Legal Issues and Challenges Confronting Recirculating Aquaculture Systems in the United States

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I. Introduction

The global aquaculture industry, currently valued at over $144 billion, has consistently grown in terms of volume, increasing at an average of 8% annually in the last 20 years.[1] In 2014, aquaculture surpassed wild-caught fish as the leading source of seafood, and, by the year 2020, the industry's value is expected to reach over $200 billion.[2] Demand factors such as global population growth and increased fish consumption have exponentially increased pressure on wild fish stocks, driving the need for seafood produced using more sustainable aquaculture techniques, such as recirculating aquaculture systems (RAS).[3]

In simple terms, recirculating aquaculture is a technology for farming fish or other aquatic organisms that typically takes place indoors and functions by reusing water that has been filtered both mechanically and biologically.[4] While, theoretically, any aquatic organism can be raised in a recirculating system, in practice, just a few freshwater species dominate globally, including tilapia, bass, trout, and perch.[5] However, commercial aquaculturists have recently shown interest in moving beyond the "big four," with marine finfish and aquatic invertebrates such as lobster and shrimp having been raised successfully in RAS facilities.[6] For example, RAS facilities commercially producing shrimp have been established in Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Minnesota, Texas, and Wisconsin.[7] Furthermore, marine and anadromous species such as Atlantic salmon and rainbow trout have become popular RAS species as use of the technology grows in the United States.[8]

While recirculating technology has existed in some form since the 1970s, its share of the larger commercial market was small.[9] Even today, many functioning RAS facilities in the United States are small, with some specializing in aquaponics.[10] However, as wild fish populations dwindle and the negative environmental impacts of more traditional aquaculture methods are brought to light, large, commercial RAS facilities culturing marine species have begun to pop up in many places around the United States. The newfound popularity of RAS brings with it multiple legal considerations. First, siting-related issues (such as those related to zoning) can result in community opposition against RAS facilities, potentially embroiling aquaculture companies in legal challenges or other local retaliation before operations can even begin. Second, as interest in RAS grows—particularly by international companies wishing to site large facilities in the United States—functional awareness of applicable federal, state, and local permitting and licensing laws is uncertain. Finally, other legal issues applicable to aquaculture operations more generally, such as those related to finance and genetic modification, can prove problematic. This report aims to increase awareness among the aquaculture community about the legal challenges impacting the success of the land-based marine aquaculture sector as it exists in the United States, both currently and into the future.

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1 *Aquaculture: An Investor Update on Sustainable Seafood,* FISH 2.0 1, http://fish20.org/images/Fish2.0MarketReport_Aquaculture.pdf.
2 *Id.*
3 *Id.*
4 Jacob Bregnballe, *A Guide to Recirculation Aquaculture*, FAO 9 (2015), http://www.fao.org/3/a-i4626e.pdf.
5 *Species,* THE UNIVERSITY OF TENNESSEE, http://web.utk.edu/~rstrange/wfs556/html-content/07-species.html.
6 *Id.*
7 Sarah Curry, *Recirculating Shrimp Farms in the United States*, FISH NAVY FILMS (Apr. 3, 2014), http://fishnavy.com/image/recirculating-shrimp-farms-u-s/.
8 Anadromous species of fish spend much of their lives in saltwater, but migrate up freshwater rivers to spawn.
9 Laura Poppick, *The Future of Fish Farming May Be Indoors*, Scientific American (Sept. 17, 2018), https://www.scientificamerican.com/article/the-future-of-fish-farming-may-be-indoors/.
10 Aquaponics is a fairly nuanced form of agriculture, where fish are raised along with plants in an integrated system.

II. Recirculating Aquaculture in General

Recirculating aquaculture is a form of intensive aquaculture in which reconditioned water circulates through an aquaculture system and no more than 10% of the total water volume in a system is replaced daily.[11] In recirculating systems, it is necessary to treat the water continuously to remove excreted waste products, and to add oxygen to keep fish alive.[12] During water reconditioning, three primary processes occur: 1) removal of solid waste, including feces and uneaten food; 2) aeration of water through the addition of oxygen and removal of carbon dioxide; and 3) removal of ammonia that fish excrete as a byproduct of the metabolic breakdown of protein.[13] These processes are conducted first using a mechanical filter, which removes the solid waste, and, second using a biofilter, which aerates the water and removes any unwanted chemicals.[14] Other important factors such as pH and water temperature regulation are also monitored and adjusted by facility personnel.

Recirculating aquaculture systems can offer many benefits to conventional methods for growing marine species of fish and shellfish. But, RAS also presents multiple related, unique challenges. For example, recirculating systems yield certain advantages regarding disease control, yet fish in RAS facilities are markedly susceptible to disease due to several factors. First, water quality can be more unstable in recirculating systems than in large ponds or flow-through systems.[15] Water quality fluctuations, such as temporary increases in ammonia or nitrite can, by themselves, result in disease or significant losses of fish.[16] Such environmental fluctuations often lead to suppressed immune systems and greater susceptibility to pathogens and disease outbreaks.[17] Second, recirculating systems favor the growth of many disease-causing organisms and foster the spread of disease because of issues including higher densities of fish and slower turnover of water.[18] Over time, harmful pathogens can become concentrated in RAS facilities, causing disease in healthy fish instead of only in those with suppressed immune systems.[19] Additionally, the continuous flow of water through a system can spread such pathogens rapidly, especially in facilities lacking adequate disinfection protocols or equipment.[20]

Despite these issues, disease-related damage can generally be mitigated more easily in RAS facilities due to the tanks' modular nature.[21] Large recirculating aquaculture operations are almost always made up of multiple independent units. This structuring makes it easy to quarantine new stock prior to introduction into tanks where there are already existing fish, therefore helping prevent the spread of disease to that existing stock. By rearing new stock in a separate quarantine tank for a few weeks after arrival, a facility

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11 *Introduction*, The University of Tennessee, http://web.utk.edu/~rstrange/wfs556/html-content/01-intro.html.

12 Bregnballe, *supra* note 4, at 13.

13 *Introduction*, *supra* note 8.

14 Bregnballe, *supra* note 4, at 13.

15 Roy P.E. Yanong, *Fish Health Management Considerations in Recirculating Aquaculture Systems – Part 2: Pathogens*, University of Florida Institute of Food and Agricultural Sciences Extension, http://agrilife.org/fisheries/files/2013/09/Fish-Health-Management-Considerations-in-Recirculating-Aquaculture-Systems-Part-2-Pathogens.pdf.

16 *Id.*

17 *Id.*

18 *Id.*

19 *Id.*

20 *Id.*

21 *Fish Health,* The University of Tennessee, http://web.utk.edu/~rstrange/wfs556/html-content/20-health.html.

can monitor the population for signs of illness. This is important, as new eggs and fish may carry diseases, even after testing negative for certain pathogens or when bought from a reputable dealer.[22] Furthermore, when new stock is cleared to move out of quarantine, fish can be held in a tank entirely separate from existing stock, thus eliminating the likelihood that any contagious diseases spread to the entirety of a facility's fish population (although operators must take care to ensure that no cross-contamination of water from the separate tanks occurs).[23]

RAS tanks can also be disinfected relatively easily. Facilities are located indoors and generally constructed of non-porous materials such as PVC and fiberglass, making it possible to completely disinfect a system in the event disease outbreak.[24] This is impossible when using other more conventional methods of aquaculture, such as outdoor ponds and raceways. In most recirculating facilities, it is standard operating procedure to disinfect units after harvest and before re-stocking, thus reducing the possibility that lingering pathogens could infect new stock.[25]

Another significant benefit of RAS systems is their isolation from marine ecosystems. Conventional marine salmon farming is often associated with high levels of sea lice, which are parasitic copepods that graze on the mucus, skin, and blood of fish.[26] Once a sea lice infestation breaks out on a farm, it is extremely hard to eliminate, as the salmon are held in a closely confined space where lice can quickly spread from fish to fish. Furthermore, the farmed salmon are unable to migrate up freshwater sources for spawning where sea lice would typically shed due to the parasites' inability to survive in a non-marine habitat.[27] Sea lice outbreaks on conventional marine aquaculture farms can have devastating impacts for wild stocks, as a single farm may increase sea lice pressure on juvenile, migrating salmon in the area by as much as 73 times above ambient levels.[28] As infected wild salmon continue their migration out to sea, there is increased risk of the parasite spreading to other wild salmon that may have never come into close proximity to the originally infested farm.[29] Recirculating aquaculture eliminates this environmental risk.

RAS facilities are also have advantages with respect to water conservation, in that they utilize only a small amount in comparison to more conventional aquaculture methods.[30] Since water in RAS facilities is reused and recirculated, the water volume requirements are only about 20% of what open pond culture demands.[31] Despite this increased efficiency, a large quantity of water may still be taken, and held out of, the natural water cycle depending on the size of a facility.[32] Furthermore, water must be continuously added to recirculating systems in order to maintain adequate water levels, and a constant supply must be

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22 *Id.*

23 *Id.*

24 *Id.*

25 *Id.*

26 *Sea Lice,* Marine Institute, https://www.marine.ie/Home/site-area/areas-activity/aquaculture/sea-lice.

27 Samantha Andrews, *Controlling the uncontrollable? Sea lice in salmon aquaculture*, Sustainable Food Trust (Oct. 27, 2016), https://sustainablefoodtrust.org/articles/sea-lice-salmon-aquaculture/.

28 *Id.*

29 *Id.*

30 Louis A. Helfrich & George Libey, *Fish Farming in Recirculating Aquaculture Systems (RAS)*, Virginia Tech Department of Fisheries and Wildlife Sciences, http://fisheries.tamu.edu/files/2013/09/Fish-Farming-in-Recirculating-Aquaculture-Systems-RAS.pdf.

31 *Id.*

32 *Id.*

available to allow systems to be shut down and drained as the production cycle requires—potentially straining available resources depending on the location of the facility.[33] Water availability can easily become an issue as RAS facilities site closer to markets in major U.S. towns and cities. For example, many major cities have to conserve water during the summer due to the demand that residential properties put on municipal water supplies.[34] In other areas, water may be sourced from aquifers, which are often heavily monitored to ensure that the environment is adequately replenishing the sources.[35] Although RAS technology exists to allow for the utilization of seawater, problems can arise, especially with respect to disinfection, as seawater contains thousands of bacteria and viruses that could prove devastating to a farmed fish population.

Regarding waste production, RAS facilities generally produce a small amount of liquid and solid waste when compared to more traditional forms of aquaculture. Although the use of recirculating aquaculture does not fully prevent waste accumulation, the biological processes within a system result in a reduction of the amount of organic compounds present, either because of simple biological degradation or mineralization within the system.[36] The volume of water discharged is generally lower and of higher quality when compared to more conventional systems.[37] Wastewater leaving the recirculation process typically comes from mechanical filters, where feces and other organic materials are separated into the sludge outlet of the filter.[38] Cleaning and flushing biofilters also adds to the total wastewater volume.[39]

After wastewater is collected, it can be treated in various ways, the most common of which separates solids into sludge, leaving cleaned waste water behind, termed "discharge water."[40] Although RAS facilities discharge far less than traditional fish farms, treatment of what is left is often costly.[41] Farms typically discharge leftover nutrients and water in one of several ways, including by: 1) drilling an injection well below the levels of an aquifer in order to pump waste below the Earth's surface; 2) building a discharge pipeline that can discharge waste into nearby waterways; 3) discharging into a municipal sewer system; 4) applying sludge to dry land; or 5) producing compost.[42] The first two methods (injection wells and discharge pipelines) can limit the potential locations in which RAS facilities can be sited, as each site must have the right combination of geography and geology to enable proper waste discharge.[43] Some aquaculture companies currently constructing large RAS facilities in the United States have explicitly stated that they have chosen their locations because they will allow the companies to discharge waste while also securing enough input water.[44]

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32 *Id.*

33 *Id.*

34 *Id.*

35 *Id.*

36 Bregnballe, *supra* note 4, at 72.

37 Fred Wheaton, *Recirculating Aquaculture Systems: An Overview of Waste Management*, University of Maryland Department of Biological Resources Engineering 57, https://articles.extension.org/mediawiki/files/9/95/RAS,_An_Overview_of_Waste_Management.pdf.

38 Bregnballe, *supra* note 4, at 72.

39 *Id.*

40 *Id.* at 72 & 74.

41 *Id.* at 10 & 11.

42 Brian Albaum et al., *Recirculating Aquaculture Systems (RAS)*, Monterey Bay Aquarium Seafood Watch 4 (Dec. 4, 2014), https://www.seafoodwatch.org/-/m/sfw/pdf/reports/g/mba_seafoodwatch_global_ras_report.pdf.

43 Johnny Bowman, *Aquaculture is the biggest change to US food production in decades*, Medium (Nov. 7, 2018), https://medium.com/edenworks/aquaculture-is-the-biggest-change-to-us-food-production-in-decades-e921a703eb0d.

44 *Id.*

As discussed further below, many discharge methods require that an appropriate permit be secured before discharge can actually occur.

Land use is also a factor influencing recirculating aquaculture. Since RAS facilities are built on land, they almost necessarily take up more dry space than more conventional methods of fish production conducted in water, such as open water net pens. This has become a point of contention for many citizens of communities where RAS facilities are sited, as concerns are often voiced that the large facilities may lead to increased industrialization of the area. Construction of a large RAS facility may also be controversial if there is limited space in the area.

Atlantic Sapphire, a Norwegian aquaculture company, is currently in the process of building a RAS facility in Miami, Florida that it has termed a "Bluehouse." Atlantic Sapphire has advertised the facility as "an all-in-one aquaculture production facility that houses every stage [of salmon], from hatching broodstock to processing of the harvest."[45] The construction of the facility is meant to take place in phases, where the size and scope of the Bluehouse can be "exponentially expand[ed]" from one phase to the next.[46] Phase one of the project will involve the construction of a nearly 384,000 square foot facility that will grow to four million square feet by phase three.[47] Atlantic Sapphire's plans to construct such an expansive facility in one of the most densely populated urban areas in the nation exemplify why some would be concerned with the construction of similar facilities in other localities with limited land availability.

It is important to note that massive RAS facilities like Atlantic Sapphire's Miami Bluehouse are not currently the norm in the United States. Generally, RAS facilities are meant to maximize production in a relatively small area of land.[48] For example, it is possible using RAS to produce over 100,000 pounds of fish in a 5,000 square foot building, whereas 20 acres of outdoor ponds would be necessary to produce an equal amount of fish with traditional open pond culture.[49] Furthermore, many of the larger RAS facilities going into production in the United States are making use of existing buildings, such as vacant warehouses or retail stores, therefore eliminating the concern that a new facility will take up large amounts of land that could have been used for other purposes. For example, a RAS facility currently being built by aquaculture company Whole Oceans in Maine is sited in a former riverside paper mill that already possesses the cooling infrastructure needed to proceed with recirculating aquaculture.[50] Whole Oceans' siting decision prevents the possibility that the former paper mill site would sit unused for years on end—a scenario in which valuable land would be wasted.

RAS also minimizes the risk of the unintentional spread of non-native and invasive species. Many of the most popular species cultivated on aquaculture farms throughout the United States are non-native to most, if not all states, including such staples as tilapia and Atlantic salmon. Commercial aquaculture can

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45 Matt Jones, *American dream within reach for Atlantic Sapphire*, Aquaculture North America (July 23, 2018), https://www.aquaculturenorthamerica.com/profiles/american-dream-within-reach-for-atlantic-sapphire-2000.

46 *Id.*

47 *Id.*

48 Helfrich & Libey, *supra* note 18.

49 *Id.*

50 Jen A. Miller, *RAS in the USA: Fad or future?*, Global Aquaculture Advocate 3 (Apr. 30, 2018), http://idealfish.com/wp-content/uploads/2018/04/ras-in-the-usa-fad-or-future-1.pdf.

easily become a pathway for the introduction of non-native species to new environments. Some non-native species flourish in their new environments, enabling an invasive population to become established, thus imposing devastating effects on native ecosystems.[51] Aquatic animals can escape from aquaculture facilities due to of a number of factors, including: 1) a lack of suitable screening over pond outflow pipes; and 2) the transportation and dropping of non-native animals into nearby water bodies by predatory birds.[52] The potential for escape is greatly reduced in RAS facilities, as fish are typically housed in indoor tanks. Predatory birds, for example, are unable to enter enclosed RAS facilities to carry off non-native fish and potentially drop them into nearby water bodies.

Facility effluent is the main pathway for fish escapes from recirculating facilities, and, as a result, RAS operators are often required to take steps to reduce that risk.[53] The main way this is done is with the aid of biofiltration so that water that has already been recirculated can largely be reused.[54] This practice limits the amount of water leaving a facility as effluent, and, thus, assists in preventing fish escape.[55] Additionally, RAS facilities must often take care to properly screen any outflow pipes as an added layer of security under applicable state laws and regulations—with some states even requiring double screening when culturing restricted species.[56]

One of the most significant drawbacks to recirculating aquaculture relates to cost. Recirculating aquaculture facilities are notoriously expensive to start up and operate when compared with less intensive aquaculture systems. Up-front costs are high as capital is required to create the facilities needed, get equipment purchased and installed, and make sure the system operates properly before stock is brought in.[57] Large amounts of financing may need to be secured in order to begin construction. Furthermore, because less fish are produced per tank per year than in more traditional systems, the capital cost per unit of fish produced increases.[58]

Operating costs are high as well, with one of the most significant expenses being repair and maintenance fees.[59] Most RAS facilities and equipment require annual maintenance and repairs which are not directly related to the amount of product moved through the system.[60] As an example, annual repair costs for a

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51 It is important to understand the difference between "invasive" and "non-native" species. Non-native species are simply species that are not native to the environment under consideration. Not all non-native species are invasive. Although alien to the environment, they are unable to survive or sustain populations that cause environmental harm. Invasive species, on the other hand, are non-native species that thrive in foreign environments, and are likely to cause harm to native ecosystems, human health, and/or the economy as a result.

52 Pam L. Fuller, *Freshwater Aquatic Vertebrate Introductions in the United States: Patterns and Pathways, in* Invasive Species: Vectors and Management Strategies 123, 141 (2003).

53 Jeffrey E. Hill et al., *Preventing Escape of Non-Native Species from Aquaculture Facilities in Florida, Part 2: Facility Evaluation Strategies*, University of Florida IFAS Extension, https://edis.ifas.ufl.edu/fa196.

54 Quenton M. Tuckett et al., *Preventing Escape of Non-Native Species from Aquaculture Facilities in Florida, Part 3: Structural Strategies*, University of Florida IFAS Extension, http://edis.ifas.ufl.edu/fa197.

55 *Id.*

56 *See* 002.00.1 Ark. Code R. § J1.01.

57 Fred Wheaton, *Recirculating System Aquaculture – What You Need to Know*, University of Maryland Department of Environmental Science and Technology 167, 171, https://agrilifecdn.tamu.edu/fisheries/files/2013/09/Recirculating-System-Aquaculture-What-You-Need-to-Know.pdf.

58 *Id.* at 172.

59 Patrick D. O'Rourke, *The Economics of Recirculating Aquaculture Systems*, Illinois State University Department of Agriculture 4, https://pdfs.semanticscholar.org/b8ea/eba8e7d83bf88d726f88192f7cf05790430f.pdf.

60 *Id.* at 4 & 5.

40 x 80 ft. RAS facility raising tilapia can amount to thousands of dollars annually.[61] Furthermore, much of the equipment used in RAS facilities has an estimated life of 15 years or less, requiring that farms pay to replace them relatively frequently.[62] This could become problematic if several pieces of vital equipment have similar estimated lives, requiring that facilities expend large sums to replace multiple pieces of equipment at the same time.

In addition to increased costs, RAS aquaculture requires a large amount of energy when compared to more traditional methods, thereby increasing both operating costs and the potential environmental impacts associated with the use of fossil fuels.[63] Total energy use depends on the source and quantity of electricity as well as a facility's location, design, and management.[64] Due to their general design, RAS facilities require energy to control water temperature, disinfect tanks, circulate water, oxygenate water, and filter water.[65] Many of these functions require that energy be expended constantly, as any full system failures could mean an entire population of fish asphyxiate due to a facility's inability to oxygenate the water. Most of this energy continues to come from fossil fuel sources, therefore potentially reducing the purported sustainability benefits that proponents of RAS aquaculture praise. While there is currently interest in using renewable energy sources or waste heat from other industries as part of a push to lessen the environmental impacts of recirculating aquaculture's energy use, the energy sources that can be employed by specific farms are dictated by a facility's location and accessibility to those energy sources, thus limiting their utility.[66]

III. Siting

The location in which aquaculture companies choose to site their RAS facilities is often a source of controversy among community members that can delay or even derail planned RAS projects. Generally, personal objections to something happening in one's area are termed "not in my back yard" or "nimby" disputes. Residents and groups who practice nimbyism—typically called "nimbys"— resist certain development solely because of its proximity to their property, where they would tolerate or even support it if built further away.[67] When disputes between nimbys and advocates of RAS development cannot be resolved informally, some nimbys file lawsuits to definitively decide the issue.[68]

It is important, however, to distinguish nimby lawsuits from legitimate concerns that community members may raise regarding the potential impact of new developments in their communities and neighborhoods. Improper facility siting, design, and operation can decrease neighboring property owners' quality of life. Consider, for instance, the impact if a large, industrial facility was sited directly

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61 *Id.*

62 *Id.*

63 M. Badiola et al., *Energy use in Recirculating Aquaculture Systems (RAS): A review*, 81 Aquaculture Engineering 57 (2018), *available* at https://www.sciencedirect.com/science/article/pii/S0144860917302327?via%3Dihub.

64 *Id.*

65 *Id.* at 58 & 59.

66 *Id.* at 57.

67 *NIMBY Law and Legal Definition*, USLegal, https://definitions.uslegal.com/n/nimby/.

68 *Id.*

adjacent to a residential neighborhood. Residents would likely be subjected to loud noises, offensive smells, or other significant, negative impacts. Furthermore, increased traffic due to the commercial operations may raise safety concerns. Like other commercial and industrial activities, aquaculture facilities can present legitimate community concerns that residents may seek to raise in public meetings and through other avenues, such as social media. In some states, negative community impacts can rise to the level of a private nuisance, allowing affected landowners to file civil lawsuits.[69]

a. Zoning

Many siting conflicts arise in the context of zoning.[70] Briefly, "zoning" is the legislative process that divides land for different activities. In the process of establishing zoning laws, municipalities must establish different geographic zoning districts and delineate what type of activities, or "uses," can occur within those districts at any given time. Each municipality's zoning laws are contained within zoning codes. Zoning ordinances are listed within such zoning codes, and serve as the specific, local regulations that govern land uses and structures within a local government's boundaries. Zoning ordinances are legally binding, but can be amended by the localities in which they are applicable. The decisions a municipality makes as to what zoning ordinances it will implement can either pave the way for aquaculture or cut off the possibility that a farm may be sited in a certain area.

In the context of RAS in the United States, zoning has most notably been discussed in relation to Nordic Aquafarms' plans to site a major land-based salmon farm in Belfast, Maine. Nordic Aquafarms is a major investor and developer in land-based aquaculture, with production facilities currently functioning in both Norway and Denmark.[71] In making its push to expand into the United States, the company identified Belfast as a prime siting location due to its "abundant access to sea- and freshwater resources that provide a good match with land-based aquaculture requirements."[72] When fully constructed, the facility will reportedly produce 66 million pounds of farmed salmon annually, constituting 8% of the United States' total yearly consumption of the fish.[73] In order to begin the first phase of construction in accordance with Belfast's local laws, however, Nordic Aquafarms had to engage in a zoning law amendment process with the town in March of 2018. The decision to amend Belfast's zoning laws to accommodate Nordic Aquafarms' operations invited widespread criticism and pushback from local citizens who feel the community will be negatively impacted by the facility's presence.

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69 A "private nuisance" is an activity that interferes with the use or enjoyment of one's property due to its irritating, offensive, or obstructive nature. In states where aquacultural activities are not protected by right-to-farm laws, offended community members can bring lawsuits in order to abate nuisance activity.

70 For more information on how local zoning decisions can impact the commercial aquaculture industry, please see the National Sea Grant Law Center's report entitled *Zoning 101: A Stakeholder's Guide to Understanding the Zoning Decisions Impacting Shellfish Aquaculture Permitting, available* at http://nsglc.olemiss.edu/projects/ag-food-law/files/zoning101.pdf.

71 Stephen Rappaport, *Nordic Aquafarms sets public information meeting*, The Ellsworth American (Mar. 19, 2019), https://www.ellsworthamerican.com/maine-news/waterfront/nordic-aquafarms-sets-public-information-meeting/.

72 Press Release, Nordic Aquafarms, *Nordic Aquafarms announces a major land-based aquaculture facility for Atlantic Salmon in Maine, USA* (Jan. 30, 2018), *available* at http://www.nordicaquafarms.com/portfolio_page/nordic-aquafarms-announces-a-major-land-based-aquaculture-facility-for-atlantic-salmon-in-maine-usa/.

73 *Id.*

Without amendment, Belfast's zoning ordinances would not allow for most of the development that was originally proposed by Nordic Aquafarms. To rectify this problem, the town proposed that four amendments be made to its existing zoning ordinances. First, the town proposed expanding an existing industrial district within the municipality to include the proposed Nordic Aquafarms facility site. This amendment would allow the company to engage in industrial activities (namely, the large-scale commercial culture of salmon). Second, the town proposed that an ordinance be modified to specifically identify "onshore aquaculture and associated activities" as allowed uses within the existing industrial district in question. Third, the town recommended revising its local Shoreland Ordinance to ensure greater consistency between existing local standards and the proposed project. Finally, Belfast suggested revising its 2009 Future Land Use Plan as applicable to the siting area in order to ensure consistency between the policies identified in the Plan and the proposed rezoning for the area.[74] After a four-hour public meeting in April 2018, the Belfast City Council unanimously approved the ordinance amendments, despite vocal public concern over the timing of the changes and the potential negative impacts that could result.[75]

While Belfast's successful zoning amendment process has allowed Nordic Aquafarms to proceed with Phase 1 of its $150 million RAS project, the town's actions were met with significant backlash from local residents. Specifically, critics felt that city officials had acted "hastily and without transparency in approving the zoning change."[76] In a more general sense, critics also voiced concerns over what negative impacts the project might have on the local environment, including those related to water effluent and climate change.[77] In response to these criticisms, Nordic Aquafarms has stated that Belfast citizens' concerns over the zoning changes and the project in general are overblown, and that any discharge from its RAS facility would go through filtration and treatment before disposal in order to reduce contaminants.[78]

After Belfast approved the necessary zoning amendments to allow Nordic Aquafarms to move forward with construction of its facility, two residents filed a lawsuit against the city in county court in August 2018 alleging the city failed to follow proper municipal processes and citizen participation procedures in amending the zoning ordinances.[79] In their complaint, the plaintiffs—who each own property bordering the site where Nordic Aquafarms plans to build its facility—argue that the city "abused its powers by approving…[the] amendments without following state statute[s] and [the] local zoning ordinance process for planning board and community involvement."[80] Furthermore, the complaints alleges that "[t]he city council took actions to purposely avoid any citizen participation in any planning processes related to amending the comprehensive plan to allow the proposed Nordic project."[81]

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74 Wayne Marshall, *Overview of City Rezoning Process, Nordic Aquafarms Project*, CITY OF BELFAST (Mar. 1, 2018), https://www.cityofbelfast.org/DocumentCenter/View/2029.

75 *Zoning change advances Nordic Aquafarms' $150M project in Belfast*, MAINEBIZ (Apr. 19, 2018), https://www.mainebiz.biz/article/zoning-change-advances-nordic-aquafarms-150m-project-in-belfast.

76 Abigail Curtis, *Belfast fish farm opponents blast zoning changes*, BANGOR DAILY NEWS (Aug. 16, 2018), https://bangordailynews.com/2018/08/16/news/midcoast/belfast-fish-farm-opponents-blast-zoning-changes/.

77 *Id.*

78 *Id.*

79 Lynda Clancy, *Belfast residents file suit against city over salmon farm zoning process*, PENOBSCOT BAY PILOT (Aug. 13, 2018), https://www.penbaypilot.com/article/belfast-residents-file-suit-against-city-over-salmon-farm-zoning-process/106075.

80 *Id.*

81 *Neighbors sue city government over Nordic Aquafarms zoning*, UNDERCURRENT NEWS (Aug. 20, 2018), https://www.undercurrentnews.com/2018/08/20/neighbors-sue-city-government-over-nordic-aquafarms-approval/.

Belfast city officials have denied the allegations in response, stating that its citizens had plenty of opportunities to speak up a public meetings.[82] The city also called the lawsuit a "typical not-in-my-backyard issue," arguing that officials "went to great lengths to invite the public to comment," through methods such as publishing multiple notices and mailing an informational document to neighbors—resulting in the receipt of approximately 150 to 200 comments in total.[83] While the merits of the case will not be heard until summer of 2019, this lawsuit exemplifies the legal issues that can arise as local governments make allowances for the benefit of controversial entities, such as large recirculating aquaculture facilities. If the plaintiffs in this case are successful, their lawsuit could delay Nordic Aquafarms' procurement of important local permits or even wholly invalidate Belfast's zoning amendments, putting the future of the RAS facility as currently sited in danger.

b. Governmental Facilities

Community pushback against recirculating aquaculture facilities' siting can also happen at the state level. Community opposition in Pensacola, Florida resulted in the state backing away from plans to build a RAS fish hatchery—officially termed the Gulf Coast Marine Fisheries Hatchery & Enhancement Center—on local Bruce Beach.[84] Originally, a $18.7 million grant from the BP oil spill was dedicated to the project by the Florida Fish and Wildlife Conservation Commission (FWC), which would fund the construction and operation of a recirculating aquaculture hatchery culturing saltwater sportfish species for five years.[85] However, soon after announcement of the project's siting, it became steeped in controversy, with some community members arguing that an "experimental hatchery was the wrong project for prime beachfront real estate that [had] gained value as the downtown area [had] developed since the contract for the project was originally inked."[86] Adding credence to this argument was an assessment from a real estate corporation that assessed Bruce Beach's fair market value at $7.7 million, while, based on a 2014 agreement, the city of Pensacola would lease the property to the FWC for an annual cost of just $50.[87]

Community members opposing the project took legal action to halt the project's construction, with two local plaintiffs filing a lawsuit against the city, the Pensacola Community Redevelopment Agency, and FWC in November of 2017 asking that the lease between FWC be declared void due to language in the lease stating it would be invalidated if construction on the hatchery did not begin by May 2017.[88] The case was still pending when FWC notified Pensacola in June 2018 that it wanted to terminate the Bruce Beach lease and begin seeking alternative sites for the project.[89] In FWC's words, the decision was "based on [its] assessment that community support for the location of the project on the Bruce Beach site [was]

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82 Susan Cover, *No let up in fight against salmon farm*, Pine Tree Watch (Jan. 31, 2019), https://pinetreewatch.org/no-let-up-in-fight-against-salmon-farm/.

83 Owen Evans, *Belfast residents challenge city zoning changes that enabled Nordic Aquafarms*, SalmonBusiness (Aug. 8, 2018), https://salmonbusiness.com/belfast-residents-challenging-city-zoning-changes-that-enabled-nordic-aquafarms/.

84 Jim Little, *FWC kills Pensacola fish hatchery on Bruce Beach, will begin seeking alternative locations*, Pensacola News Journal (June 5, 2018), https://www.pnj.com/story/news/2018/06/05/fwc-kills-pensacola-fish-hatchery-bruce-beach/673311002/.

85 *Id.*

86 *Id.*

87 *Id.*

88 *Id.*

89 *Id.*

insufficient to ensure the long-term success of the project.[90] While it noted that court rulings related to the lawsuit had been favorable up to that point, it also admitted that "ongoing legal action taken by members of the community [had] resulted in delays which [had caused] a significant financial impact."[91] As of December 2017, approximately $1.7 million had already been spent on the Gulf Coast Marine Fisheries Hatchery & Enhancement Center—state funds that were lost when FWC was forced to pull out of its originally proposed Bruce Beach site.[92]

As illustrated by the above examples, community members can assert significant influence over the success of a proposed RAS facility, whether that facility be privately owned or publicly funded. Interested parties should be aware of potential outcomes such as this prior to siting, as unnecessary funds could be expended building facilities that are ultimately doomed due to significant community pushback.

IV. Licensing and Permitting

a. Federal

As with all types of aquaculture, RAS facilities in the United States are regulated at both the federal and state levels. Local permits may also be required depending on a facility's design and the geographic location where it plans to operate. Depending on a facility's size and method of discharge, recirculating aquaculture system operators may have to obtain federal permits from the Environmental Protection Agency (EPA) under the Clean Water Act (CWA). Under the National Pollution Discharge Elimination System (NPDES) program, aquaculture facilities are considered a "point source,"[93] subject to industrial wastewater discharge limits and conditions, as facility discharges may contain pollutants at levels that could affect the quality of receiving water or interfere with the publicly owned treatment works (POTWs) that can receive those discharges.[94]

As noted above, there are two wastewater disposal methods that can likely subject RAS facilities to this program—direct discharge pipelines and discharges into municipal sewer systems. The Ninth Circuit Court of Appeals also recently held that wastewater injection wells can be a regulated pollution source under the CWA, thereby requiring a permit for those discharges as well.[95] NPDES permit holders are subject to limits on what they can discharge as well as other provisions that are meant to ensure that discharges do not impair water quality or human health.[96] Facilities must also abide by certain water monitoring and notification requirements to help ensure that wastewater discharges remain in compliance with EPA-imposed limits.[97]

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90 *Id.*

91 *Id.*

92 *Id.*

93 The term "point source" is very broadly defined in the CWA, as it has been through decades of litigation. However, generally, the term is meant to include any discernable, confined, and discrete conveyance, such as a pipe, ditch, channel, tunnel, conduit, discrete fissure, or container. By law, the term also includes concentrated aquatic animal feeding operations.

94 *Industrial Wastewater*, Environmental Protection Agency, https://www.epa.gov/npdes/industrial-wastewater.

95 *See Hawai'i Wildlife Fund v. Cty. of Maui,* 886 F.3d 737 (9th Cir. 2018).

96 *NPDES Permit Basics*, Environmental Protection Agency, https://www.epa.gov/npdes/npdes-permit-basics.

97 *Id.*

Not all NPDES permits are issued directly by the EPA at the federal level. States can become authorized to assume NPDES permitting authority within their boundaries, meaning that permit applications are submitted to the appropriate state agency for review and issuance, if approved. However, even in states that have been granted NPDES permitting authority, the EPA continues to issue NPDES permits on tribal lands (if the tribe is not administering its own approved NPDES program).

Some RAS facilities may also have to abide by federal effluent guidelines set by the EPA which are incorporated into its NPDES permits. According to 40 C.F.R. § 122.24, Concentrated Aquatic Animal Production (CAAP) facilities are point sources for which NPDES permits are required. Briefly, CAAP facilities include those that: 1) use flow-through, recirculating, or net pen systems; 2) directly discharge wastewater; and 3) produce at least 100,000 pounds of fish, mollusks, or crustaceans per year.[98] Facilities can also be deemed CAAPs by the EPA on a case-by-case basis.

CAAP facilities must abide by Effluent Limitations Guidelines (ELGs), which are national standards for wastewater discharges to surface waters and publicly owned treatment works. ELG requirements exist in addition to typical NPDES permit requirements, and demand that CAAP facilities abide by certain management practices and record-keeping activities rather than numerical discharge limits. However, not all aquaculture facilities are CAAPs, and some don't require NPDES permits at all. Facilities that are exempt from permitting requirements include those that either: 1) produce less than 9,090 harvest weight kg. per year of cold-water species, 2) feed less than 2,272 kg. of food during the calendar month of maximum feeding, or 3) discharge less than 30 days per year.

While those familiar with conventional marine aquaculture may anticipate needing to obtain permits from the Army Corps of Engineers (Corps) in addition to those required from the EPA, recirculating aquaculture's land-based nature largely eliminates this need. For example, under the CWA, the Corps has regulatory authority over activities involving the discharge of dredge and fill materials into navigable waters, including all navigable fresh water and ocean water out to a distance of 200 nautical miles. Section 404 of the CWA prohibits the discharge of dredged or fill material into waters of the United States (including wetlands) without a permit from the Corps. Thus, those activities that are affiliated with aquaculture and would result in a discharge of dredged or fill material into waters of the United States (including wetlands) must obtain a Section 404 permit from the Corps. Additionally, Section 10 of the RHA prohibits the obstruction or alteration of navigable waters of the United States without a Corps permit. However, unless construction of the facility would impact regulated wetlands, RAS facilities' only potential tie to navigable waters usually comes in the form of discharge of effluent. Corps permits are, therefore, not generally needed before beginning operation.

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98 *Concentrated Aquatic Animal Production Effluent Guidelines*, Environmental Protection Agency, https://www.epa.gov/eg/concentrated-aquatic-animal-production-effluent-guidelines#facilities.

b. State

In addition to federal permits required by the CWA, RAS operators will also have to obtain additional permits or licenses from the states in which they intend to operate. What additional approvals are required will depend on a facility's siting as well as how it chooses to conduct its operations. For example, Texas requires businesses producing and selling cultured species raised in a private facility to first obtain an aquaculture license from the Texas Department of Agriculture.[99] Furthermore, the Texas Department of Agriculture cannot issue a license for a new aquaculture facility unless the facility either has been authorized by the Texas Natural Resource Conservation Commission to dispose of wastewater, or has shown that it will not dispose of wastewater into waters of the state.[100]

Applicable licenses or documentation may also be required to conduct pre- and post-harvest activities, such as the import, export, transport, or sale of cultured aquatic animals. For example, many states require that those wishing to import or transport certain species from out-of-state first obtain a relevant license. Such state licensing requirements reduce the risk of non-native species introductions. States can also use import restrictions to limit the introduction of aquaculture-related pathogens into state waters. For example, Wyoming requires that a fish health inspection report accompany each shipment of live salmonid fish, fertilized eggs, or gametes scheduled for importation and also be on file with the state prior to entry.[101] The health report must be signed by an aquatic animal health inspector or fish pathologist and must also include information regarding the occurrence of several listed pathogens of concern.[102] If the inspecting official finds evidence of certain pathogens, such as viral hemorrhagic septicemia, the state will prohibit the infected shipments of fish from crossing state lines, thus eliminating the possibility that the pathogen enters state waters and harms the fish that dwell within. Many states have implemented similar health requirements that must be complied with prior to importation, yet the exact language and rigor of such rules varies from state-to-state.

A good example of a general state aquaculture permitting framework exists in Florida—where, as mentioned above, a massive RAS facility is currently being constructed near Miami. In its regulations, the state requires that all aquaculture producers obtain an aquaculture certificate of registration from the state Department of Agriculture and Consumer Services and apply the best management practices (BMPs) outlined by rule.[103] Florida's certificates of registration are similar to a permit or license, in that aquaculturists must apply for and be awarded a certificate after the satisfactory submission of certain fees and facility information. The Best Management Practices Manual that aquaculturists in the state must abide by contains two requirements explicitly related to RAS facilities. First, RAS systems must be designed for no direct offsite discharge or production of water. Second, RAS waste treatment systems must be designed to accommodate the semi-solid waste stream and non-recycled production effluent from filters and solids separators.[104] The manual also contains general requirements related to such things

99 *Aquaculture,* Texas Department of Agriculture, https://www.texasagriculture.gov/RegulatoryPrograms/Aquaculture.aspx.
100 Tex. Agric. Code Ann. § 134.011.
101 040-0001-10 Wyo. Code R. app. I § 2.
102 *Id.*
103 Fla. Admin. Code Ann. r. 5L-3.003.
104 Florida Department of Agriculture and Consumer Services, Aquaculture Best Management Practices Manual 7 (2016), https://www.freshfromflorida.com/content/download/64045/1520653/BMP_Rule_and_Manual_FINAL.pdf.

as compliance monitoring, nonnative species containment, prohibited species, and aquatic organism health management. Failure to abide by all applicable BMPs may result in the state imposing administrative fines or even revoking or suspending an operator's certificate of registration or license.[105] Additionally, violators can be charged with a first-degree misdemeanor, punishable by imprisonment and fines.[106] Such penalties illustrate just how vital it is for RAS operators to be aware of and adhere to state permitting and licensing requirements for aquaculture.

c. Local

Local governments may also have some authority to impose additional permitting and licensing restrictions on RAS facilities (unless a state has explicitly noted that it intends to regulate the entirety of the aquaculture industry within its borders). For example, as noted above in the context of Nordic Aquafarms' RAS facility in Maine, local zoning laws regulate whether aquaculture facilities can be built and operated within certain local districts. Accordingly, a prospective RAS operator may have to obtain a separate zoning permit from the municipality where the facility will be sited that ensures the land use of the planned development is consistent with local zoning laws. RAS operators will also likely have to obtain a building permit, which is typically issued by the local planning department, and ensures that a planned development is consistent with the safety requirements of the local building code (generally requiring that the building is structurally sound, properly built, and safe for occupation).[107] Discharges of facility wastewater into municipal sewer systems may also trigger local permitting requirements. Since localities, themselves, are considered point sources under the CWA in such circumstances, facilities wishing to discharge into local sewer systems will first have to obtain authorization from the local municipal wastewater treatment plant authority, which can impose more stringent requirements than what is required federally. Consequently, it is important for RAS operators to be aware of the permitting and licensing requirements of the local area in which they intend to operate, as such requirements vary widely from place to place.

V. Additional Challenges

a. Finance

Although issues related to siting, permitting, and licensing are the chief challenges that those wishing to engage in the recirculating culture of marine species need to be aware of, there are several additional legal issues that stakeholders should consider. The first of these relate to the high start-up and operating costs that RAS facilities require. As noted above, high costs are one of the most commonly cited drawbacks to recirculating aquaculture. However, high costs, themselves, are not the only problem—high costs often mean high debt loads for companies that can lead to bankruptcy if an operation isn't generating enough revenue.

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105 Fla. Stat. § 597.0041(2)(a).

106 *Id.* at § 597.0041(1)(b).

107 It is important to note that, in most municipalities, the building and zoning permit application process is simultaneous. Specific procedures vary from city-to-city.

Perhaps the best illustration of this challenge is VeroBlue Farms, Inc. (VBF)—a now defunct company that was based in Iowa and produced barramundi farmed using RAS. In 2017, the company was an "apparent darling of the recirculating aquaculture…industry and one of the world's largest land-based producers of barramundi."[108] It produced around 15,000 pounds of fish per week at its farms that it then delivered to large markets such as New York City, Boston, and Toronto.[109] However, in November 2018, the company filed for Chapter 11 bankruptcy protection, owing approximately $100 million in unsecured debt to its top 20 creditors and another $6 million in unsecured debt to its top creditor.[110] Additionally, the company hadn't paid almost $300,000 in county property taxes, owed the IRS an undisclosed sum, and hadn't paid approximately $135,000 of city utility bills for sewer and electric services.[111]

High costs are not the only monetary hurdles that RAS operators face. Unscrupulous actors, too, may bring financial ruin upon an RAS company. While filing its Chapter 11 claim, VBF simultaneously filed a separate civil lawsuit in federal court against its top management alleging gross misappropriation of funds, detailing in its complaint what it called "schemes consummated by the defendants" that had allegedly been going on for around three years.[112] Among the allegations, VBF accused its executives of: 1) transferring improperly priced stocks, thus allowing executives to pocket money while VBF stock lost value; 2) using company funds to finance the construction of a personal lake house for an executive; 3) illicitly paying an executive's daughter for work done under an alias that may or may not have been completed; and 4) misusing company funds for personal expenses, such as a house, company vehicles, personal travel and living expenses, and use of a VBF comptroller for personal accounting.[113] Overall, the lawsuit claims that the named VBF executives' breach of fiduciary duty and fraudulent concealment sent the company into its nearly $100 million financial hole, thus requiring that they file the aforementioned bankruptcy petition.[114] The lawsuit will not be heard until June 2020 at the earliest, leaving those negatively affected by the executives' alleged mismanagement without immediate civil recourse.

b. Technology

Technological advancements in aquaculture that are often associated with recirculating systems have also generated controversy in recent years. The cultivation of genetically modified organisms (GMOs) in recirculating aquaculture facilities, in particular, has become a point of debate. The term "genetically modified organism" generally refers to a plant or animal that has been given new traits through modern genetic manipulation, in one of two ways: 1) genetic material from unrelated species are combined; or 2) heavily modified DNA is inserted into an organism's genetic code.[115]

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108 Jason Smith & Jason Huffman, *RAS darling VeroBlue falls into bankruptcy, sues former execs for fraud*, UNDERCURRENT NEWS (Nov. 15, 2018), https://www.undercurrentnews.com/2018/11/15/ras-darling-veroblue-falls-into-bankruptcy-sues-former-execs-for-fraud/.

109 *Id.*

110 Jane Curtis, *Awash in $100M debt, VeroBlue files for Chapter 11, sues top management*, THE MESSENGER (Nov. 18, 2018), https://www.messengernews.net/news/local-news/2018/11/awash-in-100m-debt-veroblue-files-for-chapter-11-sues-top-management/.

111 *Id.*

112 *Id.*

113 *Id.*

114 *Id.*

115 *What are GMOs?*, GENETIC LITERACY PROJECT, https://gmo.geneticliteracyproject.org/FAQ/what-are-gmos/.

The aquaculture industry has shown growing interest in genetic engineering (GE) techniques, hoping to utilize the technology to increase both the sustainability and productivity of commercial farms. Perhaps the most noteworthy aquaculture company actively culturing a GE species is the Massachusetts-based company AquaBounty. AquaBounty developed its GE AquAdvantage salmon by genetically modifying hybrid Atlantic salmon to incorporate a growth hormone-regulating gene from Pacific Chinook salmon, as well as a promoter sequence[116] from ocean pout that acts as an antifreeze protein. The modification enables the fish to grow year-round instead of only during the spring and summer. The resulting fish can reportedly grow to market size in 16 to 18 months rather than the three years that conventionally cultured salmon require. AquaBounty notes that AquAdvantage salmon "will be raised in land-based production systems away from the ocean, eliminating the risk of escapes that could impact native fish populations AND the risk of pollutants or contaminants that could harm marine ecosystems."[117] The company states that such use of RAS technology would allow the GE salmon to be "raised in optimized conditions with total control of the water coming in and going out, which will allow for the removal of wastes and the recycling of greater than 95% of the water used."[118] Furthermore, AquaBounty claims that its recirculating systems would be "operated at relatively low densities, so as to optimize fish health and minimize the environmental impact of the production system."[119]

AquaBounty has faced significant pushback from both consumers and U.S. regulatory authorities in marketing its salmon. In November 2015, the Food and Drug Administration (FDA) approved AquaBounty's application to sell AquAdvantage salmon to U.S. consumers, a decision marking the first time a GE animal had ever been approved to enter the U.S. food supply. However, a rider to the 2016 Omnibus Appropriations Act banned its import until the appropriate governmental agency could mandate labels for the product. Following the Omnibus Appropriation Act's passage, the FDA issued an Import Alert for the salmon, restricting all future shipments of AquAdvantage salmon into the United States. The Import Alert severely imperiled AquaBounty's plans to market its salmon to U.S. consumers, although the company successfully made its first sale of 4.5 tons of the fish to Canadian customers in July 2017. The FDA's Import Alert was deactivated in March 2019 upon the USDA's issuance of new regulations for the labeling of bioengineered foods, marking the first time that a GE animal product has been cleared for sale to U.S. consumers.

Although AquaBounty has mostly overcome its regulatory hurdles, the question still remains of what issues operators wishing to other GE species in RAS facilities will face in the future. Notably, the extra layers of required permitting associated with the cultivation of GE species will likely be a concern. Though AquaBounty's success in gaining authorization to market its AquAdvantage salmon paves the way for similar GE fish and shellfish to follow suit, those seeking to cultivate such species will still have a steep regulatory hill to climb. The FDA asserts jurisdiction over genetically engineered animals pursuant to its authority to regulate "new animal drugs" (NADs) under the Federal Food, Drug, and Cosmetic Act (FFDCA).[120]

116 In genetics, a promoter is a region of DNA that initiates transcription of a particular gene. Transcription is the first step of gene expression, in which a particular segment of DNA is copied into RNA by the enzyme RNA polymerase.

117 *Sustainable,* AquaBounty, https://aquabounty.com/sustainable/.

118 *Id.*

119 *Id.*

120 *Restrictions on Genetically Modified Organisms: United States*, Library of Congress (June 9, 2015), https://www.loc.gov/law/help/restrictions-on-gmos/usa.php.

Under the FFDCA, NADs are deemed generally unsafe unless the FDA has approved a New Animal Drug Application (NADA) for the particular use of the "drug" ("drug," here, meaning the genetic modification).[121] Except in cases in which the FDA exercises its discretion in order to decline to require compliance, or where the animal is meant only to be used to investigational purposes, the FDA requires a GE animal to be the subject of an approved NADA based on the demonstration that it is safe and effective for its intended use (here, human consumption).[122] A NADA for a GE animal must include information on the animal's identification; chemistry; clinical purpose; labeling; components and composition; manufacturing methods, facilities, and controls; safety and effectiveness; and environmental impact, among other things.[123] This is a difficult burden to meet, and one that AquaBounty spent years overcoming. This potentially significant time requirement, in addition to the already high costs of constructing and maintaining recirculating aquaculture facilities, could significantly diminish the attractiveness of cultivating GE fish and shellfish using recirculating aquaculture in the United States.

VI. Conclusion

Despite the high-profile challenges facing some RAS operators discussed above, the future of the technology within the United States actually looks fairly bright. It is important for aquaculture stakeholders to remain cognizant of the impacts that the presence or absence of large RAS facilities can have on the communities in which they are sited. While large-scale commercial aquaculture has the potential to create many jobs—especially in areas where facilities choose to occupy existing buildings that other job-creating tenants have vacated—the negative effects of failed RAS ventures can be felt just as strongly in those communities. Webster City, Iowa, the town of approximately 8,000 people in which the bankrupt company VeroBlue operated its now defunct RAS facility, serves as a good example of this. Prior to VeroBlue's arrival, Webster City had been dealt a devastating blow when the town's main employer, Electrolux, left the town in 2011.[124] When VeroBlue arrived and began operating in Electrolux's vacated building, the town's citizens hoped that the aquaculture company would once again provide a steady source of jobs to area residents.[125] However, the town and its citizens were met again with disappointment when VeroBlue's bankruptcy forced it to close the Webster City facility's doors. Unintended consequences such as this could potentially slow recirculating aquaculture's expansion into communities that may have otherwise been eager to volunteer their land and labor force.

Regardless of unfortunate situations like that of Webster City, more RAS facilities are seeking to enter the domestic market every year. In February 2019, Nordic Aquafarms announced that one of its subsidiaries, California Marine Investments, would enter into an exclusive option agreement with the Humboldt Bay Harbor District in Northern California to lease 30 acres of land on the Samoa peninsula near the town of Eureka in Humboldt County, on which it would construct a RAS facility meant to

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121 *Id.*
122 *Id.*
123 *Id.*
124 Curtis, *supra* note 102.
125 *Id.*

culture either Atlantic salmon or anadromous steelhead trout.[126] The company noted that the site met all of its criteria "for building a safe, clean, and sustainable fish farm," and stated that it had been welcomed by local authorities who were excited about the "many benefits" the project could bring locally.[127] Specific to the location, Nordic Aquafarms remarked on the existing presence of an outfall pipe, established access to good fresh- and seawater sources, and a substation with power on site.[128] Furthermore, the company noted that key permits, including aquaculture licenses, were already in place.[129] In comparison to the public's reaction to Nordic Aquafarms in Belfast, Maine, the siting decision in California has garnered relatively little community pushback, with most criticism surrounding the facility's seemingly rushed approval and its potential impacts on wild fishermen.[130] In response, Nordic Aquafarms noted that it would work with commercial fishermen, the environmental community, and other opposing groups, and that it would "encourage a healthy, fact-based debate with people and stakeholders" in the local community.[131]

The culture of saltwater species using recirculating aquaculture could even prove beneficial for wild fishermen and the environment as a whole, given time and regulatory allowance. In May 2019, National Geographic published article questioning whether sustainably farmed salmon could help solve the bait shortage facing wild lobster fishermen in Maine.[132] Harvesting of the most popular bait source for wild lobster—wild herring—was restricted in 2018 when the New England Fishery Management Council voted to reduce the 2019 herring quota by around 70% in order to help the population recover from a record-low number of juveniles.[133] Some have postulated that farmed "salmon racks"[134] could help replace the lost herring, even though Maine fishermen have long been opposed to conventional salmon farms due to the potential damage they can cause to gulf habitat and wild fisheries.[135] In 1999, Maine's fisheries department prohibited salmon racks' use as bait due to salmon anemia being found on a Canadian fish farm only three miles away from a U.S. farm.[136] At the time, fish health experts determined that salmon byproducts could carry the virus, which could then be transmitted to wild salmon, with potentially dire consequences for both wild fish and uninfected fish farms.[137] Recirculating aquaculture could provide a solution to this problem, as salmon racks from land-based farms have a clear chain of custody, resulting in a greater guarantee that the scraps are free from pathogens and disease.[138] Fish health experts generally

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126 *Norwegian Fish Farm Says Its Samoa Operations Will Create 80 Jobs, Produce 50 Million Pounds of Salmon or Steelhead Per Year*, Lost Coast Outpost (Feb. 9, 2019), https://lostcoastoutpost.com/2019/feb/9/norwegian-fish-farm-says-its-samoa-operations-will/.

127 *Id.*

128 *Id.*

129 *Id.*

130 *Id.*

131 Jason Huffman, *California town is 'Eureka' moment for Nordic Aquafarms, but resistance expected*, Undercurrent News (Feb. 12, 2019), https://www.undercurrentnews.com/2019/02/12/california-town-is-eureka-moment-for-nordic-aquafarms-but-resistance-expected/.

132 Ret Talbot, *Maine is running out of lobster bait. Is salmon the answer?*, National Geographic (May 1, 2019), https://www.nationalgeographic.com/animals/2019/04/salmon-farms-source-bait-maine-lobsters/.

133 Penelope Overton, *Drastic cut to herring quota puts Maine lobstermen over the bait barrel*, Portland Press Herald (Oct. 22, 2018), https://www.pressherald.com/2018/10/22/drastic-cut-to-herring-quota-puts-maine-lobstermen-over-the-bait-barrel/.

134 "Salmon racks" are scraps leftover from the processing of salmon after harvest. They include the fish's skeleton along with any attached flesh, sometimes including the head.

135 Talbot, *supra* note 119.

136 *Id.*

137 *Id.*

138 *Id.*

agree that the risks of using racks from land-based facilities are lower than with many other forms of bait, which is important as Maine has some of the most stringent bait approval procedures in New England.[139] If the large RAS companies building facilities in Maine can move past the community pushback that has plagued them so far, this proposition could increase the sustainability of the industry as a whole, while simultaneously providing important human and environmental benefits.

Though the short-term future of recirculating aquaculture in the United States faces some uncertainty due to the unsettled nature of the governing legal framework, the technology's many benefits related to sustainability and production lend hope to its long-term outlook. If RAS operators can overcome potentially prohibitive issues related to factors such as cost, resource use, and permitting and licensing requirements, the cultivation of marine species using recirculating systems could become an established domestic market in the future, thus enriching the aquaculture industry as a whole within the United States. However, only time will tell whether such potential success will translate into reality. Until then, those interested in recirculating aquaculture should take all steps necessary to educate themselves on the intricates of the technology itself as well as how it is currently being received by U.S. regulatory bodies and consumers.

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139 *Id.*