

Appendix B- Applied Research and Management (RFP Projects 4, 5, and 6)

Background

The Oregon OAH Action Plan identifies the need for the State to promote OAH resilience and adaptation in our management decisions and in regional planning for ecosystems and coastal communities. Current and projected OAH impacts will be harmful to ocean life and the economic stability of all Oregonians. Applicants are encouraged to review and build on existing State planning and management efforts including, but not limited to, the following:

- [2019 Oregon Legislative House Bill 2574 \(Enrolled\)](#)
- [2016 Oregon Shellfish Task Force](#)

The OOST and the OAH Council as well as other State organized initiatives are dedicated to increasing understanding of the impacts of ocean change on key shellfish and submerged aquatic vegetation (SAV) species. A critical aspect of increasing OAH action is strengthening collaborative solutions among decision makers and industries affected by OAH. To support both thriving marine habitats (e.g., SAV) and marine resource economies considering current and future ocean changes, it is essential to strategize management needs and resources. Applicants are encouraged to leverage industry relationships (e.g., crab, shrimp, and bivalve) to maximize community involvement and resources to disseminate information regarding OAH science, impacts, and solutions.

The projects below represent key research and management gaps identified in the Oregon OAH Action Plan:

4. **\$131,625 for ecosystem modeling of SAV;**
5. **\$170,625 to develop recommendations, through workshops or seminars, for maximizing the abundance of wild shellfish, cultured shellfish and SAV in estuaries in Oregon (\$24,375); and to develop best management practices for conducting shellfish cultivation in a manner that protects or promotes estuarine health (e.g., wild shellfish and SAV) (\$146,250); and**
6. **\$175,500 to fund a study on the life cycle impacts of ocean acidification and/or hypoxia on shellfish species that are of importance to Oregon.**

ECOSYSTEM MODELING OF SUBMERGED AQUATIC VEGETATION (SAV)

(RFP Project 4)

Purpose:

Determine adaptation, resilience, and mitigation opportunities associated with SAV in Oregon's coastal ocean, bays, and estuaries, within the context of changing ocean conditions. Applicants should consider how anthropogenic stressors and human activities pose a risk to SAV and how OA and/or hypoxic conditions (as well as other ocean change multi-stressors) are exacerbating ecosystem impacts.

Geographic Scope:

Eligible locations within Oregon's coastal ocean, bays, and estuaries (see [Oregon Coastal Atlas](#) and [Oregon Explorer](#)) that exhibit particular cultural, economic, and ecosystem importance, and fill current needs for geospatial and/or temporal information about submerged aquatic vegetation (SAV).

Deliverables:

Develop spatial and/or temporal models as well as other tools to characterize general ecosystem services provided by SAV to address State information needs and promote resilience in decision making within Oregon. Applicants are asked to consider how the following models and ocean change impacts may impact data outputs:

- Habitat suitability of SAV;
- Relationship between SAV and physical factors (e.g., past and predicted trends in SAV);
- Role of SAV in the ecosystem (e.g., with relevance to estuary stability and/or productivity); and
- SAV distribution shifts over time.

Both hydrodynamic and biogeochemical processes should be addressed in models. All spatial data, metadata, and mapping work products should be delivered in compliance with the [Coastal and Marine Ecological Classification Standard](#) (CMECS) and the 2021 Federal Geographic Data Committee. Projects are encouraged to use a variety of data sources including existing and historic in-situ measured distributions (e.g., dive surveys, aerial surveys) as well as remote sensing, such as satellite data. Seasonal and interannual variability in SAV should be considered in data analysis.

Submerged Aquatic Vegetation (SAV) is widely recognized as an important living resource that provides multiple ecosystem services and benefits to marine and estuarine ecosystems. SAV includes multiple species of rooted aquatic grasses as well as macroalgae and kelp. Priority will be given to projects that develop computer models that also promote further understanding of SAV ecosystem services benefits, and directly inform management. The suite of possible of ecosystem services provided by SAV includes (but is not limited to):

- Potential to provide short-term buffering of acidified waters and/or long-term sequestration of carbon;
- Improvement of water quality and enhancement of nutrient cycling (e.g., interactions with aquaculture, regional farming, wastewater treatment);
- Provision of habitat, refuge, and nursery areas for fish and invertebrates;
- Stabilization of soft sediments and protection of shorelines;
- Contribution of organic material to food webs;
- Facilitation of complex ecological interactions within SAV communities; and
- Impacts of habitat structure to food webs including coupled species interactions (e.g., urchin barrens, otter reintroduction, nursery areas for fish and invertebrates).

Projects should consider Oregon planning documents in conjunction with additional tribal government, local government, and industry planning documents relevant to the study areas and State needs (see [2015 Oregon Nearshore Conservation Strategy](#) and the [Oregon Rocky Habitat Management Plan \(2019 update\)](#))

DEVELOP BEST MANAGEMENT PRACTICES THROUGH WORKSHOPS/SEMINARS AND SYNTHESIS DOCUMENTS

(RFP Project 5)

Purpose:

Oregon benefits from productive estuaries and environmentally sustainable mariculture operation techniques that are consistent with the conservation of wild shellfish stocks, submerged aquatic vegetation (SAV), and shellfish habitats. OAH threatens to undermine both estuary productivity and mariculture operations in Oregon estuaries. Successful proposals will describe a process and deliverables to determine best management practices (BMPs) for Oregon mariculture, that incorporates goals of estuary health and mariculture productivity. Through the work produced from this project, Oregon will be better equipped to adapt to the effects of OAH and minimize the economic impacts of OAH on mariculture operations and other estuary resources by incorporating the Best Available Science (as defined in the main RFP document) into management planning and decision-making. To this end, this project aims to update and develop BMPs through data synthesis as well as workshops/seminars.

Projects should convene scientists, resource managers, and stakeholders (e.g., industry, local governments, tribal governments, conservation community) to explore regional vulnerability, management needs, and research gaps in Oregon's estuaries and coastal oceans. Projects should work towards jointly developing BMP recommendations to address the following outcomes:

- Protect, restore, and enhance populations of wild stock native shellfish and SAV;
- Optimize the production of cultured shellfish through promotion of research on the impacts of ocean change on brood stock reproduction and larvae development; and
- Identify and describe environmentally sustainable BMPs that support the coexistence of wild stock shellfish, SAV, and production of cultivated shellfish.

Geographic Scope:

The workshops/seminars and BMP documents for commercial mariculture of shellfish in Oregon waters should focus on statewide scale for general guidance and at the estuary scale, for site-specific context and practices. Recommendations need to address all areas that are currently approved for the cultivation of shellfish and areas that have the potential for future approval.

Deliverables: (Workshops/Seminars)

Workshops/seminars should focus on how changing ocean conditions, particularly OAH, are impacting Oregon's ability to react to conservation needs of native shellfish and SAV as well as promote environmentally sustainable shellfish aquaculture. Topics can include but are not limited to the following:

- Ecological requirements of shellfish and SAV;
- Impacts of mariculture operations on native shellfish and SAV;
- Management and permitting process (e.g., interstate and intrastate transport); and

- Water quality and chemistry issues (e.g., OAH, nutrient loading, etc.)

Applicants need to clearly identify products that should be aimed at achieving workshop purposes. Final products must be made available to the public through distribution on the [Oregon Ocean Information website](#) and other venues. Funding recipients need to also consider access to information, including but not limited to, bilingual content (e.g., English as well as Spanish and/or Mam). Products should include perspectives from multiple stakeholders and could include, but are not limited to:

- Summary and synthesis products and visuals (e.g., infographics and/or videos) to clarify complex issues identified in the workshop/seminars);
- Summary documents (e.g., published papers, meeting reports) to synthesize state of knowledge, “lessons learned” from participants, including areas of consensus and topics to revisit in future meetings;
- Recommendations from workshop/seminar participants on how to achieve co-existence and productivity of wild shellfish, cultured shellfish, and SAV in Oregon’s estuaries and coastal oceans; and
- Participant surveys pre- and/or post-workshop/series to gather data on participant attitudes, perceptions, and/or perspectives as well as current and future OA and hypoxia adaptation and mitigation needs.

Consideration should be given to the level of involvement of a diversity of stakeholder participants from across marine industry sectors (e.g., coastal tourism, aquaculture, fisheries) and locations throughout Oregon. Funding recipients will need to include COVID safety considerations in the project description, with specific note to issues of equitable remote access to content and ability for underserved rural communities to have access to content. Applicants are asked to clearly identify and justify the use of funds to support travel costs for workshop/seminar participants and/or invited guests.

Deliverables: (Update and Development of BMPs)

In conjunction with seminars/workshops, projects should develop BMPs to achieve mutually agreed-upon actions, procedures, and outcomes that are followed to protect estuarine habitats, conserve living resources, and ensure regulatory compliance during commercial shellfish growing and harvest operations. These BMPs should be based on existing materials (such as Pacific Coast Shellfish Growers Association (PCSGA) - [Environmental Policy \(2001\)](#) and [the Shellfish High Health Program \(2017\)](#)), and be updated/revised/modernized to reflect current scientific knowledge, OAH impacts, and results from workshops/seminar (described above). The deliverable will be a comprehensive document that includes the suite of planning actions, management regulations, and mariculture operations that are effective, practicable, and designed to be consistent with wild shellfish stocks, SAV, and shellfish habitats.

The BMPs for mariculture of shellfish in Oregon should be developed through a collaborative process that includes multiple stakeholders, including mariculture operators, shellfish processors, commercial and recreational shellfish harvesters, public citizens and local residents,

state and federal agencies, tribal governments, regional governments, non-governmental organizations, science experts, and others. The specific project deliverables should include:

- Background research and summary of BMPs developed to guide commercial shellfish mariculture operations within different regions of the Pacific Northwest;
- Meetings and work sessions among mariculture operators, multiple stakeholders, and regulatory agencies to discuss elements of the BMP document;
- Steps to reach consensus on problematic issues and emerging topics; and
- A detailed BMP document that can be used to guide the permitting, management, and operation of new and existing commercial shellfish mariculture activities in Oregon bays and estuaries.

Projects are encouraged to synthesize current and historical data sets, where applicable, to guide BMP recommendations. Applicants should clearly identify available data sets in proposals, including why they need to be considered and how they will be analyzed. The comprehensive BMP document should include the following elements (at a minimum), and may include other elements that arise during discussions with stakeholders:

- Management and Regulatory Oversight in Oregon
- Characterization of Living Resources and Habitats
- Siting and Permitting Process for Lease Areas
- Shellfish Species, Hatcheries, and Broodstock
- Gear, Growing Techniques, Operations, and Maintenance
- Interstate and Intrastate Transport of Shellfish
- Harvest of Wild Stocks of Shellfish
- Ecological Issues and Environmental Concerns
- Public Access to Estuarine Areas
- Seafood Safety & Water Quality
- Conflicts Among Resource Users
- Research Gaps and Information Needs
- Key Contacts and Communications
- Considerations for regulatory and non-regulatory voluntary processes

LIFE CYCLE IMPACTS OF OCEAN ACIDIFICATION AND/OR HYPOXIA ON SHELLFISH

(RFP Project 6)

Purpose:

Conduct scientific research to investigate the life cycle impacts of OA and/or hypoxia to shellfish species that are of importance to Oregon. The study should focus on determination of the potential impacts of OA and/or hypoxia on cultivated and/or wild stocks of shellfish to identify vulnerable species for the purpose of informing regional resource management and community planning. Research should aid in gaining a greater understanding of the timing and extent of the effects of OA and/or hypoxia and other ocean change stressors on life cycle stages, including embryos, larvae, post-larvae, and juveniles.

Deliverables:

Applicants are encouraged to consider shellfish species of direct cultural, economic, or ecosystem importance in State waters, such as:

- Fisheries species, such as razor clams, bay clams, Dungeness crab, red rock crab, pink shrimp, and sea urchins;
- Cultured species, such as Pacific oysters; and
- Ecologically significant species, such as sea stars, mussels, abalone, and Olympia oysters.

Projects should characterize and quantify life stage impacts to shellfish in the laboratory under realistic and dynamic OA and/or hypoxia exposure regimes, and/or utilize relevant exposure gradients to assess vulnerability of shellfish to OA and/or hypoxia stressors in the natural environment. Investigations should identify the relationship between research findings for vulnerable shellfish and interpretation of current and historical OA and/or hypoxia monitoring data developed along the Oregon coast. Share the key results, findings, and vulnerability assessment with shellfish harvesters, marine resource managers, and other stakeholders through outreach activities (i.e., webinar, workshop, etc.) articulated in the proposal.