehaus, *supra* note 234, at 19.

[239] *See* 33 U.S.C. § 1314(b)(2) (1994); *see also* E.I. du Pont de Nemours & Co. v. Train, 430 U.S. 112, 112–14 (1977) (upholding the Administrator's authority to issue the 1977 effluent limitations).

[240] *See* Niehaus, *supra* note 234, at 19.

[241] *See* 33 U.S.C. § 1362(11) (defining "effluent limitation" as "any restriction established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters . . .").

[242] *See* Natural Resources Defense Council, Inc. v. EPA, 822 F.2d 104, 111 (D.C. Cir. 1987) (discussing the various effluent limitations used in discharge permits).

[243] *See id.*; *supra* Section I(A)(1).

conventional, or nonconventional.[244] The CWA defines toxic pollutants as:

> those pollutants, or combinations of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the Administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring.[245]

Conventional pollutants include "pollutants classified as biological oxygen demanding, suspended solids [TSS], fecal coliform and pH."[246] Pollutants that are neither conventional nor toxic are nonconventional pollutants.[247] Some examples of nonconventional pollutants include ammonia, chlorine, color, and iron.[248] The EPA has also designated settleable solids as a nonconventional pollutant because Congress did not assign them as either a toxic or a conventional pollutant.[249]

The limitations on toxic pollutants and existing nonconventional pollutants reflect the reduction in discharge achievable through the "application of the best available technology economically achievable (BAT)."[250] Congress, in establishing the BAT standard, intended that the EPA use the most up-to-date technology and scientific research in setting effluent limitations.[251] Therefore, the EPA, in setting BAT limits, looks to the emission limitations achieved by the "optimally operating" member of an industry.[252] Furthermore, in basing effluent limitations on BAT limits, the EPA must show that the technology is available and that the cost of attaining the limitations is achievable.

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[244] *See* 33 U.S.C. § 1311(b)(2)(A)-(E).

[245] *Id.* § 1362(13).

[246] *Id.* § 1314(a)(4).

[247] *See Natural Resources Defense Council*, 822 F.2d at 110 n.5.

[248] *See* ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 523 (2d ed. 1998).

[249] *See* Rybachek v. EPA, 904 F.2d 1276, 1292 (9th Cir. 1990).

[250] 33 U.S.C. § 1311(b)(2)(A) (1994).

[251] *See* Kennecott v. EPA, 780 F.2d 445, 448 (4th Cir. 1985).

[252] *See id.*

However, no formal comparative cost-benefit analysis is necessary.[253] The CWA, however, allows for modifications of the effluent limitations upon a showing that a point source is not economically capable of adhering to the required limitations.[254] In establishing effluent limitations in the case of toxic pollutants, the EPA must also consider:

> the toxicity of the pollutant, its persistence, degradability, the usual or potential presence of the affected organisms in any waters, the importance of the affected organisms and the nature and extent of the effect of the toxic pollutant on such organisms, and the extent to which effective control is being or may be achieved under other regulatory authority.[255]

Effluent reductions of conventional pollutants are to reflect the application of the "best conventional pollutant control technology (BCT)" standards.[256] In setting BCT limits, the EPA will look at the average effluent limitations achievable by a group of optimally performing members of an industry.[257] BCT assessments also include two cost tests: first, an examination of the relationship between the costs of reducing discharges of conventional pollutants and the resulting benefits the water derives from the reductions, and, second, a comparison of the cost to that of how much municipal treatment works would pay to treat the same discharges.[258]

Three significant differences can be seen to exist between BAT and BCT assessments. First, the two assessments set effluent limitations for different pollutants: BAT targets toxic and nonconventional

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[253] *See* Association of Pac. Fisheries v. EPA, 615 F.2d 794, 816 (9th Cir. 1980); PLATER ET AL., *supra* note 248, at 521; Sharon Elliot, Note, *Citizen Suits Under the Clean Water Act: Waiting for Godot in the Fifth Circuit*, 62 TUL. L. REV. 175, 178–79 (1987).

[254] *See* 33 U.S.C. § 1311(c).

[255] *Id.* § 1317(a)(2).

[256] *Id.* § 1311(b)(2)(E).

[257] *See* Karen M. Wardzinski et al., *Water Pollution Control under the National Pollutant Discharge Elimination System*, *in* THE CLEAN WATER ACT HANDBOOK 8, 17 (Parthenia B. Evans ed., 1994). BPT (best practicable control technology currently available) is the threshold level of control for all conventional pollutants. *See id.* BCT assessment of conventional pollutants is a more stringent standard than BPT, but the two assessments share the requirement of looking at a group of the best performers in an industry. *See id.* The evaluations of the two technologies differ because BPT has a more limited cost analysis as compared to BCT. *See id.* at 17–18; *infra* note 258 and accompanying text.

[258] *See* 33 U.S.C. § 1314(b)(4)(B) (1994); *see also* Wardzinski et al., *supra* note 257, at 18–19 (describing in detail the two cost analyses in the BCT assessment: the first in this text is the "industry cost-effectiveness test" and the second is the "POTW cost-comparison test").

pollutants, while BCT targets conventional pollutants.[259] Second, cost plays a lesser role in setting BAT limits than in setting BCT limits.[260] BCT requires a formal cost-benefit analysis whereas BAT requires addressing cost as a factor in the assessment, but to a lesser degree than a cost-benefit analysis.[261] Lastly, the BAT and BCT analyses look at different subsets of members of an industry to determine achievable effluent limitations.[262] BAT looks to the single member of an industry achieving the greatest effluent limitations whereas BCT examines only the average limitations attainable by a group of optimally operating members of an industry.[263] On the whole, BAT results in more stringent standards because cost plays a small role in the assessment of available technologies, as the cost test requires no formal cost-benefit analysis, and the effluent limitations are based on the single, optimally operating member of an industry rather than an average of a group of members.[264] However, both of the above technology standards are performance standards, meaning that the permittee must achieve certain limitations, but the CWA does not require a permittee to use a specific, designated technology to do so.[265] Rather, a permittee can utilize any technology to meet the effluent limitations.[266]

Water quality-based standards impose effluent limitations on point sources based on the amounts and kinds of pollutants in the water into which the point source discharges.[267] In general, these standards are created, interpreted, and enforced by state officials rather than by EPA officials.[268] These limitations supplement technology-based standards and protect specific bodies of water, ensuring that a body of water maintains a quality level that protects human health and the environment.[269] In the event that the technology-based standards are insufficient to make a body of water available for its intended uses, the EPA or states are to create water-quality based limita-

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[259] *See supra* notes 250, 256 and accompanying text.

[260] *See* Association of Pac. Fisheries v. EPA, 615 F.2d 794, 817–18 (9th Cir. 1980).

[261] *See supra* notes 253, 258 and accompanying text.

[262] *See supra* notes 252, 257 and accompanying text.

[263] *See id.*

[264] *See* Kennecott v. EPA, 780 F.2d 445, 448 (4th Cir. 1985); *supra* notes 244–63 and accompanying text.

[265] *See* PLATER ET AL., *supra* note 248, at 502 n.2.

[266] *See id.*

[267] *See* 33 U.S.C. § 1312(a) (1994).

[268] *See* WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW, § 4.7(A)(1), at 342–43 (2d ed. 1994).

[269] *See* 33 U.S.C. § 1312(a) (1994).

tions to achieve water quality enhancements.[270] The standards, representing the legally permissible amounts of pollutants allowed in a specific body of water, may either be quantitative or descriptive and are specific to a particular body of water.[271] Descriptive standards often refer to the appearance of the water.[272]

2. Permit Terms

Permit terms for a specific source will vary depending on whether the EPA or the state is the permit-issuer, and on the individual characteristics of the discharge and source.[273] The EPA, however, has established specific minimum requirements for all permits.[274] The permits all contain a number of boilerplate terms including, among others, requirements to mitigate violations, to allow EPA officials to inspect the facility, and to monitor and report one's activities.[275] Also, the typical permit requires that the permittee test its discharges at regular intervals to assess the quantity of discharged pollutants.[276] Most permits will also contain particular requirements concerning a specific discharger.[277] The permit adapts the effluent limitations to individual sources by setting specific discharge limitations to which individual sources must adhere.[278] The terms and conditions of the permit will include these calculated numerical requirements.[279] In the event that the EPA has not set effluent limitations, the CWA calls for the permit issuer (either the EPA or a state) to establish limitations on a case-by-case basis according to the permit issuer's best professional judgment.[280] Both the state and the EPA, when establishing these lim-

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[270] *See id.*

[271] *See* RODGERS, *supra* note 268, § 4.7(A)(1), at 343.

[272] *See id.* at 343–44. One example of a descriptive standard is "surface waters must be 'free from floating debris, scum and other floating materials attributable to municipal, industrial or other discharges. . . .'" *Id.* at 343 (citing U.S. EPA, GUIDELINES FOR DEVELOPING OR REVISING WATER QUALITY STANDARDS UNDER THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972, at 23 (1973)).

[273] *See* Niehaus, *supra* note 234, at 19.

[274] *See id.*

[275] *See id.*

[276] *See* 40 C.F.R. § 122.41(j) (1998).

[277] *See* Niehaus, *supra* note 234, at 19.

[278] *See* Elliot, *supra* note 253, at 179.

[279] *See* Natural Resources Defense Council, Inc. v. Costle, 568 F.2d 1369, 1378 (D.C. Cir. 1977). The EPA asserts that "[a]n effluent limitation must be a precise number in order for it to be an effective regulatory tool; both the discharger and the regulatory agency need to have an identifiable standard upon which to determine whether the facility is in compliance." *Id.*

[280] *See* Niehaus, *supra* note 234, at 19.

its, must take into account the same standards the EPA considers in setting national effluent limitation guidelines.[281]

IV. Different States' Treatment of Fish Farms

As mentioned earlier, the lack of national effluent limitations results in differences among states in regulating pollution from fish farms.[282] These differences in treatment stem from the states' decisions to use different water quality standards to regulate aquaculture within their borders.[283]

A. *Variations Between States*

Mississippi and Arkansas are examples of states that do not regulate a sector of their aquaculture industries: their catfish aquaculture operations.[284] Both states decided not to regulate the catfish industry, which constitutes the majority of the aquaculture industry in both states, under the CWA permit requirements because catfish ponds do not meet the 30-day discharge threshold in the regulations.[285] Mississippi has issued only one permit for a catfish aquaculture facility and Arkansas has issued none.[286]

Experts have noted that this non-regulation is problematic because the catfish industry exceeds all other aquaculture operations in Mississippi and Arkansas, and also leads the entire nation in the total production of fish.[287] As a result of the non-regulation of catfish, these states essentially subsidize growth in the industry by reducing the expenses of growing catfish by taking environmental costs out of the equation.[288] Exempting such a large industry lessens these states' ability to control discharge pollution and state water quality because of the amount of pollution the catfish industry emits.[289] The exemption from regulation of the entire catfish industry is similar to the lax regu-

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[281] *See id.*; *infra* notes 303–07 (describing the process by which the EPA creates national effluent limitations for an industry).

[282] *See* Goldburg & Triplett, *supra* note 2, at 108.

[283] *See id.* at 17; *infra* Section IV.A.

[284] *See* Goldburg & Triplett, *supra* note 2, at 111; Rychlak & Peel, *supra* note 4, at 856.

[285] *See* Goldburg & Triplett, *supra* note 2, at 111; Rychlak & Peel, *supra* note 4, at 856.

[286] *See* Goldburg & Triplett, *supra* note 2, at 111.

[287] *See* Rychlak & Peel, *supra* note 4, at 856 (discussing concerns regarding delegation of NPDES permitting authority to the states).

[288] *See id.*

[289] *See id.*

lation standards imposed on salmon netpen operators in Washington that also leads to externalization of environmental costs.[290]

In contrast to Mississippi and Arkansas, Minnesota regulates ponds that release pollutants fewer than thirty days per year because the effluents tend to have high concentrations of pollutants.[291] Minnesota mandates that all aquaculture ponds collect and properly dispose of fish wastes and effluents.[292] This regulation forces pond operators in Minnesota to internalize the costs of environmental degradation, increasing the expense of participating in the aquaculture industry.[293]

B. *Variations Within a State*

Environmental standards for effluents from aquaculture vary not only between states but also among the various types of aquaculture within a state.[294] Minnesota requires that netpen systems meet the same standards as other aquaculture facilities: all aquaculture facilities must collect, treat, and properly dispose of all uneaten fish food and all fish wastes.[295]

In contrast, Washington does not require its salmon netpen operators to collect all of their wastes.[296] Rather, Washington only requires that the operators utilize certain best management practices, by imposing vague standards regarding the running of a fish farm, such as "using properly sized feed for the size of the fish in an individual netpen."[297] These best management practices are based on state officials' assessment that no economically feasible alternatives exist for collecting and removing wastes from the netpens.[298]

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[290] *See infra* notes 296–302 and accompanying text.

[291] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 111 (citing MINNESOTA POLLUTION CONTROL AGENCY, STATEMENT OF NEED AND REASONABLENESS IN THE MATTER OF PROPOSED RULES GOVERNING REQUIREMENTS FOR AQUACULTURE FACILITIES, MINNESOTA RULES PART 7050.0216).

[292] *See infra* note 295 and accompanying text.

[293] *See supra* note 289 and accompanying text.

[294] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 111.

[295] *See* MINN. R. 7050.0216 subpt. 3A (1999); GOLDBURG & TRIPLETT, *supra* note 2, at 111.

[296] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 111 (citing WASHINGTON STATE DEPARTMENT OF ECOLOGY, MODEL MARINE NETPEN WASTE DISCHARGE PERMIT AND CONDITIONS (1996)).

[297] *Id.*

[298] *See id.* (citing WASHINGTON STATE DEPARTMENT OF ECOLOGY, FACTSHEET FOR MARINE NETPEN NPDES PERMIT (1996)).

However, Washington mandates stricter regulations for upland aquaculture, facilities on land including tanks and ponds, than for marine netpens.[299] Upland facilities must meet specific limitations of discharged suspended and settleable solids.[300] Due to this discrepancy, the state favors the least environmentally desirable aquaculture system: the netpen.[301] As the state does not require netpen operators to collect and dispose of their wastes to meet the state standards, the netpen operators are able to externalize more of the environmental costs associated with aquaculture than upland operators.[302]

V. EFFLUENT LIMITATIONS FOR FISH FARMS

Development of national effluent limitations will ensure that states and the federal government uniformly regulate fish farms.[303] Developing these limitations will be a complex process and could take up to five years from start to finish.[304] The EPA, in order to establish limitations in any industry, must: (1) perform an analysis of industry information to determine whether individual limitations are necessary for the different sectors within an industry;[305] (2) compile a group of possible control options for the industry; (3) evaluate the costs, the amount of effluent reduction, and the environmental impact of these options;[306] (4) utilize data from the options to create the proposed limitations; (5) publish the proposed limitations in the Federal Register; (6) review and incorporate comments into a final regu-

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299 *See id.*

300 *See id.* (citing WASHINGTON STATE DEPARTMENT OF ECOLOGY, UPLAND FINFISH HATCHING AND REARING GENERAL PERMIT FACT SHEET).

301 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 111.

302 *See id.*

303 *See* Natural Resources Defense Council, Inc. v. Costle, 568 F.2d 1369, 1378 (D.C. Cir. 1977) (stating that "the primary purpose of the effluent limitations and guidelines was to provide uniformity among the federal and state jurisdictions' enforcing the NPDES program and prevent the 'Tragedy of the Commons. . . .'").

304 *See* Wardzinski et al., *supra* note 257, at 21–22.

305 *See* ENVIRONMENTAL PROTECTION AGENCY, OFFICE OF ENFORCEMENT, DEVELOPMENT DOCUMENT FOR PROPOSED EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE FISH HATCHERIES AND FARMS POINT SOURCE CATEGORY 11 (1974). The analysis of the industry includes a consideration of whether differences exist in the following factors: product, wastes generated, treatability of wastewater, production process, facility size and age, geographic location, and raw materials, which would require the development of individual limitations for different sectors of the industry. *See id.* at 11, 53. The next step of the analysis involves determining the raw waste characteristics for each sector of the industry. *See id.* at 11.

306 *See id.* at 12. This information is then interpreted to determine which technology constitutes BAT, etc., to aid in developing the appropriate effluent limitations. *See id.*

lation; and, (7) most likely prepare to defend the limitations in ensuing litigation.[307]

A. *Draft Proposed Effluent Limitations for Fish Farms*

The EPA has shown that it is possible to draft effluent limitations for aquaculture because it wrote a development document for proposed effluent limitations for fish farms twenty-five years ago, in 1974.[308] During the early 1970s, there had been much discussion about regulating aquaculture effluents due to their increase, but the draft limitations never amounted to a formal promulgation of national effluent limitation standards.[309] Instead, the EPA decided to defer to the states for development of water quality standards to control pollution from fish farms.[310]

The reason for the EPA's deferral may have been widespread enthusiasm for the rapid expansion of aquaculture, as aquaculture was seen as the next great contributor to the nation's and the world's food supplies.[311] In light of this enthusiasm, the federal government focused on generating research and development funds to promote the aquaculture industry instead of developing aquaculture pollution regulations.[312]

However, as demands for regulation of aquaculture effluents are currently increasing, examining the draft limitations is helpful to see what potential effluent limitations might look like.[313] The draft limitations focused on land aquaculture facilities such as ponds and raceways and created different limitations for native fish and non-native fish.[314] Finding that technologies existed to enhance the quality of discharges from the fish farms, the EPA proposed limitations for the

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[307] *See* Wardzinski et al., *supra* note 257, at 21–22; ENVIRONMENTAL PROTECTION AGENCY, *supra* note 305, at 11.

[308] *See generally* ENVIRONMENTAL PROTECTION AGENCY, *supra* note 305 (discussing the effluent reductions attainable through varying technologies).

[309] *See* STICKNEY, PRINCIPLES, *supra* note 151, at 244.

[310] *See id.*

[311] *See* STICKNEY, HISTORICAL SURVEY, *supra* note 218, at 226–27.

[312] *See id.* at 228–29 (detailing Congress's efforts to increase funding for the research and development of aquaculture).

[313] *See* STICKNEY, PRINCIPLES, *supra* note 151, at 244.

[314] *See* ENVIRONMENTAL PROTECTION AGENCY, *supra* note 305, at 1 (discussing the subcategories covered by the document: native fish in flow-through culturing systems, native fish in pond culturing systems, and non-native fish culturing systems).

following pollutants: suspended solids,[315] settleable solids,[316] ammonia-nitrogen, and fecal coliform.[317] Although the draft limitations did not restrict the allowable increase in BOD or the discharge of other nutrients such as nitrogen or phosphorous, the EPA was able to determine the effect of fish farms on BOD and the rate and concentration of the nutrient wastes discharged by a facility.[318] In the discussion of waste characteristics from non-native fish, the draft limitations also raised the issue that escaped fish from fish farms were biological pollutants because they competed with valuable species and destroyed habitats.[319] The draft limitations further recognized the role that feeding practices and the feed conversion ratio played in minimizing pollution from fish farms.[320]

B. *European Examples of Effluent Limitations*

Certain European countries, including Cyprus, Poland, Turkey, France, Denmark, Greece, and the Netherlands limit fish farm effluents discharged into marine waters.[321] Cyprus, for example, has set effluent limitations on changes in temperature, BOD, pH, and the

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[315] *See* Norma Dove-Edwin, A Study of Four Different Effluent Treatment Systems in the Control of Fish Farm Effluent 7 (1989) (unpublished M.S. thesis, Institute of Aquaculture, University of Stirling (Scotland)) (on file with the Minnesota Pollution Control Agency Library). Suspended solids, as well as settleable solids discussed below, are composed of waste food and fish excrement. *See id.* The suspended solids parameter measures the amount of suspended material that could be removed by filtration. *See* ENVIRONMENTAL PROTECTION AGENCY, *supra* note 305, at 104.

[316] *See* ENVIRONMENTAL PROTECTION AGENCY, *supra* note 305, at 68–69. Settleable solids consist of the amount of solids that settle within one hour under tranquil conditions. *See id.*

[317] *See id.* at 5–7.

[318] *See id.* at 61–99 (summarizing the data on the characteristics of the waste discharged from the fish farms). The report of the draft limitations states that the other nutrients are not limited because the extent to which various treatment processes reduce the amount of nutrients in the discharged water must still be examined, and advanced treatment technologies had not yet been demonstrated to be effective at that time. *See id.* at 102. A more recent document states that it is necessary to monitor suspended solids, BOD, total nitrogen and phosphorous, as well as ammonia. *See* WORKSHOP ON FISH FARM EFFLUENTS AND THEIR CONTROL IN EC COUNTRIES 27 (Harald Rosenthal et al. eds., 1993) [hereinafter WORKSHOP].

[319] *See* ENVIRONMENTAL PROTECTION AGENCY, *supra* note 305, at 98–99. Also in the discussion of the selected pollution parameters for the fish farms, the author for the draft limitations suggests that "biological pollutants are considered to be of pollutional significance in non-native fish culturing operations." *See id.* at 101.

[320] *See id.* at 114–15.

[321] *See* WORKSHOP, *supra* note 318, at 13, 45, 51 (detailing the findings of a comparative study of the European nations' legislation regulating control of effluent discharges from fish farms).

amount of suspended solids discharged from fish farms.[322] Poland has also set standards for effluents discharged into marine waters.[323] These standards specify the upper-most allowable level of pollutants in effluents.[324] Turkey has prohibited the discharge of hazardous materials into marine waters and also set various effluent quality standards for other discharges.[325] Lastly, France, Denmark, Greece, and the Netherlands limit the amount of nitrogen and phosphorous discharged into their marine waters.[326] As these regulations are still relatively new, their effectiveness has not yet been assessed.[327] Moreover, one member of the Food and Agriculture Organization of the United Nations stated that much government monitoring and enforcement will be necessary for these aquaculture regulations to be effective.[328]

VI. CWA Regulation of Fish Farm Effluents

The growth in the number, size, and production capability of fish farms in the last few decades has led to widespread demand for regulation of fish farm effluents due to the increased discharges of pollutants including solid wastes and effluents, chemical pollutants, and escaped fish.[329] The current system of regulating fish farms without federal standards has proven unsuccessful because: (1) the EPA and the states have issued few NPDES permits so that many dischargers remain unregulated; (2) the states are not consistent in the way they regulate fish farms so that some fish farmers are able to externalize more environmental costs than others; and, (3) the unregulated discharge of pollutants results in extensive adverse environmental effects.[330] A strategy for enhanced regulation of salmon fish farms and the aquaculture industry in general includes: increasing the number of fish farms that are required to obtain NPDES permits, and setting federal effluent limitations.

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322 *See id.* at 51.

323 *See id.* at 50.

324 *See id.*

325 *See id.* at 49.

326 *See* Workshop, *supra* note 318, at 13.

327 *See id.* at 46.

328 *See id.*

329 *See* Stickney, Principles, *supra* note 151, at 244; *see also supra* Section I (discussing the adverse environmental effects of fish farms).

330 *See supra* Sections I, IV.

A. *The EPA Should Revise Its Standards for Determining Which Fish Farms Constitute Point Sources*

The CAAPF designation requirements in the Code of Federal Regulations are too lax.[331] The requirement that facilities which discharge at least thirty days per year are point sources that must obtain NPDES permits is currently ineffective as it allows for entire sectors of the aquaculture industry, such as catfish ponds, to remain entirely unregulated under the CWA.[332] Although salmon farms are not exempted under the thirty-day provision, catfish ponds are and, as a result, Mississippi and Arkansas regulate very few of their catfish ponds.[333] Furthermore, the requirements that certain aquaculture facilities need a NPDES permit if they produce a certain number of fish in a year or use a certain amount of food in a month are also not strict enough because they fail to regulate many small facilities, which still discharge significant levels of pollutants.[334]

The EPA should increase the number of fish farms constituting point sources that require a NPDES permit by decreasing the number of days a fish farm must discharge, in order to be regulated, from thirty days per year to a number at most below twenty.[335] If the number-of-days requirement is lowered, more fish farms will have to apply for NPDES permits because those farms discharging less than thirty days but more than twenty days will no longer be exempt from the regulations, thereby increasing the regulation of fish farms.[336]

In order to increase the number of fish farms requiring NPDES permits, the EPA should also reduce the limits pertaining to the amount of aquatic animals produced in a year and the amount of feed utilized.[337] These changes will increase regulation of smaller fish farms that are currently exempt from regulation.[338] The designation of a fish farm as a point source, however, may be meaningless unless there are effluent limitations available to create substantive requirements in a NPDES permit.

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[331] *See supra* notes 194–203 and accompanying text.

[332] *See supra* notes 285–90 and accompanying text.

[333] *See supra* notes 285–90 and accompanying text.

[334] *See* 40 C.F.R. § 122 app. C(a)-(b) (1998).

[335] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 111.

[336] *See id.*

[337] *See id.*

[338] *See id.*

B. *The EPA Should Draft Effluent Limitations for the Aquaculture Industry*

The most effective way to control pollution from salmon fish farms, as well as from the entire aquaculture industry, is for the EPA to implement effluent limitations and utilize them in granting NPDES permits.[339] National effluent limitations will provide guidelines for the EPA and states to issue NPDES permits, will provide uniform standards that all states must follow, may provide for control on more pollutants than current state standards, and will thereby more effectively control pollution from fish farms.[340] Due to the fact that the process of creating effluent limitations takes many years, the EPA should start looking at the aquaculture industry soon before more significant damage to the environment occurs.[341]

1. Legal Arguments in Support of Drafting Effluent Limitations

a. *The CWA Applies to Salmon Fish Farms*

The CWA should regulate salmon fish farms because salmon fish farms have the greatest capacity to harm the environment if their discharged pollutants remain unregulated.[342] The CWA applies to salmon fish farms because the fish farms discharge pollutants into the navigable waters of the United States from a point source.[343] Salmon fish farms meet the CAAPF designation requirements in the Regulations because the average salmon fish farm continuously discharges pollutants and produces approximately twenty-five tons (50,000 pounds) of aquatic animals per year.[344] Because the salmon fish farms are CAAPFs, they are point sources requiring NPDES permits.[345] Furthermore, the salmon fish farms add pollutants to the water in the form of solid wastes (excess fish feed and fecal wastes), effluents (excess nitrogen and phosphorous excreted by fish in their urine and gills), chemical wastes (antibiotics and pesticides), and biological ma-

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339 *See id.* at 108; Rosamond L. Naylor et al., *Nature's Subsidies to Shrimp and Salmon Farming*, 282 SCIENCE 883, 884 (1998) (calling for "strong . . . and enforceable environmental regulations"); Environmental Assessment, *supra* note 10, at ch. 7, sec. III, pt. A (recommending that a new approach for aquaculture regulation in British Columbia focus on performance-based standards).

340 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 108, 110.

341 *See supra* note 304 and accompanying text.

342 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 9.

343 *See* 33 U.S.C. § 1362(12) (1994).

344 *See* GOLDBURG & TRIPLETT, *supra* note 2, at 134.

345 *See supra* notes 194–200 and accompanying text.

terials (escaped fish).[346] These different categories of pollutants are all included in the CWA's definition of a pollutant and are introduced into the water from outside the water, thereby meeting the courts' definition of when a NPDES permit is required.[347] Since the salmon fish farms are discharging pollutants into navigable waters from a point source, the CWA applies to them.[348] Therefore, the EPA should create effluent limitations to ensure that NPDES permits are granted to salmon fish farms and enforced, in order to reduce and control pollution from salmon fish farms.

b. *Congressional Intent and the CWA*

The CWA promotes the creation of effluent limitations to reduce pollution discharged from point sources into the nation's waters because effluent limitations are a central component of the NPDES permitting process.[349] The general objective of the CWA is to establish national standards to reduce water pollution.[350] Congress envisioned that effluent limitations were to be the mechanism for reducing the discharge of pollutants from point sources and created a role for them in the NPDES permitting process.[351] As the fish farms do discharge pollutants and are considered to be point sources, all salmon fish farmers should be required to apply for NPDES permits.[352] Furthermore, the EPA should use one of its few statutory tools, effluent limitations, to control the pollutants discharged from fish farms in the NPDES permitting process by creating standards to facilitate the process of administering the permits.

c. *The EPA Has Already Promulgated Effluent Limitations for the Seafood Processing Industry*

Pollutants from salmon fish farms (solid wastes including excess fish feed and escaped fish) are similar to the pollutants discharged by seafood processors (dead fish and unused fish parts) because dischargers introduce the pollutants into the water from outside the wa-

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[346] *See supra* notes 34, 54, 61, 83 and accompanying text.

[347] *See* 33 U.S.C. § 1362(6); *supra* Sections III(A)(2)-(3).

[348] *See supra* notes 186–88 and accompanying text.

[349] *See supra* notes 232–36 and accompanying text.

[350] *See supra* note 24 and accompanying text.

[351] *See* 33 U.S.C.A. § 1311(b)(2)(A) (1994) (stating that national effluent limitations will help achieve progress in attaining the national goal of reducing pollutant discharges).

[352] *See supra* Section VI(B)(1)(a).

ter and both groups of pollutants consist of organic matter.[353] Seafood processors add pollutants to the water when they release dead fish and fish parts that had been outside of the water into the water.[354] Similarly, salmon fish farmers introduce fish feed and fish into the water from outside the water because both products are outside of the water before being placed into the fish farm water. The EPA promulgated effluent limitations for the seafood processing industry because the fish wastes were pollutants added to the water.[355] Since the salmon fish farmers also add pollutants to the water, the EPA should create effluent limitations similar to those for the seafood processing industry to regulate the pollutants discharged from salmon fish farms.[356]

Furthermore, these organic pollutants have significant effects on the environment, whether discharged from fish farms or from seafood processing plants.[357] The added organic pollutants deplete oxygen levels in the surrounding waters, degrade the benthic ecosystem, and exacerbate toxic algae blooms.[358] The EPA has promulgated effluent limitations for the seafood processing industry that regulate BOD and suspended solids in order to curtail some of these adverse environmental effects.[359] Because fish farm wastes may have similar effects on the environment to the effects of seafood processing wastes, as measured by these pollution parameters, the EPA similarly should create effluent limitations to regulate the pollution discharged from aquaculture facilities.

2. Policy Arguments in Support of Drafting Effluent Limitations

a. *Environmental Benefits*

Effluent limitations will reduce the pollution in the nation's waters attributable to aquaculture by creating minimum standards to which all aquaculture facilities must adhere.[360] This standardized regulation of the industry will promote a minimum level of consis-

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[353] *See supra* notes 34, 215–16, 227–28 and accompanying text.

[354] *See supra* notes 227–29 and accompanying text.

[355] *See* 40 C.F.R. § 408 (1998); *see also* Association of Pac. Fisheries v. EPA, 615 F.2d 794, 801 (9th Cir. 1980).

[356] *See* 40 C.F.R. § 408; *see also Association of Pac. Fisheries*, 615 F.2d at 801.

[357] *See supra* Section I(A).

[358] *See supra* Section I(A).

[359] *See* 40 C.F.R. § 408; *see also Association of Pac. Fisheries*, 615 F.2d at 802.

[360] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 108; Naylor et al., *supra* note 339, at 884; Environmental Assessment, *supra* note 10, at ch. 7, sec. III, pt. A.

tency among the states as they regulate aquaculture because all NPDES permits will have to meet the basic requirements outlined in the effluent limitations.[361] Lastly, the effluent limitations will act to reduce pollution as they will facilitate and hasten the granting of NPDES permits by providing guidelines and standards for evaluating permits.[362]

When all states have to meet minimum standards, states such as Mississippi will no longer be able to exempt large sectors of aquaculture from pollution control regulation.[363] Furthermore, salmon netpen operators in Washington will have to adhere to these effluent limitations that will be stricter than the "best management practices" which current netpen operators must follow.[364] The increased regulation of salmon fish farms and all aquaculture facilities, which will result in less discharge of pollutants, should decrease the detrimental effects associated with the discharge of solid wastes, chemical pollution, and escaped fish. The attainable reduction in discharged pollutants should increase oxygen levels in the water, reduce harm to the benthic ecosystems, reduce toxic algae blooms, reduce the adverse effects on organisms of toxic pollutants, and decrease the risks of competition between native salmon and escapees from salmon fish farms.[365]

Furthermore, those states, such as Minnesota, which already regulate all forms of aquaculture will be rewarded for their efforts as their regulatory systems will probably have to change relatively little to comply with the nationwide effluent limitations.[366] By rewarding states with advanced regulatory systems, the new effluent limitations will promote advanced regulatory systems in the future because it is much easier for a state to decrease regulations than to increase regulations. Since advanced regulatory systems will have stricter regulations, states with stricter regulations will see a reduction in the quantity of discharged pollutants, which will benefit the environment.[367]

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[361] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 108.

[362] *See id.*

[363] *See supra* notes 284–90 and accompanying text.

[364] *See supra* notes 296–97 and accompanying text.

[365] *See supra* Section I.

[366] *See* MINN. R. 7050.0216 subpt. 3A (1999). Minnesota already requires that all aquaculture facilities collect, treat, and dispose of all uneaten fish food and fish wastes. *See id.*; GOLDBURG & TRIPLETT, *supra* note 2, at 111.

[367] *See supra* note 360 and accompanying text.

b. *Benefits for the Aquaculture Industry*

National effluent limitations will also provide benefits to members of the aquaculture industry in the form of uniform costs for complying with environmental regulations across states and within states.[368] All aquaculture industries will have to internalize the environmental costs of their facilities to the level necessary to comply with the new effluent limitations.[369] Therefore, Mississippi will no longer be able to grant its catfish industry the economic benefit of not having to comply with environmental regulations.[370] Similarly, the salmon fish farms in Washington will need to internalize environmental costs just as the upland aquaculture facilities currently do, as both types of facilities will have to adhere to the national effluent limitations.[371]

However, due to stricter environmental regulations, the increase in cost to aquaculture facilities that are currently not regulated may be great because the facilities will have to invest in new technologies and new practices.[372] Furthermore, the economic benefits/subsidies granted to salmon fish farms and other unregulated aquaculture industries, in the form of not having to expend financial resources to comply with strict environmental regulations, will be absorbed by these increased costs of complying with the national limitations.[373] Therefore, the increased costs may possibly force some fish farmers out of the industry, as internalization costs may increase production costs to the point that salmon farming or other fish farming is no longer profitable.[374]

The industry as a whole, however, may benefit from the predictability of the costs inherent in a national system of regulation.[375] Any new member of the industry will know the cost of complying with the regulations with more certainty.[376] In this sense, the national regulations will also have an equalizing effect as all members of the industry

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[368] *See* Folke et al., *supra* note 57, at 173.

[369] *See id.*

[370] *See* Rychlak & Peel, *supra* note 4, at 856.

[371] *See* GOLDBURG & TRIPLETT, *supra* note 2, at 111.

[372] *See* Folke et al., *supra* note 57, at 174 (exploring the internalization of the external cost of eutrophication in the salmon industry).

[373] *See id.* at 179.

[374] *See id.* (estimating that internalizing the external costs of eutrophication would so increase the production cost of raising salmon to make the industry essentially unprofitable).

[375] *See supra* Section IV.

[376] *See supra* Section IV.

will have to comply with the costs.[377] Furthermore, this equalizing effect may foster the growth of aquaculture in new states and areas, because the costs will be more uniform across the country as compared to the current situation where aquaculture facilities migrate to states with the most lax regulations.[378]

National effluent limitations will also provide a benefit to the industry by creating better production technologies.[379] The industry must then develop new technologies and practices to comply efficiently with the regulations.[380] The creation of better technologies may result in economic and productivity benefits for fish farmers.[381] For example, for salmon fish farmers, mandated technology and the creation of better practices may result in more competitive fish feed prices, increased growth rates of the salmon, and cleaner water in which to raise the fish.[382]

C. *Possible Components of Effluent Limitations for Salmon Fish Farms*

In analyzing the available information regarding salmon fish farms within the framework the EPA follows in promulgating effluent limitations, it is possible to propose a number of components for salmon fish farm effluent limitations.[383] Due to the differences in final product, wastes produced, technologies available for pollution reduction, facility size, and geographic location between land-based aquaculture facilities and marine facilities, the EPA should create individual limitations for the different sectors of aquaculture.[384] The following sections detail possible effluent limitations for the salmon fish farm sector.

1. Control Options for the Salmon Fish Farm Industry

In order to establish effluent limitations, the EPA must compile a group of possible control options for the industry.[385] The salmon

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[377] *See supra* Section IV.

[378] *See supra* Section IV.

[379] *See* Folke et al., *supra* note 57, at 179–80.

[380] *See id.*

[381] *See* Hardy, *supra* note 129, at 74; Johnson, *supra* note 153, at 50; Harvey, *supra* note 176, at 23.

[382] *See* Hardy, *supra* note 129, at 74; Johnson, *supra* note 153, at 50; Harvey, *supra* note 176, at 23.

[383] *See* Wardzinski et al., *supra* note 257, at 21–22.

[384] *See supra* note 305 and accompanying text.

[385] *See* Wardzinski et al., *supra* note 257, at 22.

aquaculture industry currently has no control option of a structural type for preventing solid waste and biological pollution, as the closed circulating marine system with closed-wall cages is not commercially feasible at this time.[386] However, many other control options for the salmon fish farm industry exist.[387]

The following technologies and practices are available to reduce solid waste and organic nutrient pollution: (1) alterations to fish feed that reduce discharged solids by decreasing the feed conversion ratio; (2) alterations to feed that decrease the amount of nitrogen and phosphorous released into the environment; (3) an ultrasonic waste feed controller that detects when feed is no longer being consumed by fish and halts feeding; and, (4) polyculture that removes nutrients discharged by aquaculture operations.[388] The use of vaccines, plastic containing antifouling chemicals, and wrasse or onions to conrol sea lice are practices available to reduce the use of chemicals in salmon fish farms.[389] Control options are also available to reduce biological pollution from salmon fish farms including anchoring netpens to prevent storm damage and using reproductively sterile fish.[390]

Since effluent limitations do not require the use of a specific technology, a salmon fish farmer would be free to choose from the above options those that he or she thought most effective in order to achieve the required effluent limitations.[391]

2. Effluent Limitations for BOD and Suspended Solids

Formulating effluent limitations for netpens may be complicated because there are multiple control options available for each of the numerous pollutants to be regulated. Furthermore, the different pollutants and control options will have to be evaluated under different criteria. The quantity and different types of solid waste pollutants from fish farms suggest that limitations should be placed on BOD, nitrogen, phosphorous, suspended solids (TSS) and settleable solids.[392] BOD and TSS limitations will be based on BCT assessments.[393]

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[386] *See* Environmental Assessment, *supra* note 10, at ch. 11, sec. III.
[387] *See supra* Section II(A)-(B).
[388] *See supra* Section II(A)-(B).
[389] *See supra* Section II(C).
[390] *See supra* Section II(D).
[391] *See* PLATER ET AL., *supra* note 248, at 502 n.2.
[392] *See supra* notes 315–18 and accompanying text.
[393] *See supra* note 246 and accompanying text.

However, the limitations on nitrogen, phosphorous, and settleable solids will be analyzed under a BAT assessment.[394]

Some of the technologies available to limit BOD and TSS, including alterations to feed and polyculture, are likely to meet the comparative cost-benefit analysis necessary in BCT assessments because, although high in cost, the decrease in pollutant discharges resulting from these technologies is significant.[395] For example, reducing the feed conversion ratio by using different feeds can result in an eighty percent decrease in solid wastes discharged from a fish farm.[396]

Furthermore, the EPA established BOD and TSS limitations for the seafood processing industry and proposed TSS limitations in its draft effluent limitations for the aquaculture industry during the early 1970s.[397] Cyprus, too, has created effluent limitations for BOD and TSS for marine fish farms.[398] Since the technologies would likely pass the comparative cost-benefit analysis and both the EPA and Cyprus have shown it is possible to create effluent limitations for BOD and TSS, the EPA should create effluent limitations along these parameters for the salmon fish farm industry.[399]

3. Effluent Limitations for Nitrogen, Phosphorous, and Settleable Solids

As ammonia, a nitrogen compound, is deemed a nonconventional pollutant subject to BAT standards, nitrogen and phosphorous, which are not designated as a specific type of pollutant, will most likely also fall into the nonconventional pollutant category.[400] Settleable solids, too, should be treated as a nonconventional pollutant.[401] The EPA should base effluent limitations of these nonconventional pollutants on BAT.[402] In the BAT analysis, the EPA must only show that the technologies are available and that the cost is achievable.[403]

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[394] *See* PLATER ET AL., *supra* note 248, at 523; *infra* notes 400–02 and accompanying text.

[395] *See* Alvarado, *supra* note 118, at 285.

[396] *See id.*

[397] *See* 40 C.F.R. § 408 (1998); Association of Pac. Fisheries v. EPA, 615 F.2d 794, 802 (9th Cir. 1980); ENVIRONMENTAL PROTECTION AGENCY, *supra* note 305, at 5–7.

[398] *See* WORKSHOP, *supra* note 318, at 51.

[399] *See supra* notes 395, 397–98 and accompanying text.

[400] *See supra* note 248 and accompanying text.

[401] *See supra* note 249 and accompanying text.

[402] *See* 33 U.S.C. § 1311(b)(2)(A) (1994).

[403] *See* Association of Pac. Fisheries v. EPA, 615 F.2d 794, 816 (9th Cir. 1980); Elliot, *supra* note 253, at 178–79; PLATER ET AL., *supra* note 248, at 521.

The technologies for reducing nutrient pollution would meet these tests, as alternative feeds and polyculture are available and the cost of attaining them is achievable, although maybe not competitive at this time.[404]

Furthermore, the EPA has shown that it would be possible to draft limitations for settleable solids, as it proposed limitations for settleable solids in its draft limitations for aquaculture effluents.[405] More recently, France, Denmark, Greece, and the Netherlands instituted limitations on the discharge of nitrogen and phosphorous from aquaculture facilities into marine waters.[406] Since the technologies available to reduce the discharge of settleable solids, nitrogen, and phosphorous would meet the BAT cost and availability tests, and since both the EPA and some European countries have shown it is possible to create effluent limitations for these parameters, the EPA should create effluent limitations for the discharge of nitrogen, phosphorous, and settleable solids from salmon fish farms.

4. Effluent Limitations for Chemicals

The EPA should also include effluent limitations for chemicals, including antibiotics and pesticides, discharged from salmon fish farms. These effluent limitation assessments will fall under a BAT analysis as most chemicals are viewed as toxic pollutants.[407] However, the EPA already requires NPDES permits for these discharges so that some standards are already set.[408] Shifting the standards currently utilized into effluent limitations should not be a difficult task as the EPA has already done much of the necessary research.

5. Effluent Limitations for Escaped Fish

The pollutants and pollution parameters listed above are traditional in the sense that they have been frequently utilized and regulated over the last few decades. However, effluent limitations for fish farms require the creation of one new parameter. This new parameter must consider reducing the effects of escaped fish from fish farms.[409]

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[404] *See supra* notes 128–30, 141–44 and accompanying text.

[405] *See* Environmental Protection Agency, *supra* note 305, at 5–7.

[406] *See* Workshop, *supra* note 318, at 13.

[407] *See supra* notes 245, 250 and accompanying text.

[408] *See* 33 U.S.C. § 1328 (1994); 40 C.F.R. § 122.25 (1998).

[409] *See* Memorandum of Points, *supra* note 104, at 2–3; Environmental Assessment, *supra* note 10, at ch. 5, sec. II, tbl. 14; Krueger & May, *supra* note 89, at 66.

Escaped fish are not currently regulated because scientists, in the past, had seen no evidence of the adverse effects of escaped fish on the natural environment.[410] However, scientists have recently documented the reproduction of escaped fish in the wild, finding that these fish will compete with native salmon for food and habitat resources, will modify or destroy the habitat of the native salmon, and may introduce new diseases and parasites into the native populations.[411]

As the adverse effects of escaped fish have been documented, the EPA should regulate escaped fish because the escaped fish are pollutants added to navigable waters from a point source.[412] Courts have stated that live fish can constitute biological pollutants.[413] Escaped fish also meet the definition of "added" because point sources (the fish farms) physically introduce the pollutant fish from the outside world into the water. [414] The fish are initially transported from a freshwater smolt farm and introduced into the saltwater fish farm. As the escaped fish meet the statutory definition of a discharge of pollutants they require a NPDES permit, and the creation of effluent limitations will aid in setting the requirements of a permit.[415]

The EPA should treat the escaped fish as a nonconventional pollutant under a BAT standard because, similar to settleable solids, Congress did not designate escaped fish as either a conventional or toxic pollutant.[416] Due to the gravity of the environmental effects of escaped fish, as a result of their role in the decrease of native populations, a BAT analysis is preferable to a BCT analysis because the BAT analysis will result in more stringent regulations.[417] The two technologies for reducing the effects of escaped fish that are available and whose costs are achievable are: anchoring the netpens, and using

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[410] *See* Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96–257, 1997 WL 394651, at *4 (Wash. Pol. Control Bd. May 27, 1997) (questioning the existence of the causal relationship between escaped Atlantic salmon as pollutants and whether they cause pollution in the form of harm to native fish in Washington waters).

[411] *See* Environmental Assessment, *supra* note 10, at ch. 5, sec. II, tbl. 14; Krueger & May, *supra* note 89, at 66.

[412] *See supra* Section III(A)(2)-(3).

[413] *See* National Wildlife Fed'n v. Consumers Power Co., 862 F.2d 580, 583 (6th Cir. 1988); National Wildlife Fed'n v. Consumers Power Co., 657 F. Supp. 989, 1007 (W.D. Mich. 1987).

[414] *See* National Wildlife Fed'n v. Gorsuch, 693 F.2d 156, 174–75 (D.C. Cir. 1982); *Consumers Power*, 862 F.2d at 584, 588–90.

[415] *See Gorsuch*, 693 F.2d at 165 (utilizing the test to determine whether dams are required to obtain NPDES permits); *Consumers Power*, 862 F.2d at 583.

[416] *See supra* notes 247, 250 and accompanying text.

[417] *See supra* note 264 and accompanying text.

reproductively sterile fish in the netpens.[418] These two technologies reduce pollution differently. Anchoring the netpens to prevent storm damage will reduce the number of escaped fish.[419] Using reproductively sterile fish, while not reducing the likelihood of escape from the netpens, will reduce the actual effects on native fish in the event the sterile fish escape.[420] A recommendation for setting effluent limitations for escaped fish, therefore, should combine a threshold number of allowable escapees from a fish farm with the alternative of an increase in the number of allowable escapees if sterile fish are raised at the farm.[421]

Conclusion

The growth in the number, size, and production capability of salmon and other fish farms in the past twenty-five years has led to demands for national regulation of fish farm effluents. The discharges of pollutants from salmon fish farms result in numerous adverse environmental effects: (1) decreases in oxygen levels in the water; (2) increased harm to benthic ecosystems; (3) greater numbers of toxic algae blooms; (4) an increase in the adverse effects on organisms due to toxic chemical pollutants; and, (5) increased competition between native salmon and escaped fish for food and resources.

Existing laws do not effectively control discharges from salmon fish farms and other aquaculture facilities. The EPA considers some fish farms to be point sources to be regulated under the CWA; however, the EPA has not promulgated aquaculture industry effluent limitations. The lack of federal regulation discourages states and the EPA from issuing NPDES permits and also results in states regulating pollution from fish farms differently. Some states do not regulate aquaculture operations at all, which results in the fish farms regularly discharging large quantities of untreated wastes into their waterways.

National effluent limitations for salmon fish farms and the aquaculture industry as a whole will ensure consistent regulation of fish farms. National limitations will also provide guidelines to the EPA and states to facilitate the issue of NPDES permits. Lastly, the pollutants for which effluent limitations should be created for the salmon

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[418] *See* Goldburg & Triplett, *supra* note 2, at 76; Marine Envtl. Consortium v. Department of Ecology, PCHB No. 96-257, 1998 WL 377649, at *3 (Wash. Pol. Control Bd. June 1, 1998).

[419] *See* Gausen & Moen, *supra* note 93, at 426.

[420] *See Marine Envtl. Consortium*, 1998 WL 377649, at *3.

[421] *See supra* notes 418–20 and accompanying text.

fish farm industry, including BOD, TSS, nitrogen, phosphorous, settleable solids, chemical pollutants, and escaped fish, are greater than the number of pollutants any state currently regulates. Therefore, national effluent limitations will regulate more pollutants than current state standards, leading to a greater reduction in discharged pollutants. This reduction in discharged pollutants will in turn lessen the adverse effects of such pollutants on the environment.