

2025 - 2027 RESEARCH PRIORITIES

AUGUST 2025



About the Pacific Coast Shellfish Growers Association (PCSGA)

For nearly a century, PCSGA has worked to preserve and promote the time-honored tradition of cultivating and harvesting mussels, oysters, clams, and geoduck along the shores of the Western United States. Our shellfish are recognized globally for their quality, and the industry contributes more than \$300 million annually to the coastal economies of Washington, Oregon, California, Alaska, and Hawaii. Many of our members are third- and fourth-generation farmers, whose success depends on healthy marine ecosystems, sound science, and strong collaboration.

PCSGA is committed to fostering a healthy social, regulatory, and natural environment for shellfish aquaculture on the West Coast. Our members use science-based practices to produce safe, sustainable shellfish that support healthy communities, ecosystems, and people. Additionally, science is the foundation for a regulatory framework that governs when, where, and how shellfish aquaculture occurs.



PURPOSE:

The PCSGA Research Committee is charged with reviewing and updating PCSGA research priorities biennially in order to reflect the research priorities of the membership and the Board of Directors. It is intended to provide PCSGA members, researchers and academics, funders, and agencies with a current summary of the key research topics PCSGA leadership considers most important for the next two years.

In January 2025, the PCSGA Board of Directors initiated a process to gather updated research input from growers and stakeholders. Two grower workshops, held in February 2025, helped validate existing research priorities and identify emerging areas of interest. This document has also been reviewed by PCSGA legal and scientific consultants who regularly assist in site planning and the permitting process.

USE OF THIS DOCUMENT:

This document is intended to guide and inform research efforts that support the continued growth, sustainability, and resilience of the West Coast shellfish industry. It is designed for use by both those who fund research and those who seek to answer applied questions through research. By outlining clear industry priorities, this document helps align scientific inquiry with the most pressing and practical needs of shellfish growers and coastal communities.

PCSGA also uses this document to support grant proposals by demonstrating direct connections between proposed research and industry priorities. It helps articulate the relevance, viability, and applicability of proposed projects, making a stronger case for funding and collaboration. While federal funding has played an important role in advancing research for the shellfish sector, this document also underscores the need to diversify funding sources to ensure broader, more resilient support for innovation.

We encourage funding institutions, academic researchers, and partners across the public and private sectors to use this document as a roadmap for impactful and industry-aligned research.

KEY STRATEGIC GOALS:

- Link PCSGA-supported research initiatives to applicable state and federal funding mechanisms.
- Provide effective support for research-related initiatives.
- Identify grower-driven research interests and develop cost-effective internal projects.
- Improve communication with regulators about critical research needs and outcomes.
- Introduce an annual “State of the Science” session at the annual PCSGA conference to inform researchers, regulators, members, students, and scientists.

RESEARCH AREAS OF PRIORITY

I. ECOSYSTEM SERVICES AND ECOLOGICAL INTERACTIONS

Overview:

This topic remains a priority due to increasing regulatory scrutiny and the need to demonstrate the ecological benefits of shellfish farming. Research should emphasize the ecosystem benefits provided by shellfish aquaculture, particularly nature positive interactions between shellfish, eelgrass, salmonids, and other species.

Shellfish farms contribute to nearshore ecosystems by providing structured habitat, improving water quality, and stabilizing sediments. We believe that aquaculture can provide benefits in a way that enhances ecosystems. Research that compares ecological functions across cultivated and uncultivated areas is essential for balanced permitting and sustainable development.

Research Priorities:

- **Demonstration of Provision of Habitat in Intertidal or Suspended Farms.** Research focusing on demonstrating habitat benefits provided by oyster aquaculture is encouraged - especially focused on documenting use of beds by ephemeral species including salmonids utilizing time lapse video, ROV's and sonic tagging.
- **Ecological Research (including food web dynamics).** Research is needed that can discern between the use of habitat that simply concentrates on other organisms (aggregation) from use of habitat that provides increased resources (food and prey) for population enhancement.
- **Nitrogen Credit Programs.** There is interest among growers in relation to opportunities for capitalizing on the removal of nitrogen and phosphorus from nearshore waters by shellfish at harvest. Nutrient benefits associated with harvested shellfish sequestered in the tissues and shells of harvested shellfish may be quantified on a seasonal basis to help inform modeling for potential adoption of nutrient credit programs.
- **Biogeochemical Nutrient Cycling.** Denitrification in sediments utilized for shellfish aquaculture remain under researched on the Pacific Coast compared to East Coast estuaries and offer opportunities to better describe the case for shellfish aquaculture to contribute to the removal of nutrients from surface waters through natural deposition and biogeochemical processes in the sediments.



- **Co-culture of Seaweeds with Shellfish.** Co-culture of seaweeds and shellfish and other invertebrates offer opportunities to capitalize on integrated multi-trophic relationships between plants and animals and remain under researched on the Pacific coast. Ongoing projects in WA and CA are focused on growing kelp with shellfish in suspended systems. Expanding this work and exploring opportunities in other regions would be beneficial.
- **Shellfish Gear Modifications.** Shellfish gear modifications that increase habitat potential for other organisms to use as refuge while submerged are needed. Quantifying the ecosystem services associated with the use of or proximity to shellfish gear by fishes, invertebrates, birds, and marine mammals is needed.
- **Relationship Between Eelgrass and Mature Oyster Habitat.** Research on ecosystem benefits including fish use of oyster beds (esp. salmonids), mobile invertebrates (e.g., Dungeness crab), and the capacity for oyster beds to support prey organisms associated with salmonids (e.g., harpacticoid copepods) is needed. Continued work in this area is urgently required to better inform regulators of ecosystem benefits between oyster and eelgrass habitat to ease regulatory restraints related to farming shellfish in eelgrass.
- **Food Web Assessment and Analyses.** Food web assessments, including innovative tools such as environmental DNA (eDNA) analysis, provide insight into the structure, function, and resilience of coastal and estuarine ecosystems. This research can help identify critical habitat use by migratory fish species and their prey, clarify predator-prey relationships, and detect changes in ecosystem dynamics over time. Improved knowledge of food web linkages will inform habitat restoration, conservation planning, and aquaculture siting decisions by identifying areas of high ecological value and sensitivity. Integrating these assessments into broader monitoring frameworks will enhance our ability to manage for both biodiversity and sustainable resource use.
- **Salmonid Prey Resources Associated with Shellfish and Shellfish Beds.** Research on benthic zooplankton populations, including harpacticoids and amphipods is important to juvenile out-migrating salmonids, across the range of West Coast habitats. Additionally, different oyster culture techniques and practices (on bottom, bag on bottom, off-bottom longline, flip bag, etc.) are needed. Similar work is also needed to compare oyster habitat to eelgrass habitats.

II. SUSTAINABLE SHELLFISH GEAR

Overview:

“End of life” considerations for equipment and materials used in shellfish aquaculture, in both packaging and farming operations, are essential to improving environmental outcomes and strengthening the sustainability of farming and shipping practices. Advancing alternatives to conventional materials and reducing gear loss through innovation are key priorities for the industry.

Research Priorities:

- **Alternative Materials for Aquaculture Gear and Packaging:** Investigate the performance, longevity, and environmental footprint of materials, such as natural fibers (e.g., bamboo and coir) and advanced composites like carbon fiber. Research should assess their suitability for commercial use based on durability, biofouling resistance, and end-of-life impacts.
- **Designing for Durability and Reusability:** Support research and development of longer-lasting, reusable gear components made from innovative materials that are suited for repeated marine exposure, with the goal of minimizing overall use and waste.
- **Innovations in Gear Tracking and Loss Prevention:** Advance gear tracking technologies, including the integration of electronic tags, satellite/GPS tools, and artificial intelligence modeling, to reduce gear loss and improve recovery following extreme weather or other disruptive events. Emphasis should be placed on scalable and cost-effective solutions tailored to the needs of shellfish growers.

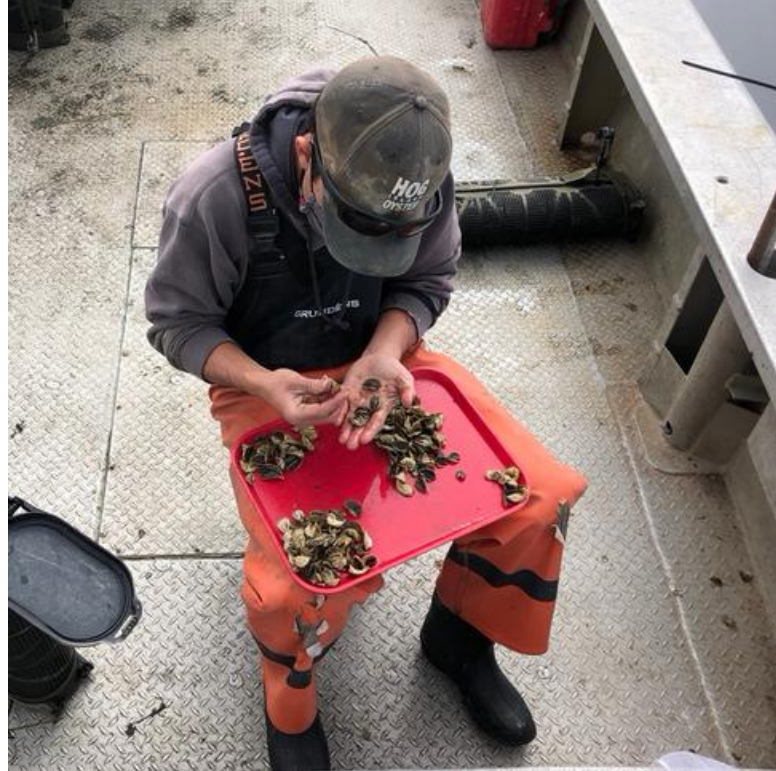
III. SHELLFISH BREEDING FOR RESILIENCE AND PRODUCTIVITY

Overview:

Genetic improvement of shellfish, particularly oysters, is essential for ensuring industry resilience in the face of disease and changing climate. Breeding programs are vital tools for adapting to stressors such as warming waters, ocean acidification, and emerging diseases like OsHV-1.

Pacific Oyster Priorities:

- **Ostreid herpesvirus 1 (OsHV-1 var), or Pacific Oyster Mortality Syndrome (POMS).** The reemergence of Pacific Oyster Mortality Syndrome (POMS), caused by *Ostreid herpesvirus 1 (OsHV-1 var)*, poses an existential threat to the U.S. shellfish industry. There is a critical need for primary research focused on breeding oysters for resistance to this and related herpesviruses in Pacific Coast waters. Additionally, assessing the potential impact of OsHV-1 var on other species, such as commercially important clams, Kumamoto oysters, and Atlantic oysters, is a high priority.
- **Genetic Mechanisms Associated with Oyster Diseases.** Research into the genetic mechanisms underlying disease resistance in oysters remains vital. Applying breeding approaches to develop genetically resistant broodstock for seed production is a key strategy. Building capacity within the industry for disease surveillance and breeding to target herpesvirus microvariants is also essential.
- **Oyster Stocks Resiliency.** Developing oyster lines that are resilient to ocean acidification (OA) and other environmental stressors is increasingly important. Growers recognize that OA will continue to intensify, making larval and seed production more difficult as seawater becomes more corrosive. Research should prioritize the development of resilient strains to ensure long-term sustainability.
- **Breeding to Reduce Mortality in Oysters.** Breeding based on quantitative genetics approaches in both diploid and triploid oysters is needed to improve resilience to multiple stressors, including high summer temperatures, hypoxia, and warming seawater and air temperatures. In parallel, research into how warming affects reproduction and maturation dynamics in oysters is urgently needed to inform broodstock management and seed production.
- **Broodstock Oyster Diversity.** Research is needed to identify genetically diverse wild and/or naturalized oyster broodstock for use in U.S. West Coast breeding programs. In addition, assessing the genetic diversity of broodstock populations currently used by growers is essential to ensure a healthy and sustainable seed supply for the industry.
- **Alternatives to Sterile Triploids.** There is growing interest in identifying safe and sustainable alternatives to “traditional” ploidy manipulation technologies for producing sterile shellfish. This includes research into silencing early sex-determining genes during oyster embryogenesis to control reproduction through non-polyploid methods.





Other Shellfish Priorities:

- **Manila Clam Breeding.** Manila clam breeding is a priority, with a focus on developing faster-growing lines that are resilient to salinity fluctuations. There is also growing market interest in “designer clams” with unique shell patterns, creating a niche for selective breeding with aesthetic traits in mind.
- **Kumamoto Oyster Breeding.** Improved breeding of Kumamoto oysters is needed to produce optimal shell shapes and enhance hatchery methods. Expanding access to high-quality, consistent seed is a widely expressed need among shellfish growers.

IV. PUBLIC HEALTH AND SHELLFISH SAFETY

Overview:

Ensuring the safety of shellfish for consumption is essential to protecting public health and maintaining trust in domestic seafood. The risk of harmful algal blooms and pathogen outbreaks is increasing, and ongoing research is needed to improve monitoring, develop predictive tools, and support adaptive management practices. Reliable science also strengthens public health policies by informing closure protocols, guiding regulatory decisions, and advancing more effective testing and mitigation strategies. Prioritizing this research helps protect consumers while supporting the stability and reputation of the shellfish industry.

Research Priorities:

- **Vibrio Forecasting.** There is an urgent need to increase the shellfish industry’s capacity to forecast and economically test for the emergence of virulent *Vibrios* in shellfish growing waters that impact shellfish.
- **HABS Forecasting.** There is an urgent need to increase the shellfish industry’s capacity to forecast the emergence of Harmful Algal Blooms (HABs) impacting growing waters including the capacity to model emergence of HABs at a finer (bay-scale) resolution than currently available.
- **Norovirus Forecasting.** There is an urgent need to increase the shellfish industry’s capacity to forecast, model, and prevent Norovirus illnesses.
- **Post Harvest Shellfish.** Research is needed to identify appropriate wet storage variables (temperature, salinity, etc.) to reduce or eliminate illness risk from vibrio, norovirus, campylobacter, salmonella.
- **Seabirds and Floating Aquaculture.** Research is needed to address emerging public health concerns from the roosting of seabirds on floating culture gear. There is a need to determine the relative human health risk associated with bird waste, as well as purge rates for campylobacter and other bacteria in various oyster species to inform best practices and regulations.

V. COMMUNITY SUPPORTED RESEARCH

Overview:

Public support and understanding are essential to the long-term viability of shellfish farming. High quality, peer reviewed research is needed to quantify and demonstrate the industry's benefits and counter misinformation.

Research Priorities:

- **Quantifying the Value of Shellfish Farms to the Local Community.** There is an urgent need to better quantify the economic value of the industry and contributions to communities in terms of direct and indirect employment. This metric needs to be developed and marketed as a published, annual contribution of shellfish farming to the economic and social health of communities.
- **Community Perceptions and Social License.** Research on community perceptions and social license is essential to understanding the broader context in which shellfish farming operates. Social science research can help identify outreach and education strategies that improve public understanding of aquaculture and increase community support for the industry. This work can assess how the public views shellfish farming and its environmental, cultural, and economic impacts. It can also explore the sources of conflict and opportunities for coexistence between shellfish operations and other coastal uses such as recreation, residential development, and conservation.
- **Consumption Habits and Rates** – Research is needed to better understand shellfish markets and evolving market trends, both domestically and internationally. This includes identifying emerging consumer segments, regional preferences, and shifts in demand across retail, foodservice, and direct to consumer channels. Further analysis should explore marketing opportunities that highlight the environmental benefits and nutritional value of shellfish, as well as optimal serving sizes and formats that align with consumer expectations. Additionally, understanding purchasing habits such as frequency, motivations, price sensitivity, and preferred product forms will help producers, distributors, and policymakers tailor strategies that support market growth and resilience.

ADDITIONAL RESOURCES CRITICAL TO THE PCSGA

Growing shellfish takes place in naturally dynamic systems, making the practice inherently adaptable and ever evolving. Over the past several decades, significant changes have occurred in both gear and production methods. Some of these changes have been driven by shifts in market demand, while others have been the result of evolving regulatory frameworks and environmental conditions. The items listed below will complement the research we hope to see pursued, providing valuable context and direction for understanding how the industry continues to adapt and innovate.

- Updated annotated bibliographies with a list of independent peer-reviewed research on relevant topics (e.g., ecosystem services, human health implications, etc.).
- Opportunities to develop and implement emerging technologies.
- Additional and improved mechanisms for sharing research and information between growers, researchers, policy makers, and the public.
- Strong partnerships between researchers and farms of varying size, which when based on mutually agreed upon expectations, and fair recognition/compensation will expand opportunities to build knowledge on a diversity of farms.



Founded in 1930, the Pacific Coast Shellfish Growers Association (PCSGA) represents growers in Alaska, Washington, Oregon, California and Hawaii. PCSGA works on behalf of its members on a broad spectrum of issues, including environmental protection, shellfish safety, regulations, technology and marketing. www.pcsga.org