



**Washington Sea Grant**  
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December 1, 2019

**Re: Progress report #2 on a three-year study to identify best management practices related to shellfish production (ESSB 6032 Sec 602 (31) of 2018 and ESHB 1109 Sec 606 (1) of 2019).**

During the 2018 legislative session the Governor proposed, and the Legislature passed, a supplemental appropriation of \$200,000 to Washington Sea Grant (WSG) to “complete a three-year study to identify best management practices related to shellfish production.” In the 2019 legislative session an additional \$400,000 was appropriated to continue the project for the second and third years. The focus for the project is to produce a collaborative, ecosystem-based management framework for shellfish aquaculture, burrowing shrimp and eelgrass—primarily as they affect the continued sustainability of shellfish aquaculture in Willapa Bay and Grays Harbor.

The bill language requires an annual report by December 1 of each year, of which this is the second. This report summarizes progress from December 1, 2018 through November 30, 2019. Progress from the inception of the project to November 30, 2018 (five months) was summarized in the initial report of December 1, 2018. In addition to reporting on WSG’s progress over the past year, this report includes a note on funding and costs (see page 4), and an updated work plan for the biennium (see Looking Ahead, page 6-8).

WSG is housed within the University of Washington’s College of the Environment and is a unique unit with federally designated responsibilities to support coastal and marine-related research, education, outreach and communications. Sea Grant programs are formal partnerships between the National Oceanic and Atmospheric Administration (NOAA) and universities in coastal states and territories. WSG serves coastal communities and resource managers by providing grants for applied research, fielding a team of technical specialists based in coastal communities, and engaging the public in activities that promote ecosystem health and ocean literacy. WSG has a decades-long history helping shellfish aquaculture businesses and public agencies navigate ecological sustainability, economic challenges and environmental change.

An outline for this project was included as Action Item 3.9 in the *Phase II Work Plan for the Washington Shellfish Initiative* (Office of the Governor, 2016). WSG’s goal is to provide shellfish growers and public resource managers with the information and assessment tools needed to

support a collaborative, ecosystem-based management approach to shellfish farming's interactions with burrowing shrimp and eelgrass, focusing on the health of the Willapa Bay and Grays Harbor estuarine ecosystems. The *Phase II Work Plan*—together with prior grant proposals to fund elements of the work—were used as initial guidance. The scope of work has since been adapted in response to information collected from working group members, shellfish growers, resource managers and the public during the first 16 months of the project.

This is how the project was described in the shellfish initiative work plan:

### **3.9 Promote collaborative, ecosystem-based management in Willapa Bay and Grays Harbor.**

Willapa Bay and Grays Harbor are complex estuarine ecosystems that support wild stocks of finfish and Dungeness crab and a historic shellfish aquaculture industry, as well as a rich array of other species. Management challenges at the system scale—such as sea level rise, ocean acidification, changes in nutrient and sediment transport, burrowing shrimp and an invasive, non-native eelgrass—are affecting both natural and anthropogenic processes. Resolving these challenges requires adaptive management and collaborative actions built on a commonly shared understanding of how the ecosystems function, how they have changed over time and what future conditions may be like. The steps below will promote cooperative, system-scale management by compiling and synthesizing information and addressing important information gaps:

- a) Compile, synthesize and maintain historical data, management plans and research findings relevant to system-scale management challenges in Willapa Bay and Grays Harbor, focusing on how these ecosystems function, how they have changed over time and projections of changes that can affect management options. Make the information available via a purpose-built website.
- b) Convene resource managers, scientists and stakeholders to verify a common understanding of the ecosystems and the top-priority management challenges in each of them, and to identify research needs and information gaps that represent barriers to tackling the management challenges at a system scale.
- c) Help address the needs identified in (b) by matching them with appropriate potential funding sources, sharing the information with other participants and promoting collaborative project proposals.

Items (a), (b) and (c) serve as reference points in the following description of progress over the past year: December 1, 2018 through November 30, 2019. A more detailed scope of work associated with these reference points is included in this report. For additional context, see Addendum A.

### **Summary of Progress**

As a consequence of working with collaborators on federal grant proposals prior to the availability of state funding, we entered the current project with a solid initial scope of work, in which projected scientific advancements and further engagement with stakeholders and agencies are equally important elements. As detailed below, we made substantial progress over the past year on item (a) by conducting a literature search, gathering and reviewing printed material as well as sources available online, drafting a science synthesis and soliciting initial reviews. Also during the past year, we completed interviews of potential working group members, finalized the working group membership and convened a public workshop with the working group to address item (b). Given the depth of involvement from scientific experts and the type of inclusive process that a complex project like this requires, our cost estimates led us

to act with collaborators to secure additional funding, per item (c). In addition to state appropriations, three federal grants are now providing research funds and staff capacity critical to this project.

### **Accomplishments**

Between December 1, 2018 and November 30, 2019, WSG and its collaborators accomplished the following.

Item (a)—Compile and summarize existing information, and make it widely available.

- Completed a literature review and source compilation project to support the science synthesis and a publicly accessible on-line database of relevant prior research. Additional sources surfaced as a consequence of the first workshop and are being incorporated.
- Developed a preliminary draft of the science synthesis and distributed it to a limited number of reviewers. Collected their input and additional information from the first workshop to inform revisions. Revisions are currently underway.
- Scoped the needed technical capacities and design parameters for a website to provide public access to the material. The website has not been launched yet.

Item (b)—Convene resource managers, scientists and stakeholders; verify science and management challenges; and identify additional research needs.

- Completed interviews with potential working group members and incorporated that information in decisions about the working group and the necessary scope of the project. One consequence was to increase the public workshops from two to four (see Addendum B on how the workshops support the project).
- Convened by invitation a working group representing entities that own, manage or regulate shellfish beds, public tidelands and other natural resources in the two bays, including shellfish farmers, public agencies and tribes. The group currently has 20 members and additional alternates (see Addendum C for a membership list).
- Held an orientation webinar for working group members on October 18, 2019. Content focused on the purpose of the project, the process and structure for taking action, the purposes and content of the first workshop, and progress on compiling existing information.
- Held an in-person workshop for working group members, collaborating scientists and the public on October 28 and 29, 2019. The workshop was held at the Willapa Harbor Community Center in South Bend. A copy of the agenda is attached to this report (see Addendum D).
  - Goals of the workshop were to present information on the ecology of Willapa Bay and Grays Harbor related to shellfish aquaculture, eelgrass and burrowing shrimp; then to elicit discussion among working group members and the scientists on management challenges and critical information needs.
  - Three international scientists participated from Japan, New Zealand and Canada—where similar ecological conditions and interactions among shellfish, seagrasses and burrowing shrimp have been studied. Scientists working locally and regionally on related research were also featured.

- A field day on October 27 oriented the visiting scientists to local conditions and provided an informal setting for discussions with local scientists prior to the workshop.
- Input on information needs and research priorities were collected during breakout discussions involving the working group, presenting scientists and public attendees.
- Videos of the presentations are being captioned and will be made available on WSG's website by the end of the calendar year.
- Followed up post-workshop with working group members, participating scientists and shellfish growers who attended the workshop but are not on the working group. We used surveys, in-person interviews and phone calls to solicit advice on future steps and identify information that may not have been captured adequately by the workshop process.
- All of the input received is now being reviewed and summarized to determine future action steps and guide investments in additional research.

Item (c)—Secure additional funding as needed.

- Developed and submitted a proposal to the National Sea Grant College Program for a West Coast aquaculture collaborative to be led by Sea Grant programs in Washington, Oregon and California. This proposal was successful, and WSG was awarded \$1,193,009 in federal funds for a three-year period beginning September 1, 2019. State appropriations for the in-state project reported on here provided the required non-federal matching funds for the federal grant.
- The scope of work for the national Sea Grant award uses the in-state project as a pilot for harnessing and applying expertise from Sea Grant programs and their public and private sector partners to address challenges of regional significance to aquaculture. To fulfill the federal grant conditions, interactions between shellfish aquaculture, eelgrass and burrowing shrimp will be interpreted and addressed in this broader, regional perspective.
- WSG is also coordinating its work on the in-state project and the West Coast collaborative with PSI, which was successful in securing a federal award of \$1,681,306 over four years from the Pacific States Marine Fisheries Commission for a coast-wide assessment of eelgrass response to shellfish culture practices to better understand the value of habitats they provide for managed fish and invertebrate species.
- The net effects of WSG and PSI securing these federal awards is that research supporting WSG's working group process in Willapa Bay and Grays Harbor will be more robust, but also that WSG and PSI have adopted additional, region-scale responsibilities for that research and additional engagement with shellfish growers and resource management agencies in all three states.

Additional note regarding funding

While WSG and its collaborators were successful in securing the additional federal support described above, funding for WSG's ongoing role in the project is still a concern, with a projected \$120,000 shortfall against combined state and federal sources by June 30, 2020. The shortfall is developing as a consequence of costs associated with: (1) staff time needed to

manage this project, coordinate with related projects, engage the working group effectively and support the public workshops; (2) electing to hold four public workshops rather than two (because there is too much material and discussion to pack into two); (3) direct workshop and travel costs for the first workshop; and (4) the cost of administering multiple funding sources and subawards to collaborating scientists.

Going forward, we would prefer to maintain the levels of staff effort and workshop support established over the past year; however, WSG is not able to do that with the current level of funding. Recognizing lessons learned from the prior year, we are taking the following actions to reduce costs to match the funding available:

- reducing WSG staff costs for the project by lowering one employee's commitment from 80% FTE to 20% FTE beginning December 1, 2019;
- scaling back our projected follow-up meetings with working group members and key constituents between workshops;
- reducing the costs for future workshops by limiting them to one day and relying on locally available presenters (to reduce travel and lodging costs);
- using non-project funding for administrative costs that would ordinarily be recovered by applying an indirect cost rate to the project, which is not allowable on the state funds; and,
- relying on the new settlement agreement working group being organized by Ecology—which is focused on an alternate Integrated Pest Management approach to controlling burrowing shrimp—to produce key ideas for best management practices that are called out in legislative language for this project.

We will also continue to apply for additional federal grant funds for the project.

The net results of these adjustments are chiefly that the process and communications supporting the working group and workshops will be less robust, and that this project's success will hinge to a substantial extent on the success of the settlement working group. The settlement working group was not anticipated when we embarked on this project, so its efforts represent a net gain in resources available to address one element of the project.

### **Looking Ahead**

Between December 1, 2019 and November 30, 2020, WSG intends to accomplish the following (see also the Revised Scope of Work, below):

1. Make the presentation videos from the first public workshop available on WSG's website.
2. Use input from the first workshop, follow-up interviews and surveys, and conversations with our collaborating scientists to prioritize information gaps and adjust the research elements of the project.
3. Provide subawards to collaborating scientists to implement the field research elements of the project in cooperation with shellfish growers and resource management agencies.
4. Make the final science synthesis, searchable bibliography and document collection available on WSG's website.

5. Plan and hold the second public workshop to present updates on research, solicit advice on assessment tools and provide information on models for collaborative, ecosystem-based management organizations.
6. Use input from the second workshop, follow-up online meetings of the working group and conversations with our collaborating scientists to finalize site- and system-scale assessment tools.
7. Develop and post outreach materials to the WSG website that interpret the science synthesis and workshop outputs for media representatives and general public audiences.
8. Plan and hold the third public workshop to review and make recommendations on aquaculture and resource management practices, and to discuss pros and cons of establishing a management collaborative.
9. Further leverage state funding to WSG by collaborating on grant proposals that address identified research needs, information gaps and implementation steps.

Revised Scope of Work: 2019-21 Biennium

Washington Sea Grant proposes the following scope of work for the 2019-21 biennium. The proposed activities align with the elements described in the state shellfish initiative and prior grant proposals, amended with additional insights gained during the past year of project activity. This scope of work applies to the \$400,000 state appropriation to WSG and an additional \$35,000 per year from the National Sea Grant College Program. In alignment with item (c) in the Shellfish Initiative action, the research activities supporting this project are funded by federal grants to WSG and PSI and are not reported here. WSG’s role in them is to administer grant funds and coordinate the research with other elements of the project.

The following table groups project activities with associated elements from the state shellfish initiative’s action item. **M** denotes a major milestone for the project. **D** denotes a deliverable product. Milestones and deliverables are briefly described with their associated activities in the first column. X indicates that described activities occur in the designated quarter.

Coast Shellfish Research: 2019-2021 Activities & Timeline	FY2020				FY2021			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
a) Compile, synthesize and maintain historical data, management plans and research findings relevant to system-scale management challenges in Willapa Bay and Grays Harbor, focusing on how these ecosystems function, how they have changed over time and projections of changes that can affect management options. Make the information available via a purpose-built website.								
1. Complete the literature review and draft synthesis report. Circulate for review, and revise to address comments.	X							
2. Develop print and web-based outreach materials that present findings from the review, and make them publicly available on WSG’s website.		X	X	X	X	X	X	X
3. Support the workshop process by developing summary materials on topics identified as high priorities for decision making or future work.	X	X	X	X	X	X	X	X

4. Finalize the literature review and synthesis report using information gained through the workshop process.			X	X				
5. Make the compiled bibliography, document collection, outreach materials, and reports from the project publicly available on WSG’s website. <b>Deliverable (D):</b> Final science synthesis, searchable bibliography and document collection are available via the WSG website.			X	D	X	X	X	X
6. Document the workshop process and provide a final report with recommendations on future actions, including whether to continue the working group or form a management collaborative. <b>Deliverable (D):</b> Final report and recommendations.							X	D
b) Convene resource managers, scientists and stakeholders to verify a common understanding of the ecosystems and the top-priority management challenges in each of them, and to identify research needs and information gaps that represent barriers to tackling the management challenges at a system scale.								
1. Hold an online orientation meeting for the working group to review the findings of the literature review and synthesis report, gather initial advice, and preview the first of four public workshops.	X							
2. Plan and hold the first public workshop to characterize the management challenges being addressed, present the state of ecological knowledge surrounding the management issues, and identify information gaps and research priorities. <b>Milestones: M<sup>1</sup></b> —First public workshop. <b>M<sup>2</sup></b> —Research priorities.	X	M <sup>1</sup>	M <sup>2</sup>					
3. Organize and facilitate online meetings of the working group to solicit input on the science synthesis, research plans and potential site- and system-scale assessment tools.		X	X	X				
4. Plan and hold the second public workshop to present updates on research, solicit advice on assessment tools and provide information on models for collaborative, ecosystem-based management organizations. <b>Milestone (M):</b> Second public workshop. <b>Deliverable (D):</b> Site- and system-scale assessment tools.		X	X	M	D			
5. Organize and facilitate online meetings of the working group to apply research findings to ideas for responsive aquaculture and resource management practices.				X	X	X		
5. Plan and hold the third public workshop to review and make recommendations on aquaculture and resource management practices, and to discuss pros and cons of establishing a management collaborative. <b>Milestone (M):</b> Third public workshop. <b>Deliverable (D):</b> Aquaculture and resource management practices recommended for field testing.					X	M	D	
6. Organize and facilitate meetings of the working group and the fourth public workshop to review overall findings, the content of a final report and						X	X	M D

<p>recommendations for future steps—including whether to establish a management collaborative.</p> <p><b>Milestone (M):</b> Final workshop.</p> <p><b>Deliverable (D):</b> Final report and recommendations.</p>								
<p>c) Help address the needs identified in (b) by matching them with appropriate potential funding sources, sharing the information with other participants and promoting collaborative project proposals.</p>								
<p>1. Manage subawards from grants on hand to support field research by collaborating scientists that address priority information needs identified in the first workshop.</p> <p><b>Milestone (M):</b> Subawards in place for the 2020-2021 field seasons.</p>		<b>M</b>	X	X	X	X	X	X
<p>2. Publicize the availability of grant competitions and other funding opportunities applicable to the issues being addressed by this project.</p>		X	X			X	X	
<p>3. Leverage state funding to WSG by collaborating on additional grant proposals that address identified research needs, information gaps and implementation steps.</p> <p><b>Milestones (M):</b> Successful proposals that address identified needs.</p>	<b>M</b>	X	X	X	<b>M</b>	X	X	X
<p>4. Take advantage of federal funding sources unique to Sea Grant programs to augment state funding for the project and related research.</p> <p><b>Milestones (M):</b> WSG and/or collaborators awarded auxiliary funds applicable to this project.</p>		<b>M</b>				<b>M</b>		

*If you would like copies of this document in an alternative format, please contact Washington Sea Grant at [seagrant@uw.edu](mailto:seagrant@uw.edu) or (206) 543-6600*



## **Addendum A: Additional Project Context (updated)**

Washington leads the nation in farmed shellfish, and the state's Pacific Coast estuaries have been top producers for more than a century. The effort described here responds to a confluence of long-standing but continually evolving issues facing shellfish farmers and resource management agencies in Willapa Bay and Grays Harbor, as well as in other estuaries and bays in Washington, Oregon and Northern California. In Willapa Bay, in particular, burrowing shrimp appear to threaten the sustainability of the industry.

This project alone cannot solve the issues being addressed. It can, however, support research and dialogue to make well-founded, consensus-based solutions more likely. Other state-funded projects are closely linked and will inform this project. Significant efforts by the Department of Natural Resources in partnership with WGHOGA, and a recently announced dialogue on integrated pest management led by Ecology and shellfish growers, are focused on the same issues and offer additional avenues to solutions. WSG will continue to collaborate closely with those efforts.

Two recent federally-funded grant initiatives were directed at dealing with challenges to aquaculture that are common across multi-state regions of the U.S. In this context, rising populations of burrowing shrimp and the ways in which native and invasive eelgrass species interact with shellfish aquaculture represent examples of environmental challenges facing aquaculture on the West Coast. Other such challenges are likely to develop as ocean and estuarine conditions change in response to ocean conditions, climate and human uses of coastal waters and watersheds. WSG and PSI—already collaborating on the Willapa Bay and Grays Harbor project—were successful in securing two of these region-scale grants that will use this project as a pilot and test bed for regional collaboration and research across the West Coast states. The regional grants thus supplement state funding for this project.

This project builds on a concept introduced in the *Phase II Work Plan* for the state shellfish initiative. The general approach embodied in Action Item 3.9 is to sustain shellfish aquaculture in Willapa Bay and Grays Harbor under changing environmental conditions by establishing an adaptive, ecosystem-based management framework similar to those established by forest management collaboratives in the state. Forest management collaboratives address ecosystem-scale challenges that cannot be met by a single owner—public or private—managing only their own property, such as dealing proactively with fuel loads on timberlands to reduce catastrophic forest fires. Collaboratives agree on system-scale goals, identify appropriate management practices and support one another in taking action. The pattern of private shellfish farms in the midst of publicly owned tidelands with resources managed by various agencies sets up a parallel opportunity in Washington's coastal bays.

Growers' uncertainty about the future viability of shellfish farming, as well as resource managers' uncertainty about ecosystem-scale impacts on protected and managed species, is driving conflicts over aquaculture practices and regulations. As both the industry and resource managers try to adapt to large-scale environmental changes that are affecting conditions in the bays, new culture practices are being implemented quickly with limited information on their impacts to adjacent shellfish farms or the environment. Meanwhile, the public remains largely uninformed about shellfish growing practices, and some stakeholder opinions appear to be influenced by misinformation.

Three developments in Washington are also shaping this project. First, it directly addresses issues identified by regulators at the "Washington Eelgrass and Shellfish Aquaculture Workshop" held in Seattle on April 11, 2017. The workshop, convened by NOAA's regional aquaculture coordinator, brought together scientists, regulators, tribes and the shellfish industry to address inconsistencies in eelgrass management related to aquaculture. This project will help fill important data gaps identified by

scientists and managers who participated in the workshop and will support interagency dialogues. The regional grant secured by PSI directly addresses eelgrass and oyster aquaculture on the West Coast.

Second, the acute need for shellfish growers to control burrowing shrimp—and the projected economic impact if production declines significantly—triggered new dialogues between shellfish farmers and state agencies. A meeting convened by the Governor’s Office on February 14, 2018, brought the various conversations together in support of a coordinated approach. The Department of Natural Resources created a Rural Communities Partnership Initiative with WGHOGA, the Washington Department of Agriculture and the Washington State Conservation Commission to specifically focus on alternative control measures for burrowing shrimp. WSG is coordinating its efforts with the DNR/WGHOGA partnership by participating in the partnership’s working group.

Third, shellfish growers and the Washington State Department of Ecology—who were locked in an appeal process over Ecology’s decision to deny a permit for using imidacloprid on burrowing shrimp—developed a settlement agreement that will result in a new dialogue on Integrated Pest Management solutions. The working group for that dialogue is highly likely to include members of this project’s working group, and any solutions it recommends can be incorporated into this project.

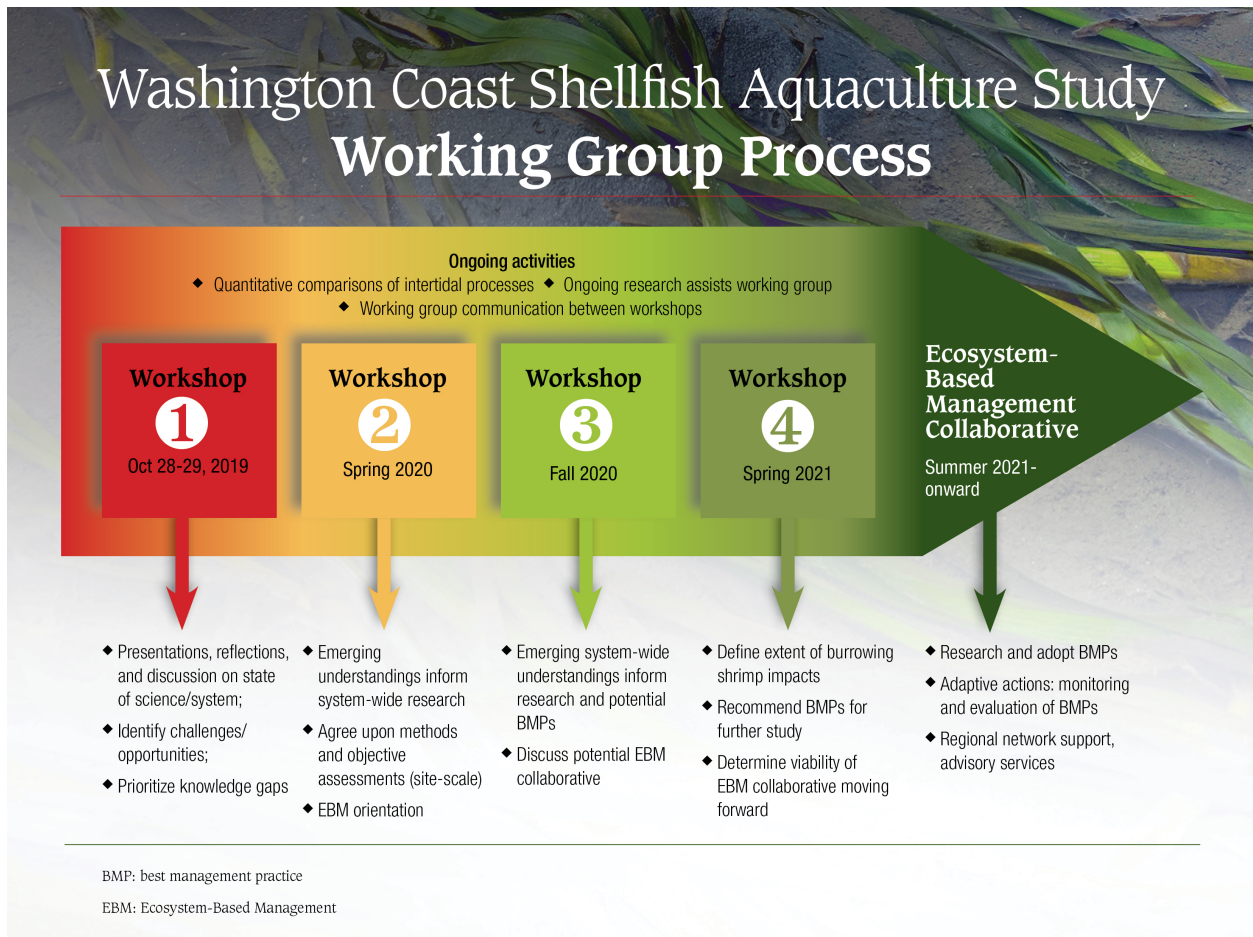
An important feature of this project is to explore the value and feasibility of establishing a management collaborative that can persist beyond the project’s timeline. Through a facilitated workshop process WSG and its collaborators will support the working group in assembling an ecosystem-based framework with the following components:

- a shared understanding among scientists, resource managers and stakeholders of how the ecosystem functions, how shellfish farming interacts with the system, and what is at risk;
- objective methods for assessing how shellfish farms and other tidelands contribute to habitat values and ecosystem processes in the bays;
- ecosystem-based aquaculture practices that optimize the value of shellfish farms for both shellfish production and as habitat; and
- an ongoing structure for collaborative management, patterned after forest management collaboratives or other proven models.

These components are reflected in the deliverables identified in the scope of work.

The dialogue and consensus building process is as important as scientific and technical information in determining the success of this project. A diverse constituency will be able to participate in the process through public workshops, working group meetings and outreach efforts. Information from the project will be widely available on websites and in publications and outreach materials.

## Addendum B: Working Group Process



## Addendum C: Working Group Membership

Working group members have been recruited from entities that own, manage or regulate shellfish beds, public tidelands and other natural resources, including shellfish farmers, public agencies and tribes. Working group primary members and their alternates as of October 28, 2019 (the first workshop), are listed below.

<i>Primary</i>	<i>Alternate(s)</i>	<i>Organization</i>
Mark Ballo	TBD	Brady's Oysters
Annie Herrold	TBD	Chetlo Harbor Shellfish
Bethany Barnard	Ray Hawks, Mugs Petit	Chinook Indian Nation
Kyle Deerkop	Tim Morris	Coast Seafoods
Hope Rieden	Harry Chesnin	Confederated Tribes of the Chehalis Reservation
Kathleen Nisbet-Moncy	TBD	Goose Point Oysters
Kim Patten	TBD	Independent Shellfish Grower
Ken Wiegardt	TBD	Jolly Roger
TBD (new NMFS Regional Aquaculture Coordinator)	Scott Anderson	National Oceanic and Atmospheric Administration - National Marine Fisheries Service
Marilyn Sheldon	Brian Sheldon	Northern Oyster Company
Mike Nordin	TBD	Pacific and Grays Harbor Conservation Districts
Scott Mazzone	Larry Gilbertson, Joe Schumacker	Quinault Indian Nation
Larissa Pfleeger-Ritzman	Jamie Judkins, Richard Ashley	Shoalwater Bay Tribe
Eric Hall	Bill Dewey	Taylor Shellfish
Glynnis Nakai	Ryan McReynolds (USFWS - Consultation & Conservation Planning Division)	U.S. Fish and Wildlife Service - Nisqually National Wildlife Refuge Complex (Grays Harbor National Wildlife Refuge)
Jackie Ferrier	Will Ritchie	U.S. Fish and Wildlife Service - Willapa National Wildlife Refuge Complex
James Losee	Zach Forster	Washington Department of Fish and Wildlife
Kristin Swenddal	Tom Gorman	Washington Department of Natural Resources
Laura Butler	TBD	Washington State Department of Agriculture
Rich Doenges	Zach Meyer	Washington State Department of Ecology

MONDAY, OCTOBER 28 AND TUESDAY, OCTOBER 29, 2019

# Washington Coast Shellfish Aquaculture Study: Workshop #1 Agenda

**Workshop purpose**

This is the first of four workshops in support of the Washington Coast Shellfish Aquaculture Study. The goal of this workshop is to advance a shared understanding among scientists, resource managers and shellfish farmers of how the ecosystems of Willapa Bay and Grays Harbor function, with particular attention to interactions among shellfish aquaculture, eelgrass and burrowing shrimp.

**9:00 a.m. – 5:30 p.m.**

Willapa Harbor  
Community Center  
916 W First St.,  
South Bend, WA

**Parking notes**

Attendees should not park on the east side of the building (left side, if facing the main entrance) or in the rear of the building. There is ample street parking throughout South Bend, but please do not park in areas which are noted “no parking” or could interfere with driveways and other access points.

**Public participation**

The Washington Coast Shellfish Aquaculture Study is not a public decision-making process. It is an applied research project to assist planning and collaboration amongst the working group members. The public is invited to hear from local, regional and global experts and observe the working group’s dialogue. Members of the public will also be able to contribute questions for discussion via notecards and provide direct input through roundtable discussions.



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9:00	<b>Registration</b>
9:30	<b>Welcome</b> Russell Callender, <i>Washington Sea Grant</i>
9:45	<b>Opening remarks</b> Jennifer Hennessey, <i>Washington State Office of the Governor</i>
10:00	<b>Workshop overview</b> Paul Dye, <i>Washington Sea Grant</i>
10:30	<b>Viewing Willapa Bay and Grays Harbor as social-ecological systems</b> Chris Harvey, <i>NOAA Fisheries</i>
11:00	<b>Break</b>
11:30	<b>ECOSYSTEM ENGINEERS ON TIDEFLATS</b> SESSION CHAIR: Jennifer Ruesink, <i>University of Washington</i>  The influence of burrowing shrimp on estuarine ecosystems Katrin Berkenbusch, <i>Dragonfly Data Science, New Zealand</i>  Nearshore ecosystems: interactions of shellfish aquaculture with species and habitat Beth Sanderson, <i>NOAA Fisheries</i>  A successful approach to managing an invasive ecosystem engineer — <i>Spartina</i> in Willapa Bay Kim Patten, <i>Washington State University</i>
1:00	<b>Catered lunch</b>
2:00	<b>BIVALVE FILTRATION AND CARRYING CAPACITY</b> SESSION CHAIR: Jennifer Ruesink, <i>University of Washington</i>  Bivalve filtration and carrying capacity Thomas Guyondet, <i>Department of Fisheries and Oceans, Canada</i>  The effects of estuarine climate on Pacific oyster growth and condition in Willapa Bay Brett Dumbauld, <i>U.S. Department of Agriculture, Oregon</i>  What's in the water and where does it go in Willapa Bay? Jennifer Ruesink, <i>University of Washington</i>
3:30	<b>Break</b>
4:00	<b>Panel: Information needs in systems thinking and ecological interactions</b>
5:00	<b>Closing</b> Paul Dye, <i>Washington Sea Grant</i>
5:30	<b>Adjourn</b>

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DAY 2 TUESDAY, OCTOBER 29, 2019 9 AM - 5:30 PM

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9:00	<b>Registration</b>
9:15	<b>Welcome</b>
9:30	<b>APPLIED SHRIMP ECOLOGY WITH IMPLICATIONS FOR MANAGEMENT</b> SESSION CHAIR: <b>Brett Dumbauld</b> , <i>U.S. Department of Agriculture, Oregon</i> Long-term change in benthic communities on intertidal sandflats, Kyushu, southern Japan, with special reference to population dynamics of ghost shrimp, mud shrimp, gastropods and bivalves <b>Akio Tamaki</b> , <i>Nagasaki University, Japan</i> Life history and ecology of burrowing shrimp in U.S. Pacific coast estuaries <b>Brett Dumbauld</b> , <i>U.S. Department of Agriculture, Oregon</i> Burrowing shrimp population dynamics and the challenges of predicting an unpredictable future <b>Katelyn Bosley</b> , <i>Washington Department of Fish and Wildlife</i>
11:00	<b>Break</b>
11:15	<b>PERSPECTIVES ON SHRIMP MANAGEMENT</b> SESSION CHAIR: <b>Steve Booth</b> , <i>Pacific Shellfish Institute</i> Two perspectives on an integrated management strategy for burrowing shrimp: applicable or not — with examples <b>Steve Booth</b> , <i>Pacific Shellfish Institute</i> Burrowing shrimp management: a grower's perspective <b>David Beugli</b> , <i>Willapa-Grays Harbor Oyster Growers' Association</i>
12:15	<b>Panel: Resource management challenges in the bays</b>
1:00	<b>Catered lunch</b>
1:45	<b>Panel: Information needs in shrimp ecology, shrimp management and resource management</b>
2:45	<b>Roundtable discussions:</b> Prioritizing information needs in service of the study's objectives and ecosystem-based management
4:30	<b>Break</b> (optional)
4:45	<b>Share-out of prioritized lists from working group</b>
5:15	<b>Concluding remarks</b> <b>Paul Dye</b> , <i>Washington Sea Grant</i>
5:30	<b>Adjourn</b>

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**Acknowledgements**

Projects currently contributing to this study are funded by Washington State appropriations, NOAA's Office of Aquaculture and the National Sea Grant College Program.

Catering for this workshop is provided by Becca's Bistro Catering Company.

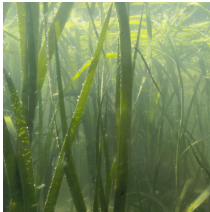
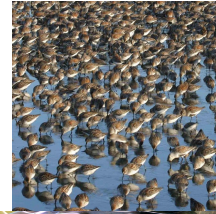
The Willapa Harbor Community Center is provided by Willapa Harbor Chamber of Commerce.

A special thank you to all of our working group members, presenters, panelists and volunteers.



**Contact**

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WSG-AS-19-03

