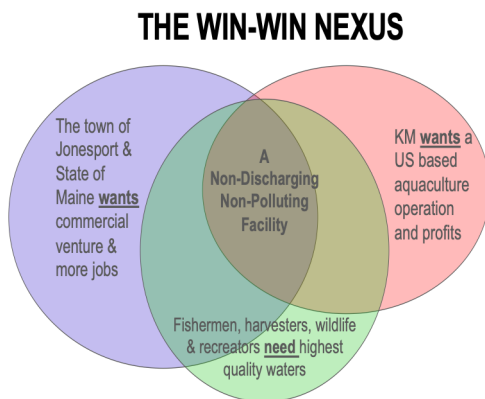


- The ENR Committee can, and should, amend LD 2187 to include upgrading Chandler Bay to its proven SA quality

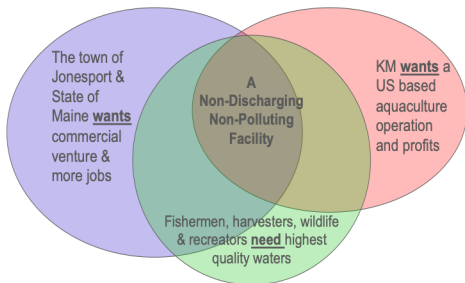


- The former principals of Kingfish Maine have built, run and are expanding a commercially proven “Best Practice” ***regenerative aquaculture facility*** “**Pine Island**” that if adopted in Jonesport would not require discharge into Chandler Bay
- Utilizing the “Pine Island” model ensures no impacts to the SA quality waters and eelgrass nursery areas that support the multi-million-dollar fishing and harvesting industry
- The Jonesport/Beals fisheries and shellfish beds depends on this high-quality water being maintained, as does all wildlife in the area
- The Pine Island model could work in Maine as we have a proven agriculture industry that grows out far more sensitive vegetation in fixed polycarbonate greenhouses and low-cost covered tunnels, even in the winter
- Its eelgrass and saltmarsh plants could be used to revegetate key areas, improving fish habitat and shoreland resilience against stormwater erosion
- This “**nature-based approach**” is in line with Maine’s shift regarding infrastructure design and remediation
- The Downeast Institute has shown almost no recruitment of green crab in Downeast waters, beds could now be restored with mature plants. They could also provide softshell clam spat to clean the water as they grow out. These larger clams could then be used to repopulate shellfish flats and conservation areas faster.
- Lower cost of entry with this scalable, modular approach means faster time to revenues and yields more jobs at a faster rate of growth. Environmental NGOs would be supportive and the State of Maine could partner via programs like the Natural Resources Fund and Outdoor Heritage Fund
- Should Kingfish Maine not wish to take this route there are several zero-discharge technologies that are available to them to use under licensing agreements

Best Practice Land-based Aquaculture and maintaining SA water quality are not mutually exclusive....

**THEY ARE COMPLEMENTARY**

## THE WIN-WIN NEXUS



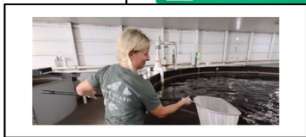
As an avid proponent of Land-Based Aquaculture (LBA) and having researched various LBA facilities and designs for over 8 years, I am submitting this testimony. My technical background stems from 7 years at the David Sarnoff Research Center in Princeton New Jersey, and 8 years at Intel Corporation focusing on new business development. I have lived in Maine for over 25 years with deep family ties to the fishing communities Downeast that go back generations.

**The upgrading of Chandler Bay to its rightful SA classification does not prohibit the location and construction of an aquaculture facility in Jonesport Maine.** In fact, the former principals of Kingfish Maine have constructed a proven commercially successful facility called Pine Island Redfish and are in the process of expanding that operation.

The key to such an operation is to use aquaponic techniques in growing out warm water marine fish, either red drum or yellowtail kingfish. In the Pine Island facility, the solids are filtered out, and the high nitrogen liquid discharge is sent to greenhouses to grow shoreland restoration plants.

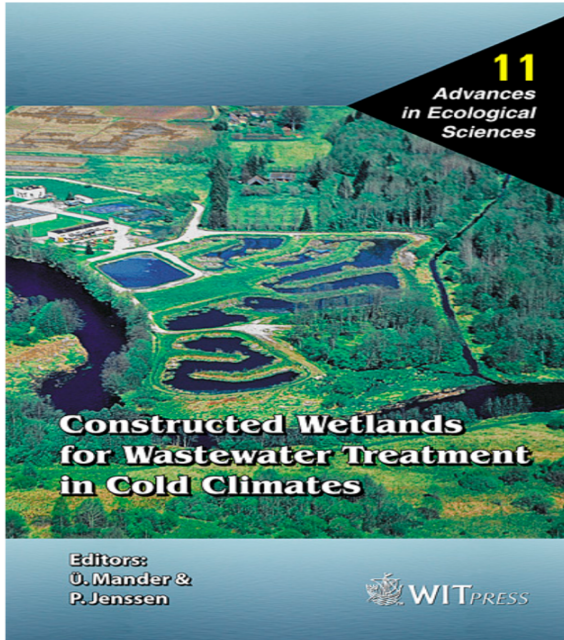
In the case of Pine Island, those plants are mangroves. In the case of Jonesport those plants could include eelgrass year-round in greenhouses and saltmarsh plants in open and semi-open constructed wetlands. This **“nature-based alternative”** to discharging pollutants into surface waters is in use in other facilities.

It could also be combined with the grow-out of soft-shell clams for restocking flats. Or growing algae in containers for feedstocks and other products. Creating more jobs while not imperiling our heritage fishing and harvesting grounds. Winter temperatures are not an obstacle. Through use of polycarbonate glazing in fully closed buildings, or retractable covers for partial closure and fully open constructed wetlands.



The Sorbey's at Pine Island





**STROUD** WATER RESEARCH CENTER

**WETLAND WASTEWATER TREATMENT**

**A constructed wetland** is an artificial wetland, marsh or swamp created as a new or restored habitat for treatment of wastewater, stormwater runoff or for land reclamation after ecological disturbances, thus providing habitats for plants and wildlife. These natural biofilters remove sediments and pollutants such as heavy metals.

**Subsurface-flow wetlands**  
This subsurface-flow wetland treats wastewater by moving it through a gravel or sand medium on which plants are rooted. In subsurface-flow systems, wastewater moves through the substrate and out. These systems require less land area for water treatment and are inhospitable to mosquitoes (as there is no standing surface water). After passing through the wetland, the water is pumped to a drip irrigation system where it gradually returns to the ground.

**What happens when it rains?**  
The wastewater is diluted by the rain and shortens treatment time. Surface and ground water is kept out by a surrounding berm and impervious liner.

**What happens in cold weather?**  
Wetlands are temperature-dependent. The engineer must design for the worst case, which is the low temperatures occurring in winter. Snow cover actually helps.

**What about odor?**  
Subsurface wetlands have wastewater flow under the gravel surface so odors are trapped and become food for microorganisms attached to gravel and plant root surfaces.

Leaching Chamber collects and drains water to the drainage area.

Wetland Plants



wetland in Stockbridge, Mass

Maine’s stellar universities and research facilities such as the Darling Marine Center, the Downeast Institute, Bigelow Labs are well familiar with grow-out of eelgrass, saltmarsh plants and biological engineering. They can provide guidance, and students to help make this a model project. A project that can apply not only to the Jonesport but others. Putting Maine on the map in terms of leadership in **regenerative aquaculture**.

All species of salt-water fish be it yellowtail, seabass or salmon can be raised in this type of facility. This is how to capitalize on Maine natural resources and technical know-how, while preserving high quality waters for fishing and other in-situ aquaculture endeavors.

**The ability to use these plant materials to revegetate eelgrass beds and saltmarshes,** helps stabilize our shorelands, and reinvigorate our shellfish beds. **Doing so makes land-based aquaculture an asset rather than a source of contention.**

Instead of levying remediation fines of \$1 Million or more for building a facility on wetlands, by incorporating open constructed wetlands, with boardwalks for visitors, transforms an “industrial site” into a birdwatchers and nature lovers’ destination.

Maine can, and should, lead in this regenerative aquaculture revolution. By utilizing a scalable modular approach, the start-up costs are brought achievable as market demand grows.

The state of Maine can take the opportunity to partner through its various programs such as the Natural Resources Fund and the Outdoor Heritage Fund. Together with Maine based conservation NGO’s who would be proud to participate.

Exhibit A



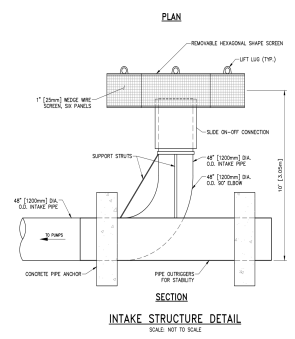
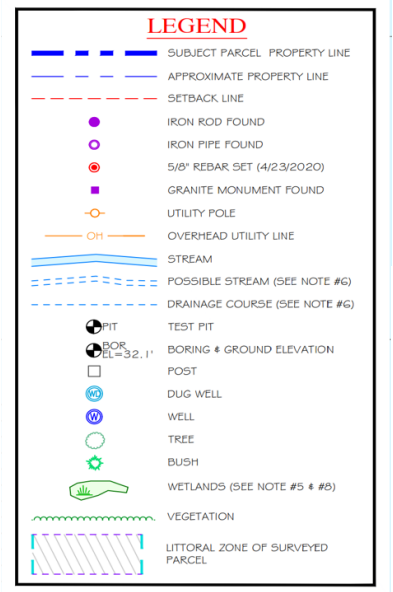
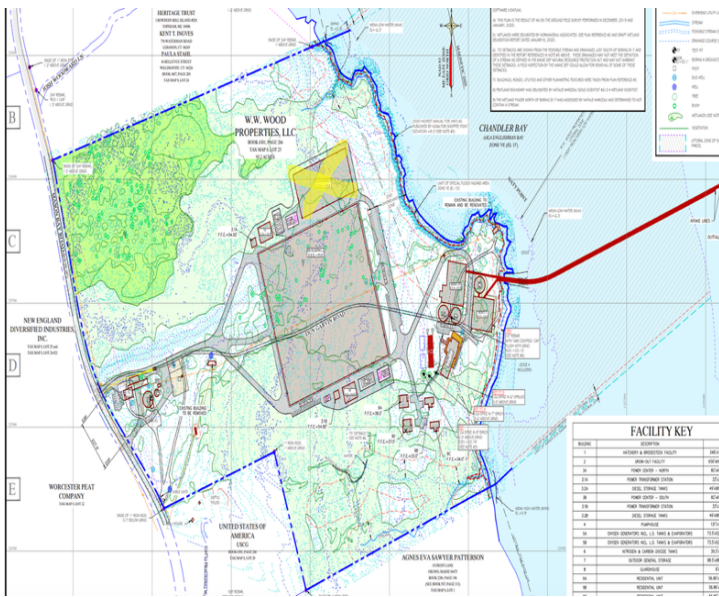
The 94-acre site at Jonesport is well suited for such a facility to be built. To date no Land-based Aquaculture (LBA) permit has been applied for by Kingfish Maine, nor let by Maine's DMR. **Due to issues raised by NOAA/USACE regarding entrainment of approximately 50 Billion shellfish eggs, larvae and potential for eelgrass damage and oxygen depletion, a revisiting of the facility design is warranted.** Today other than a few test borings, the parcel depicted in purple outline is in its natural state. To the northwest is property under conservation easement by the Maine Coast Heritage Fund.

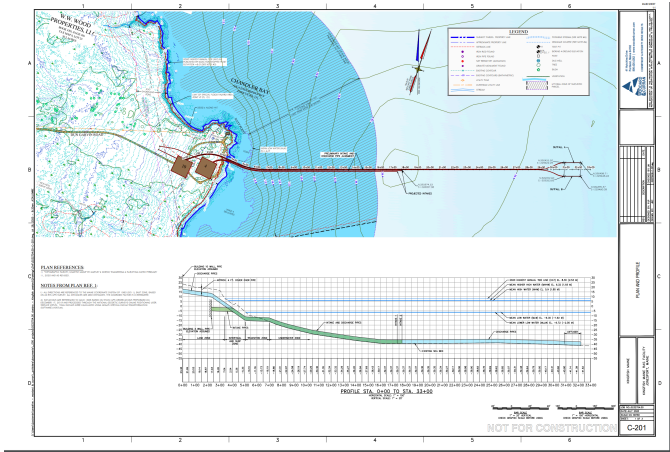
As the parent Kingfish Company has decided to do away with its proposed 54,000 sq/foot hatchery (now "X'd out in yellow), there is additional land for greenhouse use. The areas in shown in light green are wetland areas, and the darker green are proposed to be vegetated.

The red lines running out to sea are the proposed intake and discharge pipes. In the modified design the discharge pipes would no longer be needed saving considerable expense of construction.

The intake pipes could remain. However, the upturned intakes just below water level would need modification to prevent serious loss of shellfish and wild finfish larvae and eggs.

This modification could include either changing the intake mechanism or using the sand beach to act as a filtering well as other LBA facilities have done. Importantly, as only 6 million gallons of the 28M gal/day are needed for the fish tanks (the rest were for heat transfer) and there are now solar heat opportunities, considerable impacts would be mitigated.





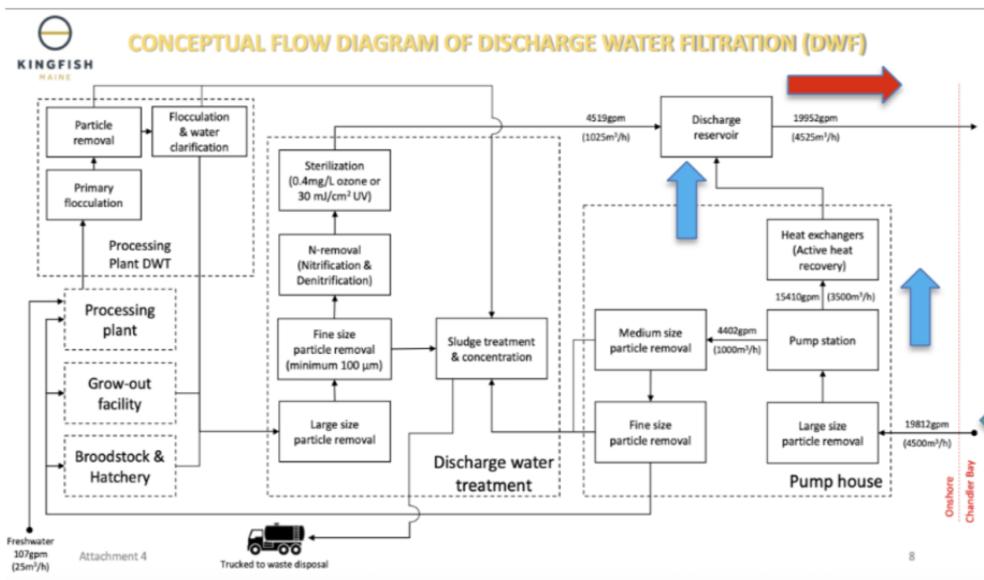
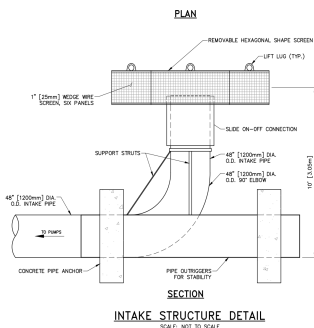
By eliminating the drawing in of 22 million gallons of water for heat transfer, billions of eggs and larvae from lobster, scallops, clams, mussels and finfish would be saved. This is especially relevant as recruitment of shellfish is paramount.

The 1" screen which covers the top of 2 four-foot diameter intake pipes will capture not only that sea life but all the zooplankton that the juvenile shell and finfish rely on for food. If you eliminate the juvenile shell and finfish, you remove the food that all larger fish, seabirds, and shorebirds depend on.

It is not only drawing from the immediate estuarial waters but as the tides and currents come in and out they bring life from surrounding areas.

The claim that was made about this design is that "all sea life will be returned to the sea". Which may be true, but it will not be returned viable or alive.

Because this is the path it takes:



Eggs, larvae, juveniles and zooplankton **less than 1" enter facility**. (green arrow)

All then go through a finer **1/64" screen** to the **Pump Station** and into the **Heat Exchanger** mechanics. (blue arrow)

Then into the **Discharge Reservoir** where they are mixed with by-products of processing and grow-out water before returned to the sea (red arrow)

- When a lobster egg releases the larvae is about the size of the head of a pin. It floats and drifts in the upper part of the water column. It can take 6-12 months to reach 1" in size as it settles to the bottom.
- Soft shell clams typically take about 2 to 3 weeks to develop a shell after fertilization.
- Clam larvae remain in the water column during their planktonic stage for about 2 to 4 weeks.
- Settlement occurs when they reach a size of approximately 2-3 mm



A salmon infected with IPNV



Maine’s state regulators requirement to use “Best Practices” is important to insure non-pollution of our coastal waters.

Nowhere is that more critical than regarding disinfection for highly communicable pathogens. **Case in point is the threat of Infectious Pancreatic Necrosis Virus (IPNV).**

While IPNV exists in very small amounts in much of Maine’s waters, it can reach pandemic levels should a cohort of contained fish become infected and the waters that they are raised in meet wild fish.

IPNV is highly a contagious and mutable finfish pathogen. There is no cure at present and while effective vaccines exist for salmon, there is less research about its use in kingfish. Should wild fish become infected in high numbers it could be catastrophic.

When tons of fish are held together in either land-based facilities, or net pens, the risks are very high. Thus far shellfish do not die from this virus, but as filter feeders they can become reservoirs for this pathogen.

| Disinfect Method                       | Key Parameters to Block/Inactivate IPNV  | Effectiveness for IPNV   | Notes / Guidelines   |
|--|--|--|--|
| Membrane Filtration (physical removal) | <ul style="list-style-type: none"> <li>Ultrafiltration pore size ~20 nm (0.02 µm) or smaller is required to physically block IPNV (<a href="mailto:frontiersin.org">frontiersin.org</a>).</li> <li>Microfiltration (&gt;0.1 µm) is insufficient – viruses ~60 nm can pass (<a href="mailto:frontiersin.org">frontiersin.org</a>).</li> </ul>   | Essentially 100% removal if properly implemented (virions are retained by the membrane). For example, a 20 nm UF filter produced virus-free water (no IPNV detected) ( <a href="mailto:frontiersin.org">frontiersin.org</a> ).   | Used for absolute pathogen exclusion. High efficacy, but expensive for large flows. Fouling must be managed. Often used on intake water in hatcheries for highest biosecurity.   |
| UV (alone)                             | <ul style="list-style-type: none"> <li>Dose: approximately 150–250 mJ/cm<sup>2</sup> UV-C needed for 99.9% IPNV inactivation (<a href="mailto:norfima.com">norfima.com</a>), <a href="mailto:ultraaque.com">ultraaque.com</a>. Lower doses (e.g. 25 mJ) are not sufficient for IPNV (<a href="mailto:norfima.com">norfima.com</a>).</li> <li>Contact time: a few seconds at high intensity (depends on reactor; ~5–10 s exposure can deliver the dose).</li> <li>Guidelines: General minimum 25 mJ/cm<sup>2</sup> in Norway (<a href="mailto:norfima.com">norfima.com</a>), but IPNV requires much higher (special case). Use medium-pressure UV for better performance on IPNV (<a href="mailto:norfima.com">norfima.com</a>).</li> </ul> | <p>High efficacy (99–99.9% virus kill) if the required dose is delivered (<a href="mailto:oxidationtech.com">oxidationtech.com</a>).</p> <p>Under clear water, 3-log<sub>10</sub> (99.9%) reduction achieved at ~122 mJ/cm<sup>2</sup> in lab tests (<a href="mailto:oxidationtech.com">oxidationtech.com</a>). In practice ~250 mJ/cm<sup>2</sup> is often targeted for full IPNV control (<a href="mailto:patents.google.com">patents.google.com</a>).</p> <p> caveat: Performance drops in turbid or UV-absorbing water – e.g. doses &gt;1800 mJ/cm<sup>2</sup> yielded &lt;2-log kill in one case of murky RAS water (<a href="mailto:oxidationtech.com">oxidationtech.com</a>).</p> | Widely used in RAS and flow-through systems for water disinfection. No chemicals added. Must ensure UVT (UV transmittance) of water is high and lamps are maintained. Regulatory point: design for worst-case (IPNV) if present. Medium-pressure UV can reduce the dose required (more effective spectrum) ( <a href="mailto:patents.google.com">patents.google.com</a> ). No residual effect – disinfects only at point of contact. |

| Disinfect Method        | Key Parameters to Block/Inactivate IPNV  | Effectiveness for IPNV   | Notes / Guidelines   |
|-------------------------|--|--|--|
| UV + Ozone (sequential) | <ul style="list-style-type: none"> <li>Ozone: target 0.1–0.3 mg/L residual ozone in contact tank, with 1–10 min contact (e.g. ~0.2 mg/L for ~5–10 min) (<a href="mailto:partanwater.com">partanwater.com</a>, <a href="mailto:partanwater.com">partanwater.com</a>, <a href="mailto:partanwater.com">partanwater.com</a>). Ensures significant virus pre-inactivation (ozone CT values on order 0.5–2 mg·min/L).</li> <li>UV: follow with ~50–100 mJ/cm<sup>2</sup> UV dose (can be lower than standalone UV dose) (<a href="mailto:sciencedirect.com">sciencedirect.com</a>). UV will polish off remaining virus and destroy ozone residual.</li> <li>Proper mixing and timing so ozone has reaction time and UV is applied after.</li> </ul> | <p>Very high efficacy, &gt;99.9% inactivation with substantial safety margin. Combined treatment can achieve near-sterilization of water. Studies show orders of magnitude pathogen reduction: e.g. ozone 0.1–0.2 mg/L + UV ~50 mJ/cm<sup>2</sup> drove microbial counts to zero in RAS trials (<a href="mailto:oxidationtech.com">oxidationtech.com</a>). IPNV, being ozone-sensitive, would be largely inactivated by ozone (even 0.01 mg/L can kill IPNV in clean water within 1 min (<a href="mailto:researchgate.net">researchgate.net</a>)) and any remainder by UV.</p> <p>Overall, UV+O<sub>3</sub> is more effective than UV alone, especially in lower quality water, as each method compensates for the other’s limits.</p> | Used in advanced recirculating systems and hatcheries for maximum biosecurity. Ozone improves water clarity and reduces UV demand; UV ensures ozone is quenched before water returns to fish (protecting fish and also adding redundancy in disinfection) ( <a href="mailto:oxidationtech.com">oxidationtech.com</a> ). More complex: requires ozone generator, contact tank, and UV unit in series, plus monitoring of ozone residual. However, it provides dual barriers against IPNV. Often referenced in industry when dealing with highly resistant agents or when water has high organic load. |

Yellowtail kingfish are proven asymptomatic carriers of IPNV. They may not show signs of illness or die from it, yet they can be highly infectious. The virus is shed through urine and feces and remains viable for weeks.

NORFIMA has set a minimal level of UV + Ozone required to ensure RAS fish are not infected from intake waters and discharge waters are free of this pathogen.

To date, the design of the proposed facility at Jonesport does not conform to NORFIMA guidelines. Kingfish Company does not vaccinate its fish. Therefore, a more rigorous disinfection design is called for.

2024 CLAM RECRUITMENT MONITORING NETWORK FINAL REPORT

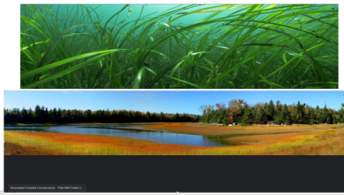


Results from the 2024 Clam Recruitment Monitoring Network can be found in the [Technical Report #6 Clam Recruitment Monitoring Network Results](#). The report summarizes data from spring and fall mudflat surveys, information about clam recruitment and growth during that time frame, seawater temperatures, and green crab density and size across 12 towns in Maine.

Overall, the average densities of soft-shell clams recovered from recruitment boxes in 2024 as a whole were higher than in 2021-2023, but were lower on average in the Midcoast region than in previous years. The location with the highest recruit densities was in Beals with an average recruit density of almost 200 clams per square foot. In 2024, there were on average 38 recruits per square foot compared to 35 recruits in 2023, 25 recruits in 2022, and 19 clam recruits per square foot in 2021. The average density of green crabs across the Network declined in 2024 with an average density of 2.5 green crabs per square foot in recruitment boxes compared to 3.7 green crabs in 2023, 5.5 green crabs in 2022, and 4.5 per square foot in 2021. The Downeast region had particularly low densities of green crabs in the boxes with an average of only 0.06 crabs per square foot and the majority of towns with zero green crabs found in all of the boxes.

Proposed discharge is 3 Times higher than what the DEP would normally allow, to maintain environmental integrity of the bays

DEP's scientists found that the nitrogen discharge levels proposed would use up more oxygen capacity than a healthy bay could support in terms of eelgrass... WHY SHOULD YOU CARE



Estuarine and Marine Nutrient Criteria

In the marine environment, the impacts of excess nutrients are similar to those seen in fresh waters. However, while phosphorus is often the limiting nutrient for growth of algae in fresh surface waters, nitrogen is typically the limiting nutrient in marine waters. In estuaries and coastal areas, excess nitrogen can cause:

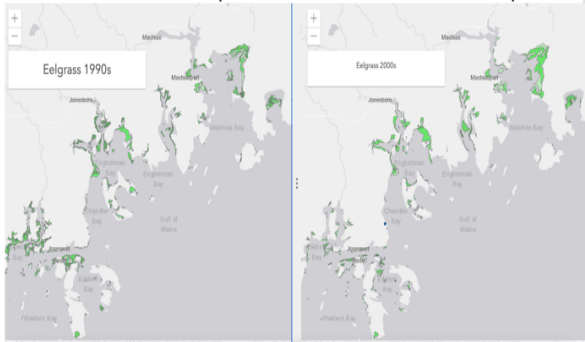
- blooms of phytoplankton and macroalgae that can smother organisms living on and within mudflats
- loss of marine vegetation like seagrasses that are important for carbon sequestration, shoreline protection, and provide important habitat and feeding grounds for juvenile fish and invertebrates
- declines in oxygen concentrations in bottom waters that can cause losses to the biological community, even fish or shellfish kills
- loss of recreational uses like swimming



From the DEP's website



Last eelgrass survey done in 2010...but it has been on a steady decline in area and density



Eelgrass bed restoration has a high likelihood of success in Downeast waters as the presence of green crabs have been shown by the Downeast Institute as being far less prevalent than in southern waters. When tested by the Institute it was found that :

*“The Downeast region had particularly low densities of green crabs in the (test) boxes ...and the majority of towns had zero crabs found in all of the boxes”*

This makes restoration of eelgrass a very likely, especially if the restoration plants have reached maturity by growing out in a greenhouse environment.

Eelgrass beds which have overall been in decline throughout Maine could be restored, in Jonesport as well as other areas Downeast. This model of regenerative fin fish aquaculture is a powerful tool for environmental improvement, rebuilding our shorelines and fishing grounds rather than negatively impacting them.

EELGRASS BEDS: Nursery & Protector

Healthy eelgrass meadows and other large salt marshland and intertidal plants draw carbon out of the ocean and the atmosphere. They protect coastlines against rising sea levels and storm surges

Larval and juvenile lobsters, scallops and other shellfish feed and hide and grow larger there

Herring spawn there. Pogey, striped bass, salmon and other juvenile fish forage and take cover in the grass beds

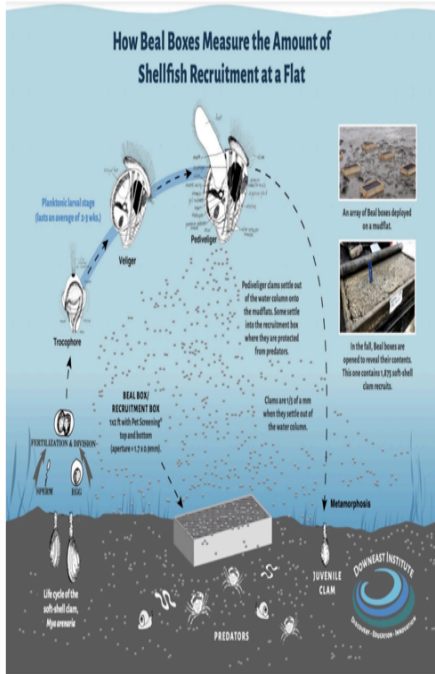
“At first, it just looks like a bunch of grass,” ..... “But look closely .. the eelgrass is teeming with animal life.”

**FOUNDATION OF THE COASTAL ECOSYSTEM**



As stated on Maine's DEP website regarding the effects of excess nitrogen in marine waters:

“Blooms of macroalgae that can smother organisms living on and within the mudflats...loss of marine vegetation like seagrasses that are important for carbon sequestration, shoreline protection and provide important habitat and feeding grounds for juvenile fish and invertebrates...declines in oxygen concentrations in bottom waters that can cause losses to the biological community even fish or shellfish kills...loss of recreational uses like swimming”

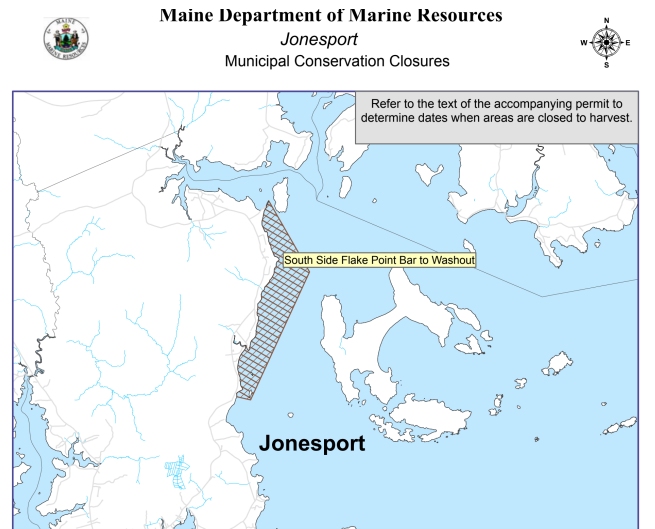


Juvenile clams settle into recruitment boxes where they are protected from most predators and can survive the growing season (April to November).

Another benefit that this Best Practice facility could provide is restoration of the clam flats.

If the Downeast Institute were to provide soft shell clam spat to be grown out to larger size in such a regenerative aquaculture greenhouse, they would help clean the water from nitrogen and other nutrients as they grow.

They could then provide larger stock to repopulate the Shellfish Conservation area at Jonesport which has been closed due to poor recruitment. These larger grown out clams could be provided to other areas Downeast as well.



**In summary:** with one simple act, by including one simple sentence in LD 2187, that is embodied in and encouraged by its Legislative statutes, the ENR Committee can pave the way for a Land-based aquaculture facility that can serve as a model for the rest of Maine.

Preserving our SA quality waters while protecting heritage fishing grounds and this most precious natural resource area is a recipe for success for all.

I thank the Committee for its time and consideration. If there are any questions or if I can help in anyway, please feel free to email me or call. My contact information is available through the Legislative submissions portal.

Holly Faubel  
Machiasport and Belfast  
LD 2187

Please see testimony attached