

Marine and Coastal Policy Research Group

The Future of Maine Aquaculture: Growth and Sustainability in Fish Farming

EXECUTIVE SUMMARY

Aquaculture is a huge source of seafood for the globe, and the industry is projected to grow enormously in the next fifty years. As climate change continues to change the environmental and economic landscape of the world, governments and communities will need new ways of evaluating and regulating the industry at a large scale. Recirculating Aquaculture Systems (RAS), a land based aquaculture method, has been proposed as the most sustainable form of aquaculture.

Through the comparison of two large scale, Atlantic Salmon, RAS aquaculture projects in Maine, I will propose a framework for comparing such aquaculture facilities to each other, and to other, traditional, facilities. This system will weigh three factors: impact on the environment, the community, and the economy. I will also compile the ways that governments can regulate this industry through existing legislation. Through these methods, communities across the country can evaluate and regulate the growth of this industry over the coming years.



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Atlantic Salmon will be raised in the Nordic Aquafarms and Whole Oceans facilities.

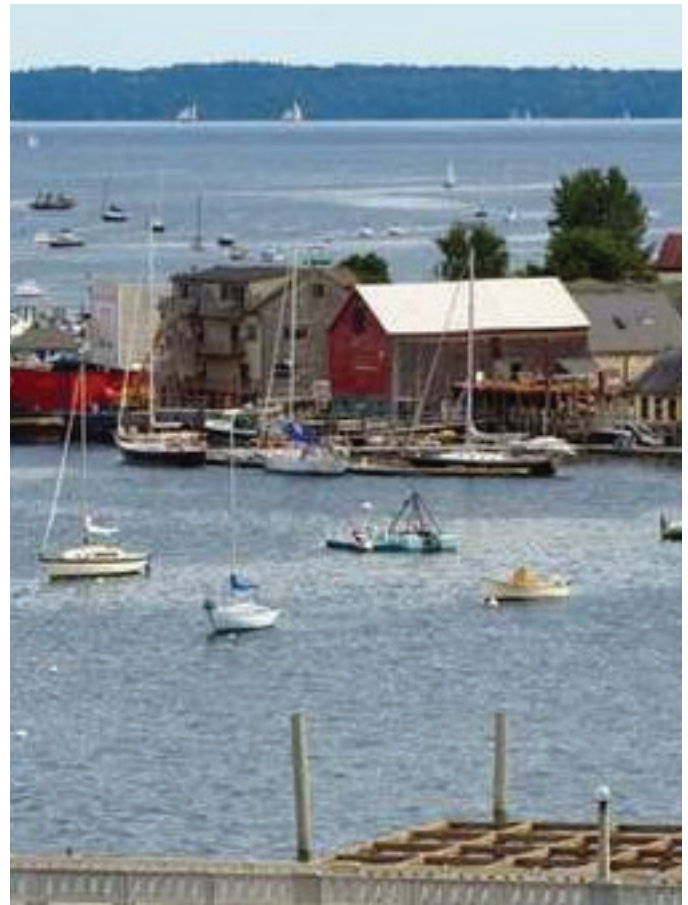
ISSUE CONTEXT:

Globally, more than 50% of the world's seafood is produced through aquaculture, the farming of fish; and that percentage is expected to rise in the coming years (NOAA). From an environmental perspective, this trend may be a good thing. An article in *The Guardian* back in 2016 cited the UN Food and Agriculture Organization, who found that 90% of the world's wild fish stocks were fully fished or over exploited (Nelson, 2016). The same article then poses the growing aquaculture industry as part of the solution to this problem. The more food aquaculture can supply, the less we must rely on exploited wild stocks.

Other meats besides seafood, like poultry, pork, or beef, have their own severe environmental baggage. An article for *Time* in 2013 started facetiously saying "You may think you live on a planet, but really you live on a gigantic farm, one occasionally broken up by cities, forests and the oceans." (Walsh, 2013) The author, Brian Walsh, backs up this claim by writing that 40% of the world's land goes to meat production, including raising all the grain needed to feed the animals. The global livestock industry creates more greenhouse gas emissions than the entire transportation industry (Carrington, 2014). The livestock industry is the single largest driver of habitat loss worldwide, and 73% of all antibiotics are used in factory farming (Coller, 2019).

The incredibly high environmental impact of meat production means we must find more sustainable sources for protein. One such source may be aquaculture. The same article that gave the fish exploitation statistics then poses the growing aquaculture industry as part of the solution to this problem. The more food aquaculture can supply, the less we must rely on exploited wild stocks (Nelson, 2016). But not all aquaculture is equal in impact.

Traditional aquaculture faces many challenges; sharing space with recreational and other commercial water users, the need to prevent the escape of fish and contaminating wild populations, the need to prevent the spread of disease to wild populations and the need to prevent eutrophication of waters from their operations. One solution posed to many of these problems is land-based aquaculture, or Recirculating Aquaculture Systems (RAS). In this method, fish are raised in a controlled, indoor environment. This means the fish need little to no antibiotics, and there is almost no chance of escape. On top of this, RAS systems can be implemented anywhere which, if scaled up, would cut down



Belfast, the town where Nordic Aquafarms is building their facility.

emissions from transporting fish by half (Conservation Fund, 2016).

RAS aquaculture is in a better position than other large scale meat to be a model of sustainable protein. I will use two case studies from Maine in this paper to think about growth in aquaculture in the US. Then, I'll propose a framework that can be used to compare potential aquaculture facilities. I will look at the Whole Oceans (WO) and Nordic Aquafarms (NA) projects in Maine. There are two companies that are starting construction on state-of-the-art, RAS facilities in Maine. These projects will be some of the largest of their kind in the US, in a relatively new arena for raising fish. When they are built and fully operational, they are projected to provide 20% of the seafood eaten in the United States. The Coller FAIRR Protein Producer Index rates a company called MOWI, a global aquaculture company that uses a lot of RAS, as the most sustainable protein source in the world. Not just that, but three of the top five companies are fish farming companies, and aquaculture corporations had the highest overall scores (FAIRR).



The paper mill in Bucksport that Whole Oceans is renovating to be their aquaculture facility.

CRITIQUE:

These two projects are similar, but even though they are planned to be located only twenty-five miles apart, they have had different receptions from the local communities. The community of Bucksport has welcomed the Whole Oceans facility. The company promises to bring many local jobs to the small town, and the operation is being advertised as having a strong mind to conservation, with the Conservation Fund as their partner. The Nordic Aquafarms project in Belfast has seen more opposition. Wastewater has been a point of contention, as Nordic Aquafarms will discharge about 7.7 million gallons of water per day, which would increase outflow into the Penobscot Bay by 90% (Hinckley, S.). With this outflow comes a concern for eutrophication, the increase of nutrients into the water that can cause harmful algal blooms. The company says that filtration will remove almost all the nutrients from the water before it's discharged, but one projection found that it may still raise nutrient levels in Penobscot Bay 48-135 times higher. The Nordic Aquafarms facility will also use about 400 million gallons of freshwater per year, a huge amount. But Jacki Cassida, the Nordic Aquafarms Community Liaison, says that the opposition has been a vocal

minority, and that Belfast has been mostly very receptive to the project. She also said that the facility discharge is a normal amount for this sized aquaculture project. It is less than other meat facilities, and the amount of nutrients filtered and amount discharged meets or exceeds Nordic Aquafarms' permits.

These discharge concerns haven't been raised as publicly of the Whole Oceans project, but this operation is actually bigger than Nordic Aquafarms. Jonathan Labaree, the Chief Community Officer at the Gulf of Maine Research Institute, thought the difference in responses to the projects could be due to their locations. Nordic Aquafarms plans to build a new facility from the ground up, while Whole Oceans has bought and is renovating an old paper mill. Labaree said that the Bucksport community has been more receptive, because this revitalization of the mill will bring jobs back that people lost when the paper mill first went under. Not only that, but the environmental concerns, while large, would be less than what the paper mill used to create.

Susan Lessard, the Town Manager of Bucksport, also gave this interpretation. She said that when the Verso Paper Mill closed in 2014, 579 jobs and 40% of the town value was lost. Since then the town has



The Green Wave aquaculture model

been looking for another industry to take over the site. Lessard said that Whole Oceans approached the town in 2016, and engaged with the community for several years before even buying the property. They sponsored local road races, met with indigenous groups, and held information sessions. According to Lessard, Whole Oceans had a representative in the local coffee shop every Thursday morning for several months to answer any questions that community members might have. After they filed for permits, a few people did file complaints, and Whole Oceans invited them to come and meet and answer any questions they had.

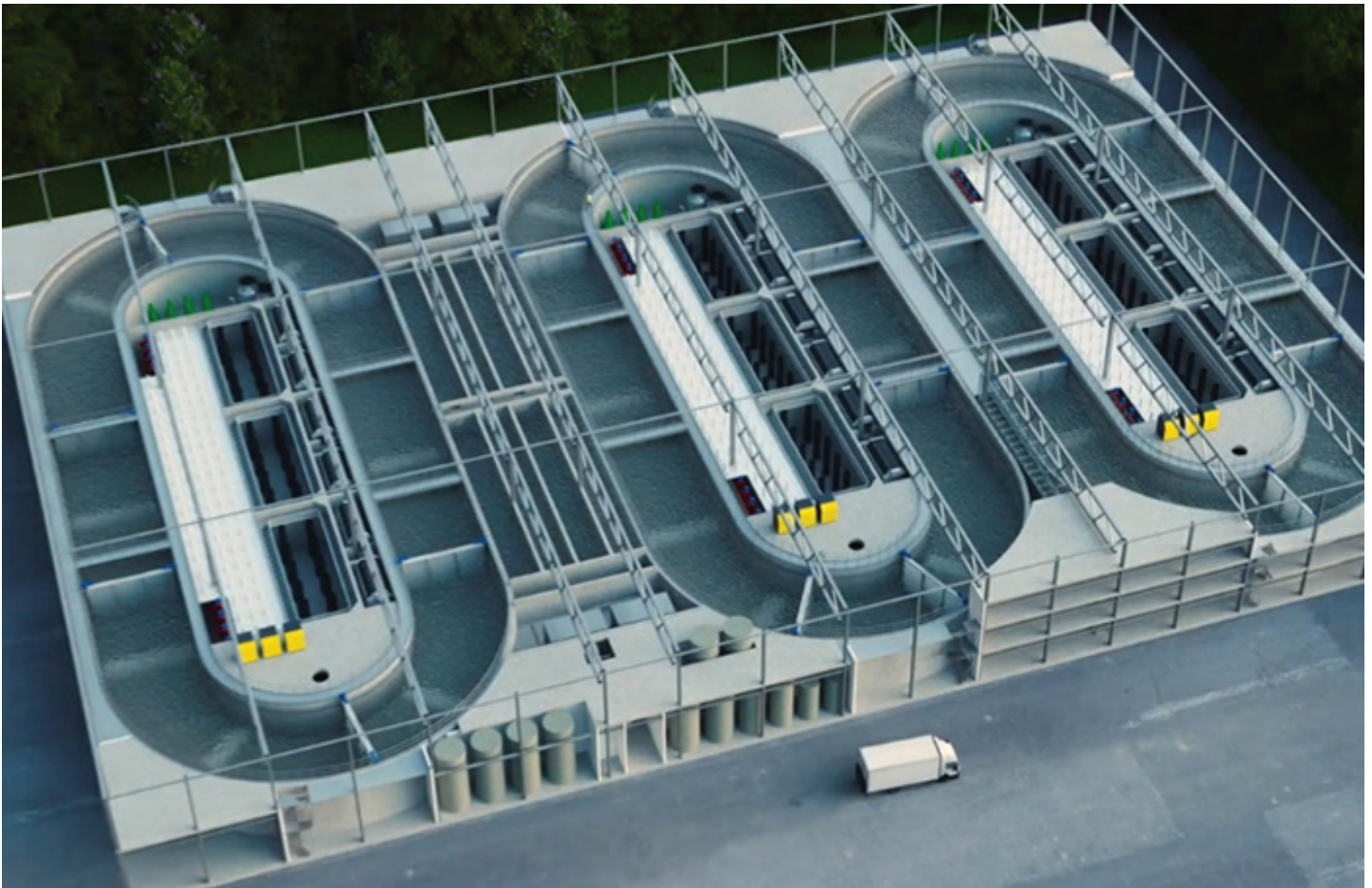
Every person I interviewed, including representatives from both companies, mentioned the locations of the projects as the main reason for the different responses. Jen Fortier, the Whole Oceans Outreach and Development Associate, said that not only was using the old paper mill better for the Bucksport community and the environment, it was also better for the company. By taking over an industrial site, it already had much of the infrastructure they would need for the aquaculture facility. It had the right zoning, and the right water and power infrastructure. Fortier also mentioned that the water sourcing was another difference in the projects. Whole Oceans is getting their water from the Penobscot River, where as Nordic Aquafarms is getting part of their water from an underwater well.

Lawrence Reichard, a journalist and resident of Belfast, has written many pieces in opposition to

the Nordic Aquafarms project, but said that he also opposed the Whole Oceans project. His main issues with the project, the Nordic project in this case, is the nutrient discharge, the water usage, the need to clear-cut forest to build the facility, and his perception of the company's lack of transparency. As a resident of Belfast, he has been mostly engaged with the Nordic Aquafarms project, but spoke about Whole Oceans as well. He said that in the face of climate change we must be doing all we can to decrease both our emissions and consumption, and he feels that industry at this scale, even of this kind that is more sustainable than most traditional meat industries, comes at too high an

environmental cost. He mentioned an organization called Green Wave, who have created another form of aquaculture. They plant vertical lines of kelp, and then interspersing vertical lines of shellfish. It sequesters carbon, filters nutrients like nitrogen, takes no feed or water input/discharge, acts as a storm buffer and can help rebuild ecosystems if you include a diverse collection of shellfish. In Lawrence's opinion, measures that are just a step in the right direction environmentally, he would say RAS facilities, are not enough in the face of climate change. He is calling for models like this, that have zero adverse environmental effects, not just reduced.

One response to this argument is to say that any step in the right direction environmentally is a good one, and that is how Whole Oceans and Nordic Aquafarms see it. Both representatives from the companies talked about the importance of not just growing a product, but of being a community and environmental agent. Both Jacki Cassida and Jen Fortier said that their companies are creating programs and relationships with local schools, at many levels, elementary and high school. Whole Oceans is also exploring a program with the University of Southern Maine. Cassida said directly that Nordic Aquafarms is interested not just in following their environmental permits, but exceeding them where they can to set a standard of environmental sustainability for the growing industry as more facilities are built in the US.



A Recirculating Aquaculture System (RAS) facility.

POLICY OPTIONS AND RECOMMENDATIONS:

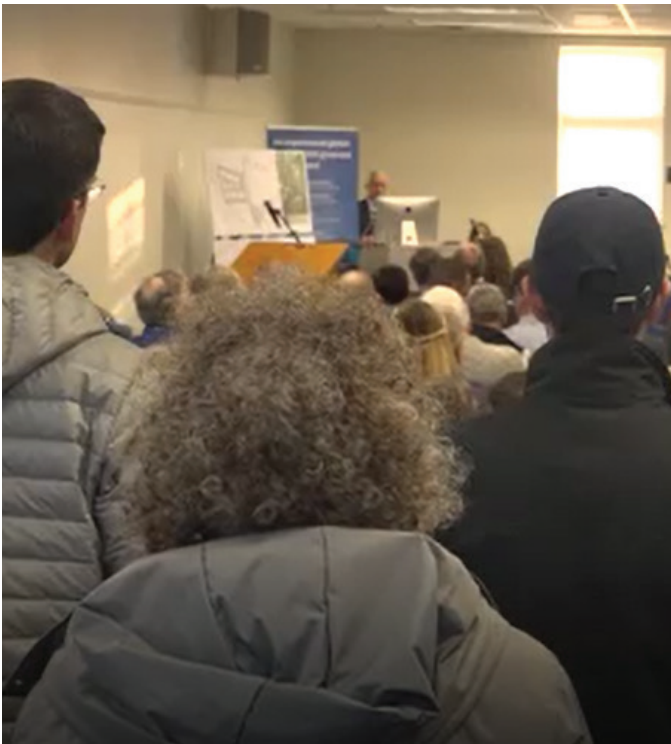
After talking to many different people about the issue, I've taken many of their biggest concerns and passions to create guidelines to assess future aquaculture projects. This can be used by community leaders of any kind; local government officials, NGO stakeholders, and even concerned citizens. When looking at a potential aquaculture project, communities and governments should balance three factors. They should look at how the proposed development impacts the environment, the company in question engages the community, and the economic impact.

FRAMEWORK:

Environmental Impact - In looking for standards to use, it was important to find an established measure; such as the Collier FAIRR Protein Producer Index. This is an organization that compares and ranks protein producing companies from around the world, on many environmental factors. A first step for someone evaluating a new aquaculture project is to check their existing rankings; they may have

data on the company in question. If they do not, they still have a good framework to use when assessing new aquaculture facilities. They assess nine risk factors when evaluating companies, six of them were particularly relevant to the environmental impact. These are Greenhouse Gas Emissions, Deforestation and Biodiversity Loss, Water Scarcity and Use (both intake and outtake), Antibiotics (how much are used on the fish), Waste and Pollution (absolute numbers discharged as well as percentages filtered), and Animal Welfare.

The Collier Index doesn't look at individual facilities, they look at full companies. That means the scope of their rankings is bigger, and that they rely on more generalized information. For instance, when looking at deforestation, they look at the number of trees removed from a forest, period. But when these factors are applied to a specific facility, the analysis can get more specific. We don't need to just look at the number of trees, but which parts of the forest those trees come from? Or what is the surrounding habitat that may be disturbed, and for which animals? Community members will have an intimate knowledge of the places being considered for development, and this



A community meeting for the Nordic Aquafarms facility.

knowledge will raise the expectations of environmental accountability for new aquaculture projects, and to make sure that this system is used to help your context specific community.

In summary, when evaluating the environmental impact of an aquaculture facility, make sure you understand it's impact in terms of Greenhouse Gas Emissions, Deforestation and Biodiversity Loss, Water Scarcity and Use, Antibiotics, Waste and Pollution, and Animal Welfare. But once you get the numbers and figures, make sure to interpret them in the context of your specific community, understand specifically where will be affected, as well as how. This brings me to the next factor to consider.

Community Engagement - It is important to think of not only the quantitative impact on the environment, but the qualitative impact as well. Communities are connected to place, so the environmental impact may be personal for towns and communities, and this shouldn't be ignored. The economical benefits, also, may be similarly personal community history is important. For example, in Bucksport the community has largely embraced Whole Oceans because of the economic revitalization of the Verso paper mill. The town has been home to industry for 100 years. It may be bringing a very similar number of jobs to the town

as Nordic Aquafarms is, but because of the community's history with the mill, the kind of jobs Whole Oceans will offer fit Bucksport specifically.

Not only are these important considerations, but the company looking to build should be invested in them as well. The way a company engages the community is crucial. They should be transparent and accessible, they should be invested in learning about what the community wants. As a community leader, understand what your community wants and expects from a new industry. Then, communicate that to the company in question, and help them to understand the importance of this kind of engagement.

Community engagement is so specific to the people involved, it's impossible to set clear guidelines on what to look for. Every community will have a different set of values and priorities, and these won't always be accounted for by the environmental and economical lenses. This category is interested in the most qualitative assessments of a project, what the community and culture values, and how the company engages with those values. When assessing new potential aquaculture facilities, take the time to understand these cultural effects that the project might have.

Economy - The biggest concern of the economical factor is jobs. Will a new project bring jobs. This is an important aspect that must be looked at systematically. First, how many jobs will the new facility bring? It's important to compare that number to the size of the project, for it is only through the context that the impact can be evaluated. Second, look at what kinds of jobs they will be. Are there entry level jobs, or jobs for people with specific skills and experiences? Do they pay well enough to support a family? Compare these answers to the needs of the community. If there are a lot of entry level jobs being created, but the town in question has plenty of opportunities like that and needs more specialized jobs, that project may not be right for that community.

The other important economical aspect when thinking about land-based aquaculture is the product itself. One of the great benefits of raising fish on land is the ability to have local seafood in landlocked places around the country. Local fish means less greenhouse gasses were emitted in transporting it, and also that less money was spent on transporting it, making it cheaper. Find out if the proposed aquaculture facility will be selling its product in the community where it's located, or if it only plans to ship them around the world.

CONCLUSION:

Once a new project has been evaluated through these three factors, the challenging part begins. The three elements must be balanced within each other, different items weighed against others. This is not an easy process, and may often not end with consensus. It's crucial that community leaders be receptive to the people they represent, facilitate dialogue about these elements, and give the people living in the community a chance to contribute to the debate, and listen to it. Through this process, hopefully, at least an understanding of where a community, and those living in it, stand can be found. This set of criteria can be used as a tool by community leaders to help them evaluate the potential aquaculture facilities that want to build in their communities.

Once a potential project has been evaluated, a community needs to be able to take action either in support or opposition. Meredith Mendelson, the Deputy Commissioner of the Maine Department of Marine Resources, made clear that land-based aquaculture is tricky, because it may fall in different jurisdictions. But even so, no individual component of it is unique. Permits for every step of the process are needed, and they can be a way to hold a project accountable to some of what they promise. Make sure that you understand the process in your town/state, for the regulations may be different.

As a future affected more and more by climate change approaches, and the demand for seafood rises, the need for sustainable aquaculture practices become all the more urgent. There are many factors to weigh, and the process is not easy. My hope is that this framework can empower communities to clarify their values, to help them focus their assessment of future projects. Communities should feel proud of the businesses they support and host. There are too many factors that are too specific for someone to decide what will be good for a community from afar. It is the people living with these businesses that should be helping to set the standard for the future.

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