Summary Report
Jefferson MRC Shellfish Aquaculture Education Forum

June 28, 2019

Report Contents

Appendices

PROGRAM SUMMARY

Jefferson County Marine Resources Committee organized a Shellfish Aquaculture Education Forum to educate themselves and the public about issues related to shellfish aquaculture. Our goals were to provide a basic understanding of the topic, emphasize science-based information and help inform future conversations so we can become better stewards of our shared commons. Five MRC members worked with the MRC Coordinator to put it together; they provided diverse perspectives, including the MRC, WA Sea Grant, Jamestown S'Klallam Tribe and shoreline landowners. Planning began in 2018. We solicited input from the Northwest Straits Commission, brainstormed topic and speaker ideas, asked for suggestions from Jefferson MRC members, and talked to staff at various agencies and members of the science/research community to come up with a list of possible speakers. We also worked with Samantha Thomas, a professional facilitator, knowing that we had taken on a controversial subject with diverse community opinions.

The 4-hour program was held on Friday, June 28, 2019. See Appendix A for presenter summaries. The registration packets (Appendix B) included an agenda, glossary, information about the MRC, brief speaker bios, an evaluation form and paper for writing down questions. Speakers had the option to include one handout about their topic in the registration packet. There was a brief time for audience questions at the end of each session and we also encouraged people to post their questions on the wall during breaks. Many of these were asked in the final Panel session. The agenda included time for small conversations ("reflection time"), large paper sheets on the wall for posting questions, dots for emphasis (to indicate that someone else also thought that was a good question) and a panel session at the end with all the speakers. The evaluation form also asked what else participants wanted to know. See Appendix C for a list of Audience questions.

The final selection of speakers created some controversy within the MRC, but the planning committee felt it was a good program and met most of our goals. People were respectful and asked really good questions.

This summary report will be shared with the Jefferson County Commissioners and the Northwest Straits Commission, as well as posted on our website.

LESSON'S LEARNED

- The program format we used for engaging the audience seemed to work well.
- Time of year: June is field season for many researchers, so some of the highly recommended scientist speakers were not available. Before choosing a program date, check with target speakers about their availability.
- Having a professional facilitator was great. She offered suggestions in the planning stage and had a friendly but firm control of the flow of the program.
- The program was 4 hours long and only 45 of the 80+ audience members stayed until the Panel Session, after the second break. Based on follow-up comments, there were multiple reasons why people left—other scheduling or family obligations, not hearing what they wanted to hear, etc. The Panel Session was one of the best sessions, especially as it started out by asking each speaker what they thought the environmental challenges were. It's hard to figure out how a speaker panel could go before topic presentations that informed the audience of the context, but maybe we should have asked each speaker to acknowledge and address environmental issues related to their topic.
- Another consideration related to program length is to consider fewer speakers and more time for questions. One of the suggestions from the evaluations was to limit the number of slides that each speaker presented.
- Facility limitations: The Northwest Maritime Center room is not ideal for viewing slides when seating extends into the second half of the large room. The screen was not quite big enough for our audience size and room arrangement. Next time we should provide more guidance to speakers about the room size and how much detail would be visible on their slides from the back of the room. Or limit the number of attendees. The portable microphone was very helpful.
- We really appreciated that everyone was respectful. We did have two "protestors" quietly handing out written opinion sheets outside the facility. They did not identify themselves on the opinion sheet and we think they also made assumptions about our organizing efforts without confirming their info. A copy of their opinion sheet can be found in Appendix E.
- Speaker choices: Starting the program with an introduction to ecosystem services was a good start. Providing the Tribal, regulatory and shellfish grower perspectives were valuable. We wanted to have more information from the scientific community about environmental impacts than we did. The DOH presentation was more about recreational

harvesting, which was not our primary focus, so could be left out next time. it is also important to work with speakers from the research community to emphasize that presentations should be suitable for a public audience, focusing on key messages and results.

- Geoduck aquaculture: Since this seemed to be the aquaculture activity of most concern, It would have been useful to spend some time describing the differences between geoduck aquaculture and commercial geoduck harvesting in the sub-tidal, as well as which regulations (i.e. HPAs) govern each type of operation.
- We included a few questions as part of the registration process. This could have been more effective if different questions were asked, but at least it gave us a sense of what was important to our attendees. See next section for more about audience feed-back.

EVALUATION & AUDIENCE FEEDBACK

Attendance:
76 attendees + 8 speakers + 2 staff
(Registration: 85 registered, 8 walk-ins, 17 no-shows)

The following is a compilation of audience feedback from the Evaluation forms. Only 26 people out of 84 attending filled out the evaluation forms.

As mentioned earlier, audience members asked great questions. Although we did not have time to answer all the questions during the program, the questions reflect the community's diverse interests related to this topic. See Appendix C for a list of all the questions asked. We hope these might inform future educational programming.

The number next to the multiple-choice answers is how many people selected that answer in the Evaluation form.

1. **Has your understanding of growing shellfish increased as a result of this forum?**
    a. A great deal 9
    b. Some 9
    c. A little 5
    d. Not at all 1

2. **Has your understanding of shellfish aquaculture permitting & regulation increased?**
    a. A great deal 8
    b. Some 11
    c. A little 3
    d. Not at all 1

3. **Has your understanding of <u>environmental concerns</u> related to shellfish aquaculture increased?**
    a. A great deal 7
    b. Some 5
    c. A little 7
    d. Not at all 5
4. **Was the length of the program:**
    a. too long 8
    b. too short 0
    c. just right 14
    d. Comments: _____

Comments included general supportive comments, too many speakers, a little too long, good time of day, morning is getter time of day, and apologies for having to leave early.

5. **What did you like or find valuable about the program?**
    - Showcasing how many agencies/organizations are involved in the industry. Such a great educational event.
    - Methods of growing and studies on impacts
    - All of it. Variety of topics and speakers. Thanks for folder contents.
    - Mix of presentations
    - Rick Mraz's presentation. It should have been done first to set the stage.
    - Sound Action concerns and effect of phytoplankton depletion by aquaculture.
    - I think it was well balanced and achieved what was desired, a general overview of information relevant to shellfish aquaculture in WA state.
    - Variety of views/perspectives on aquaculture.
    - Sound Action
    - Lots of new/unknown requirements.
    - More understanding
    - The wide variety of expertise from the speakers.
    - It was good to see the different types of shellfish farms, but it was too brief.
    - Amy Carey's presentation
    - Interesting to hear from Amy Carey and then have her concerns largely addressed by WDOE.
    - Would like to make seminar an annual event. Call me.
    - Breadth of regulation.
    - Panel at end was very interesting
    - Bringing awareness.

6. **What could we do better next time?**
    - Provide more of the environmental perspective (8 versions of this question)
    - Lengthen the panel session.

- More time for questions (although I'm completing this [form] prior to the panel—still, some participants have left)
- UW scientist input to balance industry perspective. Also provide info about research on substances like endocrine disrupters and fire retardants getting into the food web.
- Maybe have people submit their concerns about aquaculture beforehand so they can be addressed.
- The "he said she said" format did not meet my expectations that the forum would educate the community on aquaculture practices. Rather the approach created a more divisive situation.
- Give the people more controversy. We shied away from some of the issues people are most interested in. I think it would be possible to dive a little deeper into the concerns, esp. in the context of WHY we regulate the way that we do. The panel did a great job answering these inevitable questions.
- More on Jefferson County regulatory process and information about growth of industry locally.
- Better sound system and slower speakers.
- Ask presenters to do briefer presentations and speak more slowly.
- Limit the number of slides (suggest 5 max!) per speaker so the topic is short—not too detailed.
- Less commercial shellfish growers.
- Training or educational opportunities for future aquaculture farmers, particularly IMTA methods.
- Serve shellfish to eat!

APPENDIX A: FORUM PRESENTATIONS -- SUMMARIES & VISUALS

A brief summary of each speaker's presentation is included here, followed by speakers' responses to questions from the audience. Their PowerPoint presentations are available on the Resources page of the Jefferson MRC website through December 2019. (https://www.jeffersonmrc.org/resources/)

Jodie Toft, Deputy Director of the Puget Sound Restoration Fund (PSRF), began by presenting an Ecosystem Services concept which is a framework used to evaluate what people need and care about from nature. It is a human-centric approach used to identify and establish values for the services the ecosystem provides and how best to use them.

A recent paper about ecosystem services of marine aquaculture (Alleway et al, 2019. Ecosystem services of marine aquaculture: Valuing benefits to nature and people. *BioScience* 69(1): pgs 59-68) uses the following four metrics:

1. *Provisioning:* Geoduck and Pacific oyster are high yield and high value products. Can look at volume and revenue to evaluate the value of the provisions.
2. *Regulating:* Can use shellfish aquaculture to filter water for water quality improvements. Using nature to fix nature by looking at ways to marry one service to provide another service.
3. *Cultural:* Recreation and tourism are two examples of cultural values.
4. *Habitat and Supporting Services:* What are the tradeoffs given a certain place and resources? How does shellfish provide habitat? Who, what, when and how does their habitat structure support other habitat? For example, incidental cockles are recruited to and develop in geoduck tubes—this might be a resource to people who use them. Another example is oyster reefs providing benefits to other species through habitat enhancement.

In another study that looked at the ecological role of shellfish aquaculture in Puget Sound, researchers used Go-Pro cameras recording through a tide cycle to look at species assemblages on different types of shellfish farms and on control sites. They were interested in understanding which fish and crab species use the habitats. Researchers found differences in composition between farmed and unfarmed areas in some study areas and also found higher diversity in North Puget Sound aquaculture sites compared to South Sound sites. Final results of the study will be out in Fall 2019.

Toft also discussed the value of using a portfolio approach so that a diversity of habitats can support a variety of resources and ecosystem services. One of the tools PSRF uses to support the portfolio approach is restoration aquaculture. PSRF does this for Olympia oysters, pinto abalone, bull kelp and other species. For a species like the historically abundant native Olympia oyster, the goal is to restore the oyster so that the functions that the oysters supply – water filtration and provisioning of habitat – exist in the marine ecosystem, recognizing that some of those functions are now provided by aquaculture. It is a tag-team approach, using Pacific oyster shell, for example, as the substrate for Olympia oyster spat and restoration.

Kurt Grinnell, Jamestown S'Klallam Tribe Councilman, Natural Resource Policy Representative and CEO of Jamestown Aquaculture, provided a tribal perspective on aquaculture and a description of some of their aquaculture programs. The Tribe is concerned about natural reproduction of shellfish, climate changes and ocean acidification and tribal access to tidelands. As part of his introduction to Jamestown S'Klallam (JSK) tribal connections to shellfish harvesting, he talked about clam gardens as an example of 3,500-year old shellfish "aquaculture" practices.

JSK owns three shellfish farms and two shellfish hatcheries (Kona, Hawaii and Point Whitney, Brinnon, WA). Their hatcheries provide oyster seed that they put into a FLUPSY (Floating Upweller System) in Sequim Bay for grow-out. FLUPSY is a floating nursery with bins that hold different sized oyster seed and an electric motor that draws water through the bins to feed the oysters. JSK also grows clams and geoducks in Sequim Bay. JSK has a pilot program on growing geoduck seed (with UW scientists Steven Roberts and Brent Vadopalas). The geoduck seeds are planted on JSK beaches, with protective tubes for ~ 1 year then another 3-4 years without tubes before harvesting.

Natural recruitment for Pacific oysters is low in Puget Sound. JSK shellfish operations have more independence if they can grow their own oyster seed, so they got into the hatchery business as well. Most of the seed is used for their own program, but they will sell to others when there is enough. This is because Jamestown wanted to strategize for the future: 50, 100, 150 years. Their aquaculture program supports jobs, cultural experience, and restoration.

Other projects the Jamestown S'Klallam Tribe are involved in include Olympia oyster restoration; crab larvae monitoring program; European Green Crab monitoring; and ocean acidification monitoring.

Dave Steele, owner of Rock Point Oyster Co, presented on the different types of shellfish aquaculture employed in the industry.

Dave provided some historical context: prior to WWII, all Pacific oyster seed came from Japan. During the war, additional shell was brought into Puget Sound to catch Pacific oyster seed because growers could no longer get seed from Japan.

Rock Point Oyster has three farms located in Hood Canal: south of the Hood Canal bridge, Broadspit (Dabob Bay) and Quilcene Bay. They harvest Manila clams, savory (varnish) clams, Pacific oysters and Kumo oysters. Manila clams grow about 4" below the surface and varnish clams grow about 6-8" below the surface. In his operation, both are harvested by hand, using rakes. (Clams can be grown above ground in bags and harvested with a tractor.) Some growers use a predator exclusion net, but he has not needed to do so.

Dave described different methods & techniques for growing oysters (longline, trays & tumble bags, growing process in a hatchery, growing algae to feed young oysters, FLUPSY, etc.). Growing methods are driven by market preferences--whether an oyster is for shucking or sold in the shell. Harvesting is usually done by manual labor during low tide. He just purchased a machine that could automate this program.

Dave then briefly described growing geoducks and mussels. Geoducks are grown in mesh or plastic tubes for 1-2 years, then the tubes are removed. Geoduck are harvested 4-6 years later by liquefying the sediment.

Mussels are grown on long lines hung in socks and attached to rafts. The raft and the long lines provide a structure for other marine organisms to grow.

Dave talked about the challenges of managing a small shellfish aquaculture business, including working around the tides, the permitting process, finding workers, etc. It takes a couple of years and cycles to fully get through the permitting process. PCSGA (Pacific Coast Shellfish Growers Association) has adopted an updated 2019 environmental codes of practice, but they are not mandatory.

Bobbi Hudson, Pacific Shellfish Institute Director, introduced her organization and then shared findings from some of their studies.

The Pacific Shellfish Institute (PSI) mission is "Fostering sustainable shellfish resources & a healthy marine environment through research & education." PSI works with PCSGA but is a separate 501(c)3 non-profit. PSI conducts research and has studied nutrient bio-extraction (mussel removal also removes nutrient loads); Harmful Algal Blooms (HAB) monitoring; eelgrass/aquaculture interactions, ocean acidification, and emerging species that might be suitable for cultivation (rock scallop and sea cucumbers).

Bobbi focused most of her talk on a recent project funded by NOAA through Washington Sea Grant titled "Ecological Carrying Capacity and Influence of Shellfish Culture on Intertidal Habitats" which provided tools and recommendations for multi-use marine spatial planning, including sustainable shellfish aquaculture. Ecological Carrying Capacity (ECC) is the maximum extractive pressure that does not cause unacceptable change in the ecosystem (managers commonly use maximum sustainable yield; MSY). To determine the ECC, the research used an ecological modeling software called Ecopath. In this model, you look at species biomass to detect whether there is a change. The model used biomass data from 1970 and 2012 to "balance" the model for changes that occurred in South Puget Sound (the study area) for a wide range of species, including marine mammals and birds, benthic invertebrates and zooplankton.

Stakeholders (county planners, tribes, shellfish farms, The Nature Conservancy, WA state agencies, etc.) helped pose questions to simulate future changes (response of eelgrass, kelp, oyster drills, jellies, etc.). The study also simulated changes in response to management actions such as fishing pressure; a sea lion control fishery, etc. The questions were asked in order to examine trade-offs for each of the scenarios.

For example, they looked at what would happen to other species if eelgrass or kelp habitats increased or decreased; if farmed geoduck was increased ten-fold by 2025; if annual phytoplankton production decreased by 25%. EcoPATH generates a graph depicting probability of future outcomes of the impact on the population of the species you're interested in. In summary of all scenarios of future marine

production there were "few trophic effects on the South Puget Sound ecosystem when maintaining or significantly increasing shellfish aquaculture". She also noted, though, that this is for the whole South Puget Sound ecosystem and there may be different results when looking at smaller scales, such as specifically within some bays and inlets where aquaculture might be concentrated. These systems are very complex: One of the interesting species responses to increased kelp populations was a predicted increase in refugia for rockfish prey, making them harder for rockfish to find, and therefore a predicted reduction in rockfish biomass.

This report is available on PSI's website: http://pacshell.org/carrying-capacity.asp

Bobbi also talked briefly about two other recent PSI studies to inform policy and regulation: developing a tool to evaluate ecological functions of eelgrass and oyster culture habitats; and public perception survey results about awareness, and the social impact, of shellfish aquaculture. Results of both studies are available on PSI's website:

- public perception study: http://pacshell.org/pdf/PublicOpinionOfShellfishFarming.pdf
- eelgrass study: http://pacshell.org/pdf/SKEelgrassFinalReport2018.pdf

---

Amy Carey, Executive Director of Sound Action, talked about regulatory gaps in the protection of nearshore habitats as it relates to commercial shellfish aquaculture regulations.

Herring populations, chinook and orca are all in decline. We are starting in a place of habitat loss. The Washington State Hydraulic Code is a regulatory framework administered by WA Department of Fish and Wildlife. The sole mandate of this code is to protect habitat.

HPA (Hydraulic Permit Application) Program –All work that takes place in the water requires an HPA Project Permit. Sound Action reviews every permit (docks, boats, marina, mooring buoy). However, aquaculture is exempt, so Sound Action does not get to review these HPA permits, since it is not required. This exemption is not listed in the Hydraulic Code but is based on a 2007 WA Attorney General's opinion that used language from an aquaculture disease control statute to support a free pass for aquaculture in the HPA permitting.

No HPA requirement means no State protection for forage fish, juvenile salmonids and aquatic vegetation. Sound Action believes means this could means habitat loss with every aquaculture permit, resulting in net loss to the environment.

What about local permits? These are different in each county. Some are strong and others are weak. Aquaculture projects may not meet local jurisdiction thresholds for local development permits. Counties also have different regulations for different areas, depending on location & jurisdiction.

At the federal Level, aquaculture is regulated by the Army Corps of Engineers (ACOE). Most projects use a nationwide permit (NWP). This has significant habitat protection gaps. As of 2017, "New" operations are regulated but "fallow" or "existing" operations are less regulated; for example, there are no eelgrass

setback or forage fish regulations for "fallow" areas. There are approximately 25,000 acres of "fallow" aquaculture land in WA State. EPA wanted some setbacks and weighed in when the new NWP and Biological Opinion were updated in 2017, but following a change of advisors, EPA asked ACOE to remove the provision.

Amy finished her presentation by stating that this is not about shutting down aquaculture; it's about ensuring that aquaculture plays by the same rules as everyone else.

Rick Mraz, Shoreline Regulatory & Technical Lead for WA Dept of Ecology (WDOE), began by noting that in 2006-2007 WDOE was brought into the role of permitting of aquaculture when the ACOE (Corps) established Nationwide Permit (NWP) #48, which regulated aquaculture. Ecology developed state conditions associated with its review of aquaculture projects under this NWP, many of which were later adopted by the Corps as required conditions.

Aquaculture regulation is not limited to the Corps and Ecology. Lots of agencies are involved (see complicated chart in presentation). The ACOE process includes consultation with National Marine Fisheries Service, US Fish and Wildlife Service and Individual permittees. In 2017 ACOE came up with a list of 33 conditions for every aquaculture permit, including monitoring for sand lance, kelp, equipment, etc. WDOE felt these were comprehensive enough that they do not get involved in every one of these permits. When reviewing NWP 48 requests, WDOE does look at considerations related eelgrass. WDOE responds to the NWP #48 as to whether it sufficiently protects eelgrass. They can choose to either accept the NWP or can decide to craft a response and issue their own permit.

WDOE also reviews aquaculture permit requests separately under the Shoreline Management Act. This is because they work with cities and counties under the SMA to develop shoreline management programs (SMP). As each city or county's Shoreline Master Program is updated, they are required by WDOE to include guidance for aquaculture and get permits for certain aquaculture activities (including all geoduck operations). The SMA has three fundamental policy objectives:

1. Manage water dependent uses (uses that cannot be located anywhere else).
2. Protect shoreline natural resources.
3. Public access

All SMPs must meet the "No net loss of shoreline ecological functions". The SMA requires that SMP's examine local impact and are site specific – to either eliminate, reduce, or mitigate impacts.

Rick noted that Washington State also has private tidelands. In early 1900 the State sold off tidelands to establish aquaculture under the Bush/Callow Act.

Permit Appeals are happening more often now, which seems to be related to growth of geoduck aquaculture. These cases are often related to permit authorization and permit conditions regarding best management practices, monitoring for forage fish spawning, reducing canopy netting; debris clean-up,

etc. Rick talked briefly about successful and unsuccessful appeals to the Shoreline Hearings Board (SHB), the entity that considers shoreline permit appeals) and the basis for SHB decisions.

Mark Toy, WA Department of Health, provided an overview of the DOH Shellfish Program. DOH is the State's authority for implementing the National Shellfish Sanitation Program. He outlined the guiding rules and regulations, including a certificate of compliance required for sale of shellfish, what defines commercial quantities, inspection and marine biotoxin monitoring, some of the other water quality monitoring programs, shellfish protection districts, etc. He also talked briefly about recreational shellfish harvesting and informational resources for the public.

QUESTIONS & SPEAKERS' RESPONSES

What pesticide is used in oyster beds?

Response: Bobbi clarified that no pesticides are used on oyster beds in Washington State or anywhere in the U.S. Imidacloprid, previously registered for use in Willapa Bay and Grays Harbor, is not currently approved by the WA Dept. of Ecology.

Aquaculture question: What is the advantage of growing Pacific oyster in Kona, HI?

Response: Algae production is easier in Hawaii due to the sunshine.

Does Army Corps of Engineers enforce permits and monitoring?

Response: ACOE does farm visits, responds to complaints/inquires. Counties require reports.

What about forage fish habitat?

Response (Carey): there is an initial forage fish assessment. Aquaculture is required to leave equipment until forage fish eggs have hatched.

What percent of tidelands are used for shellfish culture?

Response (Mraz): Currently approximately 300 acres are permitted for geoduck aquaculture, with 30% of that in active production. WA Dept of Natural Resources owns about 25% of all tidelands in Puget Sound.

Please tell us about some of the negative effects of aquaculture (addressed to all Panel members)

- Jodi Toft: 1) Genetic risks. Looking at genetics of populations to ensure that out-planting genetics matches the local population, 2) Plastics in the environment. This is ubiquitous in all industries.

- Bobbi Hudson: 1) Localized phytoplankton depletion; 2) Benthic impacts of pseudo-feces and feces.
- Amy Carey: 1) What's happening in nearshore "breadbasket"-- benthic habitat displacement, vegetation, and hydrology/geomorphic processes.
- Rick Mraz: 1) Poor operational methods; 2) Kiddie pools in the intertidal; 3) Gear loss
- Kurt Grinnell: 1) Plastics; 2) Acknowledging impacts but want benefits
- Dave Steele: 1) Can't grow enough product for customers, but won't over-produce because of impacts; 2) Old gear with creosote
- Mark Toy: 1) Concerned about the pollutants/environmental impacts that we don't know exist or are not currently testing for (e.g. pharmaceuticals in shellfish tissue)

APPENDIX B: REGISTRATION PACKET

Shellfish Aquaculture Educational Forum

Jefferson County Marine Resources Committee

Program Agenda

1:00 pm **Welcome and Introductions** (Samantha Thomas & Cheryl Lowe)

Basic Ecological & Cultural Aspects of Shellfish Aquaculture

1:15pm **Jodie Toft, Deputy Director, Puget Sound Restoration Fund**
Various nearshore habitats, the role of shellfish in the food web, what ecosystem services they provide and highlights of a few research efforts about the habitat function of shellfish aquaculture as compared to eelgrass or other nearshore habitats or species.

1:40 pm **Kurt Grinnell, Jamestown S'Klallam**
Historical and social context for shellfish aquaculture, emphasizing tribal cultural and economic perspectives.

2:00 pm **Dave Steele, Rock Point Oyster Co**
Local commercial grower perspective about the shellfish aquaculture business (what it takes to operate, how long it's been there, challenges and economic perspectives.)

2:20 pm **Bobbi Hudson, Director, Pacific Shellfish Institute**.
Bobbi will highlight a variety of research studies about food web modeling, impacts of shellfish aquaculture to marine species, eelgrass and other habitats; and species-at-risk. She will also address best management practices and future data gaps/research needs.

2:45 pm **Reflection/Questions**

3:00 pm **Break**

Regulatory Considerations

3:15 pm **Amy Carey, Sound Action**
What environmental permits are required for shellfish aquaculture? How do significant regulatory gaps present risks to nearshore habitat, food webs and ecosystem components that are critical for forage fish, salmon and endangered orcas? Amy will discuss a general outline of the regulatory process and why improvements are needed.

3:35 pm **Rick Mraz, WA Dept of Ecology**
What is the current framework for aquaculture regulation in Washington State? Rick will describe the regulatory role of various agencies. Which agencies are involved & why it is part of their purview? Who decides specific conditions/mitigation of leases or operating permits and what are opportunities for public input?

3:55 pm **Dave Kangiser & Mark Toy, WA Dept of Health**
What is the DOH Shellfish Program? What do they monitor and why? Dave and Mark will describe the role of Department of Health in protecting human health through a wide range of programs from sampling biotoxins to developing predictive models.

4:15 pm **Reflection/Questions**

4:25 pm **Break**

Panel and Concluding Remarks

4:35 pm **Speakers Panel**

5:00 pm **Concluding comments, acknowledgements, adjourn.**

EVALUATION

Please fill out and return to us at the end of the program

1. Has your understanding of growing shellfish increased as a result of this forum?
    a. A great deal
    b. Some
    c. A little
    d. Not at all

2. Has your understanding of shellfish aquaculture permitting & regulation increased?
    a. A great deal
    b. Some
    c. A little
    d. Not at all

3. Has your understanding of environmental concerns related to shellfish aquaculture increased?
    a. A great deal
    b. Some
    c. A little
    d. Not at all

4. What else would you like to know more about?

5. Was the length of the program:
    a. too long
    b. too short
    c. just right
    d. Comments: _____

6. What did you like or find valuable about the program?

7. What could we do better next time?

Speaker Bios

Jefferson MRC Shellfish Aquaculture Educational Forum

June 28, 2019

Amy Carey, Executive Director, Sound Action

Amy Carey is the executive director of Sound Action, a regulatory watchdog group tenaciously working to protect vital nearshore habitat and species throughout the Salish Sea. With a specific focus on the Washington State Hydraulic Code, which is the primary law to protect habitat from in-water development impacts, Sound Action ensures the appropriate application of critical environmental regulations by reviewing every marine-based Hydraulic Code permit issued, commonly called an HPA, and taking legal action if required protections are ignored or when that permit violates state law. To date the organization has reviewed more than 2500 permits and the organization's work earned significant gains in habitat and species protection.

Amy has over a decade of experience leading innovative and advocacy–based regulatory oversight work specific to the frontline protection of marine nearshore habitats. In addition to her work as a member of the State Hydraulic Code Advisory Group, Amy is an appointed member of the Orca Task Force Prey Availability Working Group.

Website: https://soundaction.org

Kurt Grinnell, Tribal Council Member & Chair of the Natural Resources Committee, Jamestown S'Klallam Tribe

Kurt Grinnell is a Jamestown S'Klallam Tribal member and has served on the Jamestown Tribal Council since 2004. As the Tribe's Policy Representative for the Natural Resources department, he brings to the Council a unique perspective on natural resource conservation. He represents the natural resource interests of the Tribe as the Vice Chairman of the Point No Point Treaty Council Board and as a Commissioner on the Northwest Indian Fisheries Commission (NWIFC). He is also the Chairman of our Tribe's Natural Resource Committee.

Website: https://jamestowntribe.org

Bobbi Hudson, Executive Director, Pacific Shellfish Institute

As Director, Bobbi Hudson manages research studies and general operations of the Institute. She joined PSI in 2006 as a Research Biologist, contributing to applied research projects on the interactions of shellfish culture with the natural environment, organic pollutants, and disease and environmental stress. In 2013 Bobbi transitioned to Director but continues to serve as a scientist for PSI's diverse portfolio of biological, oceanographic and social science research projects.

Bobbi holds a B.S. and a M.S. in Environmental Science from The Evergreen State College. Her primary research interests include valuation of ecosystem services, social and ecological carrying capacity, and intertidal ecology. Bobbi also specializes in evaluation of sustainable bivalve aquaculture production in near shore environments. Prior to joining PSI, Bobbi served as a fisheries technician with the U.S. Fish and Wildlife Service, and performed shellfish and finfish work aboard commercial vessels in Puget Sound and SE Alaska. Bobbi also spent three years as a public information officer for the state of Washington.

Website: http://pacshell.org

Dave Kangiser, Water Quality Restoration Lead, WA Dept of Health

Dave has been with the Department of Health since 2014 and with the Shellfish Program since October 2018. Prior to this appointment, Dave was a Surveillance Coordinator for the Zoonotic Disease Program. He holds a master's degree in Environmental Studies from the Evergreen State College.

Website: https://www.doh.wa.gov/CommunityandEnvironment/Shellfish

Rick Mraz, Shorelands Technical and Regulatory Lead, SW Regional Office, WA Dept of Ecology

Rick Mraz is a certified Professional Wetland Scientist who works as a Shorelands Technical and Regulatory Lead. He began his career in wetlands work in Lee County, Florida in 1987. He has worked as a field biologist and environmental planner with local, state and federal agencies in Washington since 2001. Rick has degrees in Geology, Field Biology and Philosophy.

Website: https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Aquaculture

Jodie Toft, Deputy Director, Puget Sound Restoration Fund

Jodie Toft joined Puget Sound Restoration Fund (PSRF) in 2019 as Deputy Director, where advances our science, expands partnerships, and builds support for our unique brand of in-water restoration. Prior to PSRF, Jodie worked at The Nature Conservancy and The Natural Capital Project. She received her PhD in Aquatic & Fishery Sciences from the University of Washington. Her 2 kids keep her and her husband on their toes, exploring the wonders of the world, both great and small.

Website: https://restorationfund.org

Mark Toy, Environmental Engineer, WA Dept of Health

Mark Toy is an Environmental Engineer with the DOH Shellfish Program since 2007. Prior to that he worked with the American Red Cross as their Water and Sanitation Technical Advisor on Tsunami Recovery from 2005-2007 and as an Environmental Engineer with the DOH Office of Drinking Water from 1999-2005.

Website: https://www.doh.wa.gov/CommunityandEnvironment/Shellfish

Dave Steele, President, Rock Point Oyster Co.

Dave is the President of Rock Point Oyster Co. As a third-generation shellfish farmer in Puget Sound, Dave owns Rock Point Oyster Company at Tarboo Bay, Hood Canal, incorporated in 1921. He is on the Executive Committee of the Pacific Coast Shellfish Growers Association and served as President for 4 years and a retired Professional Land Surveyor working with the Dept. of Natural Resources for 37 years.

Website: https://rockpointoyster.com

Jefferson County Marine Resources Committee

The Jefferson MRC promotes a marine stewardship ethic, supports science-based projects, and works in partnership with other groups to preserve and conserve Puget Sound and the Salish Sea. We are a citizen-based, volunteer committee appointed by Jefferson County Board of Commissioners. Our members come from the fishing, boating, aquaculture, environmental, marine education, tribal, and government communities.

The Jefferson MRC emphasizes on-the-ground projects and education/outreach on marine resources issues. Our activities include:

- Monitoring kelp, forage fish and shoreline restoration projects
- Maintaining voluntary no-anchor zones that protect 110 acres of eelgrass & shellfish beds
- Rain garden installations to treat stormwater
- Olympia oyster habitat enhancement and monitoring
- Educational programs

We serve the County in an advisory capacity, with no regulatory authority. We are one of seven Marine Resources Committees affiliated with the Northwest Straits Marine Conservation Initiative (NWSI). MRCs provide local input to the NWSI and they provide us with scientific, technical, and financial assistance.

In 2018, the MRC recorded 1,811 volunteer hours, reflecting a strong community interest and support for the work of the MRC.

Northwest Straits INITIATIVE

PUGETSOUND PARTNERSHIP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Northwest Straits
INITIATIVE

partners in marine conservation

Local People. Local Solutions.

The Northwest Straits Initiative catalyzes and empowers local communities to participate in marine conservation and restoration.

By design, the Northwest Straits Initiative brings diverse interests together to protect and restore marine waters, habitats and species in Puget Sound to achieve ecosystem health and sustainable resource use.

Northwest Straits Marine Conservation Initiative

Northwest Straits COMMISSION ⟷ Marine Resources Committees (MRCs) ⟷ Northwest Straits FOUNDATION

Marine Resources Committees (MRCs)

County-based volunteers representing diverse interests working together to carry out conservation action

Northwest Straits Commission

Leverages local energy into regional Puget Sound recovery by supporting MRCs and engaging partners

Northwest Straits Foundation

Non-profit partner building philanthropic capacity to broaden MRC impacts

nwstraits.org

@NWStraits

Ecological Carrying Capacity for South Puget Sound
Ecopath with Ecosim

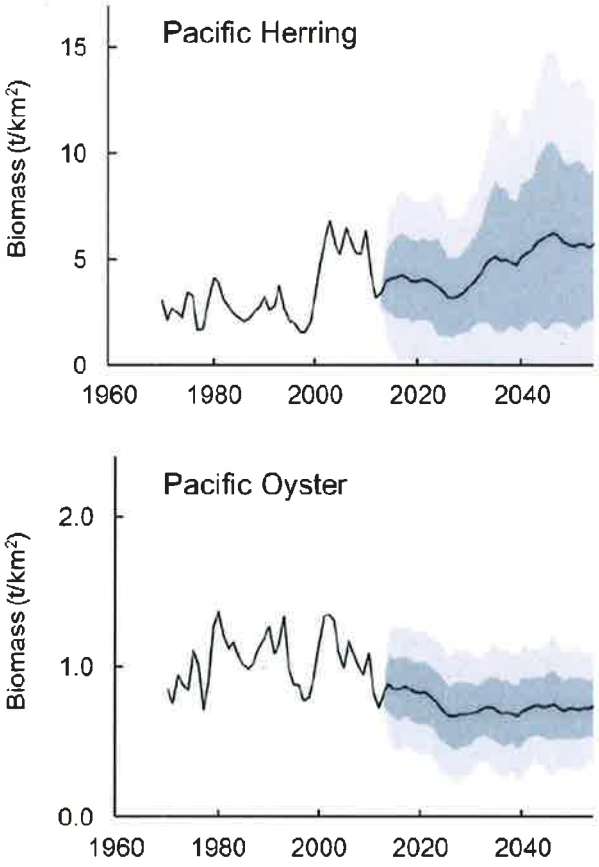
Ecological carrying capacity is the maximum extractive pressure that does not cause unacceptable change in the ecosystem. The Ecopath with Ecosim (EwE) modeling framework provides a way to visualize the biomass of a suite of species groups over time, using mortality rates or 'production' of species groups, food intake and diet composition.

Our EwE model simulates known historic changes for 1970-2012, and forecasts potential changes through 2054 for 12 key species of marine mammals, marine birds, salmon, game fish and bivalves. We selected 12 focal species groups to analyze in detail. Geoduck clam, Pacific oyster and Olympia oyster, adult Chinook salmon, adult Coho salmon, adult Chum salmon, rockfish, Pacific herring, sea lions, harbor seals, Great Blue heron, and marine birds were selected because we were interested in exploring the effect of population changes, and/or their populations would have consequences on fisheries or managed species.

Because assessment of regional carrying capacity could inform current and future management decisions, our EwE was performed in conjunction with a diverse stakeholder working group. Representatives included Puget Sound county planners, shellfish growers, and staff from state natural resource agencies, tribes and conservation non-governmental organizations. Stakeholder inclusion facilitated the best population/biomass data to be gathered, and ensured relevant scenarios were modeled.

The model we built is focused on several lower trophic level components of the food web. A key aspect of our approach is the unique application to multi-species shellfish aquaculture and harvest. Simulations forecast potential future ecosystem configurations under a variety of population changes and fishing and aquaculture management policies.

Analyses of the 1970 and 2012 mass balance models suggest that the rapid expansion of shellfish aquaculture would not likely have significantly influenced the biomasses of other species. Therefore it was not surprising that, in all our scenarios of future marine production, there were few trophic effects on the South Puget Sound ecosystem when maintaining or significantly increasing shellfish aquaculture production.



The graphs above show biomass trajectories for two of our focal species, Pacific herring and Pacific oyster, in one scenario. This scenario simulated responses when the biomass of farmed geoduck is increased 10 times (the 2012 biomass) by 2025, and the annual phytoplankton production is 25% less than it was in 1970-2012. This scenario revealed moderate biomass increases for herring and a slight decrease for Pacific oyster. (Dark gray is one and light grey is two standard deviations from the mean of 100 simulations.) Funding for this work was provided through Washington Sea Grant, pursuant to NOAA award #NA14OAR4170078.

Pacific Shellfish Institute (PSI) – 1206 State Ave NE, Olympia, WA - 360.754.2741 - www.pacshell.org
Fostering sustainable shellfish resources & a healthy marine environment through research & education.

COMMERCIAL AQUACULTURE IN THE PUGET SOUND

COMMERCIAL SHELLFISH AQUACULTURE IN WASHINGTON BEGAN ABOUT 150 YEARS AGO

In 1895, the Bush Act and the Callow Act are passed which allowed private ownership of state owned tidelands. The commercial shellfish industry declined in the early 1900's due to overharvesting and poor water quality in the Puget Sound. Today, Washington State is the largest producer of hatchery reared and farmed shellfish in the United States. Our shellfish industry employs over 3,200 people an contributes over $270 million annually.

MANILA CLAMS

Manila clams are grown on substrate and covered with nets to prevent predators from eating the clams. The clams are harvested at low tide using a rake.

PACIFIC OYSTERS

Oysters are grown directly on the bottom of the beach and grow naturally until they are harvested.

They are also grown in net bags, which help to protect the oysters from predation.

MUSSELS

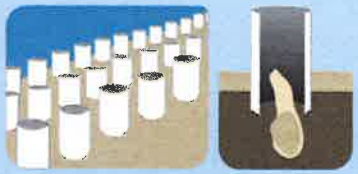
Mussels are not grown on the bottom on substrate. They are grown from ropes suspended in the water column.

Mussels also grow naturally on rocks, pilings, and other hard surfaces using byssal threads to attach themselves.

GEODUCK

Juvenile geoducks are planted in tubes that protect them from predators and hold water when the tide goes out to keep them from drying out. The tubes are covered with nets and are removed after a year.

They are harvested by pumping water around the geoduck and digging down to remove them.



WHY ARE SHELLFISH IMPORTANT IN WASHINGTON?

Shellfish are filter feeders, so they help to clean the water and improve the water quality of Puget Sound. Shellfish beds provide habitat for other animals and serve as nurseries for juvenile fish and invertebrates.

PUGET SOUND ESTUARIUM

WITH SUPPORT FROM:

PCSGA

TAYLOR SHELLFISH

PACIFIC SHELLFISH INSTITUTE

Pacific Northwest Shell Club

Photo Credits: *Nisqually Shellfish Farm*, USDA; *500 baby duck*, VIUDeepBay *Geoduck Feedlot Layer Taken Report Quality*, KBCS 91.3 Community Radio; *Mussel Buoy*, Richie Rocket. All photos have been remixed. https://creativecommons.org/licenses/by/2.0/

Geoduck Culture

The life cycle of farmed geoduck

1. Hatchery

Mature, wild, geoduck clams are conditioned in a hatchery during the winter with food and water temperatures until they are ready to spawn. They are "broadcast spawners", with males and females contributing sperm and eggs into the water column where fertilization occurs (You can't tell a male from a female until they release their eggs or sperm). They go through a free swimming larval stage before settling to the bottom and becoming tiny (1-2 mm) reproductions of big geoducks.

2. Seed

The young geoducks stay in the hatchery until they are large enough (1/4"-1/2") to plant on the beach, then they are known as "seed". When small seed are taken from the hatchery and planted into the intertidal area of a beach they are subject to predation from many marine animals such as crabs, shrimp, starfish, moon snails, fish, and birds.

3. Predator Protection

The seed are too small to dig deep into the sand when first planted so to provide protection, growers place them into short lengths (10"-12") of PVC tube or mesh sleeves pushed vertically 5"-6" into the beach. This practice allows the young geoducks to grow and dig deeper into the beach while being protected from predators. After 2 years, the body of the geoduck will be deep enough in the sand that they can avoid most predators by retracting their siphons beyond the reach of whatever would like to eat them. This is when the grower will remove the tubes or sleeves from the beach.

Good farm management requires the grower to monitor the farm, ensuring that predator exclusion devices don't become loose and get away from the site.

4. Growth

Geoduck clams feed on naturally occurring plankton found in the water column. They draw in water through one side of their siphon (or neck), filtering out the plankton that is usable as food, and pass the water back out the other side of the siphon. Since growers don't feed their farmed geoducks, the amount of plankton in the water and the rate at which the current moves the water past the clams has a great effect on how long it takes to reach a marketable size. It all depends on location, location, location.

5. Harvest

Most farms in South Puget Sound need 5-7 years before harvest occurs, while a few farms need longer. The average weight at harvest is between 1 - 1.5 lbs, with individual geoducks ranging from 0.5 - 2.5 lbs. Harvesting is a delicate art, and can take place when a low tide has exposed the farm, or by using divers when the farm is covered by water; the technique is the same. When enough geoducks on a beach have reached market size, harvesters use salt water pumped through a hose to a stinger (short pipe with a small diameter) to free the clams from the sand. The stinger has low pressure and high volume flow - think garden hose on full - to soften the sand around a buried geoduck. When the harvester locates a siphon hole, the stinger is placed on the sand and pushed deep alongside the geoduck taking great care not to direct the flow of water at the body of the clam. If that were to happen, body tissue would separate from the shell and the geoduck would die. When the stinger is alongside the body of the geoduck, the harvester reaches into the sand and retrieves the clam. This is common practice among many geoduck farmers.

6. Market

Once enough geoduck clams have been harvested, off to the market they go! Geoducks are sold in both domestic and overseas markets. Regardless of where they go, they have to arrive alive and healthy to have value. Geoducks harvested from a Puget Sound beach during the day will be boxed and shipped that evening, to arrive live the next day whether on the west or east coast of the US or overseas to China and other locales.

Some popular geoduck dishes include, but are not limited to: Chowder, Risotto, Sautéed, Fritters, & Ceviche

PCSGA

PACIFIC COAST SHELLFISH GROWERS ASSOCIATION

Shellfish Glossary

Bottom Culture
Cultivating oysters by planting oysters loosely on the bottom during growout

Byssal Thread
Strong fibers used by mussels and other bivalves to attach to surfaces. Commonly known as the "beard"

Cage Culture
Cultivating oysters in cages during growout

Cull
To select and sort oysters by quality and size

Downweller
A water flow system usually used to set spat on microcultch

Floating Culture
Cultivating shellfish in floating trays, bags or rafts

Fouling
Planktonic or larvae that colonize the surface area of an oyster's shell. Organisms include barnacles, tunicates and tube worms.

Grade
To class or sort oysters dependent on size, shape, and quality

Growout
The time in which the oyster grows from seed to market size.

Hatchery
A facility that spawns and fertilizes oysters to produce oyster seed.

Hyperphagia
Period of time when animals eat excessively to prepare for winter dormancy

Longline
A long cable anchored into the bottom that bags or equipment attach to

Microcultch
A very fine piece of oyster that oyster larvae settle on in hatchery

Nursery
A filter feed system that protects and nourishes baby oysters to a healthy size

Phytoplankton
Plankton consisting of microscopic plants that oysters feed on.

Purge
To remove grit or clean clams by soaking in water

Rack-and-bag culture
Cultivating oysters in bags that sit on racks

Sieve
Sort oysters with mesh screens

Spat/seed
Baby oysters after they have set or attached to a growing surface.

Spawn
The release of shellfish eggs and sperm into the water column. Shellfish tend to be weakest after spawning.

Suspended culture
Cultivating oysters in suspended trays, bags, or rafts. Oysters don't touch the bottom or float at the surface.

Tray culture
Cultivating oysters in trays

Tumble
Promote uniform and and strong shell growth by chiseling the shell in a tumbler.

Upweller/Flupsy
A water flow system that pushes nutrient rich water up through the nursery or silos to feed oyster seed. Can be an open or closed systems.

Vibrio
Naturally occurring bacteria in the water that can contaminate oysters and cause foodborne illnesses when consumed in high concentrations.

Wild set
Wild oysters that naturally set on the bottom or spat collectors

Tribal Harvest

Tribes have harvested shellfish for generations upon generations, feeding their communities and their culture with healthy protein from Puget Sound and coastal shores.

Recreational Harvest

In recent years Washingtonians and visitors made almost half a million trips to Puget Sound and the coast to recreationally harvest clams and oysters. Many families consider this an important family tradition that connects them to their past and their lands.

Shellfish Farming

Shellfish have been cultivated in Washington for more than 160 years, since our frontier days. The shellfish industry is a foundation of western Washington's rural economy and an important part of our state's heritage. Our shellfish are sought by consumers around the world and are a source of pride for the state.

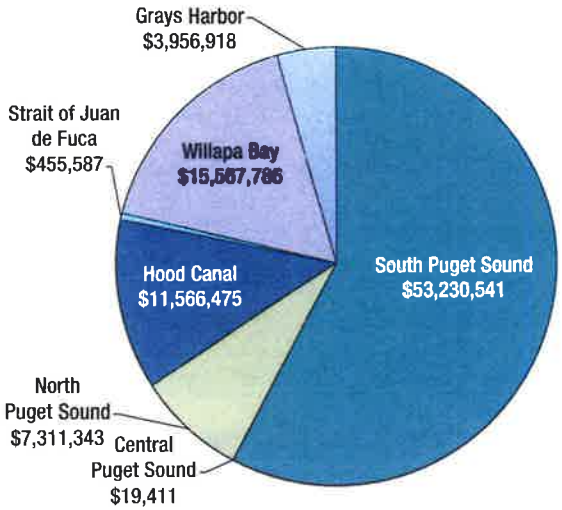
Learn more | http://bit.ly/WAshellfishinitiative

Washington: A Shellfish State

The Environmental and Economic Value of Shellfish Resources in Washington

The farming of oysters, clams, mussels, and geoduck in the cold, nutrient-rich waters of the Pacific Northwest is a long-standing tradition and an important cultural and economic part of Washington's coastal communities.

Value of Washington State Shellfish Aquaculture by Region, 2013



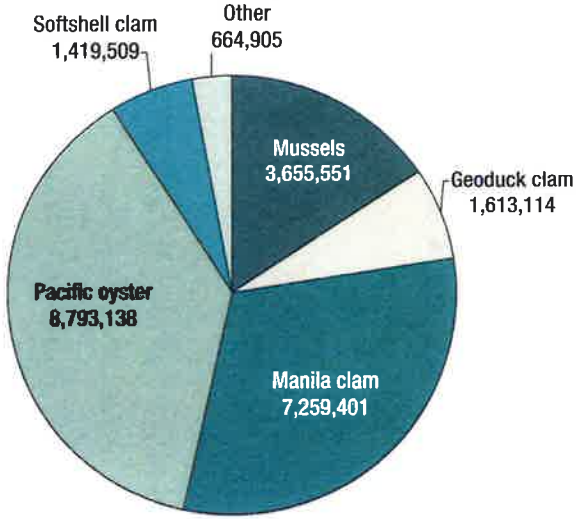
Economic Benefits

To meet the growing demand for seafood, Washington shellfish products are sold throughout the United States and exported worldwide with primary markets in Canada and Hong Kong.

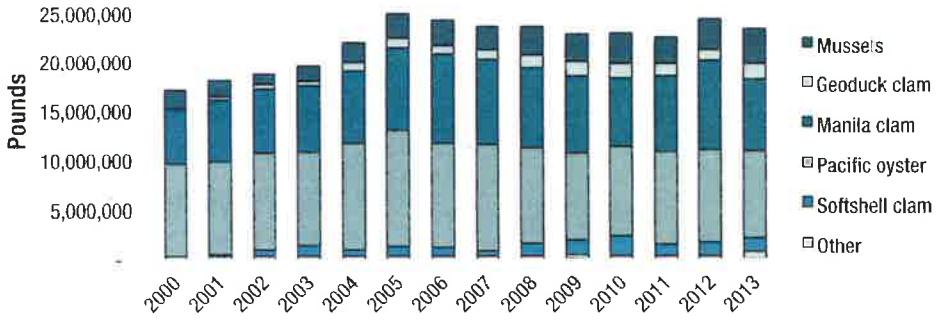
Some facts:

- Washington State is the leading U.S. producer of farmed bivalves.
- The total revenue of farmed bivalves in Washington was nearly $150 million in 2013.
- Shellfish aquaculture contributed $184 million to Washington's economy in 2010.
- Washington's shellfish industry generated 2,710 jobs in 2010.
- Washington's wild harvest shellfishery was valued over $40 million in 2012.

Washington State Shellfish Aquaculture Production by Species and Weight (lbs), 2013



Washington State Shellfish Production



WASHINGTON SHELLFISH INITIATIVE

Did You Know?

- *A single oyster contains about 0.5 grams of nitrogen.*
- *Consuming a dozen oysters is equivalent to removing 6 grams of nitrogen from the marine environment.*
- *A weekly harvest of about 200 oysters can compensate for the nutrient inputs of a typical waterfront homeowner on a properly functioning septic system.*

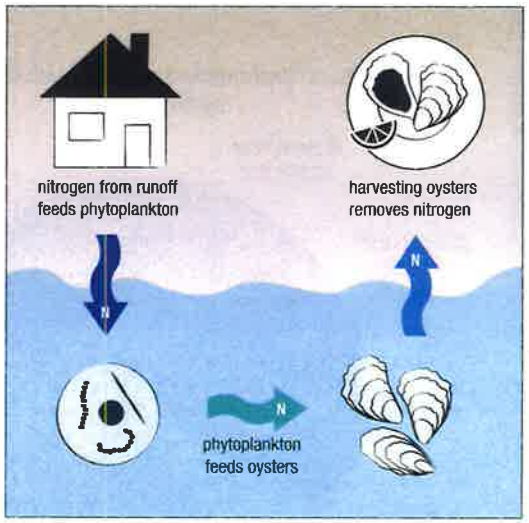
Science and Research

Research is underway to understand and develop mitigation for threats to shellfish resources including:

- *Ocean Acidification*
- *Habitat Destruction*
- *Climate Change*
- *Harmful Algal Blooms*
- *Water Quality/Runoff*
- *Restoration of Native Shellfish*

Restoring Lost Habitat

Less than 4% of historic core populations of native Olympia oysters remain in Puget Sound. Restoring native oyster habitat in historic locations can create complex nearshore habitat, natural filtration, and larval production.



Environmental Benefits

Shellfish are a key part of our marine ecosystems, providing habitat, increasing biodiversity, and helping filter and cleanse water. When shellfish feed, they filter phytoplankton out of the water, resulting in improved water clarity and quality. Clear water lets more sunlight reach the seafloor, promoting the growth of healthy seagrass habitats.

Biodiversity

Shellfish beds act like reefs, providing habitat and protection for many organisms. Scientists consistently find higher populations of marine life around shellfish beds.

Citations

Decker, K. 2015. Patterns in the Economic Contribution of Shellfish Aquaculture. In Shellfish Aquaculture in Washington State, Final Report to the Washington State Legislature. Seattle, WA.

Dumbauld, B.R., J.L. Ruesink and S.S. Rumrill. 2009. The Ecological Role of Bivalve Shellfish Aquaculture in the Estuarine Environment: A Review with Application to Oyster and Clam Culture in West Coast (USA) Estuaries. Aquaculture 290:196-223.

Northern Economics. 2013. The Economic Impacts of Shellfish Aquaculture in Washington, Oregon and California. Bellingham, WA.

Shumway, S.E (editor). 2011. Shellfish Aquaculture and the Environment. Wiley-Blackwell, Oxford, UK.

WDFW Publications. Washington Department of Fish & Wildlife. Accessed December 31, 2015. http://wdfw.wa.gov/publications/.

Photos provided by: Debbie Preston/Northwest Indian Fisheries Commission, Puget Sound Restoration Fund, Vera Trainer/Northwest Fisheries Science Center, NOAA Fisheries West Coast Region.

Contact

Julie Horowitz
Shellfish Policy Advisor
Office of Governor Jay Inslee
Julie.Horowitz@gov.wa.gov

Laura Hoberecht
West Coast Region Aquaculture Coordinator
NOAA Fisheries
Laura.Hoberecht@noaa.gov

NOAA FISHERIES

The Washington State Shellfish Initiative, led by Governor Jay Inslee, is a convergence of the National Oceanic and Atmospheric Administration's National Shellfish Initiative and the state's interest in promoting the environmental, economic and cultural importance of shellfish.

Bivalves for Clean Water

by Teri King and Janis McNeal

Bivalve Shellfish — Canaries in the Coal Mine, Grazers of the Sea

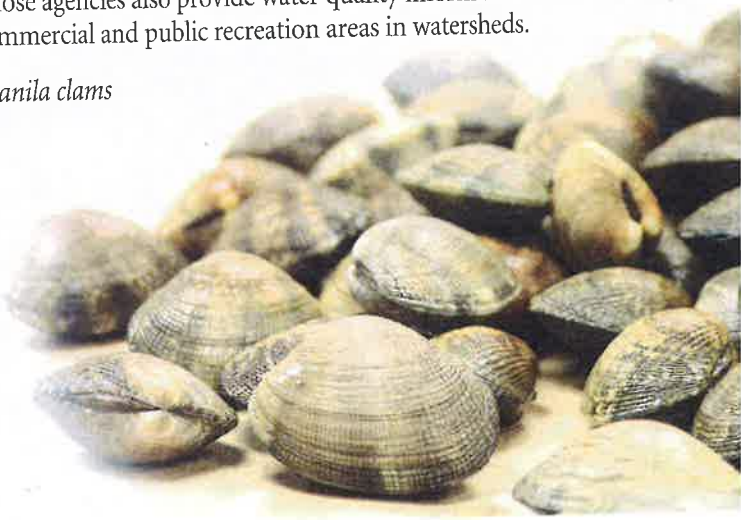
Shellfish are keystone species, studied by water quality investigators to determine the health of a water body. Clams, oysters, mussels and other bivalves filter seawater and, in the process, can accumulate environmental contaminants in their tissues. Polluted shellfish beds are often an early warning to a larger problem, upland in the watershed, that needs immediate attention. Marine water quality standards are more stringent for shellfish harvesting than for wading and swimming. Since shellfish are a food, the threshold for contamination is much lower than for external contact with marine waters.

Bivalve shellfish also play an important role in the food web. These grazers of the sea filter copious amounts of phytoplankton-rich water, converting it into a delectable dish — just as cows grazing in a pasture convert grass into steak. The role of shellfish in this transformative position within the marine ecosystem is essential in the cycling of nutrients in our marine waters. By converting phytoplankton into tissue and shell, the shellfish are able to improve light penetration in the water column, reducing overall turbidity and benefiting plants such as eelgrass. Bivalve shellfish can help control the overabundance of phytoplankton in parts of Hood Canal and South Puget Sound, where nitrogen from terrestrial sources has led to over-fertilization of marine waters. The best option for marine waters is to greatly reduce or eliminate the flow of nitrogen from land to sea. Failing that, bivalve shellfish introduced into nitrogen-rich marine waters can be an effective part of a remediation plan. The animals consume and retain nitrogen. When they are harvested, the nitrogen they consumed is removed from the system.

It's the Water

Shellfish harvested in clean water are safe to eat; shellfish harvested in dirty water are not. Clams and oysters filter the water, picking out phytoplankton, bacteria and viruses to feed themselves. Shed by all warm-blooded animals, fecal coliform bacteria are food for bivalve shellfish and can cause illness in humans who eat shellfish tainted by the bacteria.

Information about water quality at or near your beach is available from the Washington State Department of Health's Office of Shellfish and Water Protection or local county health jurisdictions. Those agencies also provide water quality information about commercial and public recreation areas in watersheds.



Manila clams

The state and counties generally do not assess private tideland water quality. Shoreline property owners may be able to infer the water quality of their tidelands based on state assessments of a nearby commercial operation or public beach. Another approach would be to sample your beach's shellfish and submit them to a lab for analysis. One test, however, will only be a snapshot of the water quality conditions on your beach on that day. The state and counties perform sampling over time and review a full set of data to make an assessment. Contamination levels can change with property use, weather and season. Do not harvest and eat shellfish if there are any doubts about their safety.

Submitting shellfish samples for testing

What to Look For: Your Land Affects Your Water

Septic Systems

Standing on your beach looking up at the land, what do you see? A house, a dog, a nicely manicured lawn — and a bright green algae trail coming from a bulkhead weep?

Does your house have a septic system? If so, do you know where it is located? If it's exposed to tidal waters at certain times of the day, it could be easily flushed out onto your beach and shellfish. Inspections are really important to make sure that all of the components of your system are working properly and the septic tank doesn't need to be pumped. Routine septic system inspections will help catch problems before they give you a stomachache. Washington Sea Grant offers a host of publications, workshops and videos about septic system operation and maintenance. Check out the Resource Guide at the end of this document for titles and links.

Animal Waste

Scoop your pet poop

How you handle pet poop in your yard is important. Dogs, cats, chickens, birds, horses and other livestock all can contribute to fecal coliform pollution. Letting the rain wash away the poop in your yard is an easy way to make it disappear, but where does it go? Does it flow, with the water, down onto your shellfish? Remember, shellfish will be filtering those particles of poop as they pass by. When animals are allowed to make deposits on the beach, the feces liquefy and become shellfish and fish food. Yuck! Pick up your dog and cat waste, bag it, and put it into the trash, not into the septic system. For horses or other livestock, contact your local conservation district for manure management assistance. Horses for Clean Water also has an extensive Web site that can help you select the right kind of manure management system for your situation.

If you have a dock or a float that seals and birds like to visit, it is important to sweep the feces into a bag, not the water, and put the bag in the garbage. Even dry feces can contain active pathogens.

Yard and Garden Treatments

What products do you use on the lawn or in your garden to keep it growing and free of weeds and pests? Are those products being picked up by the rain or the water from your sprinkler and running off onto your beach? If they are, the shellfish are filtering it and perhaps concentrating those compounds in their bodies.

Select the right plants for your shoreline

You can use slower-release fertilizers that bind better to the soil and vegetation, slowly releasing nutrients needed by the plants throughout the growing season. If you use fertilizers, use only the recommended amount. You may even decide that you don't need a bright green lawn and the fertilizer applications that go with it. A simple way to see how far your fertilizer is running is to dye it with a food-grade dye — a blue powdered drink mix will work. Fertilize with the dye-covered granules as usual, then water. If the dye is running into the water, you know the fertilizer is right there with it. Keeping fertilizer applications farther from the shoreline may help. Remember: fertilizers make sea plants, as well as land plants, grow. Washington Sea Grant offers a host of publications and workshops about Blue Thumb Gardening. Check out the Resource Guide at the end of this document for more information.

Nutrients

If you think nutrients may be running off your property into the water, look for green algae trails on your beach, leading from bulkhead weeps or freshwater seeps. Though they may not come from the fertilizer you use, green algae trails do indicate a presence of excessive nutrients running from the land into the sea. The trails could also originate from septic systems, pet waste or other sources and carry pathogens. Check out all green seeps and trace them back to their source.

A green algae seep full of nutrients

Help Your Land Filter Your Runoff

There are some simple things you can do to filter the water running off of your property and onto your shellfish. Plant and maintain shoreline vegetation. Trees, shrubs and small plants can all work together as a biological filter, taking up excess nutrients and water that would otherwise run onto the beach. The fibrous roots of trees and shrubs can also help to hold the soil on the bank and keep it from being washed down on top of your oysters or clams. Pacific oysters have an ability to clap their valves and uncover themselves — up to a point — but the smaller Olympia oysters can suffocate if buried under too much silt. Too much sediment running onto the beach can also bury clams deeper, smothering them if they cannot climb higher to expose their siphons to the water.

Trees suitable for marine shoreline plantings include: Big Leaf Maple, Douglas Fir, Pacific Madrone, Pacific Yew, Scouler's Willow, Shore Pine, Sitka Spruce, Western Red Cedar and Western White Pine. You can have your tree and a view, too! Interlimbing, windowing and skirting up are all techniques used by arborists to maintain the health of the tree and its positive impact on the ecosystem and also allow for a beautiful view out onto the bay.

These marine shoreline shrubs work in companion with trees to help bind the soil and capture rainwater: Bald Hip, Nootka and Clustered roses; Beaked Hazelnut; Ocean Spray; Pacific Ninebark; Red Twig Dogwood; Red Flowering Currant; Mock Orange; Serviceberry; Snowberry; and Vine Maple. These plants create thickets, can be pruned for more openness and are less likely to block views.

Trees and shrubs filter runoff

Don't forget groundcovers that will also help filter out nutrients and water: Bunchberry, Deerfern, Kinnikinnik, Swordfern, Trailing Blackberry and Twinflower, to name a few. Groundcovers are easy to establish, have attractive flowers, attract pollinators, like hummingbirds, and provide habitat for small mammals and birds.

One of the greatest joys Puget Sound has to offer is the opportunity to dig clams and shuck oysters, creating a healthy, delightful meal out of a day's gathering. Even more special is the ability to step right outside your front door and harvest shellfish from your own tidelands. By taking care to limit the nutrients and pathogens running off of your property and into the Sound, and by maintaining a healthy population of shellfish on your beach, you will be helping to improve the water quality of Puget Sound — one bite at a time.

Resources

Shellfish Aquaculture

Gathering Safe Shellfish in Washington — Avoiding Paralytic Shellfish Poisoning
http://wsg.washington.edu/mas/pdfs/SafeShellfishBooklet.pdf

Reestablishing Olympia Oyster Populations in Puget Sound
http://wsg.washington.edu/mas/pdfs/olyoysterlr.pdf

Small-Scale Clam Farming for Pleasure and Profit
http://wsg.washington.edu/mas/pdfs/clamfarmlr.pdf

Small-Scale Oyster Farming for Pleasure and Profit
http://wsg.washington.edu/mas/pdfs/smallscaleoysterlr.pdf

State of the Oyster *http://www.wsg.washington.edu/mas/ecohealth/state_of_oyster.html*

The Nutritional Value of Shellfish
http://www.wsg.washington.edu/communications/online/shellfishnutrition_09.pdf

Septic Systems

Landscaping Your Septic System
http://wsg.washington.edu/mas/pdfs/landscapeseptic.pdf

Pumping Your Septic Tank
http://wsg.washington.edu/mas/pdfs/pumpseptic.pdf

Septic Sense, Scents, Cents: Supreme Insights to the Fearless Flush
http://www.wsg.washington.edu/mas/pdfs/SepticSense.pdf

Homeowner's Manuals

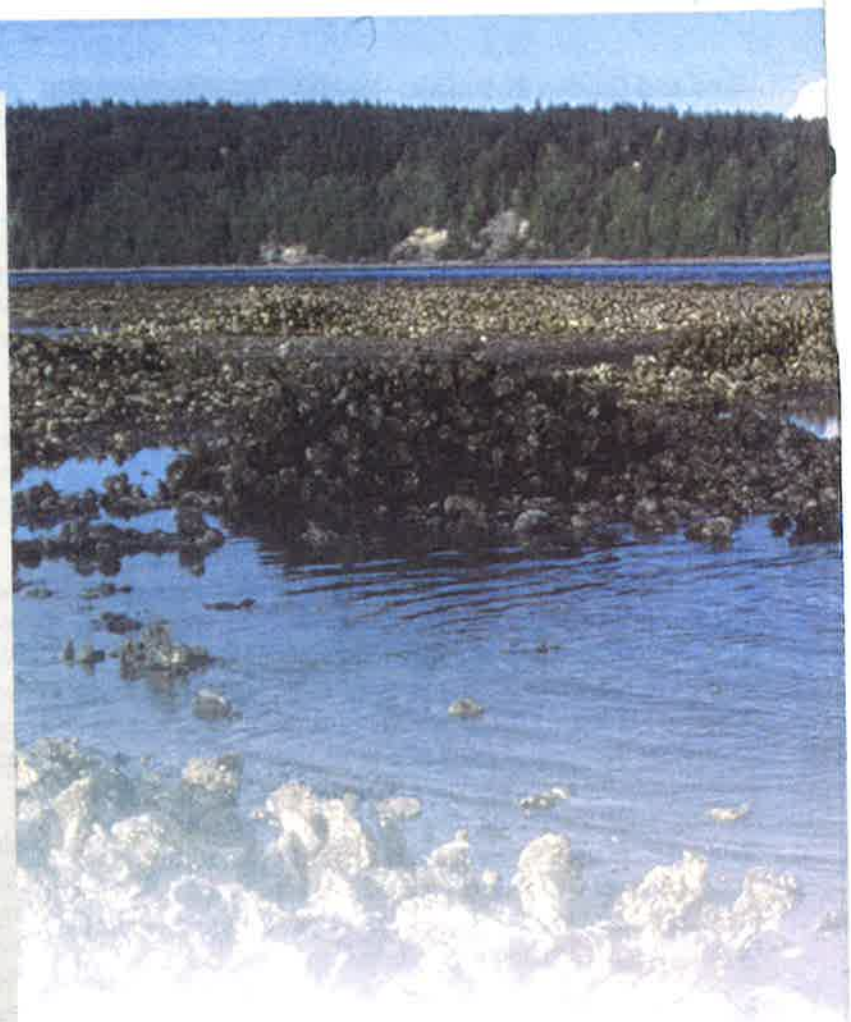
Gravity System — *http://wsg.washington.edu/mas/pdfs/gravity.pdf*
Mound System — *http://wsg.washington.edu/mas/pdfs/mound.pdf*
Pressure Distribution System — *http://wsg.washington.edu/mas/pdfs/pressure.pdf*
Proprietary Device System — *http://wsg.washington.edu/mas/pdfs/proprietary.pdf*
Sand Filter — *http://wsg.washington.edu/mas/pdfs/sand.pdf*
Videos available from *sgpubs@u.washington.edu*

Animal Waste

Conservation Commission — *www.scc.wa.gov*
Horses for Clean Water — *www.horsesforcleanwater.com*
Snohomish County Pet Waste — *www1.co.snohomish.wa.us/Departments/Public_Works/Divisions/SWM/Services/Water_Pollution/Pet_Waste.htm*

Gardening

Blue Thumb Gardening
http://wsg.washington.edu/mas/pdfs/BlueThumb.pdf



Sea Grant Washington

EPA

Washington State Department of Ecology

WSG-AS 10-01 © 2010 University of Washington

No part of this publication may be reproduced except with written permission from the publisher. Contact Washington Sea Grant, Communications, 3716 Brooklyn Avenue N.E., Seattle, WA 98105-6716, phone 206.543.6600, fax 206.685.0380, email: *seagrant@u.washington.edu* • *www.wsg.washington.edu*

Funding for this project has been provided in part through EPA Grant No. C9-00044905-0 to the Department of Ecology from the United States Environmental Protection Agency. The Department of Ecology allocates and administers funding for this project. The contents of this document do not necessarily reflect the views and policies of either the United States Environmental Protection Agency or the Department of Ecology, nor does the mention of trade names or commercial products constitute endorsement or recommendation for their use.

APPENDIX C: List of Audience Questions

Audience members asked a few questions at the end of each session. They were also asked to place POST-IT NOTE questions on large paper sheets in the back of room at each break. They were given dots to place on the POST-IT notes if they thought it was a good question, which helped us decide which questions would be posed to the Panel at the end of the day. Here are all the questions on the POST-IT notes, sorted into 3 general categories:

Regulatory & Oversight Questions

1. What pesticide is used in oyster beds? (see answer at end of Presentation Summaries)
2. What percentage of Puget Sound tidelands are used for shellfish aquaculture? (see answer at end of Presentation Summaries)
3. What percentage are in geoduck aquaculture? (7 dots)
4. Are we to assume there are no negative effects of shellfish aquaculture in Puget Sound? none were mentioned. Seems unlikely. I would like someone to discuss these. (8 dots) - *This question was given to Panel. See program notes for answers.*
5. Why are there no hydraulic permits on geoduck harvest? (7 dots)
6. How can the public consultation processes for permitting projects be strengthened? They are not good now.
7. What is the 15 ft setback and how does it impact industry and ecological health?
8. Who is following up and enforcing the conditions on permits? Is there monitoring of how well the aquaculture industry is meeting permit requirements? (2 dots)
9. Re: The filtering of water: Keeping water clean—Do shellfish store toxins & turbids in their bodies? (2 dots)
10. Is anyone tracking the amount, extent and type of aquaculture happening on private tidelands from year to year? Where can you get this info? if we don't have access to this data, how can we make informed decisions? (6 dots)
11. What is the acreage of commercial Pacific oysters vs the historical acreage of Olympia oysters? (1 dot)
12. Why is aquaculture (which replaces natural habitat) expanding in the Puget Sound when preservation of natural habitat is essential to salvage the Puget Sound ecosystem? (1 dot)

General, Research or Speaker-specific Questions

13. What is the advantage of growing Pacific oyster in Kona, HI? (see answer at end of Presentation Summaries)
14. Do forage fish spawn above a 5' tide on the beach? (yes)
15. Bobbi--What is the margin of error in results of research that takes a watershed level approach (Puget Sound South) for inlet bays? Quilcene Bay?
16. Is anyone doing eelgrass restoration alongside of commercial off-bottom grow methods?
17. Has there been research to compare historic farming methods (clam gardens) to today's methods? (1 dot)

18. Several winters ago there was a massive die-off of oysters in Dabob Bay. any idea what caused this? Was it related to any experiments on starfish virus studies? (2 dots)
19. How does the carbon footprint of shellfish farming compare to terrestrial agriculture? i.e. cow, goats, pigs) (2 dots)
20. What about the plastic bags the shellfish are in? Does ANY of this plastic end up in the sea water? (7 dots)
21. Has there been research to compare historic farming methods (clam gardens) to today's methods? (1 dot)
22. The USDA Ag Census 2017 shows aquaculture as the largest food production (and dollar value) in our county. In order for this industry to remain, there needs to be succession plans or opportunities for new/beginning and young aquaculture to enter this business. How is the shellfish industry (regulators, agencies, organizations) supporting the next generation of shellfish producers for years to come? (4 dots)
23. What educational or training opportunities are available to folks interested in integrated multi-trophic aquaculture? (1 dot)
24. Jodie—Why is research only looking at aquaculture when no disturbance? Why no pictures during harvest, disturbance, planting, etc. Also geoduck harvest—get pictures of tidelands when turned into a slurry. What about research on what commercial shellfish take out (feed on) of water vs what forage fish, salmon, natural organisms and birds eat? (5 dots)
25. If shellfish commercial growing is so great for habitat, why are numbers of orcas, marbled murrelets, loons, salmon, forage fish numbers dropping drastically as shellfish farming has increased? (2 dots)
26. Dave Steele: What taxes does your company pay to the County? the state? (4 dots)
27. What are the resources available for non-commercial shellfish growers? We are cultivating oysters for our use and want to have access to all the available science: water quality, ghost shrimp, protection of eelgrass beds, etc.
28. We live on Lindsay Beach, Dabob Bay. 2 people come by in an inflatable boat and take samples with a rake-like device in the eegrass. What are they checking for and who are they with (what agency?) (1 dot)
29. How do you test for presence of parasites and chemical contaminants? Who's testing? (1 dot)

<u>Questions for Organizers</u>

30. Will presentations be posted? reports? on web site? where? (2 dots)
31. At present, this is a pro-commercial aquaculture forum, and yet many are opposed to aquaculture. Will that viewpoint be presented here? (one dot)
32. There was no representation from any environmental groups' perspective. Why? (4 dots)

Question in the Evaluation Form: "What else would you like to know more about?

- How to sustain the industry for generations to come.

- How can new/beginning shellfish growers enter the business?
- Data from impact study
- I would have liked to hear the answer (from the panel) to the question "Do you think there should be an HPA required for geoduck harvest?
- Who else is in the audience (besides the MRC)?
- How much food is provided via aquaculture vs terrestrial farming?
- Economics/business owners/impacts
- Sound Action
- Commercial geoduck industry—used natural product.
- Best Practices for shellfish farming for personal consumption.
- More about geoduck farming. Pros and cons of blasting with water.
- Negative aspects of aquaculture.
- Is there any law or regulation that requires disclosure of money spent on lobbying at state level?
- Watershed quality concerns
- Negative impacts. Besides hydraulic permit, little was presented about. Not much on the research, except for presentation on Ecopath but no time for discussing various findings in any in-depth way.
- Cattle vs clams ☺

APPENDIX D: Outside (external) protestor's handout

"Our mission is to protect and restore the marine environments of East Jefferson County by raising community awareness of issues and generating support for Northwest Straits Commission (NWSC) programs and activities." (Jefferson County Marine Resources Committee mission statement)

HOWEVER

Today's Marine Resources Committee (MRC) Shellfish Forum does not raise "community awareness of issues." Instead it presents a biased introduction to shellfish aquaculture. The MRC forum will not discuss the destructive aspects of industrialized geoduck, oyster and other shellfish operations. Four out of seven speakers represent the commercial (for profit) interests of the industry; the other three do not address environmental concerns. The speakers include:

- Puget Sound Restoration Fund – Does not comment on commercial shellfish operations; encourages community-owned shellfish farms
- Jamestown S'Klallam - operates commercial shellfish farms
- Rock Point Oyster Co - a commercial shellfish company
- Pacific Shellfish Institute - a shellfish industry support group
- Sound Action – Does not comment on commercial shellfish operations; will only discuss the regulatory process
- Department of Ecology - has a State mandate to support commercial aquaculture
- Washington Department of Health - only monitors shellfish farms for human health

This one-sided forum is funded by taxpayer dollars through the Department of Ecology. Why is MRC presenting this program without presentations from scientists and organizations covering losses to our natural resources from commercial shellfish growers?

The public deserves a balanced discussion of how shellfish farms impact our Washington State shorelines.

- **Each industrial-sized project consumes extensive acres of shorelines.** According to the Dept. of Health, as of August, 2018 there were 143,662 acres approved for commercial shellfish harvest.
- **The farms are located in the protected waters of bays and estuaries** – critical forage fish and salmon habitat AND a priority in the effort to save our Southern Resident Killer Whales.
- **Eelgrass growth** significant to the eco functioning of marine life and birds is disrupted by the farmers' activities, net bags, tubes and other farming structures.
- **The farms affect the sea birds, water fowl and local wildlife** by changing and diminishing their feeding grounds, typically they strip the natural beach ecosystem, including with pesticides, to plant the shellfish seeds.
- **Industrial Oyster farmers have introduced a non-native oyster species**.
- **The farms involve an extensive use of plastic** tubes, mesh bags, netting, trays etc. These release quantities of micro plastics into the waters.

Geoduck Farm

Oyster Farm