

SMP Periodic Review – Response to Comments

Table 1. Inventory of Public Comment received post Scoping Period¹

Reference	Date Received	From	Topic
A	8/18/20	Local 2020	Sea level Rise
B	October 2020 Engage PT	Jahnke(s), Dennison(s), Mathew(s), Youngmann	Aquaculture
C	12/4/20	Taylor Shellfish	Aquaculture
D	12/19/20	Hansi Hals, Jamestown S’Klallam Tribe	Aquaculture
E	1/2/21	Sikes	Kah Tai Lagoon

Individual comments in each letter are numbered in the margin (for example, the comment letter from Mr. White is numbered “A” and individual comments within that letter are numbered “A-1,” “A-2,” etc.). Form letters have been assigned the same letter reference to avoid repetition. Following is the staff response:

¹ Post 4/30/20

Table 2. Staff Response to Comments

Item #	SMP Section	Comments/Suggested Edit	DSD Staff Response
A-1	4.2 Shoreline Use Element	<u>Policy 4.2.5 Sea level rise and increased frequency and magnitude of extreme storm events as a result of climate change should be taken into account when considering and evaluating shoreline uses.</u> (From Island County example, WASMP) Or, alternative New Policy to align w/ existing Jefferson County SMP: <u>Encourage all use and development to address potential adverse effects of global climate change and sea level rise</u> (From Jefferson County example, WASMP) This could also be modified to: "global climate change including ocean acidification and sea level rise."	Alternative language. <u>Policy 4.2.6 Encourage proponents of all shoreline use and development to address potential adverse effects of global climate change including ocean acidification, sea level rise and increased frequency and magnitude of extreme storm events.</u>
A-2	4.2 Shoreline Use Element	<u>Policy 4.2.6 The City of Port Townsend shall establish a program to monitor the effects of ongoing climate change on the marine environment by annually measuring sea level and marine water pH at a minimum of five established sites spread throughout Island County.</u> (From Island County example, WASMP)	Alternative language. <u>Policy 4.2.7 Support the establishment of a local and regional program to monitor the effects of ongoing climate change on the marine environment.</u> Several organizations currently monitor climate change. For the City to establish its own program would incur costs and existing staff may not have the required expertise. Absent the policy, there is nothing to preclude the city from developing a monitoring plan in future.
A-3	4.2 Shoreline Use Element	<u>Policy 4.2.7 The City should develop information about the impacts of sea level rise on the shoreline and other affected properties; the City should develop plans to</u>	Staff Recommends Alternative: Add New Policy under "Amendments to Master Program"

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		<u>address the impacts of sea level rise in collaboration with impacted property owners, the community and the Department of Ecology. These plans should include at minimum flood prevention approaches, shoreline environment impact considerations and financing approaches. The City should amend the Shoreline Master Program and other policy and regulatory tools in the future as necessary to implement these plans.</u> (Example from Olympia, WASMP).	<i>Policy 13.2.2 During the periodic review process, review current sea level rise projections; consider amendments to the Shoreline Master Program and other policy and regulatory tools to address projected impacts.</i> (SMP amendments require public participation and Ecology approval)
A-4	4.2 Shoreline Use Element	We propose adding one new design standard here to apply to all below. The wording here is phrased to allow a broader effort to protect against sea level rise that spans multiple properties. Else, individual properties will design the buildings to withstand sea level rise w/o individual sea walls, bulkheads, etc. <u>DR XX: New or modified shoreline development shall be located and designed to withstand sea level rise projections for the expected life of the development without the need for property-specific structural shore defense.</u>	Not recommended at this time. Like Island and Jefferson County, staff recommends Policy to encourage but not to regulate at this time. Development regulations linked to SLR projections would require the City adopt an emissions scenario, timeframe, and probability level (possibly by type of development e.g. hospital vs. a park). We are not currently in a position to adopt specific SLR projections and will need to rely on whatever the state may adopt.
A-5	4.8 Restoration and Adaptive Management Element	Policy 4.8.2 Encourage projects that restore/rehabilitate/enhance shoreline resources, <u>and make the shoreline more resilient to climate change.</u> Strategies may include but are not limited to a simplified permit process, reduced or waiver of permit fees, public outreach, encouraging landowners to replant with native vegetation, tax relief, and city participation in a pilot project.	Support
A-6	4.8 Restoration and Adaptive Management Element	<u>Policy 4.8.7 Climate Change: Consideration should be made for potential adverse effects of global climate change and sea level rise when designing restoration and remediation projects</u> (From Gig Harbor example, WASMP)	Support

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A-7	5.7 Natural	Policy 5.7.1 Encourage uses that are in keeping with the primary goal of environmental protection. To the extent feasible, new uses and activities should be limited to restoration projects and public access or recreational/ educational uses, <u>or sea level rise adaptation uses.</u>	Support. Note Table 5 of the SMP generally prohibits shoreline defense works in the Natural designation DR 5.7.1d; however SLR adaptation uses may include reengineering of natural features (wetlands and beach dunes) consistent with the Natural designation.
A-8	5.8 Conservancy	Policy 5.8.4 Establish best management standards for shoreline stabilization measures, vegetation conservation, water quality, and shoreline modifications within the Conservancy Designation to ensure that new development does not result in a net loss of shoreline ecological functions or further degrade other shoreline values, <u>and which take into account sea level rise projections.</u>	Support.
A-9	5.9 Shoreline Residential	New Policy 5.9.12 to align with Jefferson County SMP: <u>Proponents of a development on no-bank or low bank marine shorelines are encouraged to locate the bottom of a structure's foundation higher than the level of expected future sea-level rise.</u> (Jefferson County example, WAECMSP). <i>Staff Note: Did Local 2020 intend this as policy or development regulations(DR)? Placement is under DR 5.9.12.</i>	Staff recommends alternative language that includes both fresh and marine shorelines and uses language consistent with existing flood regulations which requires the lowest floor of new structures be elevated 2-feet above base flood elevation (PTMC 16.08). <i>Alternative: New Policy 5.9.6. Proponents of shoreline development on no-bank or low bank shorelines are encouraged to elevate the lowest floor above the level of expected future sea-level rise.</i>
A-10	5.10 Urban	Development Regulations - Uses DR-5.10.4 Multi-family residential or transient accommodation (hotel and motel) uses may be permitted as a conditional use provided they meet the requirements	Support.

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		for non-water oriented uses listed above and further that said use meets the following terms: g. Restoration/Public Access Incentive - The requirement in DR 5.10.4(c)(i) above, regarding dedication of no less than 25% of the total floor area to water-oriented uses, may be waived in whole or in part when the proposal provides restoration of ecological functions, habitat enhancement, and/or provision of public access improvements (e.g., parks, esplanades, etc.) that constitute a significant public benefit beyond that which would be required as mitigation for the development. (Thus allowing for an additional 25% of residential/transient or non-water oriented uses accessible to the general public). In addition to the Conditional Use-approval criteria, the following criterion shall apply: i. The proposal will provide "greater public benefit" consistent with this Master Program without additional probable significant adverse impacts to public health, safety or the environment, that cannot be adequately mitigated. ii. Items that may constitute a "greater public benefit" include: 1.) Preservation of critical shoreline habitat, 2.) Restoration of impaired ecological functions, 3.) Dedication to the city of land for a public park or open space, 4.) Preservation of scenic resources, and 5.) Enhanced public access amenities, and. 6.) <u>Enhance the Urban area's resiliency to sea level rise</u>	
A-11	5.11 Historic Waterfront	Management Policies - Uses	Support.

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		Policy 5.11.1 Encourage a mixture and variety of uses and activities in the Historic Waterfront Designation, particularly those that: a. Preserve and restore the historic character of Port Townsend. b. Support and reinforce the design and architectural qualities of the Water Street National Historic District when located within or adjacent to its boundaries. c. Provide an opportunity for the public to actively or passively enjoy the community's waterfront amenity. d. Provide a physical link or connection open to the public between the upland and the shoreline. e. Are water-oriented uses or are accessory to, complimentary to or support water-oriented uses. f. Enhance the character and flavor of the Port Townsend urban waterfront. g. <u>Enhance the resiliency of the waterfront to sea level rise</u>	
A-12	5.12 Boat Haven	Design Elements <u>Policy 5.12.16 Work with the Port to enhance the resiliency of the Port to sea level rise.</u>	Support.
A-13	5.13 Point Hudson	Management Policies - General Policy 5.13.1 Pursuant to Resolution 94-148, the following general goals provide the foundation for planning within Point Hudson: 1. Point Hudson must be financially self-supporting. 2. Protect small-scale nature. 3. Provide a high degree of public access/use. 4. Preserve the historic character. 5. Encourage the marine trades and water-oriented uses. 6. Maintain property in Port/public ownership. 7. <u>Enhance the resiliency of Point Hudson to sea level rise.</u>	Omit. We cannot alter Reso. 94-148. Resiliency is addressed by Item 15 herein.

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A-14	5.13 Point Hudson	Design Elements Policy 5.13.9 Preserve Point Hudson's historic character. Encourage adaptive reuse of existing buildings. Require new structures to be designed in a manner that is compatible with Point Hudson's historic character. Encourage the rehabilitation of the original Point Hudson East buildings through adaptive reuse. Limit exterior modifications to those necessary for life/safety improvements, building code compliance, historic restoration of buildings, <u>sea level rise resiliency</u> , or public access improvements. Allow additions necessary to accommodate water-oriented and adaptive reuse of existing buildings.	Alternative: Replace SLR resiliency with: flood damage prevention
A-15	5.13 Point Hudson	Future Planning Policy 5.13.15 Work in collaboration with the Port of Port Townsend to help keep Point Hudson financially self-supporting <u>and resilient to sea level rise</u> .	Support
A-16	5.13 Point Hudson	Point Hudson East sub-district (see map Appendix A page 8) DR-5.13.4 The following development, uses and activities are permitted within this subdistrict: a. Water-dependent, water-related, and non-commercial water-enjoyment uses b. Commercial water-enjoyment uses (e.g. restaurants) in existing buildings c. Public access uses, including construction of accessory buildings that promote public access (such as restrooms and gazebos), and d. Adaptive reuses i. Adaptive reuses (see Table 5.13-1 for list of allowable adaptive reuses; other unlisted non-water oriented uses may be allowed by conditional use) in the following eligible buildings, provided they do not exceed the listed	Alternative: Replace SLR resiliency with: flood damage prevention

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		percentages: Hospital (30%); Main Building (30%); Shower Building (30%). ii. Modifications/additions to allow water-oriented uses or adaptive reuse of existing structures may be permitted as follows: 1.) Exterior modifications limited to those necessary for life/safety improvements, <u>sea level rise resiliency</u>, and/or compliance with building codes are permitted. 2.) Additions of 10% or less of the existing square footage are permitted. 3.) Additions of greater than 10% of the existing square footage may be permitted as a conditional use.	
A-17	6.3 Impacts, Mitigation, Bonding and Monitoring	Management Policies <u>Policy 6.3.6 Provide for long term environmental protection by taking into account that climate change brings a rapidly changing ecosystem, and environmental impacts must always include a forward looking analysis of the anticipated ecological condition and needed mitigation.</u>	Alternative language: <i>Encourage impacts analysis and mitigation plans include projected climate change impacts over the life of the project.</i>
A-18	6.3 Impacts, Mitigation, Bonding and Monitoring	Development Regulations - Mitigation DR-6.3.4 Where mitigation for loss of or impact to shoreline ecological functions is required, a mitigation plan shall be required. Mitigation plans shall be prepared by a qualified professional as determined appropriate by the Shoreline Administrator. In addition to the requirements for critical areas special reports contained in Chapter 19.05, the mitigation plan shall contain the following: a. Inventory existing shoreline environment including the physical, chemical and biological elements and provide an assessment of their condition. b. A discussion of the project's impacts and their effect on the ecological functions necessary to support existing shoreline resources.	Not at this time. In the absence of state adopted SLR regulations, this isn't something the city is prepared or capable of doing. See # 4.

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		c. A discussion of any federal, state, or local special management recommendations which have been developed for wetlands or nearshore species or habitats located on the site; d. An assessment of habitat recommendations proposed by resource agencies and their applicability to the proposal; e. A discussion of measures to preserve existing habitats and opportunities to restore habitats that were degraded prior to the proposed land use activity. f. Planting and soil specifications; success standards; and contingency plans; g. A discussion of proposed measures which mitigate the impacts of the project to ensure no net loss of shoreline ecological functions and proposed success criteria; h. An evaluation of the anticipated effectiveness of the proposed mitigation measures to ensure no net loss of ecological functions; i. A discussion of proposed management practices which will protect fish and wildlife habitat both during construction, and, after the project site has been fully developed, including proposed monitoring and maintenance programs; j. Contingency plan if the mitigation fails to meet established success criteria; k. Any additional information necessary to determine the impacts of a proposal and mitigation of the impacts. <u>l. An evaluation of the climate change projections on the plan</u>	
A-19	6.4 Environmental Elements	Development Regulations - Earth DR-6.4.6 All shoreline uses and activities shall be located, designed, constructed and managed to minimize interference with beneficial natural shoreline processes	Not at this time. In the absence of state adopted SLR regulations, this isn't something the city is prepared or capable of doing. See # 4.

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		such as littoral drift, sand and gravel movement, erosion, and accretion. <u>How such processes will be impacted by sea level rise shall also be considered.</u> For projects proposing clearing and grading see Section 9.3 Alteration of Natural Landscape – Clearing, Grading and Vegetation Removal, Chapter 9 Specific Modification Policies and Performance Standards.	
A-20	6.4 Environmental Elements	Development Regulations - Water Quality DR-6.4.24 As a condition of approval of a permit issued in accordance with this master program, the Shoreline Administrator may apply the following conditions to protect water quality: a. The development, use or activity shall utilize Best Management Practices (BMPs) to minimize any increase in surface runoff and to control, treat and release surface water runoff to protect the quality and quantity of surface and ground water. Such measures may include but are not limited to catch basins or settling ponds, installation and required maintenance of oil/water separators, biofiltration swales, interceptor drains and landscaped buffers. <u>Such measures shall take into account climate change projections including future expected storm intensity, e.g. 24 hr rainfall events. ...</u>	Not at this time. In the absence of state adopted SLR regulations, this isn't something the city is prepared or capable of doing. See # 4.
A-21	6.6 Critical Saltwater Habitats (Fish and Wildlife Habitat Conservation Areas)	<u>Policy 6.6.5 Habitat protection and restoration projects in the shoreline jurisdiction shall consider implications of sea level rise and other climate change impacts to promote resiliency of habitats and species</u> (Example from King County and from Shelton, WASMP)	Alternative: As this is Policy rather than regulation, staff suggests replacing "shall" with "should"
A-22	6.7 Frequently Flooded Areas	<u>Policy 6.7.5 Applicants for development in low lying shoreline areas and other areas where flood elevation is</u>	Alternative: Staff suggests policy language similar to #1 and #9 of this table:

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	and Tsunami Inundation Areas	<u>controlled by tide level shall be provided with information on sea level rise</u> (From Bainbridge Island example, WASMP)	Insert new Policy 6.7.2. (renumber accordingly) <i>Encourage all use and development on no-bank or low bank shorelines to minimize potential damage from anticipated sea-level rise through appropriate location and/or design measures.</i>
A-23	6.7 Frequently Flooded Areas and Tsunami Inundation Areas	<u>Policy 6.7.6 When reviewing projects that could be affected by sea level rise adjust development standards such as building setbacks or elevation as necessary to minimize potential damage from flooding.</u> (Island County and Langley examples, WASMP)	Not necessary. Addressed by Staff suggested Policy 6.7.2 above.
A-24	6.9 Wetlands	Policy 6.9.1 Preserve and protect wetland ecosystems, and mitigate impacts, so that there is no net loss of wetland acreage and functions. Where feasible, improve wetland quality. Maintaining or restoring vegetated buffers is the preferred method for protecting/improving wetland functions. <u>Shoreline wetland subject to sea level rise must plan for development of wetland to avoid no net loss.</u>	Alternative language. Policy 6.9.1 <i>Preserve and protect wetland ecosystems, and ~~when impacts cannot be avoided require mitigation impacts, so that ensures there is~~ no net loss of wetland acreage and functions. Where feasible, improve wetland quality and plan for projected sea level rise. Maintaining or restoring vegetated buffers is the preferred method for protecting/improving wetland functions.</i>
A-25	8.3 Agriculture	Policy 8.3.2 Require buffer zones of permanent vegetation between tilled areas and associated water bodies in order to retard surface runoff, reduce siltation, and promote valuable shade for fish habitats. <u>Include climate change projections of more intense precipitation when considering surface runoff.</u>	Alternative language suggested: <i>Encourage measures that will minimize the impact of more intense precipitation anticipated with climate change.</i>
A-26	8.7 Industrial and Port Facilities	We realize this may be a significant change. The idea is how do we be sure our port and water dependent industry continue to have access to the shoreline as it moves inward?	Cannot support. This would essentially expand shorelines jurisdiction which requires an act of the State.

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		DR 8.7.1 Only water-dependent industry and water-related industry shall be permitted in the shoreline jurisdiction. <u>This shall include areas of future shoreline based on sea level rise projections.</u>	
A-27	9.2 General Policies and Regulations	Policy 9.2.1 Locate and design all new development in a manner that prevents or minimizes the need for shoreline modifications <u>today and in the foreseeable future, given sea level rise projections.</u>	Alternative language: Policy 9.2.1 <i>Locate and design all new development in a manner that prevents or minimizes the need for shoreline modifications <u>for the design life of the project.</u></i>
A-28	9.7 Shoreline Stabilization Measures & Flood Protection Works	<u>Policy 9.7.8 When new development occurs within the shoreline jurisdiction, the following measures apply: City of Port Townsend should notify all prospective developers of new that their development may be impacted by sea-level rise and should encourage all such new development to be set back a sufficient distance to avoid the need for shoreline protection during the expected life of the development. (King County example, WASMP).</u>	Alternative: <i>Notify prospective developers of the potential impacts of sea-level rise. Encourage them to address the potential adverse effects through strategic location and design to avoid the need for shoreline modifications during the design life of the development.</i>
A-29	9.7 Shoreline Stabilization Measures & Flood Protection Works	<u>Policy 9.7.9 Fill should be allowed to accommodate berms or other structures to prevent flooding caused by sea level rise, when consistent with the flood hazard reduction provisions in this Shoreline Program. Any such fill should include mitigation assuring no net loss of ecological functions and system-wide processes. (Olympia example, WASMP).</u>	Not recommended. Appears covered by existing Policy 9.7.4 and 9.7.7.
A-30	14.6 Restoration Goals, Priorities and Objectives	The goals and objectives included here are developed for the Port Townsend shoreline and are consistent with the basin wide general recommendations related to nearshore habitats in the Watershed Management Plan for the Quilcene-Snow Water Resource Inventory Area 17 (October 28, 2003), which includes Port Townsend. Overarching goals for restoring the Port Townsend shoreline are to:	Not recommended. Per Ecology guidance, staff recommends removal of Chapter 14 from the SMP to create a stand-alone document which will allow revisions as needed without triggering a formal SMP Amendment. (see Checklist 2009a). Chapter 14

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		improve water quality, restore degraded and lost habitat and corridors, and improve connectivity of the shoreline environments in terms of both space and time, and include <u>considering sea level rise projections for all of these goals.</u>	currently states: 3. <i>The goal of restoration is a persistent, resilient system.</i>
A-31	Chapter 15 Definitions	Ordinary High Water Mark (often abbreviated OHWM) That mark on all lakes, streams, and tidal waters that will be found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland in respect to vegetation as that condition exists on June 1, 1971 or as it may naturally change thereafter; or as it may change thereafter in accordance with permits issued by the local government or the Washington State Department of Ecology; provided that in any area where the ordinary high water mark cannot be found, the ordinary high water mark adjoining salt water shall be the line of mean higher high tide, and the ordinary high water mark adjoining fresh water shall be the line of mean high water. <u>Note that per WA State Ecology “Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State”, page 105 (and also noted on page 75), one of the factors that should be taken into consideration when determining OHWM is sea level rise data.</u>	Alternative language: <i>(Note: Consult current Ecology guidance for factors that should be taken into consideration when determining OHWM (e.g., tidal data, sea level rise data).</i>
B-1	Chapter 5 and Section 8.4 Aquaculture	Concerned about oyster farming at Hudson Point	Limited amendments are planned to comply with state statutes and in response to comments from Jamestown S’Klallam and Taylor shellfish. All future projects must comply with applicable regulations including “no net loss”.

C-1	8.4 Intro	Aquaculture is the farming or culturing of aquatic organisms. Aquaculture encompasses a wide variety of activities including hatching, seeding, planting, cultivating, feeding, raising, and harvesting of plants and animals. These activities may have widely differing impacts on the aquatic and shoreline environment.	Revised introduction to improve consistency with WAC173.26-020 (2):
C-2	Policy 8.4.1	Limit aquaculture within the City's shoreline jurisdiction to the following: a. Geoduck harvesting within Department of Natural Resources tracts; <u>Commercial shellfish aquaculture waterward of the OHWM, provided that the project is consistent with all applicable federal, state, and local requirements.</u>	Support.
C-3	Policy 8.4.2	Ensure that, when permitted, aquaculture developments are located, designed and operated in a manner that is compatible with existing uses and in keeping with the natural shoreline environment and the environmental protection and restoration policies of this Master Program.	Staff proposes limited amendment to 8.4.2 to delete the natural shoreline environment
C-4	New Policy 8.4.3	<u>Potential locations for aquaculture practices are relatively restricted due to specific biophysical requirements such as water quality, temperature, substrate, dissolved oxygen, and salinity. Priority should be given to aquaculture uses in areas having high potential for such uses.</u>	No action needed. City SMP Section 5.6 Aquatic, prioritizes water-dependent uses. DR 5.6.2 aquaculture is a permitted use in the aquatic designation.
C-4a	Policy 8.4.3	Taylor Shellfish does not address the existing Policy which reads:	Staff recommends deleting existing Policy 8.4.3. There are no established aquaculture operations within the city limits. The city cannot deny uses that are permitted by the zone provided they comply with

		Protect established aquaculture operations from incompatible uses that may seek to locate nearby. Demonstration of a probability that such an adjacent use would result in damage to, or destruction of such an aquaculture operation shall be grounds for the denial of that use.	adopted regulations including compliance with the State Department of Ecology Stormwater Management Manual for Puget Sound.
C-5	New Policy 8.4.4	<u>Maximum effort to protect water quality should be made in areas with high potential for aquaculture and current aquaculture areas that have been identified as sensitive areas.</u>	No action needed. Port Townsend is a relatively small UGA. Much of the shoreline is high bank. Limited low bank areas are primarily developed to urban densities. The north and east shores are high energy. The south shore is urbanized and the waters subject to significant vessel traffic. There are currently no aquaculture areas in the city limits and no areas of high potential have been identified. The City has adopted and implements the State Department of Ecology Stormwater Management Manual for Puget Sound.
C-6	New Policy 8.4.5	<u>The County should support community restoration projects associated with aquaculture when they are consistent with this program.</u>	Support with minor edits –Becomes Policy 8.4.3 rere
C-7	Policy 8.4.6	<u>The County should consider local ecological conditions and provide limits and conditions to assure appropriate compatible types of aquaculture for the local conditions as necessary to assure no net loss of ecological functions. Aquaculture should not be permitted in areas where it would result in a net loss of ecological functions or adversely impact eelgrass and macro-algae. Aquacultural facilities should be designated and located so as not to spread disease to native aquatic life, or establish new nonnative species which cause significant ecological</u>	Support with minor edits. Becomes Policy 8.4.4

		<u>impacts. Unavoidable impacts to ecological functions shall be mitigated.</u>	
C-8	DR 8.4.1	The following aquaculture activities may be permitted: c. <u>Commercial geoduck harvesting, when permitted by the Department of Natural Resources (DNR) on a DNR tract. Shellfish aquaculture waterward of the OHWM, provided that the project is consistent with all applicable federal, state, and local requirements.</u>	Staff proposes to delete DR8.4.1 and address in Chapter 5 Shoreline Environments, Table 5 and DR 5.6.2 Note: for upland areas (above OHWM) the existing SMP limits new commercial aquaculture is limited to the Boat Haven Marina and Marine Trades District. Revisions may be considered during this periodic review.
C-9	DR 8.4.3	Geoduck harvesting <u>aquaculture</u> shall <u>should</u> not be permitted in <u>adversely impact</u> kelp beds or in eelgrass beds unless approved by the Washington State Department of Fisheries.	Replaced existing 8.4.3 and moved above Geoduck subheading. Consistent with language from WAC 173-26-241 (3)(b)(i)C which is not limited to geoduck aquaculture
C-9a	DR 8.4.4	Taylor letter does not address. Proposals for mechanical harvesting that involve substantial substrate modification shall be evaluated using the policies and performance standards for Dredging (Section 9.5) in addition to the provisions of this section.	Consistent with WAC 173-26-241 (3)(b)(i)D(ii) replaced with <u>Commercial geoduck aquaculture that requires significant clearing and grading shall not be permitted.</u>
C-10	DR 8.4.5	Applications for geoduck harvest <u>aquaculture</u> shall be submitted on forms provided by the City of Port Townsend and shall include but are not limited to, the following information: a. Tract <u>Farm</u> size and location; b. Harvesting techniques;	Revised DR 8.4.5 to improve consistency with WAC 173-26-241 3(b)(iv)F

		c. A description of associated upland operations (e.g., truck transportation, processing, etc.); d. Hours of operation; e. A description of existing shoreline conditions (including flora, fauna, natural processes, and adjacent uses); f. Relationship to other permits, rules, and regulations; g. Proposed method for marking tract boundary.	
C-11	DR 8.4.6	Commercial geoduck harvesting <u>aquaculture</u> may be allowed as a permitted <u>conditional</u> use when permitted by the Department of Natural Resources and provided that the applicant demonstrates that the location, design, and operation of the <u>proposal</u> harvest will not: a. Conflict with existing adjacent uses either directly (e.g., obstructing navigational channels) or indirectly (e.g., noise). Limitations on hours of operation may be required to protect adjacent uses. b. Cause a significant adverse impact on natural shoreline processes; c. Cause significant adverse cumulative impacts (i.e., aquaculture operations should be adequately spaced). d. Degrade critical habitat areas or environmental restoration sites; e. Interfere with the migration of aquatic organisms except where specifically intended by the design or operation of the facility; or	Revised DR 8.4.6 to improve consistency with WAC 173-26-241 (3)(b)(iv)H In the case law cited, it appears the courts objection was not a cart blanc 'limitations cannot be applied to aquaculture activities' but that the case specific conditions were not deemed reasonable. WAC- 173-26-241 3(b)(iv)H "....<i>Local governments must allow work during low tides but may require limits and conditions to reduce impacts, such as noise and lighting, to adjacent existing uses.</i>"

		f. Significantly degrade aesthetic quality of the state's shorelines.	
D-1	8.4 Aquaculture	Supports comments from Taylor Shellfish	Comment noted.
D-2	Tables 5.12-1 Boat Haven and 5.13-1 Point Hudson	Request that aquaculture be allowed in marine water and tideland locations.	Amendments are intended to comply with the SMA. Staff recommends allowing aquaculture of native and naturalized species within existing marinas.
D-3	DR 8.4.1 Aquaculture	Objects to prohibition of commercial shellfish seeding/culturing – inconsistent with SMA. Suggests revision to permit shellfish aquaculture of native and naturalized species waterward of the OHWM, provided consistent with applicable requirements.	Section 8.4 has been revised consistent with the SMA.
E-1		Objects to future Kah Tai Lagoon boardwalk as shown in the City's Parks Plan.	The SMP does not directly address the boardwalk. Any future project proposal would be required to meet applicable regulations including the "no net loss" standard. (Parks Director has been cc'd).

Commented [JS1]: If PC agrees, add in bill format

EngagePT

Ambassadors: Rick and Debbie Jahnke

Participants:

1. Larry Dennison (ldennison021@wavecable.com)
2. Rick Dennison (rln@cablespeed.com)
3. Ellie Mathews
4. Carl Youngmann (cyoungmann@gmail.com)
5. Anonymous

note: Those participants giving email addresses are willing to be on the City's contact list to receive updates and other information. The following information is from summary notes taken during discussions. All errors belong to the ambassadors.

Participant 1 was engaged by telephone and confirmed that Participant 2 agreed with his statements and concerns

Participants 3 and 4 were engaged in person, socially distanced in their garden

Participant 5 was engaged via a neighborhood email request

Questions and Responses

1. Should additional property tax dollars be levied as part of the "banked capacity" from the annexation of the fire department? If so, how should they be spent? What are your budget priorities?

P1, P2: Infrastructure must be maintained. Our priorities are backwards; no more expenditures downtown, take care of the neighborhoods.

P3, P4: Any budgetary freeboard should be directed toward the maintenance of the city. If we take annexation money, do not spend it on new capital projects. Don't take on any new infrastructure projects, i.e., make sure the roof doesn't leak before you put in the swimming pool (speaking figuratively, not about our pool).

2. What do you want from our streets? How do we best preserve, improve, operate, and program our streets sustainably into the future?

P1, P2: Our urban streets cost \$M/mile brand new; \$300K+/mile ordinary maintenance; why aren't we doing ordinary maintenance? Streets were in much better condition when we moved here in the 1970s. The county knows how to maintain streets; the city should sit down with the county and develop a contract to maintain our streets.

P3, P4: A lot of our roadways are in marginal condition. It's the 'broken window/graffitti' syndrome, maintaining what we have rather than taking on new projects; follow the pavement management plan.

P5: I would like to see more and better bike lanes all over town.

3. What type of pedestrian and bicycle facilities on Discovery Road will provide the greatest benefit to the most people and increase our community's use of healthy, active transportation?

P3, P4: Generally, more benches would be helpful along all our streets for our aging population.

P5: I would like to see more and better bike lanes all over town.

4. What should be the future of the City's municipal golf course?

No one surveyed chose to address this question

5. What do you most want or need the Library to be in the future and how do we ensure the path forward is financially sustainable?

P3, P4: Live within your means; we all have to live to within our means. Spend less on self-promotion and provide books and materials and facilitating access to information. A library is a unique source of information available to all regardless of economic standing; a library's first job is to provide access. Library is for using information sources for people who need help accessing. The library should be using money to assist folks to access a huge array of government services and information. Library is an exclusive point of access. It should be going on its own \$1M+ budget for everything it needs and not drawing on our reduced general revenues.

6. What feedback do you have for our public safety officers? What are they doing well and what can they improve?

P3, P4: From what we have observed, our police handle mental health and domestic violence cases very well. We have been pleased with our interactions with local law enforcement.

7. What will it take to recover from COVID-19 and how do we build lasting resilience into the future?

P1, P2: Local 2020 had a speaker from Bavaria several years ago who talked about efforts to keep the young folks in their small town. They developed biodigester and wind turbine technologies and created good living wage jobs while becoming energy independent and kept their young people home. Our boat haven and the wooden boat school are a great example of training leading to living wage jobs. Our bed taxes should be spent on more than downtown because tourists are interested in more than downtown.

The ways we have had priorities set in the last 20 years are backwards. We used to engage citizens at the beginning, with neighborhood charettes, that was the process to determine priorities but now there seems to be a line between government and the public; citizens are brought in after the fact.

P3, P4: We need to hang on tight until we are in a better place. We must pick and choose what we can afford to support. It is easy to get diverted by wants not needs. Tourist needs don't solve our local need for living wage jobs and tourism is the first thing we lose in a recession; we need living wage jobs, supporting small manufacturing.

P5: As far as covid recovery, I think we're doing all we can do in our town, although I would discourage any further laxing of rules or further openings. I appreciate any and all efforts to improve our town in any way possible. These are difficult times, so my expectations aren't high right now. More importantly, we all must stay safe and healthy while the country and planet seems to be on a downward swirl on many levels...sorry for my pessimism. I do remain hopeful and do enjoy the outdoors whenever I can!

8. How do we prioritize investments in our aging sewer system over the next 10 years?

P1, P2: water and sewer rates - ~58% of our water bill is taxes and surcharges - leads me to question is it dedicated to something - storm drainage work being done where?

P3, P4: Maintain existing infrastructure with the fees and taxes collected. Don't encourage sprawl. Denser housing would lower the cost per capita.

9. *How do we protect and restore valuable aquatic resources for future generations, provide for water-dependent uses, and ensure access to public shorelines?*

B-1

P3, P4: We have concerns about proposed oyster farming at Hudson Point, how this will affect the surrounding area.

10. *What does water supply sustainability for Port Townsend and the Mill look like for the next 20, 50, and 100 years?*

P1, P2: Why are we chlorinating our water so much after we built the expensive new system? If it is state of the art, why do we need so much chlorine?

P3, P4: Our mill is aware that kraft paper stinks but is making good progress toward such improvements as cogeneration, biochar; it is trying to be the best it can be. It is a major recycler, with old cardboard carton a significant portion of what is recycled. The mill is a good partner.

December 4, 2020

Via email: jsurber@cityofpt.us
Judy Surber
City of Port Townsend
250 Madison Street
Port Townsend WA 98368

Via email:
michelle.mcconnell@ecy.wa.gov
Michelle McConnell
Washington State Department of Ecology
300 Desmond Drive SE
Lacey, WA 98503



RE: Port Townsend Shoreline Master Program Periodic Review Comments

Dear City of Port Townsend and Department of Ecology:

I am general counsel for Taylor Shellfish Farms and a fifth-generation shellfish farmer. As you may recall, I submitted comments in April 2020 requesting that the City and Ecology include revisions to the City of Port Townsend's Shoreline Master Program aquaculture policies and regulations within the scope of the periodic SNIP review. I appreciate that the City and Ecology have chosen to include aquaculture revisions within the scope of the periodic review, and I am submitting these comments to request specific changes to the aquaculture policies and regulations, building off my previous comment letter.

As previously discussed, the Port Townsend SMP was approved in 2007, with minor revisions in 2011 and 2018. Since 2007, there have been significant updates with respect to the treatment of aquaculture in SMPs. There have also been important studies and analyses completed on shellfish aquaculture over the last several years demonstrating that this activity has insignificant environmental impacts given current practices and regulatory conditions. Additionally, the Growth Management Hearings Board issued a recent decision, *Taylor Shellfish Company, Inc., et al. v. Pierce County and Ecology*, Case No. 18-3-0013c, Final Decision and Order (June 17, 2019), rev'd in part, Order on Motion for Reconsideration and Request to Correct Scrivener's Errors (Aug. 7, 2019), confirming shellfish aquaculture is a preferred, waterdependent use; aquaculture policies and regulations in SN/1Ps must be consistent with the Shoreline Management Act, chapter 90.58 RCW, and implementing Guidelines, chapter 173-26 WAC; and restrictions on aquaculture must be based on current scientific and technical information.

We suggest the following revisions to the Port Townsend SNIP's aquaculture policies and regulations to ensure it is consistent with the law and science pertaining to this activity. Section headings are presented in bold, proposed deletions are shown in strikethrough and additions are in underline. Rationale supporting the requested revisions follows in italics.

Aquaculture is the farming or culturing of aquatic organisms. Aquaculture encompasses a wide variety of activities including hatching, seeding, planting, cultivating, feeding, of

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raising, and harvesting of plants and animals. ~~These activities may have widely differing impacts on the aquatic and shoreline environment~~

C-1

The language shown as stricken above has no basis in the SIVL4 or the Guidelines. We are also aware of no scientific and technical basis for the position that aquaculture activities, as currently conditioned and practiced, have widely differing impacts. Rather, expert resource agencies recently completed a programmatic consultation of shellfish aquaculture impacts on listed species and critical habitat. That consultation determined that the environmental impacts of shellfish aquaculture are avoided and minimized through reasonable conservation measures such as using appropriate gear, regularly maintaining farms and equipment, and surveying for forage fish spawn in areas where spawning habitat is not avoided.

Policy 8.4.1

C-2

Limit aquaculture within the City's shoreline jurisdiction to the following:

- a. ~~Geoduck harvesting within Department of Natural Resources tracts~~ Commercial shellfish aquaculture waterward of the OHWM, provided that the project is consistent with all applicable federal, state, and local requirements;

Limiting aquaculture to geoduck harvesting within Department of Natural Resources tracts is inconsistent with the classification of this activity as a preferred, water-dependent use, and there is no scientific or technical information that supports this restriction. This restriction is inconsistent with the SMA and the Guidelines. RCW 90.58.020 ("uses shall be preferred which are consistent with control of pollution and prevention of damage to the natural environment, or are unique to or dependent upon use of the state's shoreline"); RCW 90.58.100(1) (requiring the use of scientific and technical information in developing SMP updates); WAC 173-26-176(3)(a) (stating as a policy goal "[t]he utilization of shorelines for economically productive uses that are particularly dependent on shoreline location or use"); WAC 173-26-201(2)(a) (use restrictions shall be based on scientific and technical information); WAC 173-26-201(2)(d) ("the act establishes policy that preference be given to uses that are unique to or dependent upon a shoreline location"); WAC 173-26-221(2)(c)(iii) (all shellfish beds (including commercial) are recognized in the guidelines as providing important ecological functions). Accordingly, it should be removed and replaced with a policy stating aquaculture is allowed provided it is consistent with regulatory requirements.

Policy 8.4.2

C-3

~~Ensure that, when permitted, aquaculture developments are located, designed and operated in a manner that is compatible with existing uses and in keeping with the natural~~

1 The programmatic consultation documents are available on the Seattle District Corps of Engineers website, and include a 2015 programmatic biological assessment by the Corps, a 2016 programmatic biological opinion by the National Marine Fisheries Service, and a 2016 programmatic biological opinion by the U.S. Fish and Wildlife Service. <https://www.nws.usace.army.mil/Missions/Civil-Works/Regulatory/Shellfish-Aquaculture/>
of

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~~shoreline environment and the environmental protection and restoration policies of this Master Program.~~

Taylor Shellfish agrees that shellfish aquaculture operations should avoid and minimize impacts to the environment and other uses according to the standards established in the SMA and Guidelines. However, this policy as stated goes beyond the allowances and preferences afforded aquaculture, and it also suggests that the existing shoreline environment is in a natural state, when in fact it has largely been influenced by other types of shoreline use and development.

Policy 8.4.3

Potential locations for aquaculture practices are relatively restricted due to specific biophysical requirements such as water quality, temperature, substrate, dissolved oxygen, and salinity. Priority should be given to aquaculture uses in areas having high potential for such uses.

We recommend incorporating this new policy to ensure the SMP is consistent with and advances aquaculture policy provisions in the Guidelines. WAC 173-26-241(3)(b)(i)(B).

Policy 8.4.4

Maximum effort to protect water quality should be made in areas with high potential for aquaculture and current aquaculture areas that have been identified as sensitive areas.

Similar to the new, recommended policy provision above, this policy is consistent with and advances aquaculture provisions in the Guidelines. WAC 173-26-241(3)(b)(i)(B).

Policy 8.4.5

The County should support community restoration projects associated with aquaculture when they are consistent with this Program.

Taylor Shellfish, along with other shellfish growers in Washington State, supports community restoration projects involving aquaculture activities. These projects improve water quality, provide habitat for numerous aquatic species, and help local communities to protect, and

become champions for, the health of the aquatic environment. We recommend the SMP explicitly support these activities.

Policy 8.4.6

The County should consider local ecological conditions and provide limits and conditions to assure appropriate compatible types of aquaculture for the local conditions as necessary to assure no net loss of ecological functions. Aquaculture should not be permitted in areas where it would result in a net loss of ecological functions or adversely impact eelgrass and macro-algae. Aquacultural facilities should be designed and located so as not to spread disease to native aquatic life, or establish new nonnative species which ol'

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cause significant ecological impacts. Unavoidable impacts to ecological functions shall be mitigated.

This new policy is consistent with and advances aquaculture policy provisions in the Guidelines. WAC 173-26-241(3)(b)(i)(A), (C).

DR-8.4.1

The following aquaculture activities may be permitted:

Shellfish aquaculture waterward of the OEIWM, provided that the project is consistent with all applicable federal, state and local requirements.

~~All other aquaculture developments and activities are prohibited within the shoreline jurisdiction, including fish pens and commercial shellfish seeding/culturing.~~

As discussed above, prohibiting commercial shellfish aquaculture is inconsistent with the classification of this activity as a preferred, water-dependent use, and there is no scientific or technical information that supports this prohibition. This prohibition is inconsistent with the SMA and the Guidelines and should be removed in favor of allowing this activity provided it is consistent with all applicable regulatory requirements.¹

DR-8.4.3

¹ Additional revisions should be incorporated into Chapter 5 of the SNIP, as aquaculture is identified as a prohibited activity in the Natural (DR-5.7. 1.b), Shoreline Residential (DR-5.9. 1.a), Urban (DR-5.10. 1.a), and Historic Waterfront (DR-5. 11. 1.a) shoreline environments, Commercial shellfish aquaculture should be identified as an allowed use in these environments, and it should be identified as a permitted use in Table 5.12-1 and Table 5.

Geoduck harvesting aquaculture shall ~~should not be permitted in~~ adversely impact kelp beds or eelgrass beds ~~unless approved by the Washington State Department of~~

This revision is necessary to ensure consistency with the Guidelines. The Guidelines specify: "Aquaculture does not include the harvest of wild geoduck associated with the state managed wildstock geoduck fishery." WAC 173-26-241(3)(b)(i)(A). They further state that aquaculture should, rather than shall, not be permitted in areas where it would adversely impact eelgrass and macroalgae. "Should" and "shall" are defined and carefully utilized in the Guidelines, WAC 173-26-020(34),(37), and the SMP should use these terms in a consistent fashion. Additionally, shellfish farming activities often coexist with eelgrass. Taylor Shellfish has many farms that have been in operation for several decades, and in some cases over a century, that coexist with eelgrass. Impact to eelgrass from aquaculture activities are typically minor in nature and brief in duration. Moreover, commercial shellfish beds can benefit eelgrass through several mechanisms, including stabilizing sediments, increasing water clarity and light penetration, improving dissolved oxygen and nutrient sequestration, enriching sediments,

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reducing desiccation, supporting the food web, and providing habitat structure. Aquaculture-eelgrass interactions are discussed in the programmatic consultation documents discussed above, along with the attached literature from Confluence Environmental Company.

DR-8.4.5

C-10

Applications for geoduck harvest aquaculture shall be submitted on forms provided by the City of Port Townsend and shall include but are not limited to, the following information:

- a. ~~Area~~ Farm size and location;
- b. Harvesting techniques;
- c. A description of associated upland operations (e.g., truck transportation, processing, etc.);
- d. Hours of operation;
- e. A description of existing shoreline conditions (including flora, fauna, natural processes, and adjacent uses);
- f. Relationship to other permits, rules, and

As discussed above, the SMP provisions addressing geoduck activities should reference aquaculture, rather than merely harvest. The reference to "tract" in subsection "a" of this regulation appears to denote wildstock harvest activities, which are managed separately from aquaculture under the Guidelines. For this same reason, "g" should be removed.

DR-8.4.6

C-11

Commercial geoduck harvesting aquaculture may be allowed as a per-mitted conditional use provided that the applicant demonstrates that the location, design, and operation of the propgsaL will not:

- a. Conflict with existing adjacent uses either directly (e.g., obstructing navigational channels) or indirectly (e.g., noise). ~~Limitations on hours of operation may be required to protect adjacent uses.~~
- b. Cause a significant adverse impact on natural shoreline processes;
- c. Cause significant adverse cumulative impacts ~~(i.e., aquaculture operations should be adequately spaced).~~
- d. Degrade critical habitat areas or environmental restoration sites;
- e. Interfere with the migration of aquatic organisms except where specifically intended by the design or operation of the facility; or
- f. Significantly degrade aesthetic quality of the state's shorelines.

These revisions are designed to ensure compliance with the SM4 Guidelines, which specify that wildstock geoduck harvest on DNR-owned property is not considered aquaculture and provide that new geoduck aquaculture activities may be permitted pursuant to a conditional use permit. WAC 173-26-241(3)(b)(i)(A), (iv). The limitation on hours of operation should be removed because it would not allow for successful operations. On at least two separate occasions, the Shorelines Hearings Board has rejected permit conditions designed to address

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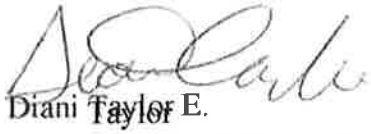
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visual impact concerns when the conditions unduly burdened this preferred use. In one case, the SHB rejected conditions prohibiting work on shellfish farms at night, reasoning that the

"[r]estrictions which make successful aquaculture operations impossible should only be imposed if no other alternative can adequately assure compliance with shoreline regulations and attendant protections for nearby property owners." *Marnin v. Mason County*, SHB No. 07-21, Modified Findings Q/Fact, Conclusions Q/Law and Order at COL 12, 13, 14 (Feb. 6, 2008). In the second case, the SHB rejected restrictive conditions that unreasonably prevented aquaculture merely to protect neighbors from noise and light impacts. *Taylor Shellfish Farms v. Pierce County*, Findings of Fact, SHB Nos. 06-039, 07-003, 07-005, Conclusions of Law, and Order at COL 10, 12. (Jan. 23, 2009). The parenthetical reference to adequate spacing between operations to prevent significant impacts should be removed because it is unsupported by scientific and technical evidence. Shellfish farms frequently abut each other and do not cause significant, cumulative impacts.

Again, I greatly appreciate your consideration of these comments. If you have any questions or are interested in obtaining additional information, please let me know.

Sincerely,

A handwritten signature in dark ink, appearing to read "Diani Taylor E.", is written over the printed name.

Diani Taylor E.
General Counsel, Taylor Shellfish Farms

To: Margaret Barrette, Pacific Coast Shellfish Growers Association

cc: Jesse DeNike, Plauché & Carr

From: Phil Bloch, Marlene Meaders, and Chris Czesla



Date: July 29, 2016

Re: Eelgrass and Shellfish Aquaculture – Review of Relevant Scientific Literature on Ecological Functions and Interactions

This memorandum summarizes scientific literature and observations regarding ecological function at sites containing shellfish aquaculture. As the summaries below note, the introduction of shellfish aquaculture to intertidal habitats has numerous potential positive and negative interactions. Some of these interactions are short-term associated with specific aquaculture activities while others are long-term. However, shellfish aquaculture, when implemented with appropriate best management practices and minimization measures, appears to have minimal individual and cumulative effects to ecological function, particularly when the ecological benefits associated with shellfish aquaculture and the landscape context are considered in addition to the potential suppression or loss of intertidal habitats in areas where aquaculture occurs.

This review of ecological functions evaluates the potential negative and positive interactions of shellfish aquaculture with estuarine habitats through the various potential mechanisms that aquaculture interacts with estuarine habitats.

Ecological Impact Assessment

Negative Interactions of Shellfish Aquaculture

While the placement of gear or activities associated with shellfish aquaculture can result in a disturbance, this change does not necessarily equate to a negative impact. The interactions that can potentially result in a disturbance to the surrounding environment include: (1) shellfish aquaculture gear, (2) working practices, and (3) cumulative effects with other stressors. This information primarily focuses on kelp and native eelgrass also known as submerged aquatic vegetation (SAV). Intermediate levels of disturbance can be associated with increased diversity and species richness (e.g., Connell 1978) because competitively dominant species are unable to exclude other species, a concept that has been observed in a wide variety of ecosystems including marine reefs (e.g., Rogers 1993) and eelgrass beds (Reusch 2006). Dumbauld et al. (2009) indicated that it is important to not only consider disturbance in

terms of a degradation from baseline functions, but also how disturbance can influence the resilience of the system to withstand or recover from additional disturbances. This concept of resiliency is also explored in this section in relation to eelgrass habitat and shellfish aquaculture.

Shellfish Aquaculture Gear

Equipment associated with the culture of shellfish (e.g., nets, racks, bags) can lead to shading, which may affect the spatial extent and density of SAV in the immediate vicinity of shellfish gear. The type and concentration of equipment influence the level of this effect. For example, Everett et al. (1995) found that oyster racks could lead to a total loss of eelgrass directly under the racks. Comparatively, Rumrill and Poulton (2004) determined that the spatial extent of an eelgrass bed and shoot density were negatively influenced when oyster longline culture was closely spaced (1.5 ft to 2.5 ft) but showed no significant effects compared to control sites when spacing occurred at 5-ft and 10-ft spaces between longlines.

Predator exclusion netting used in Manila clam and geoduck clam aquaculture can be detrimental to SAV. Predator exclusion netting is generally not placed over shellfish in areas with eelgrass. However, in at least one example in Washington State (Fisk Bar, Samish Bay), eelgrass recruited into a geoduck clam culture area after the placement of aquaculture gear stabilized the sediment and protected the new eelgrass shoots from erosive wave energy (see the discussion below in positive interactions of shellfish aquaculture). During the grow-out portion of the culture cycle, predator exclusion nets were placed on the bed and Horwith (2013) reported a total loss of eelgrass under predator exclusion netting due to shading effects from *Ulva* sp. growth on the net surface. It should be noted that the eelgrass was shown to recover within 2 years of net removal (Horwith, pers. comm., 2014). Under such a scenario, the functions of eelgrass may have been temporarily offset by the development of a macroalgal community, as described by Powers et al. (2007). Predator exclusion nets or culture gear often gets colonized with macroalgae (Figure 1), which was quantified by Powers et al. (2007) as providing comparable ecosystem functions (e.g., nursery habitat, epibiota biomass) as seagrass beds. However, for the time that they are in place, the netting can negatively impact SAV directly underneath the predator exclusion nets.



Figure 1 **Macroalgae Colonizing Oyster Lines in Blue Heron Bay**

Source: Dewey, pers. comm., 2015

Other effects of shellfish aquaculture gear to SAV include the potential to abrade, scour, or desiccate the plants, although the overall effects can be both positive and negative. For example, Wisehart et al. (2007) explored the concept that, while shellfish can break eelgrass blades through abrasion or harvesting techniques, the reduction in density can release individuals from intraspecific light competition and result in increased growth rates near the aquaculture plots. Similarly, Wisehart et al. (2007) reported that scouring or dredging can result in higher eelgrass seedling density and seed production in the disturbed areas from a mechanical dredge harvest. Alternatively, eelgrass blades can desiccate on shellfish or aquaculture gear, which can eventually lead to a reduction in shoot size (Wisehart et al. 2007, Tallis et al. 2009). These tradeoffs are explored in more detail below.

Working Practices

Shellfish harvest can cause localized and temporary increases in suspended sediments, physical damage and/or removal of SAV, as well as changes to other metrics (e.g., biomass, seed germination, growth). The two practices that likely generate the most suspended sediment are mechanical harvest of oysters and geoduck clam harvest. Shellfish aquaculture typically occurs in areas with sand or gravel substrate, which are substrate sizes that have high settling velocities. For example, Mercaldo-Allen and

Goldberg (2011) reported that suspended sediments may take 30 minutes to 24 hours to resettle in areas typical of oyster and clam aquaculture operations. Suspended sediment effects of shellfish harvest are generally short-lived and recovery is rapid (Short and Walton 1992, Liu and Pearce 2015). Additionally, shellfish culture often occurs in shallow estuarine embayments where freshwater runoff, currents, and wind waves can lead to naturally high background levels of suspended sediments. Therefore, pulse disturbances of suspended sediment by shellfish harvesting often fall within baseline measurements and the natural variability of the system.

Tallis et al (2009) compared eelgrass densities in areas that were harvested: (1) by hand in ground culture, (2) using a mechanical dredge harvester, or (3) by hand on longlines. Although there was a 70% reduction in eelgrass productivity at all aquaculture sites when averaged together, Tallis et al. (2009) pointed out that effects to eelgrass from aquaculture occurred in both directions (positive and negative), and the magnitude of effects observed were dependent on the site and type of harvest method. For example, mechanical dredge harvesting had the greatest level of impact and longline and ground culture had the lowest. While the authors concluded that oyster aquaculture taking place within an eelgrass bed will affect eelgrass, they also indicated that there are opportunities for decreased impacts with tailored culture methods and timing.

Wisehart et al. (2007) also examined the effects of different aquaculture techniques on eelgrass biomass, density, and growth rates in Willapa Bay. As discussed above, the authors reported that shellfish aquaculture may facilitate increased growth rates due to a reduction in intraspecific competition by surrounding plants (e.g., increased light availability), increased seed supply and germination, and a more open seed dispersal setting. In addition, while oysters grown on longlines caused some minor reduction in eelgrass density and cover, the highest eelgrass growth rates occurred at the longline culture and reference sites. These areas also had the greatest eelgrass biomass, density, and percent cover. The study reported statistically significant site and culture type interactions for most variables, suggesting that site-specific conditions may be just as influential as aquaculture techniques in determining eelgrass parameters.

Boat access can also result in potential negative impacts to eelgrass shoots. Ruesink et al. (2012) conducted experimental treatments in Willapa Bay where they imposed two disturbance types: shoot damage and shoot removal. For the most part, the extent of damage from boat propellers would result in taking off the ends of the shoots (i.e., shoot damage), but not removing the entire shoot. Regrowth for eelgrass that is only damaged on the surface requires branching of the plant to replace the lost biomass. Growth rates of eelgrass affected by shoot damage for less than 4 weeks recovered within 2 months following a single cutting event when the rhizome was still rooted. There would be no long-term reduction in eelgrass density for this type of action.

Potential longer term impacts were calculated based on an accumulation of shoot removal over a year or more (e.g., consistent access routes). If the shoot is removed, the removal area can be repopulated by rhizome extension from shoots at the edge (asexual reproduction) or germination of seeds (sexual reproduction). Ruesink et al. (2012) reported that recovery of eelgrass after complete shoot removal (6.6 x 6.6 ft gaps) could occur after 2 years. Based on this rate of recovery, a conservative estimate of a

propeller scar width of 3 ft could replace the lost biomass in approximately 0.9 year. If regrowth occurs at a rate faster than removal, it can be assumed that there would be no significant loss in biomass from this type of activity unless an area is not allowed to regrow through continuous disturbance.

Cumulative Effects with Other Stressors

Boström et al. (2006) conducted a meta-analysis of the scientific literature associated with plant-animal interactions in seagrass landscapes. According to this analysis, the authors indicated that, "The growth and recruitment dynamics of seagrasses as well as man-made and/or natural disturbances create complex spatial configurations of seagrass over broad (metres to kilometres) spatial scales. Hence, it is important to identify mechanisms maintaining and/or threatening the diversity-promoting function of seagrass meadows and to understand their effects on benthic populations and communities." It is well recognized that there are a variety of natural and anthropogenic stressors on aquatic environments (Dennison 1987, Fonseca and Bell 1998, Shaughnessy et al. 2004, Boese et al. 2005, Mumford 2007, Thom et al. 2011, Stevens and Lacy 2012).

A few studies address landscape-scale changes to eelgrass relative to shellfish aquaculture. The most comprehensive analysis of factors that drive the changes at a landscape-scale was conducted by Dumbauld and McCoy (2015). This study modeled eelgrass (*Z. marina*) density in Willapa Bay and compared a number of predictors, including: (1) distance to estuary mouth, (2) distance to channel, (3) salinity, (4) elevation, (5) cumulative wave stress, and (6) shellfish aquaculture. The amount of eelgrass cover within oyster aquaculture beds was slightly lower than the model predicted, but the impact directly associated with aquaculture represented less than 1.5% of the total predicted eelgrass cover in any year. Eelgrass is generally present and intermingles with oysters on all aquaculture beds at the tidal elevations where eelgrass is found in Willapa Bay, which suggests that current oyster aquaculture practices do not substantially reduce and may even enhance the presence of eelgrass at the estuarine landscape scale. The observed reductions in eelgrass cover in Willapa Bay are within the range of existing natural disturbances to the system (e.g., winter storms) that eelgrass is inherently adapted to. Furthermore, when the functional value of eelgrass and shellfish are combined, and the landscape matrix of habitats are considered, it is possible that a broader ecosystem perspective would find benefits from the presence of aquaculture (Dumbauld and McCoy 2015).

Aside from the overall low amount of impact to eelgrass at the landscape-scale, the Dumbauld and McCoy (2015) work also indicated that the harvest method was a significant predictor in explaining eelgrass reduction. For example, mechanically harvested beds had a significantly lower amount of eelgrass compared to beds harvested by hand or with a mixed harvest technique (similar to the results reported by Tallis et al. 2009). Comparatively, the type of aquaculture (e.g., longline, seed bed, fattening ground) was not a significant contributor to the variation of eelgrass predicted versus actually observed. The authors suggested that, overall, aquaculture resulted in a minor change to eelgrass at the landscape-scale because the effect of culture was variable enough at smaller spatial scales as to eliminate a significant effect at the landscape-scale.

As stated throughout this report, the landscape-scale is very important to consider when trying to protect for mobile species, such as fish and crabs. This sentiment was stated within Semmens (2008),

where the author indicated that, “From a management perspective, it may therefore be tempting to downplay the importance of fine-scale benthic habitats in favor of larger-scale estuarine features such as deep tidal channels and salinity gradients for smolt-sized fish.” Although it is important to understand small-scale effects in order to effectively manage potential effects to eelgrass, it is the landscape-scale that determines how species will use the habitat.

Eelgrass Resilience

Holling (1973) defined resilience as “a measure of the ability of these systems to absorb change of state variables, driving variables, and parameters, and still persist.” In a study of evaluating the effects of disturbances to eelgrass, Reusch (2006) notes that eelgrass shows “remarkable resilience” towards small scale physical gap disturbance. Native eelgrass exhibits a stable and possibly increasing trend in distribution and abundance in areas like Willapa and Humboldt bays where oysters have been actively farmed for over 100 years and are currently used by commercial growers (Barrett 1963, Tallis et al. 2009, Dumbauld et al. 2011). Therefore, it appears that there is resilience of eelgrass to the level of shellfish aquaculture activities in these estuaries. It is notable that shellfish aquaculture in both Willapa Bay and Humboldt Bay represent approximately 20% or more of the surface area within the bay.

Positive Interactions of Shellfish Aquaculture

Many effects of shellfish aquaculture can be considered a positive interaction with SAV and the surrounding habitat. According to Forrest et al. (2009), “the acceptability of aquaculture operations or new developments should recognize the full range of effects, since adverse impacts may be compensated to some extent by the nominally ‘positive’ effects of cultivation.” There are a number of effects described below that can potentially result in beneficial changes to the surrounding environment.

Sediment Stabilization and Eelgrass Colonization

Shellfish have been labeled “ecosystem engineers” because of the ecological roles that they play in coastal habitat processes (Jones et al. 1994, Lenihan 1999). For example, the presence of shellfish can protect shorelines from erosion by stabilizing sediments and dampening waves (Meyer et al. 1997, Scyphers et al. 2011, Spalding et al. 2014). This same function provided by shellfish can benefit eelgrass. Eelgrass has been known to expand into areas after sediments are stabilized. There are numerous examples along the West Coast where eelgrass expanded into shellfish aquaculture plots. The information for most of these examples is primarily anecdotal, with notable exceptions (e.g., Ward et al. 2003), and the cause has not been directly linked to the aquaculture operation. Overall, current shellfish aquaculture practices have not been associated with significant loss in the spatial extent of eelgrass and in some cases can be linked to expansion of eelgrass at a landscape-scale.

Potential recruitment of eelgrass into shellfish aquaculture plots is driven by three main mechanisms. First, by providing a larger boundary layer and slowing water current speed, shellfish may increase recruitment of floating seeds as they travel singly or within detached reproductive shoots. Retention of seedlings could also be facilitated by the structure shellfish gear provide, although the density and type of gear can impede seed dispersal (see Tallis et al. 2009). Seed dispersal is typically limited outside of an

eelgrass bed; approximately 80% of seeds travel within 33 ft (10 m) of parent plants (Orth et al. 1994, Ruckelshaus 1996). Therefore, this effect is only important when eelgrass beds are nearby. Second, by filtering seawater and increasing sediment organic content, bivalves provide superior conditions for seed germination. Eelgrass seed germination is dependent on burial depth, with the highest germination occurring at the anaerobic/aerobic interface (Bigley 1981). Seeds buried below this depth have very low germination and are essentially lost from the population. Shellfish may act to bury and fertilize seeds at a depth that is appropriate for germination. Third, shellfish may increase the survival of seedlings, which have very high mortality rates, by increasing light levels, nutrients, and protecting against erosion and herbivory (Orth et al. 1994, Ruckelshaus 1996). Note that filter-feeding effects to light levels are discussed in more detail below. Reusch (2006) characterizes *Z. marina* as a continual recruitment species where seedlings are continuously being introduced into existing beds in addition to establishing into canopy gaps and adjacent areas.

A case study that highlights the potential for eelgrass to colonize into an area previously devoid of eelgrass is a sand bar (Fisk Bar) in the center of Samish Bay, Washington. Prior to geoduck aquaculture on Fisk Bar, seeds from the surrounding eelgrass beds would occasionally result in ephemeral shoots on the sand bar that would get eroded during winter storms. In 2002, geoduck nursery tubes (6-inch-diameter polyvinyl chloride [PVC] tubes) for planting geoduck seed were placed to establish the first geoduck crop on Fisk Bar (Figure 2). Shortly after nursery tubes were placed, eelgrass began to fill in and establish a dense bed around the tubes (Dewey, pers. comm., 2015). For this first crop of geoduck, individual net caps were placed on each tube. When the tubes were removed 2 years after seeding, eelgrass was established well enough that it remained and thrived on the sand bar.

In 2008, when the geoducks were harvested, eelgrass was significantly reduced but not eliminated. After this first harvest event, nursery tubes were reinstalled, seeded with geoducks, and the entire tube field was covered by predator exclusion nets. As described above, Horwith (2013) reported a total loss of eelgrass in areas where the predator exclusion netting was placed. The eelgrass loss was attributed to shading effects from *Ulva* sp. growth on the net surface. Recovery of eelgrass began 1 year after removal of tubes and nets. In July 2014, Dr. Horwith (pers. comm., 2014) indicated that, "there is no longer any significant difference in eelgrass coverage or density between the farmed and unfarmed areas" (see Figure 2). Overall, the Fisk Bar eelgrass bed appears to be resilient and thriving in an area where it could not previously establish.



Fisk Bar, Samish Bay, 2002: Planting Geoduck Seed with Culture Tubes and Individual Net Caps. No eelgrass bed present prior to planting activities.



Fisk Bar, Samish Bay, 2014: Eelgrass Bed prior to Harvest Activities

Figure 2 Eelgrass at Fisk Bar, Samish Bay, between 2002 and 2014

Source: Dewey (pers. comm., 2015)

Increased Water Clarity and Light Penetration

Shellfish aquaculture can result in a reduction in turbidity due to removal of phytoplankton and particulate organic matter through filtration (Peterson and Heck 2001, Newell and Koch 2004, Cranford et al. 2011). By consuming phytoplankton and particulate organic matter, shellfish increase the amount of light reaching the sediment surface that is available for photosynthesis (Dame et al. 1984, Koch and Beer 1996, Newell 2004, Newell and Koch 2004). Improvements to water clarity and light penetration can improve habitat conditions that promote the growth of SAV and other aquatic vegetation. There is an optimum range for feeding efficiency, identified as suspended solid concentrations between 5 mg/L and 25 mg/L based on oysters in Chesapeake Bay, Maryland (Cerco and Noel 2007). Therefore, this benefit can be limited when suspended sediment concentrations are outside of this range.

The removal of nutrients (especially nitrogen) through filtration can also benefit SAV growth by reducing epiphytes and macroalgae (Figure 3). Epiphytes (primarily diatoms) can form thick layers on eelgrass blades. This is a natural process, and important in the food chain because this layer of epiphytes is grazed by aquatic invertebrates (van Montfrans et al. 1984, Nelson and Waaland 1997). However, overproduction of epiphytes is a result of nutrient water column pollution (Williams and Ruckelshaus 1993, Hauxwell et al. 2001, Nielsen et al. 2004). Shellfish aquaculture can provide mitigation of these conditions through water filtration and control of nutrients that promote the growth of epiphytes.

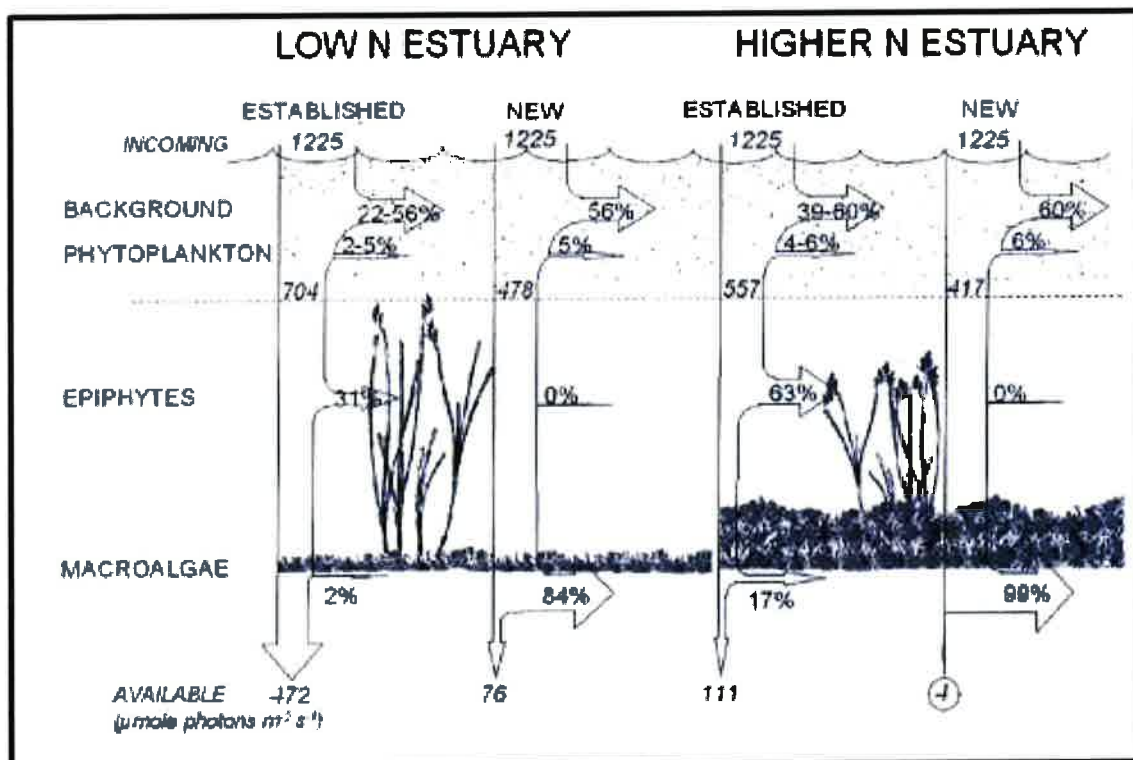


Figure 3 Illustration of Nitrogen Concentration Effects to Eelgrass

Source: Hauxwell et al. (2001)

Another service potentially provided by shellfish related to epiphytes was explored by Peterson and Heck (2001). The authors observed a significantly reduced epiphytic load on seagrass leaves when mussels were present. Spaces between shells of adjacent mussels were thought to provide a predation refuge for epiphytic grazers (e.g., small gastropods and amphipods). Increased densities of epiphytic grazers could then lead to an increased amount of grazing, which consequently might lead to an increase in leaf light absorption. This study also noted that the mussels themselves may potentially reduce epiphytic loads by consuming the epiphyte propagules before recruitment to the leaves. Although likely a benefit to eelgrass, the shellfish would need to be in the eelgrass bed to provide this service for epiphytic grazers.

Macroalgae does not colonize eelgrass shoots in the way that epiphytes do, but changes in the amounts of nutrients in the aquatic environment can shift the competitive balance between aquatic vegetation species, allowing plants that can respond quickly to nutrients to dominate (Taylor et al. 1995, Schramm and Nienhuis 1996, Taylor et al. 2001, Cardoso et al. 2004, Nielsen et al. 2004, Mumford 2007, Smetacek and Zingone 2013). The mechanism for loss of eelgrass and other SAV is likely related to a combination of light competition (Nienhuis 1996), smothering by macroalgal blooms (den Hartog and Phillips 2000), and competition for nutrients (Nienhuis 1996).

Improvements to Dissolved Oxygen and Nutrient Sequestration

Phytoplankton, as primary producers, create oxygen through photosynthesis. The mechanism by which dissolved oxygen (DO) is reduced is a result of a phytoplankton bloom produced by an increase in nitrogen in the system. As Albertson et al. (2002) indicated, south Puget Sound is sensitive to nitrogen addition generating phytoplankton blooms. When excess plankton die from not being consumed, bacteria consume the plankton and have a secondary bloom as a result, which consumes oxygen and results in low DO concentrations. This process is also known as the biochemical oxygen demand (BOD) of the system.

Washington Department of Ecology created a model of south and central Puget Sound, Washington (Ahmed et al. 2014) to identify how much nutrient sources are contributing to low DO concentrations. The model predicted minimum DO concentrations under natural conditions (left map of Figure 4), which was then used to evaluate whether water quality standards (right map of Figure 4) were being violated. Figure 4 shows that DO falls below the applicable criterion throughout most of south and central Puget Sound. Ahmed et al. (2014) also predicted that reducing the internal human nutrient load would decrease the magnitude and extent of DO depletion in south and central Puget Sound. According to recent modeling by Banas and Cheng (2015), the authors hypothesized that “these inlets [Henderson, Eld, Totten, Hammersley, and upper Case inlets] are at noticeably lower risk of eutrophication than they would be in the absence of shellfish aquaculture.”

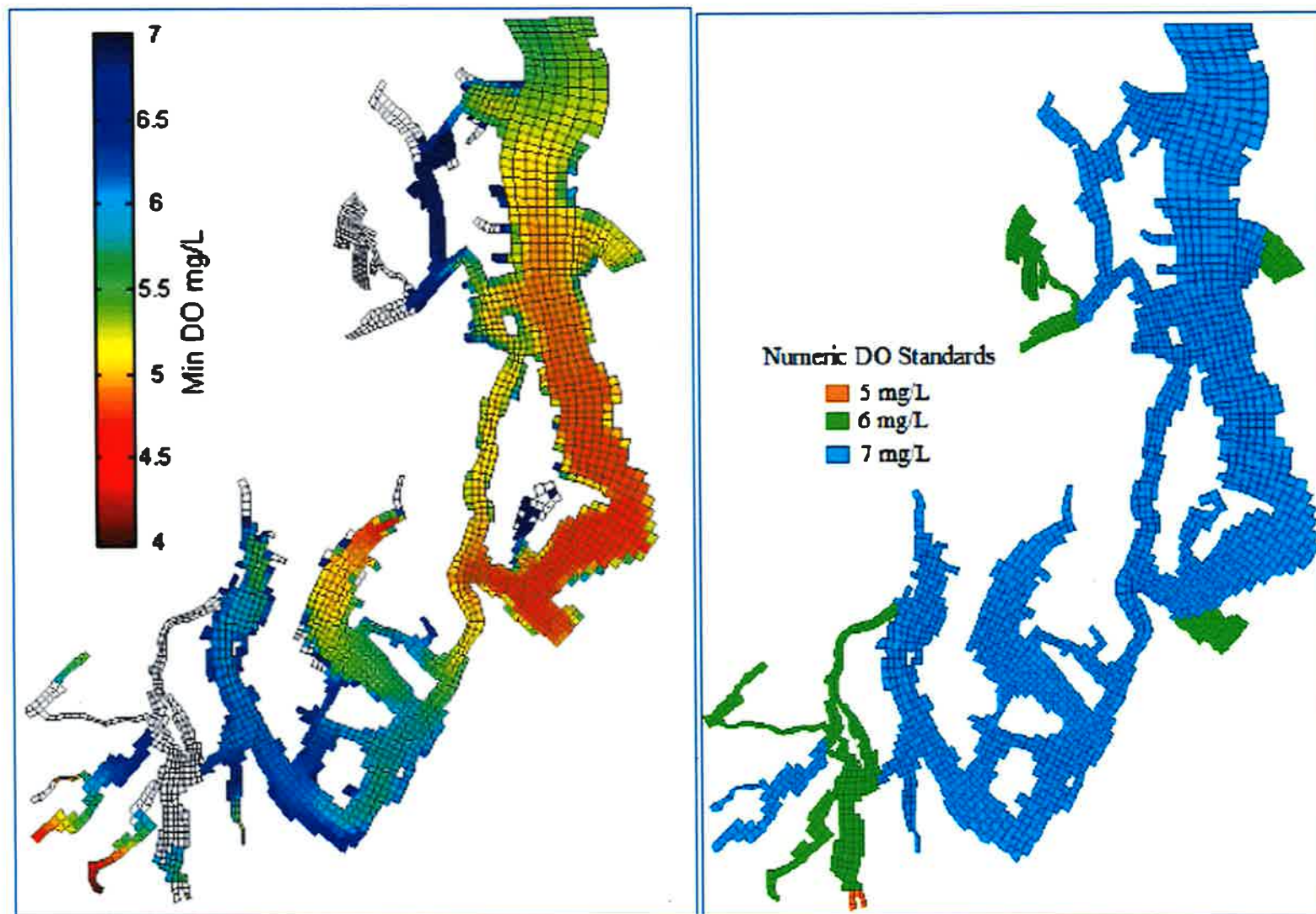


Figure 4 Minimum Dissolved Oxygen below the Numeric Standard under Natural Conditions

Source: Ahmed et al. 2014

An emerging body of literature is indicating that shellfish aquaculture, or the presence of a dense bivalve community, may provide some control of human nutrient loading to water bodies (Newell 2004, Shumway et al. 2003, Newell et al. 2005, Burkholder and Shumway 2011, Kellogg et al. 2013, Banas and Cheng 2015, Bricker et al. 2015). Bivalves remove more nutrients from the water column than they input as biodeposits, which can have a net benefit to water quality. As bivalves filter organic matter from the water column, they assimilate nitrogen and phosphorus into their shells and tissue (Figure 5).

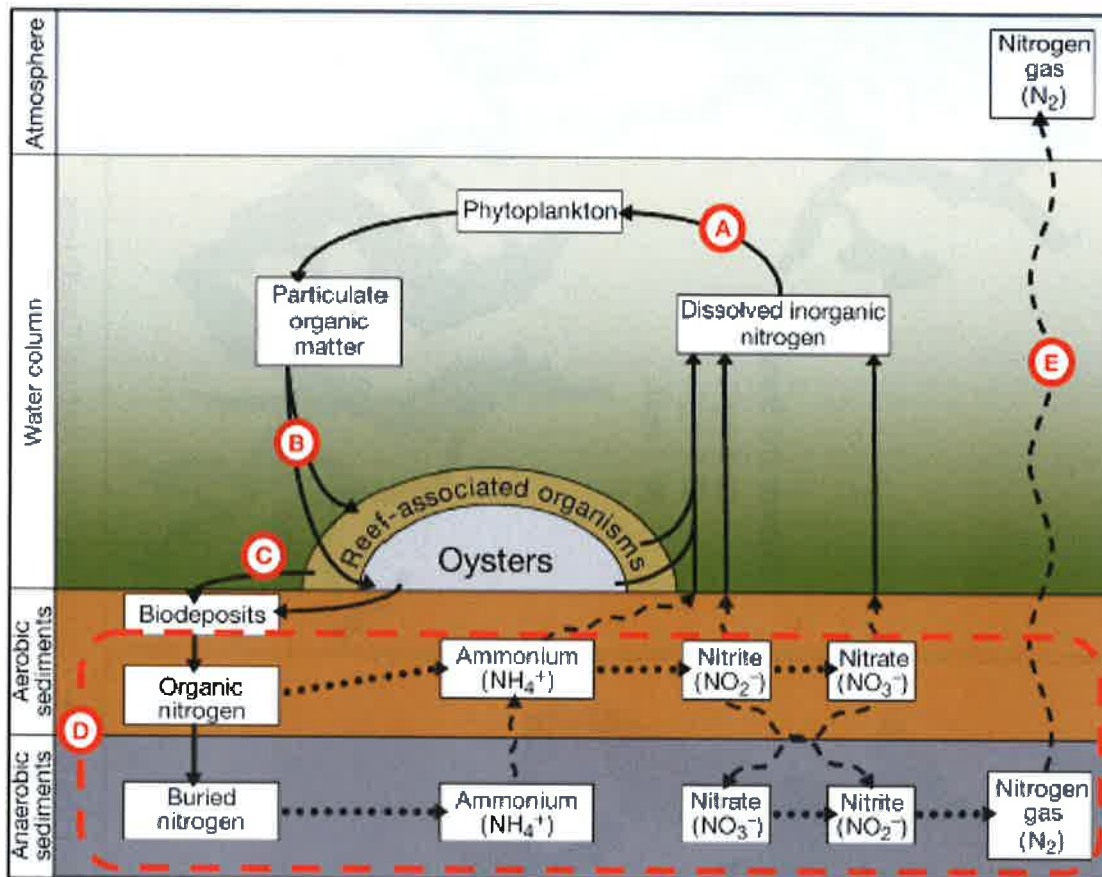


Figure 5 Nitrogen Pathways Associated with Oysters and Reef-Associated Organisms

Notes: Phytoplankton use dissolved inorganic nitrogen for their growth (A), oysters and reef-associated organisms filter phytoplankton and other particulate organic matter from the water column (B), some of the associated nitrogen is incorporated into organisms and some is deposited on the surface of the sediments (C), and, given the right conditions, a portion of the nitrogen in these biodeposits is transformed into nitrogen gas (D) which diffuses out of the sediments back to the atmosphere where it is no longer available to phytoplankton for growth (diagram adapted from Newell et al. 2005).

Source: Kellogg et al. (2013)

When shellfish are harvested, the sequestered nutrients are permanently removed from the system, also known as bioextraction. According to Newell (2004), bioextraction is one of the only methods

available that removes nutrients after they have entered a system, which can then make that system more resilient to nutrient loading and ultimately decreases in DO. Similarly, bivalve filter-feeding also serves an important role in improving water quality conditions through benthic-pelagic coupling, which is when biodeposits become incorporated into aerobic surficial sediments, and microbially mediated processes facilitate nitrification-denitrification coupling to permanently remove sediment-associated nitrogen as nitrogen gas (also shown on Figure 5).

The amount of benefit to water quality is dependent on species-specific filtration rates. A recent effort to calculate filtering capacity within south Puget Sound (Ferriss 2015) compiled clearance rates for Pacific oyster, Manila clam, and geoduck (Table 1). According to Banas and Cheng (2015), the potential for local control by shellfish was shown to be possible in Henderson, Eld, Totten, Hammersley, and upper Case inlets, and Oakland Bay. Therefore, shellfish filtration in estuaries could have an influence on local water quality parameters, even if small compared to the inputs into the system.

Table 1 Clearance Rate Calculations for Pacific Oyster, Manila Clam, and Geoduck.

Species	Indiv. W_{wet} (g)	$L\ hr^{-1}\ indiv^{-1}$	$L\ hr^{-1}\ W_{wet}^{-1}$	Source
Pacific oyster	11.52	3	0.260	Kobayashi et al. 1997, Ruesink et al. 2006
Manila clam	18.19	1	0.060	Ruesink et al. 2006, Solidoro et al. 2003
Geoduck	980	3	0.003	Davis 2010
Source: Banas and Cheng 2015				

An example of the potential benefits offered by shellfish filtration and nutrient sequestration is provided by Kellogg et al. (2013), who partially quantified the removal of nutrients from the water column at a subtidal oyster reef restoration site compared to an adjacent control site in the Choptank River within Chesapeake Bay, Maryland. The authors indicated that denitrification rates at the oyster reef in August were “among the highest ever recorded for an aquatic system.” In addition, a significant portion (47% and 48% of total standing stock) of the available nitrogen and phosphorus were sequestered in the shells of live oysters and mussels. An ancillary benefit of the shellfish reef structure, which is also true for shellfish aquaculture gear and shellfish, was that the structure and faunal composition provided ample microhabitats for communities of nitrifying microbes. One of the conclusions by Kellogg et al. (2013) was that oyster reef restoration could be considered a “safety net” to reduce additional downstream impacts to water quality. Because shellfish aquaculture provides many of the same benefits, with the added benefit of the total removal of nutrients at harvest, commercial shellfish aquaculture can be considered a net benefit to water quality ecosystem functions.

Sediment Enrichment

The biodeposits created through bivalve filter feeding contribute to organic materials in the sediment surface, as described above. When organic materials accumulate, the amount of DO needed to break down the material can be exceeded and lead to anoxic conditions in the sediment (Nizzoli et al. 2005). Effects are variable, depending on the type of culture. For example, suspended culture results in only the transfer of organic material to sediment compared to more mixing for ground culture. Effects are

expected to be localized, and the extent is influenced by the density of shellfish relative to water circulation (Callier et al. 2006, Dumbauld et al. 2009, Konrad 2013).

Eelgrass can derive nutrients from both the sediments and the water column. The interstitial water (or sediment porewater) contains relatively higher concentrations of dissolved inorganic and organic nutrients than the water column, and eelgrass obtains most macronutrients from sediments. Sediment reservoirs of nutrients can become depleted when biogeochemical regeneration rates cannot meet plant demands (Short 1987). However, in the course of removing water column particulates, shellfish also alter sediment characteristics positively by moving carbon and nutrients from the water column to the benthos. Although studies related to sediment “fertilization” from bivalve deposition have shown enhanced eelgrass growth along the East Coast (e.g., Peterson and Heck 1999), similar studies in the Pacific Northwest appear to show no effect on eelgrass growth (Wagner et al. 2012, Ruesink and Rowell 2012, Wheat and Ruesink 2013). Studies in the Pacific Northwest indicate that eelgrass is not generally nutrient limited or that sediment porewater nutrients are naturally high.

Reduced Desiccation

As the tide recedes, shellfish retain seawater as they shut down filter feeding to wait for the returning tide. The water that is retained in the mantle cavity is expelled prior to the tide returning, creating a spray of water that is released into the surrounding environment. One of the species that can expel a significant amount of water is the geoduck (Figure 6). Water retention and release from other shellfish species may act in a similar fashion. Although this is likely a minor ecosystem function, it potentially reduces desiccation pressure when eelgrass is exposed during a low tide.

Shellfish gear can also result in the creation of micro-habitat around the structures, which can also retain water and provide opportunities for eelgrass growth. For example, at an existing longline aquaculture operation in Humboldt Bay, California, there is scouring around the PVC posts and eelgrass is growing within the depressions. Based on the surrounding habitat, the presence of culture is providing a slight change in elevation that allows eelgrass to persist. While sediment changes shift seasonally, especially at higher elevations, existing data suggests that sediment changes are minor, especially in relation to the natural sediment dynamics that drive the system (Forrest and Creese 2006, Forrest et al. 2009, Osborne 2015).

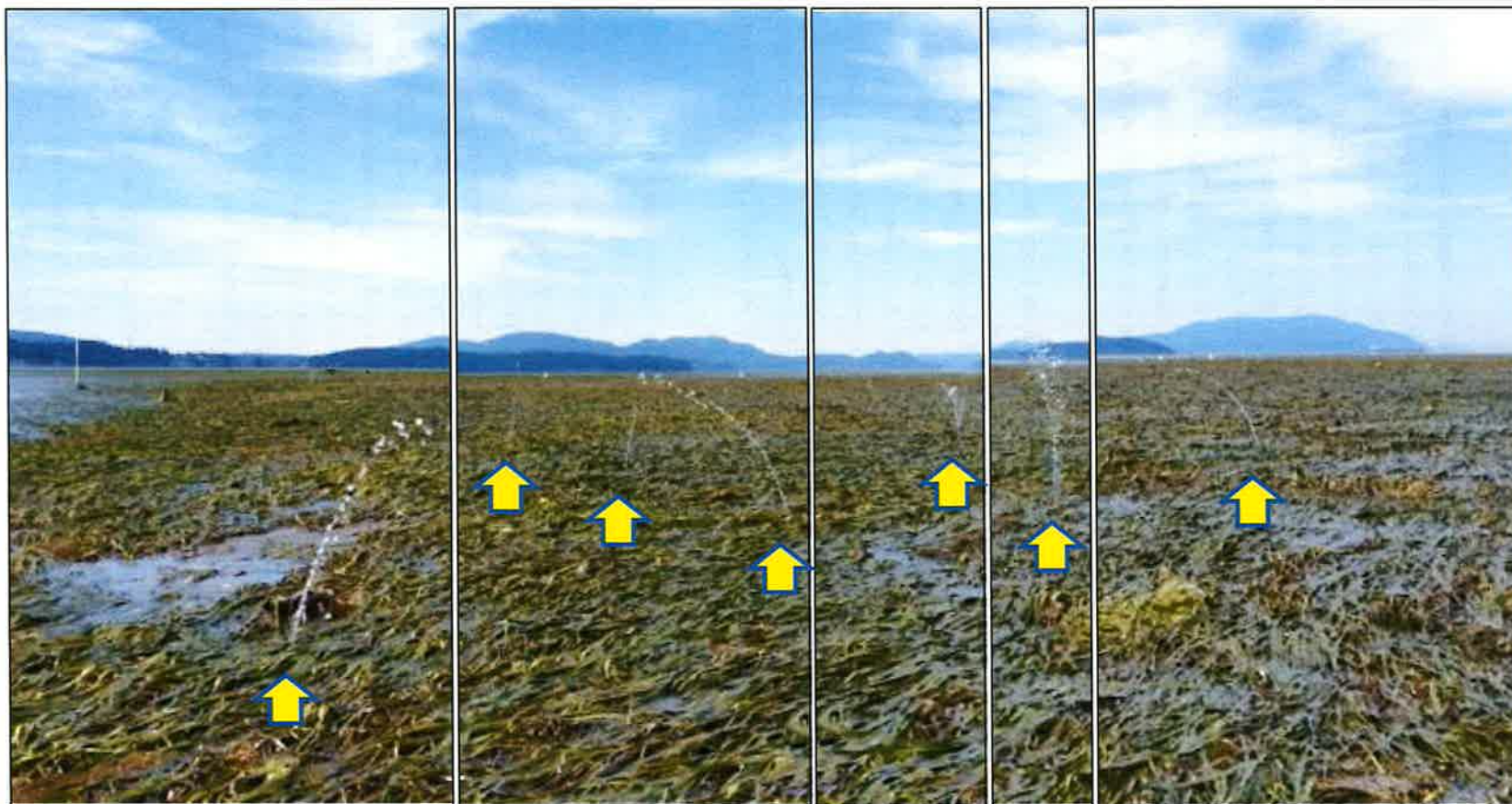


Figure 6 Potential Ecosystem Service (Reduced Desiccation) Provided by Geoduck Aquaculture to Native Eelgrass

Notes: Arrows indicate geoduck expelling water onto the adjacent eelgrass bed.

Source: Dewey (pers. comm., 2015)

Support of the Food Web

Eelgrass and kelp (i.e., SAV) are common perennial aquatic plants that create three-dimensional habitat structure and form extensive intertidal and subtidal beds in estuaries and coastal areas. These beds are an important component of coastal ecosystems because they stabilize coastal sediments, provide direct and indirect food sources for marine species, and provide nursery habitat for many marine species (Phillips 1984, Short et al. 2000, DNR n.d.). Because eelgrass and kelp are autotrophs, which means that they produce complex organic compounds (e.g., carbon-based solid) from simple substances present in the surrounding environment (e.g., light and nutrients), many ecosystem functions of plants cannot be replaced by higher trophic organisms, such as shellfish. That said, many of the cultured shellfish crops, with the exception of triploid oysters, spawn several times before reaching harvest size. These events produce billions of planktonic larvae, the vast majority of which are consumed by predators.

In addition, structured habitat (both eelgrass and shellfish aquaculture plots) can result in a higher abundance of prey organisms. Hosack (2003a) reported that important fish prey, such as harpacticoid copepods, exhibited an inverse trend with higher densities in both dense eelgrass and oyster habitats. These observations parallel those of Ferraro and Cole (2007, 2011, 2012), from oyster bottom culture in Yaquina Bay, Oregon, Willapa Bay, Washington, and Grays Harbor, Washington. The authors reported similar species abundance and richness in benthic macrofaunal communities between native eelgrass and oyster habitat in the three areas studied. Both eelgrass and oyster habitats had significantly more prey resources than mudflat or sandy habitats. This serves to illustrate the relative importance of eelgrass and shellfish-rich habitat in coastal estuaries as refugia and a source of prey for foraging nekton and other marine life.

A recent study by Dumbauld et al. (2015) studied whether intertidal oyster aquaculture in Willapa Bay effects the distribution and feeding ecology of juvenile salmonids. The study identified no significant differences in the density of juvenile salmonids caught in the four habitat types analyzed (undisturbed open mudflat, seagrass, channel habitats, and oyster aquaculture), and few significant associations with the prey items that the fish consumed. The majority of salmon found over low intertidal habitats were not dependent on structured habitat (e.g., eelgrass or oyster aquaculture) for prey items. Chum salmon was the possible exception, which is typically a smaller fish during estuarine residency. The final conclusion by Dumbauld et al. (2015) was that: "Permanent or 'press' disturbances like diking marshes, dredging and filling shallower estuarine habitats and even hardening shorelines would be expected to have significant impacts for other stocks and life history variants with smaller juveniles that utilize upper intertidal areas (Fresh 2006; Bottom et al. 2009), but our research suggests that short term 'pulse' disturbances like aquaculture which alter the benthic substrate in lower intertidal areas used primarily by larger juvenile salmon outmigrants may pose a less significant threat to maintaining resilience of these fish populations."

Finally, McDonald et al. (2015), included observations of fish species and groups associated with PVC tubes and nets, including flatfish, demersal fish, and surfperch (discussed in more detail below). The results of the McDonald et al. (2015) study were incorporated into a recent model for central Puget Sound that looked at the effects of geoduck aquaculture on food web ecology (or predator-prey

interactions). This effort reported that a 120% increase in the current level of geoduck culture would result in substantial increases in biomass densities of surfperch, nearshore demersal fish, and small crabs, and decreases in great blue herons, bald eagles, seabirds, flatfish, and certain invertebrates (e.g., predatory gastropods and small crustaceans) (Ferriss et al. 2015). The results were based on the mediating function in the Ecopath with Ecosim (EwE) model, which to a certain extent forced the entire food web to use the resources associated with the geoduck farms rather than more broadly. When this was not the case (e.g., without the mediating function), there was no change in the food web ecology associated with central Puget Sound. Based on a recent conversation with the authors (McDonald, Pers. Com. 2015), it was understood that the Ferriss et al. (2015) paper was intended as a way to identify new research priorities and potential pathways of effect, and was not intended to be used as a way to predict impacts from an increase in gear associated with geoduck aquaculture operations. The model represents a model reality which is useful for evaluating general patterns and to identify sensitivities of resources to ecosystem changes, however the model is not and should not be used as predictive, nor should values be considered to be absolute (McDonald, pers. com. 2015). Due to assumptions implicit in the model outputs, further field observations will be needed to validate modelled predictions associated with increasing geoduck culture are being realized and to further validate the model.

Preikshot et al. (2015) developed a similar EwE model, but for south Puget Sound with parameters extracted from observations during the period 1970 to 2012, and not using the mediation functions in the same manner as Ferriss et al. (2015). This parameterized model by Preikshot et al. (2015) was used to evaluate the potential effects of growth in shellfish aquaculture on other aspects of the food web. The model forecasted various scenarios through 2054, and the scenarios that included a 10-fold expansion of shellfish aquaculture (oysters, mussels and geoduck clams) was unlikely to significantly influence the biomass of other species. While such ecosystem models can identify biomasses of ecosystem components, they are not an effective mechanism for identifying the mechanism for biomass change and the cause of that change may be due to processes outside of the modelled area (e.g., salmon life stages that occur beyond the modelled area). That said, the model identified few negative feedbacks associated with bivalve aquaculture. Overall, the study suggested that shellfish aquaculture, as presently configured and even with a significant expansion of culture activities, is benign or beneficial to most species.

Habitat Structure (Density-Dependent)

A significant benefit offered by shellfish aquaculture is the ability to provide nursery habitats that create transitional zones between mudflats and SAV habitat. One of the most comprehensive analyses of the attributes relevant to identifying the role of nursery habitat was performed by Heck et al. (2003). The authors conducted a meta-analysis of more than 200 papers that compared seagrass beds to other habitats, and examined the data using the attributes suggested by Beck et al. (2001) for defining the ecological processes operating in nursery habitats, including: density, growth, survival, and migration to adult habitat. The results indicated that few significant differences existed between the relevant attributes when seagrass meadows were compared to other structured habitats, such as oyster reefs, cobble reefs, or macroalgal beds. The most important determinant of nursery value was the presence of structure rather than the type of structure.

What does appear to be an important determinant in terms of the quality of habitat provided is density and diversity. Optimal foraging/movement and fitness strategies depend on a mosaic of different habitats, and edges or transitional zones between two habitat types often represent areas with increased biological diversity (Holt et al. 1983, Orth et al. 1984, Boström et al. 2006). For example, several species of fish are found in higher densities in patchy eelgrass beds versus continuous dense beds (Orth et al. 1984). Holt et al. (1983) suggested that some species of fish require open feeding areas and refuge areas in the same location, and that patchy vegetation with a high percentage of edges may support higher densities of mobile foraging species.

The observations of edge effect are partially supported by a recent study in Humboldt Bay, California, by Pinnix et al. (2013). The study used acoustic transmitters that were surgically implanted into out-migrating coho salmon (*Oncorhynchus kisutch*) smolts. During their residency in Humboldt Bay, coho smolts primarily used deep channels and channel margins. They were detected near floating eelgrass mats adjacent to the channels, but not over eelgrass beds. The results from this study potentially emphasize the importance of edge habitat and the need for structural heterogeneity during salmonid residency and migration through the estuary.

In terms of prey resources, similar to that reported above, Tanner (2005) found epifauna, such as tanaids and gammaridean amphipods (i.e., typical salmonid prey items), exhibited significantly higher abundances at sand/seagrass edges versus seagrass bed interiors. Similarly, Hirst and Attrill (2008) determined that eelgrass patches, regardless of size or number of plants, were found to support a higher level of biodiversity than surrounding sand habitats. Thus, it could be argued that modest displacement of eelgrass resulting in some patchiness may be neutral or beneficial for certain species, such as salmonids, provided that an abundance of eelgrass was present in the surrounding environment to ensure that none of the other ecological functions provided by eelgrass were significantly reduced.

Ancillary Benefits

In addition to direct beneficial interactions between shellfish aquaculture and eelgrass, the presence of aquaculture within an embayment or watershed may provide indirect benefits to SAV through a variety of mechanisms. The aquaculture industry is inherently reliant on the maintenance of good water quality conditions to ensure the safety and survival of their product. Because of this incentive, there are numerous examples of actions taken by aquaculture companies and their supporters that result in improvements to water quality and/or the prevention of anthropogenic activities threatening water quality and habitat function in areas where aquaculture occurs (Dewey et al. 2011).

Examples of some ancillary benefits of the shellfish aquaculture industry include:

- Working with local jurisdictions and regulators to identify and eliminate point and non-point source pollution, including agricultural, industrial, and municipal discharges.
- Participating and providing input on regulatory updates to ensure that high water quality standards are included in local, state, and federal policies.

- Lobbying state and federal legislatures for improvements to water quality and developing water quality standards (e.g., shellfish industry contribution to the enactment of the Clean Water Act in 1972).
- Maintaining ownership or leases of large aquatic areas and upland, thereby eliminating the risk of environmentally deleterious uses.
- Participating in and collecting water quality samples as part of monitoring programs with federal and state agencies (e.g., National Shellfish Sanitation Program) to track water quality trends and identify areas targeted for improvement. These efforts have directly resulted in numerous areas now being determined suitable for shellfish harvesting and have provided data for other target areas with opportunities for improvement.
- Donating to local and state organizations to improve water quality conditions within the estuaries that shellfish aquaculture occurs.
- Organizing and participating in beach cleanup events that collect marine debris from both shoreline development and shellfish aquaculture operations.
- Actively engaging in efforts to quickly remediate and clean up oil spills and other hazardous waste sites to protect water quality and the health of shellfish.
- Encouraging shellfish gardening through sponsored seed and gear sales (e.g., Taylor Shellfish annual events in Washington State). Shellfish gardening encourages land owners to learn about the importance of maintaining properly functioning septic systems, controlling pet and domestic animal wastes, and the fate of herbicides and pesticides from lawns and gardens.

CONCLUSIONS

This technical report provided a review of the relevant literature, as it pertains to interactions between shellfish aquaculture and the surrounding environment. Overall, commercial shellfish aquaculture is a highly regulated activity within federal, state, and local jurisdictions. As indicated by numerous independent researchers and agencies, a well-managed shellfish aquaculture farm can result in minimal individual and cumulative adverse impacts to ecological functions, and for some parameters (e.g., water quality) can result in net positive benefits to the surrounding environment. Shellfish aquaculture can work within the resiliency of the system because of the avoidance, conservation, and minimization measures developed, and advancing technologies that allow for a reduction of human presence within a farm.

Although shellfish aquaculture does not provide identical functions as eelgrass, there are similarities in terms of the organisms it supports and services that it provides. Some of the most pertinent examples include enhanced water quality and clarity, nutrient cycling, habitat structure, and prey resources that can support an elevated community of fish and wildlife.

Through a thorough exploration of the literature we believe that properly implement aquaculture activities have minimal, or even beneficial, individual and cumulative environmental impacts and are

consistent with a finding of no net loss of ecological function in the estuarine habitats where aquaculture occurs. Shellfish aquaculture is a temporary pulse disturbance (compared to a long-term press disturbance such as a bulkhead). Although there may be short term effects, on the landscape scale these effects are distributed both spatially and temporally.

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JAMESTOWN S'KLALLAM TRIBE

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December 19, 2020

Via email: jsurber@cityofpt.us

Judy Surber, Planning Manager

City of Port Townsend

Development Services Department

250 Madison Street, Ste. 3

Port Townsend, WA 98368

RE: Port Townsend Shoreline Master Program Periodic Review Comments

Dear Judy Surber,

The wealth and well-being of the Jamestown S'Klallam Tribe (JST) and the City of Port Townsend's communities are intricately tied to our waters and associated freshwater and marine resources. We appreciate the City's efforts to perform its periodic review of the Shoreline Master Program (SMP). We further appreciate your time to bring our staff up to speed on the timeline and focus of the periodic review, and to update your distribution list to include Luke Strong-Cvetich (lstrong@jamestowntribe.org) and Sissi Bruch (sbruch@jamestowntribe.org).

The Jamestown S'Klallam Tribe has coordinated efforts with Taylor Shellfish Farms (TSF) in reviewing the updates to the SMP and we agree with the comments they have submitted dated 12/04/2020. Overall, we support TSF efforts in adding and/or modifying policy to ensure the Port Townsend's SMP update is consistent with aquaculture policy provisions in the SMP Guidelines. The Tribe supports restoration projects and commercial aquaculture of native and naturalized species to provide for local seafood, improve water quality and protect the Tribe's Treaty Rights. D-

Specifically, under Chapter 5 - in table 5.12.1 related to permitted, conditional and prohibited uses at Boat Haven, we request that allowed aquaculture include marine water and tideland locations (instead of exclusively upland). Likewise, in table 5.13.1 related to permitted, conditional and prohibited uses of Point Hudson, we request that aquaculture be allowed, and that the allowed aquaculture include marine water and tideland locations. D-2

Further, under DR-8.4.1, we object to the prohibition of commercial shellfish seeding/culturing, as this prohibition is inconsistent with the Shoreline Management Act and D-3

D.

the SMP Guidelines as well as with the classification of this activity as a preferred, water-dependent use. Instead, we suggest language within DR-8.4.1 that permits: Shellfish aquaculture of native and naturalized species waterward of the OHWM, provided that the project is consistent with all applicable federal, state, and local requirements.

We appreciate your consideration of these comments and thank you for this opportunity to participate in Port Townsend's Periodic Review of their Shoreline Master Program.

Sincerely,



Digitally signed by Hansi Hals
DN: cn=Hansi Hals, o=Jamestown S'Klallam
Tribe, ou=Natural Resources,
email=hhals@jamestowntribe.org, c=US
Date: 2020.12.20 17:31:31 -08'00'

Hansi Hals
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Cc: Michelle McConnell, Shoreland Planner, ECY (via email)

Judy Surber

From: Ron Sikes <b1rdbush@gmail.com>
Sent: Saturday, January 2, 2021 11:44 AM
To: Lance Bailey; Judy Surber
Subject: Shoreline Master Program Periodic Review Comments
Attachments: kahtai_final_map from 2020 Parks Recreation and Open Space Plan-2.pdf; Kah Tai N. Park - 1 of 1.jpeg

I am writing about my concern in the proposed park plan for the Kah Tai Lagoon Nature Park. The new map, Exhibit 64 Kah Tai Lagoon Park concept, draft Jan. 2020, shows a boardwalk "connecting" across the wetland (bullrushes) at the south east corner of the lagoon. This is a terrible idea regards the waterfowl and shorebirds resting and feeding in this shoreline area. Trumpeter Swans have been often loafing many days this December in the area proposed for a boardwalk. This is where we see congregations of ducks and fall migrating shorebirds. During the park planning workshop held last year, I pointed out the proposed boardwalks conflict with water birds. E

There are ample lagoon viewing places along the South Trail. I don't see the justification for a boardwalk placed where it would have a very negative impact to one of the main features of this park - to attract a great diversity of water dependent bird species. This planned access is in conflict with the ecological values of the lagoon.

Thank you for considering my comments.

Ron Sikes
1709 Gise St.
Port Townsend

Ron Sikes
1709 Gise St.
Port Townsend

Exhibit 64. Kah Tai Lagoon Park Concept

KAH TAI LAGOON NATURE PARK



- Bird Habitat:** Habitat conservation for birds & other wildlife
- Boardwalk Connection:** Boardwalk & overlook connecting over sensitive ecosystems
- Loop Trails:** ADA accessible loop trails through the whole park, informal connecting trails & educational signage
- Wayfinding:** Improved signs & entrances for wayfinding through out the park
- Forest & Prairie:** Enhanced native prairie & forest ecosystems
- Pond Connection:** Improved ecological connection between ponds
- Picnic areas:** Convert restroom into picnic shelter, provide additional ADA picnic areas & shelters.
- Improved Entrance:** Gateway at entrance with wayfinding & opened views
- Opened Views:** Vegetation removed to allow sight lines into park for improved safety

PROS PLAN

DRAFT January 2020



Source: HBB 2019.



