

June 2013

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Garrett Wheeler
Golden Gate University School of Law

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Recommended Citation

6 Golden Gate U. Env't'l L. J. 295 (2013).

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A FEASIBLE ALTERNATIVE: THE LEGAL IMPLICATIONS OF AQUACULTURE IN THE UNITED STATES AND THE PROMISE OF SUSTAINABLE URBAN AQUACULTURE SYSTEMS

GARRETT WHEELER*

I. INTRODUCTION: TRAGEDY OF THE OCEANS

The world's ocean fish stocks are in peril. A 2011 report issued by an international team of marine scientists found that the world's marine species face threats "unprecedented in human history"¹ with "loss of both large, long-lived and small fish species causing widespread impacts on marine ecosystems."² Nutrient runoff, introductions of non-native species, climate change, over fishing, and physical disturbance are all contributing to the oceans' decline.³ Meanwhile, global per capita seafood consumption is at an all-time high,⁴ as the Earth's growing

*Doctor of Jurisprudence Candidate 2013, Golden Gate University School of Law. The author would like to thank his faculty advisor, Professor Deborah Behles, and the *Golden Gate University Environmental Law Journal* editors who reviewed this Comment, including Dan Dressman, Dawn Withers, Cody Nesper, Vadim Sidelnikov, and Alexandra Baraff. The author also extends his gratitude to Zeke Grader for inspiring research on the topic of sustainable aquaculture.

¹ Press Release, Int'l Programme on the State of the Ocean, Multiple Ocean Stresses Threaten "Globally Significant" Marine Extinction (June 20, 2011), *available at* www.stateoftheocean.org/pdfs/1806_IPSOPR.pdf.

² A.D. Rogers & D.d'A Laffoley, INTERNATIONAL EARTH SYSTEM EXPERT WORKSHOP ON OCEAN STRESSES AND IMPACTS 5 (2011).

³ *See id.* at 6.

⁴ FOOD & AGRIC. ORG. OF THE UNITED NATIONS, THE STATE OF WORLD FISHERIES AND AQUACULTURE 2010, at 3 (Jan. 2010) (estimating "an apparent per capita supply of about 17 kg (live weight equivalent), which is an all-time high"), *available at* www.fao.org/docrep/013/i1820e/i1820e.pdf.

population continues to enjoy healthy, protein-laden nourishment.

The resulting situation is a stark example of what ecologist Garrett Hardin famously called “the tragedy of the commons,” the concept that overexploitation of a limited public resource inevitably occurs when multiple individuals act independently in their own self-interests.⁵ The once-bountiful resources of the sea have now been exploited to a point where both marine-scientists and food-economists question the future of this essential food source.⁶ While technology undoubtedly played an important role in expediting the loss of ocean resources,⁷ technology in the form of aquaculture⁸ is now seen as the solution.⁹ But can the practice of farming fish resolve the problem of a sea short of seafood? A burgeoning global aquaculture industry believes that aquaculture can satisfy a growing demand for seafood while alleviating damaged ocean ecosystems—an optimistic vision that nevertheless leaves many questions unanswered.¹⁰ Central to the inquiry over ocean resource renewal is the viability of environmentally sustainable aquaculture methods and the legal framework that will ensure ecologically sound practices.

As the United States begins to implement a variety of new aquaculture techniques in the ocean and on land, it will likely play a major role in shaping a regulatory structure that can encourage the growth of environmentally responsible aquaculture practices. Whether that development takes place on land, near the coast, or miles out to sea

⁵ See Garrett Hardin, *The Tragedy of the Commons*, SCI., Dec. 13, 1968, at 1243, available at www.garretthardinsociety.org/articles/art_tragedy_of_the_commons.html.

⁶ See *A Sea of Troubles*, ECONOMIST, Dec. 30, 2008, available at www.economist.com/node/12853926.

⁷ For example, the conversion from sail to engine power before World War I, the invention of synthetic fibers in the 1950s, and the use of radio positioning and communication systems all played a role in increased efficiency in the commercial fishing industry. See J.F. Caddy & K.L. Cochrane, *A Review of Fisheries Management Past and Present and Some Future Perspectives for the Third Millennium*, 44 OCEANS & COASTAL MGMT. 654, 662 (2001), available at www.udc.es/dep/bave/jfreire/pdf_ecologia_gestion_pesqueras/Fisheries_management_3rd_millennium%20%28Ocean_Coast_Man%29.pdf.

⁸ “Aquaculture” refers to the general practice of farming aquatic organisms. See *Farming Fish: The Aquaculture Boom*, WORLD RESOURCES INST. (1999), www.wri.org/publication/content/8382.

⁹ See David Jolly, *Fish Farming Overtaking Traditional Fisheries*, N.Y. TIMES, Jan. 31, 2011, available at www.nytimes.com/2011/02/01/business/global/01fish.html?_r=0 (“With most of the world’s fisheries operating at or above their sustainable yields, aquaculture is seen as the only way to increase the supply of fish in a world hungry for protein.”).

¹⁰ This “optimistic vision” is perhaps best evidenced by a quick Internet news search for the term “aquaculture,” where one is greeted by an endless number of articles and sources that describe the economic and environmental success that aquaculture promises. See, e.g., Tim Bradner, *Alaska’s Mariculture Industry Small, But Growing; State’s Oysters Command Top-of-the-Line Price*, MORRIS NEWS SERV. (Oct. 24, 2012), homernews.com/stories/102412/business_mariculture.shtml#UKA4Lobds1I.

will largely depend on the outcome of future legal forays and policy initiatives.

Although considerable scholarly analysis has been devoted to the environmental problems and legal complexities surrounding the development of open-ocean aquaculture,¹¹ little has been written on the alternative: sustainable land-based facilities. These systems are models of modern ecological engineering and can be located anywhere, including urban settings such as brownfields,¹² abandoned industrial sites, and warehouses. They can feed local populations and provide local jobs without compromising the health of our oceans and wild fish stocks. Sustainable land-based systems are already operating in American cities like Brooklyn,¹³ Baltimore,¹⁴ and Milwaukee.¹⁵

Recirculating aquaculture systems (RAS) and aquaponic systems are closed-loop, land-based farms that re-use water and are capable of producing fish, vegetables, flowers, fruits, and herbs.¹⁶ RAS technology eliminates the environmental problems associated with conventional aquaculture methods, such as outdoor pond systems and ocean net pen systems. RAS facilities are “sustainable, infinitely expandable, environmentally compatible, and have the ability to guarantee both the safety and the quality of fish produced.”¹⁷ Unlike conventional systems, which are limited by environmental and geographic constraints, as well as the threat of disease transference, indoor systems can produce fish in completely controlled environments without risk of escapement or spread of disease.¹⁸ Moreover, RAS conserves heat and water through water reuse, running on ninety to ninety-nine percent less water than conventional systems and providing environmentally safe waste-management treatment.¹⁹

¹¹ See generally Brandee Ketchum, *Splitting Scales: Conflicting National and Regional Attempts To Manage Commercial Aquaculture in the Exclusive Economic Zone*, 6 J. FOOD L. & POL'Y 1 (2010).

¹² See AQUACULTURE COLLABORATIVE RESEARCH SUPPORT PROGRAM, OR. STATE UNIV., A STUDY OF AQUACULTURE BROWNFIELDS: ABANDONED AND CONVERTED SHRIMP PONDS IN THAILAND (2003), available at pdacrsp.oregonstate.edu/pubs/workplns/wp_10/10GISR1.html.

¹³ See *A Fish Grows in Brooklyn*, SEED MAG., Sept. 7, 2006, available at seedmagazine.com/content/article/a_fish_grows_in_brooklyn/.

¹⁴ See *Maryland Unveils Green Recirculating Aquaculture*, THEFISHSITE (July 7, 2009), www.thefishsite.com/fishnews/10283/maryland-unveils-green-recirculating-aquaculture.

¹⁵ Barbara Miner, *An Urban Farmer Is Rewarded for His Dream*, N.Y. TIMES, Sept. 25, 2008, available at www.nytimes.com/2008/10/01/dining/01genius.html.

¹⁶ See *What Is a Recirculating Farm?*, RECIRCULATING FARMS COAL., www.recirculatingfarms.org/what-is-a-recirculating-farm (last visited Apr. 7, 2013).

¹⁷ Michael B. Timmons, *Competitive Potential for USA Urban Aquaculture*, in URB. AQUACULTURE 137, 138 (Barry Costa-Pierce et al. eds., 2005).

¹⁸ *Id.*

¹⁹ *Id.*

Growth and change are all but inevitable for the United States' aquaculture industry. The environmental problems associated with ocean-based operations and their traditional land-based counterparts are inexorably linked and therefore must inform both established and developing regulatory bodies of law. The current legal regimes affecting aquaculture production in the United States, in particular the federal Clean Water Act, will play a central role in shaping the development of the industry.

Sustainable, land-based aquaculture technologies, including recirculating systems, promise to provide environmentally sound aquaculture methods that are in many ways legally and economically preferable to ocean-based technologies. These systems are not only feasible, but essential to achieving an environmentally sustainable aquaculture industry. The implementation of such technologies should therefore be encouraged through the introduction of new law and policy initiatives.

II. A BRIEF HISTORY OF AQUACULTURE

Pioneered by the Chinese a few thousand years ago, growing and harvesting fish, crustaceans, mollusks, and aquatic plants is an ancient practice that has only recently become a booming international industry.²⁰ After World War II, a shift in the economic conditions of developed nations coincided with a population boom, leading to an increase in the demand for fish and shrimp.²¹ Aquaculture as a large-scale commercial practice quickly developed, particularly in Asia, where over fishing and environmental degradation had caused significant declines in wild stocks.²² In the last half-century, aquaculture has grown exponentially, with global production increasing from less than one million tons in 1950 to 52.5 million tons in 2008.²³ About half the seafood consumed around the world now comes from farms, and that percentage is likely to increase.²⁴ Nearly half of the world's aquaculture facilities are ocean-based; the rest are situated in freshwater ponds,

²⁰ See FOOD & AGRIC. ORG. OF THE UNITED NATIONS, SMALL PONDS MAKE A BIG DIFFERENCE: INTEGRATING FISH WITH CROP AND LIVESTOCK FARMING (2000), available at <ftp://ftp.fao.org/docrep/fao/003/x7156e/x7156e00.pdf>.

²¹ KATHRYN WHITE ET AL., SEAWEB ACQUACULTURE CLEARINGHOUSE, AT A CROSSROADS: WILL AQUACULTURE FULFILL THE PROMISE OF THE BLUE REVOLUTION? 6 (2004), available at www.seaweb.org/resources/documents/reports_crossroads.pdf.

²² *Id.*

²³ *Id.*

²⁴ See FOOD & AGRIC. ORG. OF THE UNITED NATIONS, THE STATE OF THE WORLD FISHERIES PART ONE (2010), available at www.fao.org/docrep/01_3/i1820e/i1820e01.pdf.

estuaries, or land-locked facilities.²⁵

The United States ranks thirteenth in total aquaculture production.²⁶ In 2010, Asia accounted for eighty-nine percent of world aquaculture production by volume.²⁷ In the United States, the majority of aquaculture currently occurs on land, with channel catfish representing eighty-one percent of the 287,132 tons of finfish produced in 2008.²⁸ Catfish production takes place in large freshwater ponds in the southeastern states of Mississippi, Louisiana, Arkansas, and Alabama.²⁹ Domestic catfish production peaked in 2008, with 234,000 tons valued at \$39 million. The states of Arkansas, Louisiana, and Mississippi provide aquaculture jobs to nearly 4,000 people, representing thirty-seven percent of the nation's total direct employment in the industry.³⁰

In 2005, there were 2,347 farms housing 48,003 aquaculture ponds in the United States, along with 415 raceway³¹ facilities and 315 farms operating non-recirculating systems including tanks, vats, and vaults.³² By contrast, there were only 415 farms with recirculating aquaculture systems (RAS) nationwide.³³

III. ENVIRONMENTAL PROBLEMS ASSOCIATED WITH AQUACULTURE

In the past decade, a new wave of industrial and governmental enthusiasm for ocean-based operations, particularly for offshore farms located in the 200-mile wide Exclusive Economic Zone (EEZ),³⁴ has

²⁵ *Id.*

²⁶ *See id.* The countries that produce more farmed fish than the United States are China, India, Vietnam, Indonesia, Thailand, Bangladesh, Norway, Chile, Philippines, Japan, Egypt, and Myanmar. *Id.*

²⁷ *Id.* at 6.

²⁸ *National Aquaculture Sector Overview: United States of America*, FOOD & AGRIC. ORG. OF THE UNITED NATIONS, www.fao.org/fishery/countrysector/naso_usa/en#tcN9009C (last updated Feb. 1, 2011).

²⁹ *Id.*

³⁰ *Id.*

³¹ Raceways, or flow-through systems, move water through an elongated structure to maintain necessary levels of water quality. *See Raceways*, COLORITE PLASTICS, www.coloriteaerationtubing.com/aquacult_pages/aquaculture_raceways.htm (last visited Apr. 25, 2013).

³² NAT'L AGRIC. STATISTICS SERV., U.S. DEP'T OF AGRIC., METHODS USED FOR AQUACULTURE PRODUCTION BY STATE AND UNITED STATES: 2005, *available at* www.agcensus.usda.gov/Publications/2002/Aquaculture/aquacen2005_06.pdf.

³³ *Id.*

³⁴ *See* 50 C.F.R. § 600.10 (Westlaw 2013). The exclusive economic zone is a zone prescribed by the United Nations Convention on the Law of the Sea, giving the United States and other coastal nations jurisdiction over economic and resource management within their respective zones. The EEZ extends 200 nautical miles from the seaward boundary of each coastal state.

garnered attention as well as controversy.³⁵ Proponents³⁶ view open-ocean farms as playing a major role in solving the United States' \$9 billion seafood trade deficit,³⁷ while opponents³⁸ warn of potentially devastating economic, social, and environmental consequences.³⁹

New technologies are allowing operators to cultivate fish and other seafood in exposed, open-ocean environments that were inaccessible only twenty years ago.⁴⁰ However, the rise of offshore aquaculture poses significant threats to sensitive marine environments and "represents a fundamental transition in the human claim on the Earth's surface."⁴¹

Open-ocean aquaculture facilities operate in largely pristine areas and are intimately connected with their surrounding aquatic ecosystems.⁴² Common species cultivated in the open ocean include mostly finfish such as salmon, cod, and tuna.⁴³ Large underwater cages are placed in the water, and as ocean currents flow through the cages, the spread of waste and chemical byproducts can implicate the health of the seafloor and the surrounding water column.⁴⁴ Escaped fish also pose a

³⁵ See OCEAN CONSERVANCY, RIGHT FROM THE START: OPEN-OCEAN AQUACULTURE IN THE UNITED STATES 2 (2011), available at www.aces.edu/dept/fisheries/education/documents/Open_Ocean_Aquaculture_Right_from_the_Start_bytheOceanConservancyorganization.pdf ("The future of ocean fish farming has become the focus of considerable debate. Some entrepreneurs would like to see the industry develop as fast as possible. Others would prefer to see the industry go away entirely. At Ocean Conservancy, we believe that . . . poorly operated [open-ocean] aquaculture threatens marine life and wastes natural resources.").

³⁶ See Alessandra Bianchi, *The Next Seafood Frontier: The Ocean*, CNN MONEY, Apr. 28, 2009, money.cnn.com/2009/04/27/smallbusiness/farming_the_open_oceans.fsb/. Companies like Open Blue Sea Farms, founded in 2009, believe environmental regulations in the United States are a "disservice to America" because they prevent the increased production of domestically farmed seafood. *Id.*

³⁷ Although food security issues are beyond the scope of this Comment, the net trade deficits for seafood are staggering. In 2008, the United States imported approximately 5.2 billion pounds of seafood, worth \$14.2 billion, and exported only a value of \$4.3 billion, leaving a trade deficit of approximately \$9.9 billion in edible seafood products. The two largest components of U.S. seafood imports are shrimp and salmon. Such deficits generally contribute to a depletion of foreign exchange reserves. See HAROLD F. UPTON & EUGENE H. BUCK, CONG. RESEARCH SERV., RL32694, OPEN OCEAN AQUACULTURE 6-7 (2010), available at www.cnire.org/NLE/CRSreports/10Sep/RL32694.pdf.

³⁸ Opponents of an unregulated open-ocean aquaculture industry include not-for-profit organizations such as Food and Water Watch and the Ocean Conservancy. See, e.g., FOOD AND WATER WATCH, DISASTERS IN OCEAN AQUACULTURE (2009), available at documents.foodandwaterwatch.org/doc/disasters.pdf; OCEAN CONSERVANCY, *supra* note 35, at 28-29.

³⁹ See OCEAN CONSERVANCY, *supra* note 35, at 3-7.

⁴⁰ *Id.*

⁴¹ *Id.* at 8.

⁴² *Id.* at 4.

⁴³ *Id.* at 9.

⁴⁴ *Id.* at 13.

threat to marine ecosystems by introducing non-indigenous species, compromising the genetic fitness of native populations through interbreeding, and disease translocation.⁴⁵ Disease and parasites may also spread to nearby native populations, and attempts by operators to apply drugs and chemicals to contain those threats can damage the surrounding ecosystem.⁴⁶ Predatory fish and marine mammals are also drawn to cages full of captive fish, leading to injury, death, and harassment by operators trying to protect their stocks.⁴⁷ Finally, operational failures are all but inevitable: in at least one instance, an entire fish cage broke free from a tow vessel and was sent floating adrift in the open ocean, endangering marine species as well as any ocean-going vessels unfortunate enough to cross its path.⁴⁸

Compared to the negative environmental impacts of ocean-based aquaculture facilities, the negative impacts of land-based systems are easily minimized. Unlike ocean-based operations, isolated terrestrial facilities have fewer problems with escapement.⁴⁹ The spread of disease is also easier to control because fecal matter and feed waste are not in direct contact with the surrounding marine ecosystem.

Despite these benefits, land-based facilities are not without their own environmental concerns. Potential impacts of conventional land-based aquaculture facilities include the introduction of freshwater fish into natural ecosystems,⁵⁰ which can occur through either purposeful release or accidental escape.⁵¹ These introductions adversely impact local resources through hybridization, loss of native stocks, predation, disease transmission, and changes in habitat.⁵² Additionally, interactions between aquaculture farms can result in self-pollution and disease transmission in areas where high-density farms may use water

⁴⁵ *See id.*

⁴⁶ *Id.* at 13.

⁴⁷ *Id.* at 14.

⁴⁸ Reed Flickinger, *Towed Aquaculture Fish Pens Break Free*, W. HAW. TODAY, Mar. 30, 2011, available at ahabsjournal.typepad.com/ahabs_journal/2011/03/towed-aquaculture-fish-pens-break-free.html (“Two towed pens being tested for offshore fish farming by Kona Blue Water Farms broke free from their tow vessel last week, said company co-founder Neil Sims He said if any ocean users find the errant cage, Kona Blue Water Farms would like to be notified and a reward would be offered.”).

⁴⁹ “Escapement” refers to fish that escape their confined area, a common problem with open ocean net pens. *See Top 10 Problems*, FOOD & WATER WATCH, www.foodandwaterwatch.org/fish/fish-farming/offshore/problems/ (last visited April 10, 2013).

⁵⁰ Some land-based systems are connected with adjoining water bodies such as a pond or creek.

⁵¹ *See* Fisheries & Aquaculture Dep’t, *Impact of Aquaculture on Environment*, FOOD & AGRIC. ORG. OF THE UNITED NATIONS, www.fao.org/fishery/topic/14894/en (last updated May 27, 2005).

⁵² *Id.*

contaminated by neighboring installations.⁵³

Effluent discharge can also be a problem for land-based facilities. For example, raceway systems used to cultivate salmonids typically produce high total daily loads of effluent discharge, which are extremely difficult to treat.⁵⁴ Large concentrated aquatic animal production (CAAP) facilities also produce a variety of waste products. These byproducts add nutrients and solid⁵⁵ loadings to receiving waters such as rivers or streams that can, in the absence of proper treatment, result in the discharge of thousands of pounds of nitrogen and phosphorus per year and up to several million pounds of total suspended solids per year.⁵⁶ Several chemicals and therapeutic drugs are also used by the CAAP industry and may be released into receiving waters.⁵⁷ Finally, traditional land-based facilities are associated with the introduction of pathogens into receiving waters, with potential negative impacts on native ecosystems.⁵⁸

In addition to problems stemming from the discharge of hazardous material, the growth of conventional land-based aquaculture may also be limited by dwindling water supplies. For example, the productivity of the domestic catfish industry is currently threatened by decreasing groundwater resources in the Mississippi Delta.⁵⁹

IV. LEGAL REGIMES AFFECTING AQUACULTURE IN THE UNITED STATES

As the United States aquaculture industry embarks on a new period of expansion,⁶⁰ a host of uncertainties arise concerning the role that

⁵³ *Id.*

⁵⁴ Robert C. Summerfelt, *Introduction*, in *AQUACULTURE EFFLUENTS: PROCEEDINGS FROM THE CONFERENCE, AMES, IOWA, OCT. 9, 2003* (Robert C. Summerfelt & Richard D. Clayton eds.), available at www.ncrac.org/oldfiles/NR/rdonlyres/A9050D4C-D204-4C5D-A553-1A0CEE5DF6B9/0/Effluentsproceedings.pdf. This is because “[d]ilute, but large effluent volumes are discharged . . . add[ing] up to high total daily loads.” *Id.*

⁵⁵ See U.S. ENVTL. PROT. AGENCY, COMPLIANCE GUIDE FOR THE CONCENTRATED AQUATIC ANIMAL PRODUCTION POINT SOURCE CATEGORY, at app. J (Mar. 2006), available at water.epa.gov/scitech/wastetech/guide/aquaculture/guidance_index.cfm (“Biosolids,” or solids, refer to waste material, usually manure or uneaten food).

⁵⁶ U.S. ENVTL. PROT. AGENCY, ECONOMIC AND ENVIRONMENTAL IMPACT ANALYSIS OF THE PROPOSED EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS FOR THE CONCENTRATED AQUATIC ANIMAL PRODUCTION INDUSTRY 8-3, at 9-1 (2002), available at water.epa.gov/scitech/wastetech/guide/aquaculture/upload/2009_03_24_guide_aquaculture_ea_complete.pdf.

⁵⁷ *Id.* at 9-1.

⁵⁸ *Id.*

⁵⁹ Summerfelt, *supra* note 54, at 4.

⁶⁰ See Allison Winter, *Obama Admin Hands Offshore Aquaculture Oversight to NOAA*, N.Y. TIMES, Apr. 23, 2009, www.nytimes.com/gwire/2009/04/23/23greenwire-obama-admin-hands-

various statutory regimes—and the agencies charged with their enforcement—will play. The most fundamental questions facing regulators are which agencies have jurisdiction on land and in the ocean, whether relevant statutory regimes can work in a cohesive manner, and whether aquaculture facilities can be effectively regulated.

The regulatory framework currently associated with aquaculture production in the United States is a confusing patchwork of statutory and agency overlaps. The situation is due largely to the fact that aquaculture operations take a myriad of forms, each posing unique environmental concerns with the potential to trigger a host of legal violations. Ocean net pens, for instance, are placed in the open ocean miles from land, while pond farms are located in coastal or inland areas. Shellfish are cultivated in marine hatchery systems in bays along the ocean bottom,⁶¹ and RAS utilize indoor tanks.⁶² This diverse array of aquaculture techniques translates into equally diverse legal regulation, with the United States Environmental Protection Agency (EPA), the Army Corps of Engineers (Corps), the United States Fish and Wildlife Service (FWS), the National Oceanic and Atmospheric Administration (NOAA), the United States Department of Agriculture (USDA), and the Food and Drug Administration (FDA) each assuming a portion of jurisdictional oversight.

Regulating potential pollution from aquaculture facilities, the EPA restricts the discharge of pollutants into navigable waters and oversees a national permit program via the Clean Water Act (CWA).⁶³ The CWA further charges the Corps with the responsibility of issuing dredge and fill permits.⁶⁴ The EPA also regulates the treatment, storage, and disposal of hazardous and non-hazardous solid waste under the Resource Conservation and Recovery Act (RCRA), although regulatory authority is generally administered by the states.⁶⁵ RCRA places “hazardous” waste into both specifically “listed” and general “characteristic” categories.⁶⁶ Therefore, waste generated from fish farms, including fish feces and discharges of ammonia-nitrogen, as well as water treatment

offshore-aquaculture-oversig-10648.html (quoting Commerce Secretary Gary Locke: “As wild fish stocks decline, it is important to be able to have more aquaculture . . . NOAA needs to engage in a program to set up criteria and rules in which safe aquaculture can be provided.”).

⁶¹ MICHAEL TIMMONS ET AL., *NEW YORK AQUACULTURE INDUSTRY: STATUS, CONSTRAINTS AND OPPORTUNITIES* 32 (May 2004), available at www.seagrant.sunysb.edu/Images/Uploads/PDFs/themearias/Fisheries/NYAquacultureIndustry04.pdf.

⁶² *Id.* at 5.

⁶³ See 33 U.S.C.A. § 1342 (Westlaw 2013).

⁶⁴ 33 U.S.C.A. § 1344 (Westlaw 2013).

⁶⁵ 42 U.S.C.A. § 6921 et seq. (Westlaw 2013); 40 C.F.R. §§ 239-279 (Westlaw 2013).

⁶⁶ 40 C.F.R. § 261.3(a)(2) (Westlaw 2013).

chemicals, may be regulated under RCRA insofar as they are stored, treated, and disposed.

With respect to potential impacts on species and ecosystems, both FWS and NOAA administer the Endangered Species Act (ESA), protecting threatened and endangered species through the designation of critical habitat areas for listed species.⁶⁷ Freshwater species are listed by the Secretary of Interior, while marine species are listed by the Secretary of Commerce.⁶⁸ Aquaculture operations with potential to affect critical habitat areas of threatened or endangered species must pay close attention to ESA regulation. In some instances, compliance must be achieved by submitting a habitat conservation plan and obtaining permits for the incidental “take” of threatened or endangered species.⁶⁹

Additionally, the Rivers and Harbors Act of 1899 provides for the regulation of vessel traffic and dictates safety and navigation measures for ocean-based aquaculture structures.⁷⁰ The Act delegates enforcement responsibilities to the United States Coast Guard under the oversight of the Corps.⁷¹ Ocean-based facilities are prohibited from depositing “floating craft of any kind . . . whereby navigation shall or may be impeded or obstructed.”⁷²

Finally, under the authority of the Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSA), the primary law governing fishery management in the United States, the New England and Gulf of Mexico Regional Fishery Management Councils exercise regulatory oversight over ocean-based farms.⁷³ In New England, the Council established evaluation criteria for ocean aquaculture proposals,⁷⁴ while the Gulf of Mexico Council developed and implemented an offshore aquaculture fishery management plan in 2009.⁷⁵

Moreover, NOAA recently announced its authority to regulate aquaculture under the MSA.⁷⁶ NOAA released its official policy in June 2011 in an ambitious document that seeks to “integrate environmental, social, and economic considerations in management decisions

⁶⁷ 16 U.S.C.A. § 1533 (Westlaw 2013).

⁶⁸ See NAT’L OCEANIC & ATMOSPHERIC ADMIN., ENDANGERED SPECIES ACT FACT SHEET (2008), available at www.noaa.gov/factsheets/new%20version/esa_nov08.pdf.

⁶⁹ See 16 U.S.C.A. § 1539(a)(2)(A) (Westlaw 2013).

⁷⁰ 33 U.S.C.A. § 407 (Westlaw 2013).

⁷¹ *Id.* § 415(b).

⁷² *Id.*

⁷³ See 16 U.S.C.A. §1801(b)(5) (Westlaw 2013).

⁷⁴ See UPTON & BUCK, *supra* note 37, at 13.

⁷⁵ *Id.*

⁷⁶ See NAT’L OCEANIC & ATMOSPHERIC ADMIN., MARINE AQUACULTURE POLICY (June 2011), available at www.nmfs.noaa.gov/aquaculture/docs/policy/noaa_aquaculture_policy_2011.pdf.

concerning aquaculture.”⁷⁷ The policy’s purpose is “to enable the development of sustainable marine aquaculture” in the oceans of the United States,⁷⁸ illustrating heightened governmental focus on the expansion of ocean-based aquaculture within the EEZ.⁷⁹ Despite language indicating that NOAA’s policy is concerned with active stewardship and sustainability,⁸⁰ there is no discussion of the prospect of alternative land-based aquaculture systems, a major oversight given the tumultuous history of open-ocean aquaculture.

To make matters even more complicated, because farmed fish are ultimately sold as food, the USDA offers its own reports and monitoring. The FDA is also evaluating the production of genetically modified fish⁸¹ and is charged with approving the use of antibiotics and other drugs on farmed fish.⁸²

This regulatory patchwork has resulted in a notable few attempts at comprehensive regulation. In 1980, for example, Congress passed the National Aquaculture Act (NAA) to promote the development of the United States aquaculture industry and establish a national policy.⁸³ The NAA recognized that annual harvests of wild fish and shellfish were operating beyond optimum sustainable yield, “thereby making it more difficult to meet the increasing demand for aquatic food.”⁸⁴ The Act further emphasized that the United States’ dependence on imported seafood “adversely affects the national balance of payments and contributes to the uncertainty of supplies.”⁸⁵ At the center of the Act’s substantive policy was the placement of the Department of Agriculture as the lead federal agency responsible for collecting and analyzing “scientific, technical, legal, and economic information relating to aquaculture, including acreages, water use, production, marketing, culture techniques, and other relevant matters.”⁸⁶

⁷⁷ *Id.* at 1.

⁷⁸ *Id.*

⁷⁹ See *id.* at app. 1, at 9 (“The purpose of this appendix is to establish a set of goals to guide NOAA’s regulatory and programmatic actions with respect to aquaculture production in federal waters of the U.S. Exclusive Economic Zone and to provide a list of implementing actions that NOAA will take to achieve each goal.”).

⁸⁰ *Id.*

⁸¹ *An Overview of Atlantic Salmon, Its Natural History, Aquaculture, and Genetic Engineering*, U.S. FOOD & DRUG ADMIN., (last updated Aug. 27, 2008), www.fda.gov/AdvisoryCommittees/CommitteesMeetingMaterials/VeterinaryMedicineAdvisoryCommittee/ucm222635.htm.

⁸² See 21 C.F.R. § 514.1 (Westlaw 2013).

⁸³ 16 U.S.C.A. § 2801(b) (Westlaw 2013).

⁸⁴ *Id.* § 2801(a)(1).

⁸⁵ *Id.* § 2801(a)(2).

⁸⁶ 16 U.S.C.A. § 2804(c)(1)(a) (Westlaw 2013).

Although the NAA aimed to create a comprehensive aquaculture strategy, it did little in the way of regulation or enforcement and instead acted merely as an impetus for further study of industry growth potential. For example, the Act created no regulatory oversight authority, assigning the Department of Agriculture the responsibility only to “consult with the Secretary of Commerce and the Secretary of Interior, other appropriate Federal officers, States, regional fishery management councils . . . and representatives of the aquaculture industry.”⁸⁷ Moreover, although the NAA directs the Department of Agriculture to identify “regulatory constraints” on the aquaculture industry and formulate a corresponding “regulatory constraints plan,”⁸⁸ the subcommittee responsible for these actions has done little to address these constraints in a concrete way.⁸⁹ Instead, actions such as the 2012 issuance of a draft National Aquaculture Research and Development Strategic Plan provide guidance for agencies to develop “new approaches for accelerating technology commercialization” of the United States aquaculture industry.⁹⁰

The lack of a comprehensive regulatory aquaculture policy has given way to efforts like the National Sustainable Offshore Aquaculture Act of 2011, the latest Congressional effort concerning aquaculture regulation, proposed by Representative Lois Capps, D-Santa Barbara.⁹¹ The bill, which failed to pass Congressional approval and was referred to the House Subcommittee on Fisheries, Wildlife, Oceans, and Insular Affairs in July of 2011, would have set an unprecedented regulatory framework for offshore fish farm operations by addressing environmental, social, and economic concerns.⁹² Central to the bill was a new permitting process mandating would-be ocean fish farmers to obtain authorization from the Secretary of Commerce after meeting a series of requirements aimed at minimizing potentially adverse impacts on marine ecosystems.⁹³ The requirements included identifying appropriate locations for farms, complying with site inspections, limiting where certain fish species may be farmed, and preventing escapement, disease, and harmful waste discharge.⁹⁴ In addition, the bill attempted to initiate a

⁸⁷ 16 U.S.C.A. § 2803(a)(2) (Westlaw 2013).

⁸⁸ 16 U.S.C.A. § 2808 (Westlaw 2013).

⁸⁹ D. Douglas Hopkins et al., *An Environmental Critique of Government Regulations and Policies for Open Ocean Aquaculture*, 2 OCEAN & COASTAL L.J. 235, 250 (1997).

⁹⁰ See NAT'L OCEANIC & ATMOSPHERIC ADMIN., DRAFT NATIONAL AQUACULTURE RESEARCH AND DEVELOPMENT STRATEGIC PLAN (2012), available at www.nmfs.noaa.gov/ocs/mafacc/meetings/2012_08/docs/jsa_aqua_rd_plan_draft_8jun2012.pdf.

⁹¹ National Sustainable Offshore Aquaculture Act of 2011, H.R. 2373, 112th Cong. (2011).

⁹² *Id.* § 2.

⁹³ *Id.* § 5.

⁹⁴ *Id.*

research program designed to solve significant data quandaries and address concerns with the ecological sustainability of further aquaculture development and expansion.⁹⁵ Although the bill did not become law, its potential impact on the United States aquaculture industry as a whole was substantial, and it may represent a trend toward more comprehensive regulation. At the moment, however, uncertainty abounds and aquaculture operators are left to sift through a seemingly endless array of federal and state regulatory laws.

A. THE FEDERAL CLEAN WATER ACT

Although there are a host of environmental regulations governing various aspects of aquaculture operations, none is more significant than the CWA, a federal statute enacted “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.”⁹⁶ The CWA implicates aquaculture operations by imposing liability on those facilities that threaten the water quality of surrounding water bodies.⁹⁷

The Act’s central legal mechanism is the National Pollutant Discharge Eliminations System (NPDES) permitting program, which prohibits discharge except in accordance with the permit issued.⁹⁸ Specifically, the program regulates the discharge of pollutants from any “point source” (“discernible, confined and discrete conveyance . . . from which pollutants are or may be discharged”⁹⁹) into navigable waters.¹⁰⁰ Furthermore, it requires that dischargers comply with technology-based¹⁰¹ and water-quality-based¹⁰² effluent limitations. While the CWA gives the EPA Administrator authority to issue permits for effluent discharges, a State may acquire permitting authority from the EPA, provided the State can ensure compliance with federal water quality limitations.¹⁰³ The NPDES program places restrictions on “quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters.”¹⁰⁴

Aquaculture facilities, both terrestrial and ocean-based, require

⁹⁵ H.R. 2373 § 7.

⁹⁶ 33 U.S.C.A. § 1251 (a) (Westlaw 2013).

⁹⁷ *See* 33 U.S.C.A. § 1252(a) (Westlaw 2013).

⁹⁸ *See id.* §§ 1311(a), 1362(12), 1342.

⁹⁹ *Id.* § 1362(14).

¹⁰⁰ *See id.* § 1342.

¹⁰¹ *See id.* § 1311(b).

¹⁰² 33 U.S.C.A. § 1312 (Westlaw 2013).

¹⁰³ *Id.* § 1342(b)(1)(A).

¹⁰⁴ *See id.* § 1362(11).

NPDES permits if they meet the Concentrated Aquatic Animal Production (CAAP) facility classification.¹⁰⁵ In 2004, the EPA promulgated a final rule establishing water controls for CAAP facilities, which are defined as facilities that produce at least 100,000 pounds per year in flow-through, recirculating systems that discharge wastewater at least 30 days a year, or facilities that produce at least 100,000 pounds a year in net pens or submerged cage systems.¹⁰⁶ As of 2004, the rule applied to roughly 245 facilities.¹⁰⁷ The rule established effluent limitation guidelines and new source performance standards for specific types of commercial and non-commercial aquaculture operations.¹⁰⁸ Rather than setting numeric limits, the rule requires best management practices to control discharge, including the development of Best Management Practice (BMP) plans.¹⁰⁹ The rule also sets forth technology standards based on best conventional pollutant control technology (BCT) and best available technology that is economically achievable (BAT).¹¹⁰

Depending on the rate and scale of development for sustainable aquaculture systems, it is possible that even large-scale RAS systems will qualify as CAAP facilities and thus be subject to NPDES permitting.¹¹¹ However, the implementation of BMP and the use of BAT can ensure highly manageable and effective regulation, encourage environmentally sound aquaculture practices, and provide clear industry management guidelines to operators. Small-scale RAS systems, on the other hand, may be free from permitting requirements altogether, depending on state jurisdiction and local permitting requirements.

The CWA distinguishes between two types of water pollution sources: “point source” and “nonpoint source.”¹¹² “Nonpoint sources” include urban and cropland runoff, animal waste, storm sewer dischargers, construction sites, mining and logging operations, and atmospheric deposition.¹¹³ While “point source” discharges fall under

¹⁰⁵ Thomas R. Head, III, *Fishy Business—Regulating Aquaculture Operations in the United States*, 18 NAT. RESOURCES & ENV'T, 21, 54 (2003).

¹⁰⁶ Effluent Limitations Guidelines and New Source Performance Standards for the Concentrated Aquatic Production Point Source Category, 69 Fed. Reg. 51,892 (Aug. 23, 2004).

¹⁰⁷ *Id.* at 51,906.

¹⁰⁸ *Id.* at 51,892.

¹⁰⁹ *Id.* at 51,897.

¹¹⁰ *Id.* at 51,895.

¹¹¹ CAAP qualifications are based on amount of discharge as well as total production tonnage. *See* Effluent Limitations Guidelines and New Source Performance Standards for the Concentrated Aquatic Production Point Source Category, 69 Fed. Reg. 51,892 (Aug. 23, 2004).

¹¹² 33 U.S.C.A. § 1362(14) (Westlaw 2013).

¹¹³ ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION: LAW, SCIENCE, AND POLICY 629 (6th ed. 2009).

control of the NPDES permitting program, “nonpoint sources” are subjected to far less rigorous regulation because the EPA initially deemed the regulation of runoff pollution infeasible.¹¹⁴ Both ocean-based and traditional land-based systems will likely qualify as a “point source” and fall subject to NPDES permitting programs.¹¹⁵ Sustainable land-based systems, in contrast, can avert point-source qualification altogether, and even those that do meet point-source requirements are more apt to conform to permit requirements because of greater operational control.

The term “navigable waters” is defined as “the waters of the United States, including the territorial seas.”¹¹⁶ This definition, and the extent of Congress’s authority to regulate certain waters, expanded considerably as a result of the U.S. Supreme Court ruling in the 1985 case *United States v. Riverside Bayview Homes, Inc.*¹¹⁷

The case involved a land development company that placed fill materials into wetlands adjacent to navigable bodies of water.¹¹⁸ A lawsuit was filed by the Corps to prevent further development without proper dredge and fill permitting.¹¹⁹ The federal district court held that the property was a covered wetland subject to the Corps’ permit authority.¹²⁰ After the Sixth Circuit reversed the lower court’s ruling, the Supreme Court ruled in favor of the Corps, holding that “a definition of ‘waters of the United States’ encompassing all wetlands adjacent to other bodies of water over which the Corps has jurisdiction is a permissible interpretation of the Act.”¹²¹ This ruling has substantial consequences for aquaculture facilities located directly in or adjacent to a wetland area, because such facilities fall squarely within CWA jurisdiction.

Another important case in the jurisprudential history of the CWA is the 2006 United States Supreme Court decision *Rapanos v. United States*.¹²² In a 4-1-4 split decision, Justice Scalia’s opinion for the plurality limited “waters of the United States” to permanent water bodies, rejecting the Corps’ argument that intermittent flows should be included in the statutory definition.¹²³ Like *Bayview*, the case involved a

¹¹⁴ *Id.* at 763.

¹¹⁵ The U.S. Supreme Court has held that the CWA’s definition of a “point source” as a conveyance “makes plain that a point source need only convey the pollutant to ‘navigable waters.’” *S. Fla. Water Mgmt. Dist. v. Miccosukee Tribe of Indians*, 541 U.S. 95, 105 (2004).

¹¹⁶ 33 U.S.C.A. § 1362(7) (Westlaw 2013).

¹¹⁷ *See United States v. Riverside Bayview Homes, Inc.*, 474 U.S. 121 (1985).

¹¹⁸ *See id.*

¹¹⁹ *Id.* at 124.

¹²⁰ *Id.* at 125.

¹²¹ *Id.* at 135.

¹²² *Rapanos v. United States*, 547 U.S. 715 (2006).

¹²³ *Id.*

developer's plan to fill a wetland in preparation for the construction of a shopping mall. The plurality in *Rapanos* ruled in favor of the developer, holding that "waters of the United States" includes "only relatively permanent, standing or flowing bodies of water."¹²⁴ Therefore, although *Bayview* implicates aquaculture facilities located near wetland areas, *Rapanos* may limit liability for those facilities located near seasonal water bodies.

In addition to limiting regulation to "navigable waters," courts may also be reluctant to apply the CWA definition of "pollutants" to aquaculture facilities. The CWA defines pollutants 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 the water."¹²⁵ However, the CWA list of pollutants does not contain a catch-all phrase and "the list has been construed as suggestive rather than exclusive."¹²⁶

In *Association to Protect Hammersley, Eld, & Totten Inlets v. Taylor Resources, Inc.*, the U.S. Court of Appeals for the Ninth Circuit issued a decision interpreting the term "pollutant" in the context of an aquaculture facility.¹²⁷ The plaintiff, a landowners' advocacy organization, brought suit under the CWA against a mussel facility growing mussels attached to suspension ropes anchored to the sea floor of Washington's Puget Sound.¹²⁸ The mussels matured on the ropes, feeding exclusively on the nutrients found naturally in the water.¹²⁹ The facility operator held no permit. The Ninth Circuit struck down the plaintiff's argument that a discharge of mussel feces and shell material into navigable waters constituted a "pollutant," holding instead that the emissions were not "pollutants" subject to permitting requirements.¹³⁰ The court based its analysis on a distinction between materials "altered by a human or industrial process" and those that were the result of "natural biological processes."¹³¹

Although the Ninth Circuit held that shell and feces discharges were

¹²⁴ *Id.* at 732.

¹²⁵ 33 U.S.C.A. § 1362(6) (Westlaw 2013).

¹²⁶ Bridget B. Romero, Casenote, *Is There a Need To Regulate Mussel Harvesting? The Ninth Circuit Declares No Pollution, No Problem!*, 10 MO. ENVTL. L. & POL'Y REV. 158, 162 (2003).

¹²⁷ *Ass'n to Protect Hammersley, Eld, & Totten Inlets v. Taylor Res., Inc.*, 299 F.3d 1007 (9th Cir. 2002).

¹²⁸ *Id.* at 1010.

¹²⁹ *Id.*

¹³⁰ *Id.* at 1016.

¹³¹ *Id.* at 1017.

not “pollutant[s]” under the CWA, a district court within the First Circuit was willing to subject similar discharges to CWA regulation.¹³² In *U.S. Public Interest Research Group v. Atlantic Salmon of Maine, L.L.C.*, the district court held that aquaculture facilities discharging salmon feces and urine into the ocean were subject to the CWA since they were discharging “pollutants” and the salmon net pens were “point sources.”¹³³ The court reasoned that escaped salmon, as well as salmon feces and urine, were “pollutants” under the CWA because they constituted “biological materials” or “agricultural wastes,” both of which are explicitly mentioned in the statutory definition. In addition, antibiotics added to the feed qualified as “pollutants” under the “chemical waste” part of the statutory definition.¹³⁴

The disparate results in *Association to Protect Hammersley* and *Atlantic Salmon* represent a split with potentially profound impacts on aquaculture facilities located in the ocean and on land. Taken as a whole, these judicial interpretations indicate some willingness by the courts to qualify fish feces, escaped fish, and other organic discharges as “pollutants.” This definition has particularly serious implications for aquaculture facilities that are not self-contained and are thus highly susceptible to escapement and fecal matter discharge.¹³⁵ Moreover, while the Ninth Circuit’s limited definition excludes fecal matter, it still leaves escapement and the discharge of other potentially hazardous materials open to a “pollutant” determination. Although it is difficult to predict whether this split will be resolved, either by the Supreme Court or additional legislation, it is certain that a self-contained, highly adjustable aquaculture facility such as an RAS, will significantly decrease CWA liability in the “pollutant” context.

Meanwhile, compliance with CWA requirements are is extremely difficult for ocean and traditional land-based facilities because they are often located directly in navigable waters and can easily be subjected to “point source” NPDES permitting requirements. Although the “territorial seas” defined as “navigable waters” only extend three nautical miles seaward, courts have held that the federal EPA may issue permits and regulate discharges that occur in “all ocean waters,” which includes the EEZ.¹³⁶

Ocean net-pens are particularly prone to pollution discharge from

¹³² See *U.S. Pub. Interest Research Grp. v. Atl. Salmon of Me., L.L.C.*, 215 F. Supp. 2d 239, 249-50 (D. Me. 2002).

¹³³ *Id.*

¹³⁴ *Id.* at 248.

¹³⁵ See Fisheries & Aquaculture Dep’t, *supra* note 51.

¹³⁶ See *Pac. Legal Found. v. Costle*, 586 F.2d 650, 655-56 (9th Cir. 1978), *rev’d on other grounds*, *Costle v. Pac. Legal Found.*, 445 U.S. 198 (1980).

fish in the form of waste, escapement, disease transference, or from additives such as antibiotics and feed.¹³⁷ Therefore, even the most well-intentioned ocean operator may find itself in violation of the CWA, a law that imposes both civil and criminal penalties for “knowing” or “willful” violations.¹³⁸ Moreover, as the recent closure of an oyster farm that had operated for over forty years in an estuary in Northern California illustrates, even seafood production free of CWA liability may be subject to closure if it is located in a government-protected wilderness area.¹³⁹

B. OTHER LEGAL CONSIDERATIONS FOR LAND-BASED AQUACULTURE SYSTEMS

1. State Fish Farm Permits

Although the full extent of CWA jurisdiction may be not clearly defined, most states have enacted legislation that calls for aquaculture regulation in addition to and independent of federal environmental statutes. Therefore, although the CWA NPDES permitting process may be inapplicable to some RAS systems and other sustainable technologies, state laws may apply. For example, Florida’s legislature enacted the Florida Aquaculture Policy Act (FAPA) in 2005, with the intent to “enhance the growth of aquaculture in this state, while protecting Florida’s environment.”¹⁴⁰ FAPA delegates regulatory authority to the Florida Department of Agriculture and Consumer Services, charging the Department with the “duty to coordinate and assist the development of aquaculture.”¹⁴¹ The FAPA permitting process is relatively straightforward: an applicant must fill out a short certificate of registration, providing a property description and the location of the facility, and documentation of compliance with local rules and regulations. These regulations include best management practices and recordkeeping requirements.¹⁴² A \$100 annual fee must be deposited into a General Inspection Trust Fund. The statute also provides that all fish except for “shellfish, snook . . . and prohibited and restricted freshwater

¹³⁷ OCEAN CONSERVANCY, *supra* note 35, at 13-14.

¹³⁸ 33 U.S.C.A. §§ 1319(c)(2),(3) (Westlaw 2013).

¹³⁹ Paul Payne, *Point Reyes Oyster Farm Owners File Lawsuit To Block Closure*, PRESS DEMOCRAT, Dec. 4, 2012, www.pressdemocrat.com/article/20121204/ARTICLES/121209881?p=1&tc=pg.

¹⁴⁰ Fla. Stat. § 597.0021(1) (Westlaw 2013).

¹⁴¹ *Id.* § 597.0021(2).

¹⁴² Fla. Stat. § 597.004(1)-(3) (Westlaw 2013).

and marine species identified by rules of the Fish and Wildlife Conservation Commission, may be sold” by a certified producer “so long as product origin can be identified.”¹⁴³ To date, there are over 900 reported aquaculture operations participating in FAPA, producing a wide range of seafood including fish, mollusks and aquatic plants.¹⁴⁴

Other states, such as New York and California, do not have comprehensive aquaculture laws, and no permits are required independent of environmental statutes like CWA and the National Environmental Protection Act (or corresponding state analogues).¹⁴⁵ However, a state agency is likely to place restrictions on the importation, transportation, and possession of certain species¹⁴⁶ and require registration in some circumstances. For example, California Department of Fish and Game regulations¹⁴⁷ require registration for all aquaculture facilities other than “animals . . . maintained in closed systems for person, pet industry or hobby purposes.”¹⁴⁸ In New York, laws pertaining to aquaculture are set out in the context of regulated activities within tidal wetlands, environmental and fishery conservation, and shellfish production permitting.¹⁴⁹ RAS and other closed-loop systems are likely excluded from these requirements, other than importation licenses, because they do not require the use of marine areas.¹⁵⁰

2. *International and Interstate Transportation: The Lacey Act*

Passed in 1900 to protect wildlife from the threat of illegal commercial hunting, the Lacey Act makes it unlawful to “import, export, transport, sell, receive, acquire or purchase” any fish, plant, or wildlife “taken, possessed, transported, or sold” in violation of state, federal, or foreign law.¹⁵¹ Prosecution under the Lacey Act can also be triggered by

¹⁴³ *Id.* § 597.004(5).

¹⁴⁴ See *Aquafarm Program*, DIV. OF AQUACULTURE, FLA. DEP’T OF AGRIC. & CONSUMER SERVS., www.floridaaquaculture.com/bad/aquaintro.htm (last visited Apr. 4, 2013).

¹⁴⁵ See generally CAL. PUB. RES. CODE § 21000 et seq. (Westlaw 2013). The California Environmental Quality Act (CEQA) is California’s version of the National Environmental Policy Act, 42 U.S.C.A. § 4321 et seq. (Westlaw 2013), and requires a report of the potential environmental impacts of agency approved projects.

¹⁴⁶ See CAL. CODE REGS. tit. 14, § 238.5 (Westlaw 2013) (“All aquaculture products stocked . . . must be legally reared or possessed by an aquaculturist registered in this state. No person shall stock aquaculture products which are parasitized, diseased or of an unauthorized species.”).

¹⁴⁷ See CAL. CODE REGS. tit. 14, § 235 (Westlaw 2013). Title 14 governs Natural Resources, and Chapter 9 (§ 235 et seq.) pertains to aquaculture requirements for the state.

¹⁴⁸ CAL. CODE REGS. tit. 14, § 235(a) (Westlaw 2013).

¹⁴⁹ See *Marine Permits and Licenses*, N.Y. STATE DEP’T OF ENVTL. CONSERVATION, www.dec.ny.gov/permits/6084.html (last visited Apr. 10, 2013).

¹⁵⁰ *Id.*

¹⁵¹ 16 U.S.C.A. § 3372(a)(1) (Westlaw 2013).

the violation of a separate federal law such as the Endangered Species Act, thereby compounding the penalty under state permitting or environmental law.¹⁵²

Every state has established regulations pertaining to protected, prohibited, restricted, or approved exotic or game species. In California, for example, transporting dreissenid mussels without authorization is prohibited.¹⁵³ While a fine of up to \$1000 may be issued for violating California law,¹⁵⁴ a person who transports dreissenid mussels across state lines may also be prosecuted under the Lacey Act, with substantially harsher penalties. Felony provisions under the Lacey Act, triggered by knowingly selling wildlife with a market value over \$350, can result in fines of up to \$20,000 and imprisonment.¹⁵⁵

The Lacey Act is a potentially significant imposition for aquaculture operators because any interstate commerce involving farmed fish or particular species of fish can carry substantial legal consequences. Sustainable aquaculture technologies are also far less susceptible to liability under the Act because locally produced fish are generally sold to nearby markets—the ideal scenario for systems located in urban areas—and will not require interstate shipping. Of course, for those fish sold interstate, steps should be taken to ensure that regulated species are not transported across state lines.¹⁵⁶

3. Antibiotic Use and FDA Guidelines

The FDA's involvement in the regulation of the aquaculture industry is quite extensive due to the continual need to treat and prevent fish disease.¹⁵⁷ The Center for Veterinary Medicine (CVM) is the FDA division charged with regulating the manufacture and distribution of food additives and drugs given to animals. Although the use of drugs in aquatic-based facilities raises its own array of concerns such as the

¹⁵² See 16 U.S.C.A. § 3373(a)(1) (Westlaw 2013). This provision accounts for possessing, transport, and selling fish or wildlife “in a manner unlawful under, any underlying law, treaty, or regulation.”

¹⁵³ CAL. FISH & GAME CODE § 2301(a)(1) (Westlaw 2013).

¹⁵⁴ *Id.* § 2301(f)(1).

¹⁵⁵ 16 U.S.C.A. § 3373(d)(1)(b) (Westlaw 2013).

¹⁵⁶ For a more detailed analysis of how aquaculture operators may be affected by the Lacey Act, see generally ELIZABETH R. RUMLEY, THE NAT'L AGRIC. L. CTR., AQUACULTURE AND THE LACEY ACT (2010), available at www.nationalaglawcenter.org/assets/articles/springsteen_lacey.pdf.

¹⁵⁷ CTR. FOR VETERINARY MED., FOOD & DRUG ADMIN., U.S. DEP'T OF HEALTH & HUMAN SERVS., GUIDANCE FOR INDUSTRY #152: EVALUATING THE SAFETY OF ANTIMICROBIAL NEW ANIMAL DRUGS WITH REGARD TO THEIR MICROBIOLOGICAL EFFECTS ON BACTERIA OF HUMAN HEALTH CONCERN 1 (2002), available at www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/ucm052519.pdf.

spread of antibiotic resistance in marine ecosystems, human consumption of fish treated with antibiotics may also present health hazards and thus requires extensive regulation. The CVM must approve a drug pursuant to a New Animal Drug Application (NADA) before it can be used in agriculture or aquaculture. Manufacturers must demonstrate, using specifically defined methods, that their drugs are safe and effective.¹⁵⁸ The FDA considers a drug “safe” if there is a “reasonable certainty of no harm to human health from the proposed use of the drug in food-producing animals.”¹⁵⁹

While the effects of antibiotic resistance on marine life are beyond the scope of this Comment, it is worth noting that the FDA’s regulation of aquaculture has come under heavy scrutiny owing to potential oversight problems regarding antibiotic approval, genetic engineering provisions, and labeling.¹⁶⁰ The actual prevalence of antibiotic use on fish farms is also heavily underreported.¹⁶¹ Operators of sustainable aquaculture facilities, however, will have little trouble complying with FDA requirements because technologies like RAS systems have little need to use antibiotics due to the increased ability to limit the entrance of pathogens into the contained environment. Moreover, in the case of a disease event, alternative treatments are more effective in the RAS context because of the relatively small quantity of water that must be treated.

V. PROBLEMS WITH CURRENT AQUACULTURE LAW AND POLICY AND THE PROMISE OF SUSTAINABLE URBAN AQUACULTURE

The current legal framework for aquaculture operations in the United States exists as a non-comprehensive, piecemeal collection of laws, policies, and regulations. The National Aquaculture Act of 1980 signaled an attempt by Congress to establish a comprehensive approach; however, the Act has yet to materialize into concrete, substantive law.¹⁶² Instead, aquaculture operators are regulated by a vast array of laws, most

¹⁵⁸ See General Provisions for New Animal Drug Provisions, 21 C.F.R. § 514.1(b)(8) (Westlaw 2013).

¹⁵⁹ CTR. FOR VETERINARY MED., *supra* note 157, at 2.

¹⁶⁰ For an extensive assessment and evaluation of FDA aquaculture regulation, see Graham M. Wilson, *A Day on the Fish Farm: FDA and the Regulation of Aquaculture*, 23 VA. ENVTL. L.J. 351 (2004).

¹⁶¹ CHARLES M. BENBROOK, THE NW. SCI. & ENVTL. POL’Y CTR., ANTIBIOTIC DRUG USE IN U.S. AQUACULTURE 5 (2002), available at m.iatp.org/files/421_2_37397.pdf.

¹⁶² U.S. COMM’N ON OCEAN POLICY, AN OCEAN BLUEPRINT FOR THE 21ST CENTURY 333 (2004), available at www.oceancommission.gov/documents/full_color_rpt/000_ocean_full_report.pdf.

notably the federal Clean Water Act (CWA) and related state permitting requirements, the Resource Conservation and Recovery Act (RCRA), the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and the Rivers and Harbors Act (RHA).

There are three broad problems with the resulting regulatory overlap. First, because the regulatory system is comprised of numerous laws and regulations, each with specific jurisdictional boundaries, there is a great potential for the system to contain loopholes. For example, the CWA regulates only “navigable” waters and “territorial seas” within the United States, resulting in the possibility of less stringent standards for effluent discharge in the EEZ. Second, the piecemeal structure is inherently burdensome for potential aquaculture operators, investors, and industry leaders. The difficulty of determining proper compliance under all possibly applicable laws creates considerable risk for any person operating a non-sustainable aquaculture facility in the United States. Finally, the current legal framework does little to actively promote actual sustainable aquaculture practices.

Despite these deficiencies, RAS facilities are far better positioned to meet regulatory demands and cope with the current regulatory patchwork. Because RAS farms afford operators nearly total environmental control, optimized species growth can be achieved on a year-round basis, guaranteeing a product that is safe for consumers and the environment, and free of chemicals and heavy metals.¹⁶³ The scalability of RAS farms is equally impressive; they can be as tiny as a desktop, for personal use, or occupy large warehouses for commercial operation.¹⁶⁴ Finally, because RAS farms can be located almost anywhere, including in or near urban centers, community farms can minimize fuel used for transport and leave a miniscule carbon footprint. The warehouses of Cleveland, old industrial sites in Detroit, and even the desert of Las Vegas are all potential sites for producing fresh seafood.¹⁶⁵

RAS systems are currently used to grow catfish, striped bass, tilapia, crawfish, blue crabs, oysters, mussels, salmon, shrimp, and clams. Although the economic feasibility of commercial RAS operations is disputed,¹⁶⁶ several studies indicate real economic viability.¹⁶⁷ In

¹⁶³ Timmons, *supra* note 17, at 139.

¹⁶⁴ See, e.g., Southern Regional Aquaculture Center’s Guide for Constructing a Small RAS System for Use in a Classroom, *available at* srac.tamu.edu/index.cfm/event/getFactSheet/whichfactsheet/182/.

¹⁶⁵ In fact, at least one operation already exists in Las Vegas. See Caitlin McGarry, *North Las Vegas Shrimp Farm Open for Business*, LAS VEGAS REV. J. (July 8, 2011), www.lvrj.com/business/north-las-vegas-shrimp-farm-open-for-business-125202273.html.

¹⁶⁶ *Id.*

¹⁶⁷ The study found that further improvements on bio-filtration systems, feed nutrition, and

particular, operations located in urban areas present opportunity for real economic success. One study that examined the possible gains of an indoor tilapia industry in the state of New York concluded that “New York’s competitive advantage is the ability to grow the highest possible quality tilapia product on the doorstep of the consuming market.”¹⁶⁸ The report focused on urban areas as ideal locations for sustainable aquaculture facilities, pointing to product freshness, low transportation and processing costs, branding opportunities, and cheaper feed.¹⁶⁹ In addition, New York already has an existing aquaculture infrastructure, including several universities actively researching indoor systems and a host of business institutions with aquaculture expertise.¹⁷⁰ The urban areas in the United States ripe for aquaculture development include those American cities that could serve a large consumer base with minimal costs, such as Cleveland, Detroit, Los Angeles, or New York City.¹⁷¹

Because they pose little threat to surrounding ecosystems, sustainable land-based systems are generally less susceptible to environmental regulation than traditional land-based operations. For example, operators are able to exercise precise controls to meet CWA requirements, even when their facilities are adjacent to navigable waters and otherwise subject to CWA liability under *Riverside Bayview* and *Rapanos*. While conventional land-based facilities, particularly raceways and ponds, have issues with CAAP requirements or nonpoint runoff, RAS facilities can all but eradicate liability by running in a closed-loop, self-sustaining mode. These systems produce minimal amounts of effluent, and some are even able to capture effluent for other uses, such as the production of fertilizer.¹⁷²

The United States is now at a crossroads between implementing a regulatory system that encourages the growth of sustainable, ecologically sound aquaculture practices and continuing to foster operations that are environmentally perilous and subject to a bevy of tough environmental regulations. The environmental hazards associated with traditional land-based and current ocean-based aquaculture, both near-shore and in the

productive species targeting will ensure economic viability. See ANDREW M. LAZUR ET AL., AQUACULTURE WHITE PAPER NO. 2: LAND-BASED AQUACULTURE PRODUCTION SYSTEMS, ENGINEERING AND TECHNOLOGY: OPPORTUNITIES AND NEEDS 11-15 (2003), available at www.nrac.umd.edu/files/Whitepapers/wp_no2_land_based.pdf.

¹⁶⁸ TIMMONS ET AL., *supra* note 61, at 14.

¹⁶⁹ *Id.*

¹⁷⁰ For example, Cornell University’s Department of Biological Engineering now offers a short course on Aquaculture. See *id.*

¹⁷¹ See Martin P. Schreiber & Chester B. Zarnoch, *Urban Aquaculture in Brooklyn New York, USA*, in URB. AQUACULTURE 207, 275 (Barry A. Costa-Pierce et al. eds., 2005).

¹⁷² Michael B. Timmons, *Competitive Potential for USA Urban Aquaculture*, in URB. AQUACULTURE 213 (Barry Costa-Pierce et al. eds., 2005).

EEZ, are well founded and supported by a history of ecological degradation.¹⁷³ Escapes, disease, and water pollution are the most commonly cited examples, though they are only a fraction of the encountered problems. The consequence of these infractions is a trail of litigation and regulation left in the wake of reckless industry expansion. While the future of ocean-based aquaculture is unclear, its susceptibility to environmental regulation will almost certainly slow its growth dramatically in the United States.

Changes to the current regulatory approach are inevitable; the impending shift provides a momentous opportunity to implement a drastically improved system. Implementing an ecosystem approach to aquaculture (EAA) in the United States, and thereby promoting a sustainable aquaculture industry, is the first step toward a well-balanced and effective aquaculture regulatory structure.

An EAA is defined as “a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity, and resilience of interlinked social-ecological problems.”¹⁷⁴ This approach, adopted by the Food and Agriculture Organization of the United Nations (FAO), places emphasis on all the essential components of sustainability—ecological, social, and economic—by considering wild fisheries and aquaculture as interdependent systems.¹⁷⁵ Although an EAA is often perceived as complex and difficult to implement, concrete examples of successful EAA implementation exist.¹⁷⁶

The advantages of an EAA are four-fold. First, the state of our damaged and depleted oceans will improve by allowing impaired aquatic ecosystems to regenerate and eventually support larger wild stocks. Second, the demand from consumers for high-quality, low-cost seafood free from pollutants and chemicals can be met with a domestic product that will ease the growing trade deficit caused by seafood importation from foreign markets. Third, because urban centers serve as major

¹⁷³ See OCEAN CONSERVANCY, *supra* note 35, at 33 (“Without a sufficiently precautionary national plan, Chile massively expanded its production of farmed Atlantic salmon over the past two decades. Disease has begun to ravage the oversized industry; . . . 7,500 direct jobs have been lost, with untold consequences for the marine environment.”).

¹⁷⁴ FOOD & AGRIC. ORG. OF THE UNITED NATIONS, *Ecosystem Approach to Aquaculture*, in 5 AQUACULTURE DEV. supp. 4 (2010), available at www.fao.org/docrep/013/i1750e/i1750e00.htm.

¹⁷⁵ FOOD & AGRIC. ORG. OF THE UNITED NATIONS, THE STATE OF WORLD FISHERIES AND AQUACULTURE PART 1 138 (2012), available at www.fao.org/docrep/016/i2727e/i2727e00.htm.

¹⁷⁶ For example, in the European Union, a Marine Strategy Framework Directive is being implemented within the new European Union Common Fisheries Policy as part of an ecosystem-based management approach. See INDRANI LUTCHMAN ET AL., TOWARDS A REFORM OF THE COMMON FISHERIES POLICY IN 2012—A CFP HEALTH CHECK 51 (2009), available at www.ieep.eu/assets/440/cfp_healthcheck.pdf.

distribution hubs, new jobs will be created, improving social and economic development in blighted areas.¹⁷⁷ Fourth, the needed infrastructure—water sources, warehouse space, and grocery and restaurant proximity—is already in place. The potential for sustainable urban aquaculture is limitless compared to open-ocean aquaculture, and unlike conventional land-based facilities and ocean-based farms, its growth is not likely to be stunted by regulation. Instead, law and policy makers are in a position to promote sustainable practices via a well-managed EAA.

Perhaps most fundamental to a workable and effective policy that utilizes an EAA approach is the use of best available technologies (BATs). Congress could accomplish with aquaculture much of what it has successfully accomplished in other effective environmental regulation contexts¹⁷⁸ by placing a mandate on operators to use technologies that limit harm to the environment while simultaneously enabling efficient production of seafood. BATs can also be implemented for use in decisionmaking, risk assessment, and project planning. Such technology-forcing legislation would result in expanded use of sustainable systems including RAS technology and would ensure that operators are presented with clear and explicit compliance guidelines.

In addition to encouraging the use of BATs, future law and policy initiatives should promote the use of adaptive management systems, or structured processes that reduce decision making uncertainties by increased system monitoring. Already used by state agencies such as the Massachusetts Department of Fish and Game,¹⁷⁹ adaptive management includes monitoring aquaculture facility performance, providing feedback to operators and regulators, and allowing for adjustments related to aspects of future management plans.

Throughout all implementation phases of an ecosystem-based approach, participatory mechanisms should be constructed to allow for input by both the public as well as industry groups. As with the National Environmental Protection Act and corresponding state laws that require a public-participation process for proposed agency action,¹⁸⁰ comment periods and public documentation should accompany the development of new aquaculture law and policy. Participatory mechanisms will allow

¹⁷⁷ Schreiberman & Zarnoch, *supra* note 171.

¹⁷⁸ See, e.g., 42 U.S.C.A. § 7479(3) (Westlaw 2013) (defining “best available control technology”).

¹⁷⁹ The Massachusetts Department of Fish and Game uses adaptive management systems to address growing concerns about climate change and its effects on fish and wildlife within the state. See, e.g., *Adapting to Climate Change*, MASS. DEP’T OF FISH & GAME, www.mass.gov/dfwele/climatechange.htm (last visited May 1, 2013).

¹⁸⁰ 42 U.S.C.A. §§ 4321-4347 (Westlaw 2013).

industry leaders, environmentalists, fishermen, and concerned citizens to partake in the construction and implementation of a new United States aquaculture industry.

VI. CONCLUSION: HELPING REVITALIZE AMERICAN CITIES

As the federal government continues to encourage the expansion of ocean-based aquaculture in the EEZ, not only will the environment be subject to an array of potential threats, but those looking to invest in the domestic production of seafood will also be confounded by legal uncertainties and liabilities imposed by the CWA and other laws. Rather than continue to press for an unsustainable system plagued by liability and staunch opposition from the environmental community and fishermen, new incentives in the form of grants, subsidies, and political support are needed to aid the development of a sustainable urban aquaculture industry. The alternative is to allow the American legal system to continue regulating through enforcement and litigation, an option that is both inefficient and costly.

Although the extent to which sustainable aquaculture practices will be implemented in the United States is not clear, the promise of domestic seafood production flourishing within its cities is real. Minimal impact on the environment equates to minimal legal expenditure, and investors and entrepreneurs are already beginning to show interest. It is the challenge and duty of future generations “to encourage the art of aquaculture in urban areas and plan creatively for its beauty and utility in revitalized cities.”¹⁸¹ In more concrete terms, urban aquaculture may be the only way to provide fresh, local seafood while steering clear of environmental problems and possible legal liability.

¹⁸¹ Barry Costa-Pierce & Alan Desbonnet, *Preface*, in *URB. AQUACULTURE* ix, x (Barry Costa-Pierce et al. eds., 2005).