Maine Aquaculture Site Visit Report

October 20–25, 2025
Prepared for: Chugach Regional Resources Commission (CRRC)
Prepared by: Jeff Hetrick, Director, Alutiiq Pride Marine Institute; Annette Jarosz, Mariculture Director, Alutiiq Pride Marine Institute; Briana Murphy, Mariculture Liaison, Alutiiq Pride Marine Institute

Introduction

From October 20–25, 2025, representatives from the Chugach Regional Resources Commission (CRRC) and the Alutiiq Pride Marine Institute (APMI) conducted a study trip to Maine to tour aquaculture operations, research facilities, and make industry connections. The purpose of the visit was to gain insight into the structure, innovation, and management practices of Maine's mature aquaculture sector—particularly regarding kelp, shellfish, and invertebrate industries—and to explore models that may inform development in Alaska.

The itinerary included site visits to Atlantic Sea Farms, Mook Sea Farm, American Unagi, The Darling Marine Center and Maine Aquaculture Innovation Center, The Center for Cooperative Aquaculture Research, Maine Coast Sea Vegetables, and the Downeast Institute, as well as meetings with Sebastian Belle of the Maine Aquaculture Association and other key industry figures.

Atlantic Sea Farms
Biddeford, Maine
Visit Date: Monday, October 20, 2025 – 10:30 AM

The CRRC delegation began its tour at Atlantic Sea Farms' facility in Biddeford, Maine. The company operates from a large, converted warehouse containing research laboratories, a kelp nursery, and multifaceted processing areas, including state-of-the-art blanching, mincing, rinsing, packaging, and cold storage systems. Staff members Thew Suskiewicz and Cara Blaine provided the tour.

The operation maintains a high level of biosecurity and demonstrates a strong willingness to share information. Atlantic Sea Farms is currently contracting while exploring a revised business model. Previously, the company processed kelp four days per week year-round, though processing has been temporarily scaled back.

The facility has also undertaken research on dulse (*Palmaria palmata*) cultivation in agitated tank systems and proprietary methods for seeding lines for grow-out. Most of their lab work is grant-funded. Staff discussed monitoring kelp growth by both Atlantic Sea Farms personnel and their growers. Most farms are small (10-30 acres), and the company is diligent in coordinating seed string delivery and managing quality.

Seed string is typically inoculated at around 2,000 spores per mL, though densities between 500–1,500 spores per mL are also used. Staff noted that lower seeding densities generally reduce nursery complications but do not necessarily correlate with higher or lower grow-out densities. Great care is taken to deliver "perfect spools," aided by easy access to sori and the lack of the 50/50 rule (Maine seaweed hatcheries must source parent material from Maine's coast, but that is the only limitation). Contamination is mitigated using ethanol-based solutions when needed. Contaminated spools are isolated and sanitized with ethanol, and the

nursery uses a dilute F/2 medium biweekly. Strict hygiene and inspection protocols are followed, including daily spot checks for contamination.

One helpful tip shared was to grow sorus tissue from non-reproductive sugar kelp collected and taken back to the hatchery. The process involves cutting off the kelp at the meristem and distal tip, retaining just the middle portion of the frond; this section is submerged in seawater in the hatchery, which with agitated water can produce new sorus tissue within approximately three weeks. Another helpful tip involved using "go-backs"—during the last portion of the spore release process, sorus tissue pieces removed from the refrigerator are wiped with a paper towel—if the paper towel doesn't wipe away with spores on it, those piece of sorus tissue are kept separate from the more "fertile" pieces which produce brown residue when wiped, and used only if necessary. ASF has used sorus tissue that has been stored for up to three days, after which spore release has not been successful. Staff noted that adding seawater near target spore densities can sometimes stimulate additional release to increase ratio of spores/mL.

The company's ratio of seed string to biomass is roughly 10,000 feet of seed string per 30,000 pounds of wet kelp, while mid-level farmers manage 8–16 acres, using 35,000–50,000 feet of seed string to produce 100,000–250,000 pounds annually.

Mook Sea Farm
Damariscotta, Maine
Visit Date: Monday, October 20, 2025 – 3:00 PM
The team toured Mook Sea Farm, Maine's largest oyster hatchery and farm, where 60% of Maine's oysters are produced. The tour was led by Andy, the hatchery manager.

The facility includes a holding area that allows seawater to be recirculated in the event of heavy rainfall, preventing contamination from runoff. During such periods, adult oysters ready to be harvested are removed from grow-out areas on the farm and held in totes similar to standard fish totes before being sent to market. Any shutdown in harvest operations results in unrecoverable income losses, underscoring the importance of water quality control. Mook Sea Farm has achieved breakthroughs in heterotrophic algae and bacterial culture, producing feed densities of 300 million cells per mL in compact one-gallon bags—enough to feed the entire hatchery for a day. The system remains proprietary but reflects over a decade of refinement. The hatchery also continues to raise phototrophic algae.

Mook Sea Farm removes oysters from the hatchery at 1.5 mm, significantly earlier than typical practice, which reduces hatchery load and increases turnover efficiency. Juveniles are reared in two systems: a bubbler system and a standard air-lift system, providing operational redundancy.

American Unagi
Waldoboro, Maine
Visit Date: Tuesday, October 21, 2025 – 9:00 AM
Host: Sara Rademaker, Owner and Founder
The visit began with a presentation on the eel fishery in Maine. No facility worldwide has yet succeeded in cultivating eels from the hatchery stage at commercial scale; even in Japan, experts estimate that implementation of commercial hatchery production of eels is 20–30 years away. Eels have an extended larval stage as "glass eels" and spawn in an uncharted area of the Atlantic Ocean, presumed to be near the Bermuda Triangle. Their larvae drift thousands of miles to

freshwater rivers, and it is believed that environmental factors during drift influence genetic expression, complicating captive breeding efforts.

In Maine, fishermen capture glass eels—approximately the size of a toothpick—using seines. They are sold at roughly $2,500 per pound, with each eel valued at about one dollar. American Unagi is the only eel farm in the United States. Typically, glass eels caught in Maine are shipped to Asia for grow-out and processing, then re-imported at five to six times the original price. After the larval stage, eels are exceptionally hardy, tolerant of fluctuations in salinity, and can be shipped in high densities.

The Maine fishery operates under a quota system established in the 1980s, with allocations including those for the Passamaquoddy Tribe (which manages their allocation as a derby), which partners with American Unagi. The facility is divided into two sections—hatchery/farm and processing—and uses a drum filter for recirculating freshwater, separating solids for removal. The solid waste, rich in phosphate, is being evaluated to be sold/donated to a neighboring fertilizer company.

A single freshwater well pump services the facility, using approximately 75,000–90,000 gallons per day (about 65 gallons per minute). The farm is divided in half to prevent total system failure in case of contamination or mechanical malfunction. Eels are periodically graded by size: tanks are drained, and fish are pumped to an inspection area where they are passed through a size grader before tanks are cleaned and restocked.

At harvest (1–3 years), eels are processed onsite using a butterfly machine that splits the fish, removes the spine and guts, and rinses fillets in a cement mixer before setting them out to dry. Females grow significantly faster than males, though the reason males are not culled or sorted remains unclear.

Lunch with Sebastian Belle
Maine Aquaculture Association and National Aquaculture Association
Gardiner, Maine
Tuesday, October 21, 2025 – 11:30 AM

CRRC staff met with Sebastian Belle, President of both the Maine Aquaculture Association and the National Aquaculture Association (of which APMI's Director Jeff Hetrick is a board member), accompanied by MAA's Christian Brayden (special projects manager). The discussion focused on Maine's aquaculture policy environment, permitting processes, and industry challenges.

Christian described his authorship of a kelp economic analysis and his extensive permitting outreach work. Sebastian highlighted the Kingfish project farming yellowtail in Jonesport (currently housed at CCAR) and emphasized the importance of community engagement and social licensing to bring such projects to fruition.

Maine's aquaculture leasing process allows for limited-purpose experimental leases (400 square feet, up to ten leases connected) and standard leases (up to 100 acres), the latter of which can take five or more years to secure. The state is currently about three years behind in processing lease applications. Discussion also touched on the MARA Act, leadership changes at the National Aquaculture Association, and ongoing regulatory inflexibility under prior administration.

The Darling Marine Center and Maine Aquaculture Innovation Center

Damariscotta, Maine
Tuesday, October 21, 2025 – 2:00 PM
The group was hosted by Craig Candon (hatchery manager) and Tom Kiffney, a postdoctoral fellow. Chris Davis joined the latter half of the tour, along with Sara Lacourciere, the kelp hatchery manager.
The visit began in the hatchery, where staff demonstrated scallop spawning on fiberglass plates and provided an overview of their algae culture systems. Much of the facility was under renovation. The team observed equipment, including autoclaves recommended for algae culture work.

The kelp program maintains a gametophyte bank and has acquired equipment from the liquidation of Running Tide Technologies. The tour included their direct seeding machine, which the Darling Center hasn't had a chance to use yet, where sporophytes could be pumped in, mixed with an adherent, and deposited on the seeding substrate. This machine, originally designed for "pucks," will require retrofitting for kelp spools. They also had a piece of equipment, from a Korean tour staff attended, that "sews" seed string directly onto growlines, keeping the line taut and flush rather than spiraled, which simplifies removal of the seed line at the end of a farming year and improves seeding consistency.
Later, the group toured the Damariscotta River test site, where oysters and scallops were outplanted. They inspected heavily biofouled scallop lantern nets, examined small oysters in "OysterGro" baskets, and visited a larger commercial oyster farm using similar equipment. The group also toured Chris Davis's private farm, observing hanging mussel and oyster nets, and sampled oysters.

Chris Davis's company, founded in 1989, continues bottom culture operations. They seed oysters at 30+ mm for one-year growout cycles. A flupsy upriver provides warmer overwintering conditions before seed is transplanted to the raft site near DMC.
The Damariscotta River is technically an estuary, not a freshwater river. That evening, the team met with Damian Brady, Director of the Maine Aquaculture Innovation Center, at King Eider Pub and discussed aquaculture policy and the Alaska AOA Draft Plan. Chris Davis and Tom were also present.

Center for Cooperative Aquaculture Research (CCAR)
Ellsworth, Maine
Visit Date: Wednesday, October 22, 2025 – 11:00 AM
Host: Steve Eddy, Director
The delegation visited the Center for Cooperative Aquaculture Research (CCAR) in Ellsworth, Maine, where they were met by Director Steve Eddy who conducted the tour and provided a detailed overview of the facility's structure and operations.
CCAR functions primarily as a business incubator for developing aquaculture enterprises, providing access to infrastructure, water systems, and technical support for emerging aquaculture ventures. Companies typically lease space for two to five years while refining their culture systems before transitioning to private or custom-built facilities. Notably, American Unagi originated at CCAR, and Kingfish Maine (yellowtail) has also used the facility to initiate operations before expanding.

CCAR differentiates itself from research institutions such as the Darling Marine Center and the Maine Aquaculture Innovation Center by focusing on commercialization and business incubation rather than academic research. The center also supports interns and graduate students

who conduct aquaculture research on-site, often working in collaboration with businesses operating at the facility.

One current incubation project, Salmogen, is working on salmon aquaculture using biogenetic methods to promote sterility and higher heat tolerance to adapt to warming ocean conditions. The company competes with established firms such as BioMar and Hendrix Genetics. The facility is modular and organized for strict biosecurity, with each operational unit having separate housing, water intake, and recirculating systems. The infrastructure has evolved over time through successive expansions and renovations, giving it a well-used but highly functional appearance.

During the tour, the team viewed a hydroponic system integrating tilapia aquaculture with small-scale greens production, where nutrient-rich effluent is circulated through clay beads that support plant growth.

They also observed sea urchin cultivation experiments. While CCAR has successfully reared urchins through the hatchery phase, there is currently limited market demand. Maine's urchin fishery once thrived following the cod collapse but has since declined to an unstable $2 million annual fishery. Urchins feed heavily on sugar kelp, consuming more than is convenient to collect in the wild, but Eddy admitted likely wouldn't be able to support a commercial market. Culture success rates are low—less than 2% survival through the larval stage—and outcomes appear independent of stocking density. CCAR does not use *Ulvella lens*, a biofouling algae commonly used on settlement plates elsewhere, because it is considered invasive in Maine.

The group also saw yellowtail broodstock rescued in 2012 from a discontinued net-pen operation. Three tanks of yellowtail were maintained in a modular building with a recirculating seawater system. One tank housed the original 2012 broodstock, and the other two contained subsequent generations produced at CCAR.

Maine Coast Sea Vegetables
Hancock, Maine
Visit Date: Wednesday, October 22, 2025 – 2:00 PM
Hosts: Seraphina Erhart, Owner; Grace, Staff Member
At Maine Coast Sea Vegetables (MCSV), owner Seraphina Erhart and staff member Grace hosted the tour. The discussion focused on the importance of establishing national standards for seaweed testing and labeling, directed by industry leadership at the USDA and FDA levels. Seraphina noted inconsistencies among testing agencies and emphasized the need for greater standardization.

She also expressed interest in closer collaboration between Maine and Alaska's seaweed sectors, particularly on national kelp policy and industry development issues. Her international travel and participation in global seaweed networks have provided valuable connections and insights.

MCSV operates with a collector-based business model. The company provides annual quotas specifying which seaweed species and volumes it intends to purchase. Dedicated collectors—many now representing multi-generational families—harvest, dry, and sell product back to MCSV. Collectors are highly experienced in determining optimal kelp species, moisture content, and drying conditions, and have long relationships collecting for MCSV.

Harvesters are paid $12–18 per pound of dried kelp, and the company trusts their expertise in achieving appropriate moisture levels, typically drying within 36 hours of harvest to

prevent fermentation and the visible signs of salt excretion and build up on the dried seaweed tissue. Harvested seaweed may be staged on-site before processing.

The team toured MCSV's production facility, which included moisture control rooms where humidity can be adjusted using humidifiers or dehydrators to optimize packaging quality (for whole leaf sugar kelp in particular, moisture was added just before final packaging to ensure kelp leaf stayed intact, rather than being too brittle to withstand packaging and shipping). The processing line featured a hammer mill**,** sifter, and automatic jarring machine, as well as manual sorting tables where staff inspect dried seaweed for imperfections, rocks, or debris.
The warehouse contained three rows of shelving units stacked with boxes of kelp in various product forms. Seraphina noted that packaging flexibility and careful handling of whole-leaf products remain key challenges.

The visit concluded with a product tasting and retail review, after which all visitors purchased samples to take home.

Downeast Institute (DEI)
Jonesport, Maine
Visit Date: Thursday, October 23, 2025 – 10:45 AM
Host: Dr. Brian Beal, Research Director
Lunch with: Kyle Pepperman, Executive Director, Downeast Institute; Brian Beal, Research Director, Downeast Institute; Laura Campbell, Quahaug Bay Conservancy.
Following a delayed start due to vehicle issues, the team arrived at the Downeast Institute (DEI) and was greeted by Dr. Brian Beal, Research Director. Founded in 1987, DEI moved to its current site in 2003 and has undergone several NSF-funded expansions to enhance its hatchery, ocean acidification, and educational facilities.

The hatchery wing contains large tanks for various species and life stages, supporting both research and commercial seed production. DEI's genomic research on the Eastern oyster (*Crassostrea virginica*) positioned it as a vital producer for Maine's oyster industry when other hatcheries, including Mook Sea Farm, faced setbacks. DEI tried for several years to culture the flat oyster (*Ostrea edulis*), but finally gave up after many unsuccessful attempts.

Dr. Beal explained the use of conditioning tanks—large holding systems connected to temperature-controlled plumbing—to simulate seasonal conditions. By gradually raising water temperature by 0.5–1°C per day over eight weeks, and then applying a warm-water shock (24°C), staff can induce spawning on demand, allowing flexible scheduling.

The team also observed mussel hatchery systems, where old lobster lines are wrapped around PVC frames and suspended in tanks. Mussel larvae are added, and algae feed is provided manually from five-gallon buckets. Beal reported that 7 million larvae typically yield 2 million seed, which are then scraped and transferred to socks.

Ongoing research on golden mussel genetics has achieved 92% desired traits after four generations. DEI has been attempting scallop culture since 1987, with limited success—only one successful spawn at Mook Sea Farm to date.

The team also examined oyster culture systems, including "Coke bottle" setups and upwellers built from five-gallon buckets with screened bases. DEI's plumbing systems are largely custom-built.

Other species in culture included Arctic surf clams (*Mactromeris polynyma*)—a valuable species in Canada and Japan and found in Prince William Sound. Culturing this species remains extremely challenging.

DEI's algae culture mezzanine featured over 20 Kalwall tubes plumbed to a 2,000-gallon reservoir, enabling efficient drainage and ergonomic operation. The facility cultures multiple microalgae species, including *Isochrysis, Pavlova, Chaetoceros, Chlorella, Tetraselmis,* and *Nannochloropsis*, enriched with CO_2.

Additional infrastructure includes a biosecure quarantine room (8x10 feet) draining to a 2,000-gallon holding tank that can be bleached and neutralized before discharge, allowing safe work with non-native species.

The tour concluded with a discussion over lunch with Executive Director Kyle Pepperman, Brian Beal, and ED TKfrom the Quahog Conservation District, who described plans for a new laboratory and a lobster hatchery. Beal shared that he plans to present a paper on lobster hatchery protocols at the upcoming Northeast Aquaculture Conference.

Afterward, Beal entertained the group with stories from Downeast Maine and explained the origins of several buildings on-site, including the "Sulking Shed," a sieving shed near a historic lobster pound.

Beal described DEI's large-scale field projects along nine coastal stations studying recruitment, growth, and mortality of bivalves across temperature gradients. Seed collected from grow-out boxes are overwintered in 4-foot raceways within the hatchery, a setup originally designed for crab reclamation.

Conclusion and Reflections

The Maine site visits provided CRRC and APMI staff with valuable insight into how a mature aquaculture industry integrates research, policy, and commercial development. Key takeaways include:

- Centralized research capacity is essential for innovation. Institutions like DEI, CCAR, and the Darling Center directly support commercial ventures while maintaining academic rigor.
- Business incubation models, as demonstrated by CCAR, could provide an adaptable framework for Alaska's emerging aquaculture businesses, bridging the gap between pilot-scale and full-scale production.
- Product quality and safety standards, emphasized by Maine Coast Sea Vegetables and Atlantic Sea Farms, underscore the need for consistent, industry-driven regulation in the seaweed industry.
- Biosecurity and redundancy are fundamental to hatchery success, evident in operations from Atlantic Sea Farms to Mook Sea Farm.
- Cross-sector collaboration—between scientists, industry, communities, and regions—has been critical to Maine's success and provides a strong model for Alaska's mariculture development.

CRRC staff returned with numerous practical ideas and strengthened relationships with Maine partners who expressed interest in continued collaboration. The visit reinforced the potential for Alaska's coastal communities to develop resilient, community-oriented aquaculture systems rooted in sustainability, local empowerment, and innovation.