National Marine Fisheries Service

Alaska Aquaculture Program

NOAA FISHERIES

Alaska Region

AQUACULTURE ACCOMPLISHMENTS

Fiscal Year 2023

SEPTEMBER 2023

National Marine Fisheries Service

Alaska Aquaculture Program

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U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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Acknowledgements

NOAA Fisheries Alaska Regional Office and Alaska Fisheries Science Center would like to thank our university, industry, and agency partners who provided aquaculture research needs, and enabled this work to move forward.

Credits

Illustrations by Juliana Cornett.

Alaska Region's Fiscal Year 2023 Aquaculture Accomplishments

Strategic Alignment

In response to NOAA's recently issued 2023-2028 Aquaculture Strategic Plan, we have aligned the NOAA Fisheries Alaska aquaculture activities in support of three of NOAA's Aquaculture strategic goals: 1) Manage Sustainably and Efficiently, 2) Lead Science for Sustainability, and 3) Educate and Exchange Information. Each of the projects listed below link back to a NOAA strategic goal and objective. Out of the 17 objectives identified in NOAA's 2023-2028 Aquaculture Strategic Plan, the Alaska Aquaculture Program prioritized the following 10 objectives in fiscal year 2023.

NOAA Aquaculture Strategic Plan 2023-2028. Credit: NOAA Fisheries

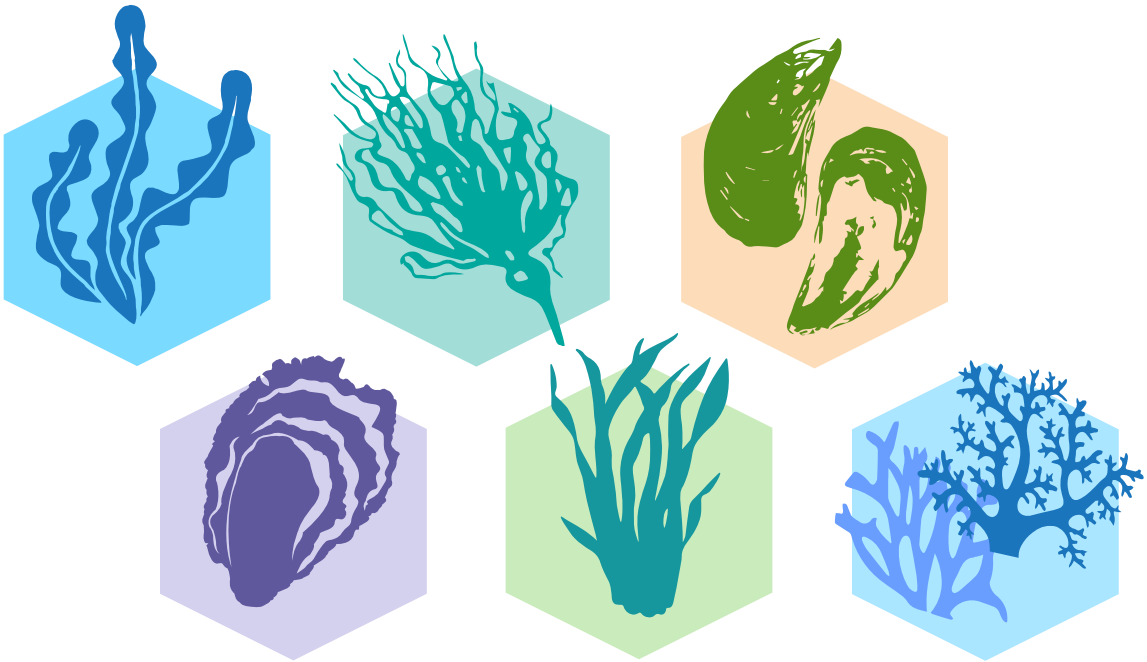
The Alaska Region's Aquaculture Program prioritized the following objectives in Fiscal Year 2023 (not in rank order)

1. Work with states and federal agencies to execute directives under existing Executive Orders, policies, plans, and statutes to promote sustainable aquaculture as part of NOAA's seafood portfolio.
2. Provide and use best available science, information, and tools (e.g., siting, water quality and genetics models, peer-reviewed publications) for permit reviews and environmental consultations.
3. Identify Aquaculture Opportunity Areas to support planning for commercial aquaculture development in locations that reduce user conflict, maximize compatible uses, and minimize impacts to public trust resources through scientific analysis and public engagement.
4. Provide science-based products and tools, including bolstering the translation of research results into advice that supports regulatory and management decision-making.
5. Conduct coordinated, applied scientific research to support industry development, including innovations to improve industry success.

6. Strengthen and diversify data collection to support aquaculture industry management and development.
7. Confront climate change proactively, identifying threats and leveraging science-based resilience, mitigation, and adaptation opportunities.
8. Seek, listen to, and incorporate stakeholder needs into decision-making by collecting information and feedback on key aquaculture topics using new and existing collaborative relationships.
9. Improve perception, social license, awareness and understanding of aquaculture by strengthening communication with the general public, external stakeholders, and within NOAA to enhance awareness of available resources, expertise, and the current state of science regarding marine aquaculture.
10. Advance innovative approaches to aquaculture literacy and provide equitable access to education and extension materials. Use these resources to inform the public and other stakeholders on the challenges and benefits of aquaculture and the current state of science and the industry.

NOAA Fisheries aquaculture staff on a farm tour in Kodiak, AK. Credit: NOAA Fisheries

This report highlights updates on the 14 projects that supported each of the above Alaska aquaculture priorities, as well as updates on other notable accomplishments over the last year.



Goal 1:
Manage Sustainably and Efficiently

Work with states and federal agencies to execute directives under existing Executive Orders, policies, plans, and statutes to promote sustainable aquaculture as part of NOAA's seafood portfolio.

Update ESA Section 7 Informal Consultation Template to Include Marine Aquaculture

The Alaska Region Protected Resources Division is working with Federal Action Agencies to improve the efficiency and effectiveness of Endangered Species Act (ESA) Section 7 consultations. In January 2023, they kicked off the year with ESA Section 7 consultation training for the U.S. Army Corps of Engineers and Alaska Department of Transportation. In March 2023, they updated the standard mitigation measures for aquaculture in their template for informal ESA Section 7 consultations. Protected Resources staff are developing a checklist to ensure that all consultation request packages will provide sufficient information for Section 7 analysis.

Alaskan Kelp being harvested at Sea Quester Farms. Credit: NOAA Fisheries

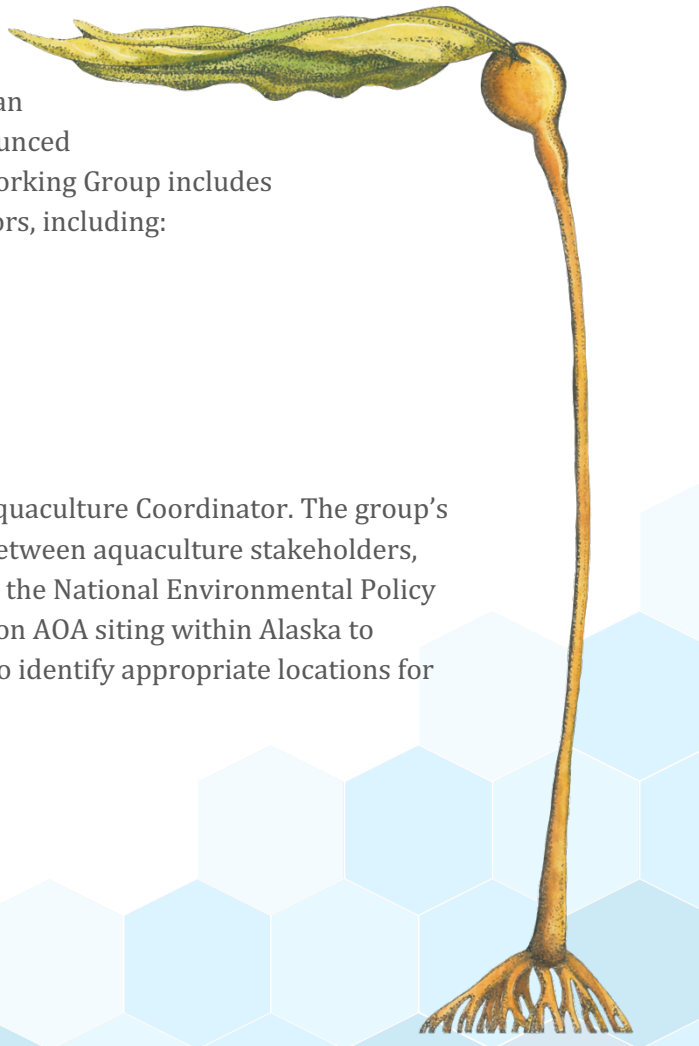
Provide and use best available science, information, and tools (e.g., siting, water quality and genetics models, peer-reviewed publications) for permit reviews and environmental consultations.

Develop Portfolio of Marine Spatial Analysis Data for Aquaculture Development in Alaska

In June 2023, NOAA announced the selection of Alaska as the next region to begin the Aquaculture Opportunity Area (AOA) identification process. As part of this effort, the NOAA Fisheries Alaska Regional Office and the National Centers for Coastal and Ocean Science partnered to create and populate a portfolio of marine spatial analysis data for aquaculture development in Alaska. This portfolio, along with additional information (workshops, project meetings, Indigenous Knowledge, research from agencies and other organizations) will lay the groundwork for future Site Suitability Analysis and the development of Atlases as part of the Alaska AOA identification process.

Identify Aquaculture Opportunity Areas to support planning for commercial aquaculture development in locations that reduce user conflict, maximize compatible uses, and minimize impacts to public trust resources through scientific analysis and public engagement.

Develop and Operate an Aquaculture Opportunity Area Interagency Working Group



The NOAA Fisheries Alaska Regional Office established an AOA Interagency Working Group after Alaska was announced as the next region to explore AOA identification. This Working Group includes participants from state and federal aquaculture regulators, including:

- Alaska Department of Natural Resources
- Alaska Department of Fish and Game
- Alaska Department of Fish and Game
- NOAA Fisheries Alaska Region
- U.S. Army Corps of Engineers

The Working Group is chaired by the Alaska Regional Aquaculture Coordinator. The group's function is to increase coordination and collaboration between aquaculture stakeholders, gather and review siting data, identify research gaps for the National Environmental Policy Act (NEPA) analysis, provide feedback and suggestions on AOA siting within Alaska to minimize user conflicts and maximize production, and to identify appropriate locations for AOAs in Alaska.

Goal 2:
Lead Science for Sustainability

Provide science-based products and tools, including bolstering the translation of research results into advice that supports regulatory and management decision-making.

Assessing the Potential Habitat Provisioning of Kelp Aquaculture Farms in Alaska

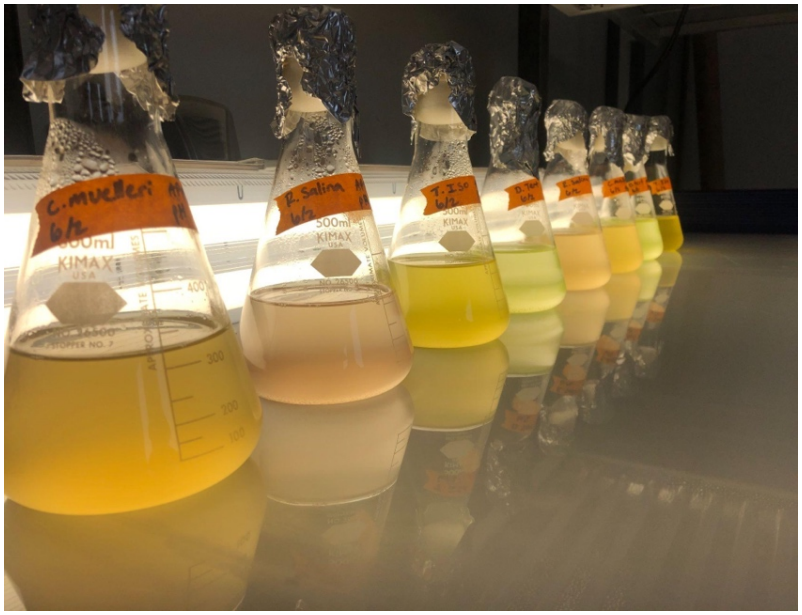
There are anecdotal reports that kelp farms may provide habitat for fish and invertebrate species. However, this question has not been explored scientifically in Alaska until now. This project is built on a strong collaboration between kelp farmers in Kodiak, Alaska, and Alaska Fisheries Science Center researchers. We are using a three-pronged approach to assess how local kelp farms and natural kelp beds provide habitat for other species:

1. Visual surveys with GoPro cameras to identify which species are using kelp as habitat in both natural bull kelp beds and farm locations.
2. SMURFs (Standard Monitoring Units for the Recruitment of Fish) to capture specimens and confirm abundance and species composition in both the kelp farm and natural kelp bed
3. Environmental DNA (eDNA) to further confirm which species are present, and identify potential species missed by the first two methodologies.

This multi-year project will help advance the understanding of the ecosystem benefits of kelp farms versus natural kelp beds in Alaska. Year 1 work was focused on developing a strong relationship with the growers, and deploying cameras for visual surveys in both natural and farm kelp habitats. During Year 2 we hope to introduce the SMURFS and eDNA profiling. Collectively, these monitoring techniques will help us determine any differences in species composition and abundance between the kelp farm and natural kelp bed. This information could be used to determine the benefits of kelp farm siting, ecosystem services provided by kelp farms, and to improve the social license and promotion of kelp farms in Alaska. We are also producing a short film highlighting this research, and our collaboration with local kelp farmers.

Sugar kelp (Laminaria saccharina) being harvested. Credit: NOAA Fisheries

Conduct coordinated, applied scientific research to support industry development, including innovations to improve industry success.



Left: Juvenile Pacific oysters from Alaska Shellfish Farms in Halibut Cove. Right: culturing algae in the new Alaska Fisheries Science Center hatchery. Credit: NOAA Fisheries

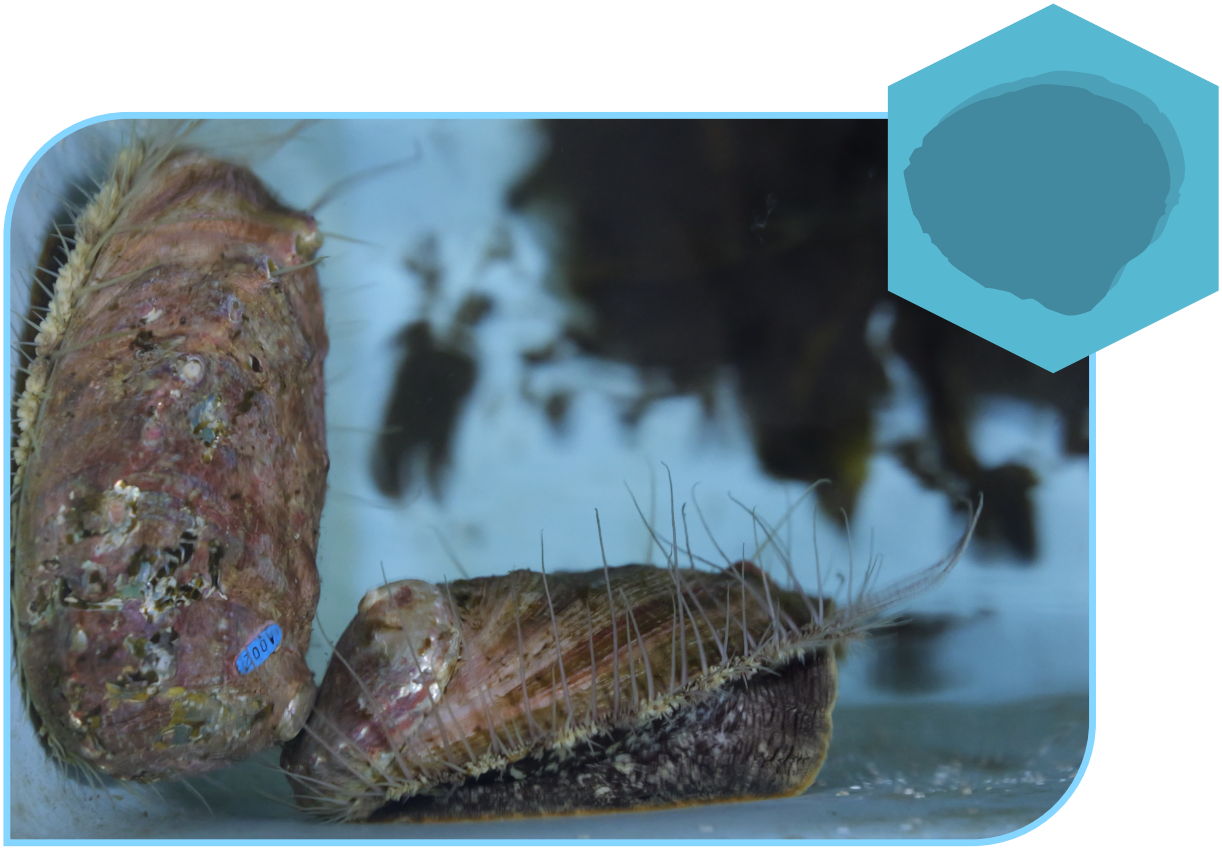
Oyster Selective Breeding

The Pacific oyster (*Crassostrea gigas*) industry is poised for rapid expansion in the region. However, the lack of oyster hatchery capacity to produce oyster seed and strains optimized for growth in Alaska present significant hurdles for current and future farm operations. To date, oysters within a hatchery have not been spawned successfully, consistently, and cost-effectively in Alaska. This creates a reliance on larvae supplied from hatcheries outside the state and an extreme insecurity and shortage of hatchery seed supply. The goal of this project is to resolve the scientific barriers and identify cost efficiencies to producing larvae and seed that are optimized for growth in Alaska. We will house, condition, and spawn the broodstock and subsequent generations at NOAA facilities in Juneau, Little Port Walter, Kodiak, and at collaborating aquatic farm sites. We will assess production metrics (growth rates, mortality, and tissue composition) and work with USDA and industry partners to compare cohorts for selective breeding.

Current Pacific oyster genetic selection programs have created oyster strains that are optimized for growth in the Pacific Northwest where the range, seasonality, and variability of temperature, pH, tidal amplitude, and salinity regimes in the nearshore differ from those found in Alaska. In 2023, collaborative research projects with the USDA-ARS Pacific Oyster Genomic Selection (POGS) project and Pacific Hybreed were established to identify genetic groups with improved performance in Alaskan waters. Once the genetic groups have been identified, we will conduct genomic and crossbreeding selection to create Alaska-specific broodstock that will be available for industry use.

Pinto Abalone Mariculture Potential

There is high interest in diversifying the mariculture species grown in Alaska, with a focus on species with high market values. Abalone are cultivated across Asia and in California, and fetch a high market price. There is one species of abalone found in Alaska, the pinto (or northern) abalone (*Haliotis kamtschatkana*). However, it remains unknown whether growing this species would be cost effective. One of the major food sources of abalone is kelp, presenting an opportunity to build off of Alaska's kelp industry. This project is a partnership between the University of Alaska Fairbanks College of Fisheries and Ocean Sciences and Alaska Fisheries Science Center researchers to conduct diet and energetics studies to assess growth rates, feed rates, preferred food source, and energetic demands at various temperatures. The results will inform whether this species could be viable to cultivate. Efforts in FY23 focused on comparing abalone growth rates between various food sources (red ribbon algae - *Devalaraea hecatensis*, sugar kelp - *Saccharina latissima*, and a mix of the both), and constructing wet lab space for husbandry efforts. Our next steps will include spawning and rearing larval abalone, and conducting experiments to inform dynamic energy budget (DEB) models.



Pinto Abalone at the Alutiiq Pride Shellfish Hatchery. Credit: NOAA Fisheries

Strengthen and diversify data collection to support aquaculture industry management and development.

Determining Environmental Effects of Aquaculture

Seaweeds in the intertidal zone of Kodiak, Alaska. Image Credit: NOAA Fisheries

In collaboration with industry, the Alaska Fisheries Science Center is helping to support development of a growing kelp farming industry in Southcentral Alaska (Kodiak Island, Kachemak Bay, and Prince William Sound). This project will collect information to examine the environmental and ecological effects of kelp and oyster farms in the region, and assess how kelp and oyster growth differs across the region. Researchers are using SCUBA to collect information on large and mobile animals via transect counts. Smaller organisms will be assessed in quadrat counts, and infaunal assemblages (animals living in sediments on the ocean floor) using benthic cores. Researchers are also collaborating in the design and implementation of "production arrays" – moorings that will contain instrumentation to monitor ocean conditions, as well as kelp lines and oyster bags to better understand how environmental conditions influence the growth and survival of mariculture species. Farmed sites will be compared to nearby control sites and, where possible, assessed for before and after impacts. This work is part of a larger 5-year collaboration between the Alaska Fisheries Science Center, University of Alaska Fairbanks, Prince William Sound Science Center, Tribal entities, and farmers funded through the Exxon-Valdez Oil Spill Trustee Council to support aquaculture efforts in the Gulf of Alaska. This information will be used to inform permitting and promote sustainable industry expansion.

Assessing 100 Years of Change in Canopy Kelp Ecosystems

The kelp aquaculture industry relies on reliable access to spores from wild kelp beds. Dramatic declines in kelp forest ecosystems have been observed in many parts of the world, driven by climate change and other anthropogenic factors. The complex and extensive coastline of Southeast and Southcentral Alaska have precluded regular surveys of canopy kelp extent that would allow for the detection of long-term changes, presenting a significant knowledge gap on the long-term resistance of Alaska kelp species to changing environmental conditions. To begin to fill this gap, Alaska Fisheries Science Center researchers analyzed historical and modern surveys to understand the change in spatial coverage and species composition of canopy kelp between two time points captured in surveys conducted in 1913 (Cameron 1915) and from 2004 to 2010 (Shorezone Alaska). Our results indicated that canopy kelp habitat increased throughout the Gulf of Alaska where there was coverage from both surveys. Kelp in Southcentral Alaska showed extensive recovery after the catastrophic Novarupta volcano eruption of 1912. Kelp in Southeast Alaska showed persistence and spatial increase that closely matched the range increases of sea otters. Observations of thermally tolerant kelp species increased more than observations of cold adapted species between the two surveys. This project is the first time that the Alaska Cameron expedition maps have been digitized, which will allow for further analyses of temporal trends in this widespread and important habitat.

Develop Aquaculture Research Database

The Alaska Fisheries Science Center created a database collating information on all aquaculture research products and projects that have been conducted to date in Alaska (1986-2022). Staff also created an annotated bibliography of peer-reviewed literature on economic studies related to kelp and shellfish. This project is the first time that all existing aquaculture research in Alaska can be easily accessed in one place, and will aid in the identification of remaining research gaps. The Center was able to complete this project with staff support from an employee professional development program (LANTERN).

Bull kelp at Sea Quester Farms.
Credit: NOAA Fisheries

An example of the Cameron (1915) kelp expedition maps from Southeast Alaska, showing canopy kelp locations colored based on the estimated thickness of the bed (yellow=thin, blue=very thick, pink=medium).

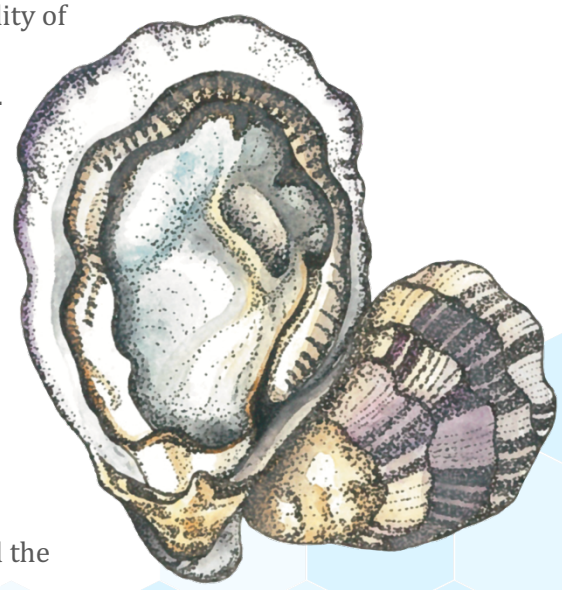
Confront climate change proactively, identifying threats and leveraging science-based resilience, mitigation, and adaptation opportunities

Environmental Drivers of HABs at Oyster Farms in Alaska

Alaska Fisheries Science Center research on HAB Drivers at the Salty Lady Seafood Co. oyster farm. Credit: NOAA Fisheries

Mariculture is a rapidly growing industry in Alaska, with farmed Pacific oysters (*Magallana gigas*) significantly contributing to this industry's profit. This project focused on identifying environmental factors that influence oyster health and toxicity in a high-latitude Alaska shellfish farm. Determining which factors contribute most strongly to the health of farmed oysters, and to toxin levels in oyster tissue, is critical in allowing oyster mariculture to expand in a safe and profitable way in Southeast Alaska.

As part of an ongoing Harmful Algal Blooms (HABs) monitoring project, the Alaska Fisheries Science Center sampled water column and oyster tissue weekly from March to October, and monthly from November to February, at an oyster farm in Southeast Alaska. The goal was to assess environmental conditions, phytoplankton community composition, and oyster health and toxicity. This monitoring revealed a large Alexandrium bloom in June-July 2023. Collaborators were able to gain more data on bloom dynamics and validate the use of SeaTox ELISA kits for Paralytic Shellfish Poisoning (PSP) testing in oyster tissue. Researchers found no clear environmental signature preceding the bloom. As a result, giving farmers the tools to directly measure the presence of toxic cells will likely be the best approach for the industry. The ELISA kits were able to accurately detect PSP levels above legal limits. This raises the possibility of using these kits for monitoring efforts. Researchers will be comparing the utility of various methods of HAB detection. Data on oyster health will be compared with larger monitoring efforts underway in Southcentral Alaska.



Findings from this monitoring data will enable shellfish farmers to selectively harvest seafood, minimize risks to human health, and reduce economic losses in Alaska. This information can also benefit siting processes for future farms. This project is funded by the NOAA Office of Aquaculture, and collaborators include staff at the Alaska Fisheries Science Center, Alaska Sea Grant State Fellows, students at the University of Alaska Fairbanks College of Fisheries and Ocean Sciences, NOAA Hollings Scholars, and the owner and employees of the oyster farm.

Goal 3:
Educate and Exchange Information

Seek, listen to, and incorporate stakeholder needs into decision-making by collecting information and feedback on key aquaculture topics using new and existing collaborative relationships.

Alaska Aquaculture Action Plan and FY23 Priorities

The Alaska Regional Office and Alaska Fisheries Science Center coordinated on updating the Five-Year Joint Aquaculture Action Plan and developed FY23 priorities which support the Alaska Mariculture Development Plan and Five-Year Action Plan and align with NOAAs' Aquaculture Strategic Plan. We used the Action Plan to prioritize both regional and science center work, and support funding for oyster selective breeding work, harmful algal bloom monitoring work, and projects assessing the potential habitat provisioning of kelp aquaculture.

Improve perception, social license, awareness and understanding of aquaculture by strengthening communication with the general public, external stakeholders, and within NOAA to enhance awareness of available resources, expertise, and the current state of science regarding coastal, marine, and Great Lakes aquaculture.

Advancing Aquaculture Communication

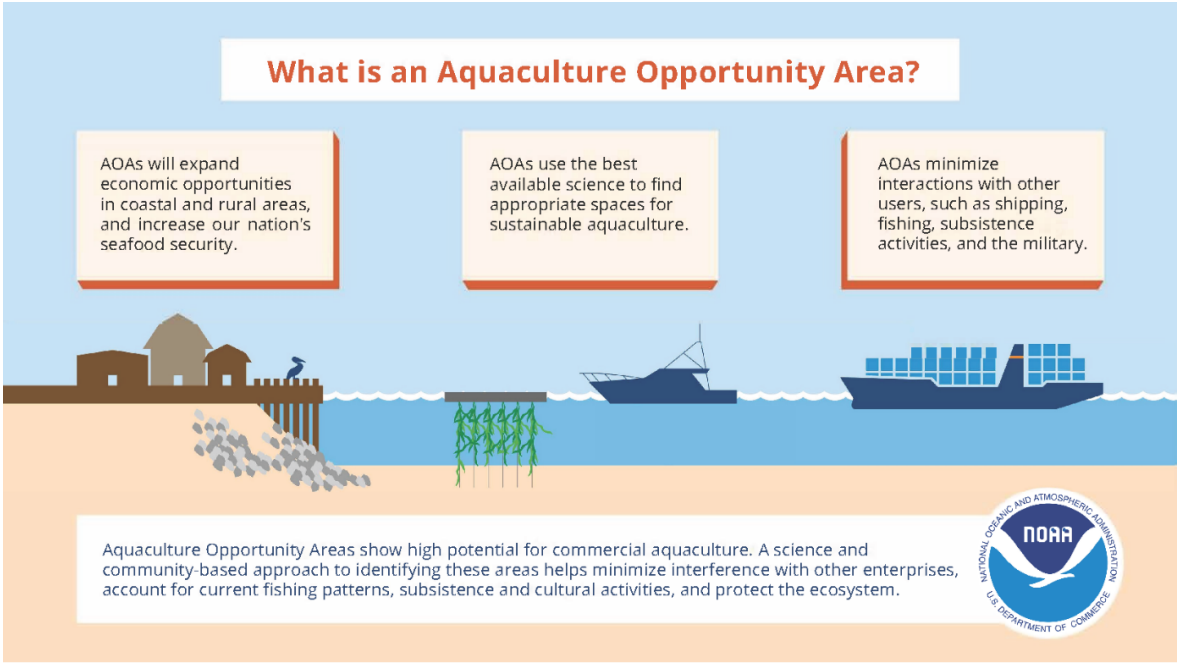
A key focus of our Alaska Aquaculture Program is to provide accessible, relevant, and up-to-date information on marine aquaculture to the public. We have worked to keep the Alaska Regional Office and Science Center aquaculture webpages updated and create partnerships to promote aquaculture messaging. We developed a feature story on the U.S. Department of Commerce's $49 M grant award issued to the Alaska Mariculture Cluster project to support the local mariculture industry.

Regional Office and Alaska Fisheries Science Center staff have also worked to improve aquaculture curriculum in Alaskan schools, and have developed new curriculum, teaching aids, and hosted an aquaculture workshop for educators. We presented publicly at the Alaska STEAM conference, and participated in events at local schools. In addition, we developed a new educational seaweed tumble culture for a local Juneau school, and launched a series of science communication video projects to further educate the public about aquaculture and the work being done by the NOAA Fisheries Alaska Aquaculture Program. Our annual accomplishments reports highlight the strategic alignment of our work with NOAA goals and objectives and how we have accomplished them at a regional level.

Left: Alaska Fisheries Science Center and Alaska Regional Office staff conducting a "NOAA Live! event". Right: staff conducting a STEAM night at a local school. Credit: NOAA Fisheries

AOA Aquaculture Communications

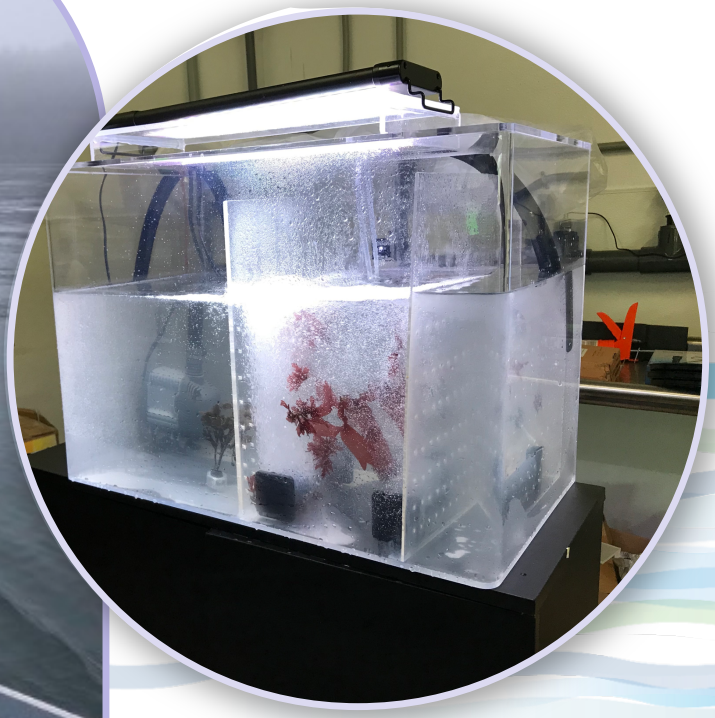
With the launch of the Aquaculture Opportunity Area identification process in Alaska, we have focused on increasing communications and engagement with stakeholders, Tribal Governments and Indigenous communities, and the general public. The initial AOA Rollout included a press release and feature story, radio interviews with Alaska Regional Office and Office of Aquaculture staff, and a dedicated Alaska Region AOA webpage. This content was promoted and amplified on agency social media outlets. The Alaska Regional Office scheduled a series of public presentations by the Regional Aquaculture Coordinator and National Centers for Coastal Ocean Science lead, to communicate the AOA process with communities around Alaska. Next steps will include: 1) Developing a Request for Information (RFI); 2) Producing a series of one-page informational sheets to raise awareness about the RFI; 3) Planning upcoming listening sessions where the public can provide comments on the RFI.



Advance innovative approaches to aquaculture literacy and provide equitable access to education and extension materials. Use these resources to inform the public and other stakeholders on the challenges and benefits of aquaculture and the current state of science and the industry.

Mobile Aquaculture Units for Alaska Classrooms

Following the success of the 2021 tumble culture for K̲'aach' (Dulse, Red ribbon algae, *Devaleraea mollis*), constructed for a classroom in Klukwan, the Alaska Regional Office's Sea Grant Fellow redesigned the mobile aquaculture unit for a classroom in Juneau. This new tumble culture was designed for a more compact, quieter classroom operation, with the potential to grow additional seaweed species. We also expanded on the curriculum that was developed in 2021, and are in the process of developing an educational video to document the project as it unfolds. This short documentary will focus on the students' experiences and the methodologies associated with the mobile aquaculture unit and seaweed curriculum. The video will serve as an additional educational resource and public outreach material for sharing and developing the curriculum.



Left: AFSC researcher pointing to kelp harvest buddy.
Below: Modified mobile aquaculture unit for Juneau classroom.
Credit: NOAA Fisheries

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September 2023

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