Protect Zangle Cove
Post Office Box 1786
Olympia, WA 98507
Email: protectzanglecove@gmail.com
Web: http://protectzanglecove.org

In coalition with:
Coalition to Protect Puget Sound Habitat
APHETI
Washington Sierra Club - Aquaculture
Friends of Anderson Island Shoreline
Friends of Burley Lagoon
Case Inlet Shoreline Association
Citizens of Harstine Island and Shine Beach

February 23, 2016

Tony Kantas, Senior Planner
Thurston County Planning Department
2000 Lakeridge Drive SW
Olympia, WA 98502-6045

Subject: Comments on Confluence Document, 11/20/15, Supporting the ChangMook Sohn Industrial Geoduck Farm Application, 930 76th Ave NW, Parcel No. 12911440101, Case No. 2014108800

Issue: Native Eelgrass and the Pacific Northwest National Laboratories Eelgrass Restoration Project in Zangle Cove

Dear Mr. Kantas,

The most important and significant issue related to the Sohn geoduck aquaculture permit is the ongoing Pacific Northwest National Laboratories (PNNL)/Department of Natural Resources eelgrass restoration project, funded by the Environmental Protection Agency, the United States Department of Energy and the Washington State Department of Ecology, of which Zangle Cove is a documented test site.[1] The PNNL report, dated 2014, states that three sites (Anderson Island, Liberty Bay and Westcott Bay) have not been successful eelgrass restoration test sites. **The two sites that have been successful are Joemma Beach and Zangle Cove.**

Zangle Cove is significant in the effort to restore and preserve the important eelgrass habitats of Puget Sound for endangered species – a goal that is a priority for Washington State. It is also significant in that eelgrass restoration in Puget Sound has an economic benefit that far outweighs any benefit from an individual geoduck farm. Zangle Cove, as an eelgrass restoration site, should be off-limits to industrial aquaculture.

Discussion: The importance of eelgrass in the restoration of Puget Sound.

EoPugetSound.org magazine states that eelgrass "harbors as much life as an old growth or tropical forest, and it hides in the waters just off shore. Without it, scientists say, there would be precious few salmon or herring, and little prey for orcas. It means hundreds of millions—perhaps billions—to the local economy and chances are, most Puget Sound residents have never heard of it. It is eelgrass, and there may be no plant more central to Puget Sound's environmental wellbeing."[2]

[1] Pacific Northwest National Laboratories/Department of Natural Resources "Eelgrass Restoration in Puget Sound," 2014. Previously provided to Thurston County Planning Department
[2] Attachment H: "Shedding New Light On Eelgrass", 2014, https://www.eopugetsound.org/magazine/eelgrass

Dr. Ron Thom, a biologist working on eelgrass restoration at the Pacific Northwest National Laboratory, says in the article: "Eelgrass is critical to what we know and love about Puget Sound." In the article, Dr. Thom relates just a few of the plant's benefits:

> *Eelgrass protects young salmon and shellfish such as Dungeness crabs. It stymies coastline erosion with its root and shoot system, and is central to the food web. Its narrow, olive-colored leaves house millions of tiny organisms that will in turn feed larger invertebrates, and eventually, the fish we catch and the birds and whales we watch.*

Jeffrey Gaeckle, a Department of Natural Resources eelgrass expert, describes the importance of eelgrass that will "restore natural functions and ecological services within the nearshore waters of Puget Sound" and he describes the fact that over time, "the patchy transplant pattern initially planted should coalesce into continuous fringing beds or shallow, expansive meadows."[3]

In 2015, the Shoreline Hearing Board denied a permit for a geoduck farm in Pierce County on the Detienne property primarily because of the presence of eelgrass on the site. Other factors in the denial were recreational use of the area, herring spawning and designation of the area as a shoreline of state-wide significance because some parts of the farm were below the -4.5 tidal elevation. The Superior Court upheld this denial on 4/3/15. The Shoreline Hearings Board cites in its Findings of Fact, Conclusions of Law, and Order in the Detienne case[4] that:

> *P. 9 Eelgrass serves essential functions in the developmental life history of fish and shellfish. WAC 22-110-250. It provides refuge sites and shelter from predators for fish and invertebrates, and for other small organisms. Eelgrass is a source of food for many marine animals and birds and is habitat for red algae and other marine plants. It also provides physical stabilization of the nearshore area. Seagrasses baffle wave and tidal energy, protecting subtidal sediments and shorelines from erosion and can alter local and regional hydrography. Seagrasses such as eelgrass are the only rooted organisms in the near-shore region and they serve as the foundation for thousands of vertebrate and invertebrate species that use it for shelter, foraging, spawning, habitat, and nurseries…*
>
> *….There has been a marked decline in eelgrass and other sea grasses world-wide, which can be classified as a global crisis…*
>
> *…protection of eelgrass beds is preferable to replacement of beds because the surrounding environment loses the functions and values the destroyed eelgrass beds provide, and replacement efforts are not always successful, and can take a long time…*
>
> *…Documented success of restoration by replanting is rare.*

[3] Pacific Northwest National Laboratories/Department of Natural Resources "Eelgrass Restoration in Puget Sound," 2014. Previously provided to Thurston County Planning Department
http://wdfw.wa.gov/grants/ps_marine_nearshore/files/eelgrass_restoration_in_puget_sound.pdf

[4] Attachment M: Shoreline Hearings Board, State of Washington, Coalition To Protect Puget Sound Habitat, Petitioner and Paul H. Garrison and Betty N. Garrison, Petitioners-Interveners, v. Pierce County, Darrel de Tienne and Chelsea Farms, LLC, Respondents

Discussion: The importance of eelgrass to the Puget Sound economy

According to eopugetsound.org ,[5] restoration of eelgrass will bring both environmental and economic value to the State of Washington:

> *A billion-dollar plant?*
>
> *Successful eelgrass recovery efforts would mean a boon for the ecosystem, but also for the Puget Sound economy.*
>
> *Achieving the state goal of a 20 percent increase in eelgrass by the year 2020 would increase the number of fish available for commercial and recreational fishing in the Sound, according to a 2012 study published in the journal Ecosystems[6] by researchers at the Northwest Fisheries Science Center. In all, the study looked at 37 different cases where eelgrass provided ecosystem services "of either provisioning or cultural value," from benefits to salmon and commercial geoduck harvests to recreational fishing of rockfish and lingcod.*
>
> *Take into account eelgrass as an overall anchor for the nearshore ecosystem, and the dollar return is significant. Salmon alone infuse hundreds of millions of dollars per year into the local economy, as do Pacific herring and shellfish, such as Dungeness crabs. Iconic, tourist friendly wildlife like seabirds and killer whales also depend on eelgrass for their survival, directly or indirectly.*
>
> *"Killer whales don't eat eelgrass, but they do eat salmon, and salmon grow up in the eelgrass," says biologist Fred Short.*

Discussion: The importance of Zangle Cove and the Pacific Northwest National Laboratories eelgrass restoration project.

The goal of Washington State is to increase eelgrass in Puget Sound by 20% by 2020.[7] Because Zangle Cove is a thriving test site for eelgrass restoration, Zangle Cove is significant. Based on information cited above:

1) Eelgrass is subject to disturbance such as turbidity and to stressors such as shellfish aquaculture;
2) It is difficult to restore eelgrass for a variety of reasons;
3) Zangle Cove is the furthest south in Puget Sound where native eelgrass has been found recruiting;
4) Zangle Cove is one of the PNNL eelgrass restoration sites;
5) Zangle Cove is a thriving test site for eelgrass restoration.
6) Native eelgrass has been documented by DNR to be adjacent to and/or on Mr. Sohn's tideland.

[5] Attachment H: Shedding New Light On Eelgrass, 2014, https://www.eopugetsound.org/magazine/eelgrass

[6] Attachment K: The Role of Eelgrass in Marine Community Interactions and Ecosystem Services: Results from Ecosystem-Scale Food Web Models, Mark L. Plummer, 2012.

[7] Attachment J: 20% More Eelgrass (Zostera marina) by 2020, Restoration Site Selection and Testing, and Resolving Regulatory and Social Barriers to Conservation and Recovery; Lara Aston, Marine Sciences Division, Coastal Ecosystems Research Group, 2013; http://www.ecy.wa.gov/programs/sea/shorelines/smp/toolbox/docs/eelgrass_jan2013.pdf

Based on these facts, it would be counterproductive to permit a geoduck farm in the vicinity of the eelgrass restoration project. No shellfish aquaculture activity should be permitted within at least 1000 or more lateral feet of the eelgrass restoration project or within 1000 feet of any documented or previously documented native eelgrass.

Discussion: History of eelgrass in Zangle Cove:

Contrary to the Confluence assertions that eelgrass is 330 feet from the Sohn Project Area and that the Sohn tideland is not on the alluvial fan of Zangle Cove and so therefore the Sohn tideland cannot support eelgrass,[8] these are the facts:

- In 2006, two patches of self-recruiting native eelgrass were found by property owners on Zangle Cove: 1) the one mentioned by Confluence west of Zangle Stream; and 2) a second patch of eelgrass on or adjacent to Mr. Sohn's tideland property.

- Neighbors have photos from 2006 of both of these patches and the photo of the second eelgrass patch shows its proximity to the Sohn beach.[9]

- Neighbors have photos from 2006 of Mr. and Mrs. Sohn digging and raking near or within this second eelgrass patch for crabs along with email confirming this observation.[10]

- In 2006 neighbors alerted DNR of the eelgrass on Zangle Cove and a DNR eelgrass expert came out and documented the patches.

- In 2007 DNR eelgrass expert, Jeffrey Gaeckle, documented the presence of both patches of eelgrass with GPS coordinates in an email dated 7/25/07.[11]

- One of the patches documented in 2007 was on or adjacent to Mr. Sohn's tideland and thus Mr. Sohn's tideland is hospitable to native eelgrass. It is unclear if this patch still exists or if the disruption of the patch over time by the raking for crabs caused its loss.

- Crabs typically like to hide in eelgrass.[12]

- In 2008 neighbors took photos of four separate patches of native eelgrass self-recruited in Zangle Cove.[13]

- The unusual finding of self-recruiting native eelgrass on Zangle Cove initiated the inclusion of Zangle Cove in the Puget Sound wide Pacific Northwest National Laboratories eelgrass restoration project.

- The Boston Harbor community participated in the 2015 restoration project, helping with bundling of the eelgrass at the Boston Harbor Marina for planting in Zangle Cove.

[8] Confluence Environmental Company Response to Public Comments, 11/20/15, p. 15
[9] Attachment B: 2006 Photos of two native eelgrass patches in Zangle Cove.
[10] Attachment C: 2006 Photos of crabs and eelgrass raked from the second eelgrass patch.
[11] Attachment F: 2007 DNR Jeffrey Gaeckle email to Townsends
[12] http://www.ecy.wa.gov/programs/sea/pugetsound/species/eelgrass.html
[13] Attachment D: 2008 Photos of four native eelgrass patches in Zangle Cove.

- Based on aerial photographs of Zangle Cove at low tide, Mr. Sohn's tideland property is mainly or wholly on the alluvial fan from Zangle Creek.[14]

- Neighboring tideland property owners are united in their support of the eelgrass restoration project in Zangle Cove.

The PNNL document references the test eelgrass restoration project in Zangle Cove as follows:

> *… Our expectation was that South Sound was largely inhospitable to eelgrass and restoration would be difficult. However, we found that portions of the South Sound may be very good for supporting eelgrass and recruitment limited. The decline on Anderson Island suggests that a strong southwest exposure may be undesirable in the region, so future work should focus on the north or east sides of landmasses (e.g., Zangle Cove) or where the fetch is minimized (e.g., Joemma State Park). Joemma State Park also has significant flushing resulting in coarser sediments, and this may be beneficial in the South Sound where turbidity is a concern. Patchy suitability and potential recruitment limitation may make parts of the South Sound ideal for restoration and meeting the goals set forth for 2020. P. 30*
>
> *Test plantings at several locations in south Puget Sound (i.e., Joemma State Park and Zangle Cove) suggested the possibility of successful restoration. Test plantings at Anderson Island, Liberty Bay, and the head of Westcott Bay were unsuccessful, which suggested that further investment in restoration at those locations would be unadvisable unless stressors were identified and abated. P. 5*
>
> *Zangle Cove and Westcott middle had some mortality, which is expected with the first year of this type of transplanting (e.g., Vavrinec et al. 2007), but did well enough to warrant further investigation for large-scale restoration. P.24*[15]

Discussion: Thurston County should look to the Detienne Shoreline Hearings Board (SHB) denial[16] of a geoduck permit, not the Haley Shoreline Hearings Board approval of a geoduck permit.[17]

Confluence states on page 1 of their document, that many of the concerns raised by public comment on the Zangle Cove project "were raised and addressed for a geoduck aquaculture proposal in Case Inlet (Haley Farm)" and thus Confluence relies on the Haley Farm permit to justify the Sohn Farm permit.

[14] Attachment A: Aerial photo of Zangle Cove at extreme low tide.
[15] Pacific Northwest National Laboratories/Department of Natural Resources "Eelgrass Restoration in Puget Sound," 2014. Previously provided to Thurston County Planning Department
http://wdfw.wa.gov/grants/ps_marine_nearshore/files/eelgrass_restoration_in_puget_sound.pdf
[16] Attachment M: Shoreline Hearings Board decision on the Detienne geoduck Farm.
http://protectzanglecove.org/assets/20140222_SHB_Detienne_Denial.pdf
[17] Shoreline Hearings Board decision on the Haley geoduck farm, previously provided to Thurston County Planning Department as Appendix A to the Confluence report of 11/20/15.
http://protectzanglecove.org/assets/20150515_SHB_HaleyDecision.pdf

Discussion: The Detienne SHB decision is relevant for Zangle Cove

1. The primary reason the SHB denied the Detienne geoduck farm permit (denial was upheld in Superior Court) was because of established eelgrass. Zangle Cove also has established eelgrass along with an even more significant condition: a multi-million dollar eelgrass restoration project.

2. A second reason the SHB denied the Detienne permit was related to recreational use, in that case wind surfing. Zangle Cove also is an area of high recreational use, a destination for boaters and kayakers from Boston Harbor Marina and the neighborhood. It is historically a recreational use area, not an oyster cultivation area. The facts of this historical use were thoroughly documented in our letter to you of 3/30/15, including records of tideland sales dated 1903 to 1927 that show that the State of Washington originally sold these tidelands for non-aquaculture use.

Discussion: The Haley Farm SHB decision is not relevant for Zangle Cove--four glaring reasons

1. Eelgrass and eelgrass restoration on Zangle Cove

    - Haley Farm, Line 4, page 3: "No eel grass, kelp, or rooted aquatic vegetation have been identified on the site."[18]

    - Zangle Cove not only has self-recruiting native eelgrass, but is part of the Puget Sound wide eelgrass restoration project funded by the EPA and the United States Department of Energy, Department of Natural Resources and Battelle.

2. Zangle Cove is a residential area;

    - Haley Farm, Line 4, page 3: "The distance (fetch) from the site to the closest point on the opposite shoreline is over two miles," i.e., no one can see the farm from two miles across the bay.[19]

    - Zangle Cove is a high density neighborhood just across the Cove from Mr. Sohn's tideland, a few hundred feet away. While Sohn is on a high bank and will not see his own farm from his front window, all the other neighbors will have front row seats.

3. Zangle Cove is a neighborhood:

    - Haley Farm, Line 17, page 2: "Excluding the Haley property, the closest residence abutting the shoreline is 2,000 feet away."[20]

    - Zangle Cove is a tight knit shoreline residential neighborhood within Boston Harbor with at least 18-22 households having a direct or partial view of Mr. Sohn's tideland. Boston Harbor, with some

[18] Shoreline Hearings Board decision on the Haley geoduck farm, previously provided to Thurston County Planning Department as Appendix A to the Confluence report of 11/20/15.
http://protectzanglecove.org/assets/20150515_SHB_HaleyDecision.pdf
[19] Ibid.
[20] Ibid.

1793 residents in the near vicinity[21], also has a marina that caters to both resident and non-resident clients who use Zangle Cove as a destination for boating and kayaking and other beach activities.

4. Zangle Cove is a relatively protected shoreline and supports migrating salmon:

    - Haley Farm, Line 1, page 16: "...because the Haley Farm is on an exposed shoreline and not in an enclosed area like Dutcher's Cove, the concerns regarding potential impact from harvest activities on migrating salmon were not present."[22]

    - Zangle Cove is not an exposed shoreline such as the Haley Farm and DOES have migrating Salmon. Tribal Fishermen historically come every year to Zangle Cove, in fact, to the exact Sohn beach, to fish for Salmon in the fall. See attached photos taken 9/24/15.[23]

Discussion: Zangle Cove is even more unique than Detienne because of the eelgrass restoration project.

The Zangle Cove case, like the Detienne case, has unique features that should preclude a geoduck farm, the primary one being that Zangle Cove is a test site for the Sound wide eelgrass restoration project as mentioned above. There are differences in the uniqueness of these two cases:

- The proposed Detienne farm was in an area of extensive eelgrass, some of which had been damaged by a previous farm and was in a primarily subtidal and partly intertidal area.

- The proposed ChangMook Sohn farm in Zangle Cove is in South Puget Sound in an intertidal area where no eelgrass is expected to be found, but where, by some miracle of nature, native eelgrass has recruited. It is the furthest south that this has been found in Puget Sound. Mr. Gaeckle of the Washington Department of Natural Resources states in his report: **"It is generally believed that there is a limited distribution of eelgrass in South Sound and the presence of eelgrass in Zangle Cove is of interest to the Nearshore Habitat Program … and of particular interest to the Submerged Vegetation Monitoring Project…"**

The Detienne geoduck farm permit application was denied by the Shoreline Hearings Board and that denial was upheld by the Superior Court. Where the emphasis in the Detienne case was to protect the existing eelgrass, the emphasis in Zangle Cove must be to allow for the expansion of the natively recruiting and restored eelgrass. So while in the Detienne SHB hearing much ado was made about the footage of buffers to the existing eelgrass (and the permit was still denied), the strict number of feet within Zangle Cove from the Sohn tideland to the natively recruiting and restored eelgrass is not relevant. It should be enough, in this small cove, that nothing interferes with the multi-million dollar eelgrass restoration project and the ***expansion*** of the eelgrass that Washington State taxpayers are paying for.

[21] https://nextdoor.com/neighborhood/bostonharborwa--olympia--wa/
[22] Attachment E: Photos of Tribal fisherman netting for salmon above the Sohn tideland, dated 9/24/15
[23] Shoreline Hearings Board decision on the Haley geoduck farm, previously provided to Thurston County Planning Department as Appendix A to the Confluence report of 11/20/15.

Discussion: Geoduck harvest silt plumes are stressors on eelgrass.

There is no dispute that geoduck harvest activities generate silt plumes. In the Shoreline Hearings Board denial of the permit for the Detienne application:[24]

> "…the applicants did not consider impacts of farming activities to eelgrass on adjacent properties. They only considered whether sedimentation from subtidal operations would flow towards shore and into the eelgrass bed at the Farm Site. Yet Ms. Meaders (Confluence) admitted that sedimentation from intertidal harvest, in particular, would travel laterally along the shore, and that this would be more problematic."

Confluence also fails to address this issue related to the ChangMook Sohn proposal.

Shellfish aquaculture is a stressor on eelgrass:

> *Page iii, Abstract, of the PNNL report:*
> *Surveys of stakeholders identified dredging/filling, shoreline development, water quality, and commercial aquaculture as the most significant stressors on eelgrass, and noted that new regulations and improved enforcement of existing regulations would be necessary to ensure continued recovery and protection of eelgrass.*
>
> *Page 29, Section 4.3, Stakeholder Input:*
> *The stakeholders we surveyed identified dredging and filling, water quality, shoreline development, and commercial aquaculture as the greatest stresses to eelgrass. As the human population in Puget Sound is projected to increase, attention to protecting critical habitats and limiting stressors will be critical to meeting eelgrass recovery goals.*[25]

Discussion: The importance of recreation in Zangle Cove.

We will discuss more fully the historical importance of recreation in another letter. Zangle Cove is a high use recreation area because of the community of Boston Harbor and proximity of the Boston Harbor Marina. Claims that the geoduck farm would be visible only 13 % of the time are misleading since **the lowest daytime tides of the year occur during the summer months, Memorial Day Weekend through Labor Day, and the farm would be visible or obstructive 76% to 87% of the daylight hours during this time period**.[26]

Conclusion

As we wrote previously on February 15, 2015,[27] the multi-million dollar taxpayer funded eelgrass restoration project, for which Zangle Cove is a thriving test site, should take precedence over an individual property owner

[24] Attachment M: Shoreline Hearings Board, State of Washington, Coalition To Protect Puget Sound Habitat, Petitioner and Paul H. Garrison and Betty N. Garrison, Petitioners-Interveners, v. Pierce County, Darrel de Tienne and Chelsea Farms, LLC, Respondents

[25] Pacific Northwest National Laboratories/Department of Natural Resources "Eelgrass Restoration in Puget Sound," 2014. Previously provided to Thurston County Planning Department, Abstract, Page iii, http://wdfw.wa.gov/grants/ps_marine_nearshore/files/eelgrass_restoration_in_puget_sound.pdf

[26] Attachment G: Tide Visibility Chart

[27] Attachment L: Protect Zangle Cove Letter to Thurston County, 2/19/15, regarding eelgrass in Zangle Cove

geoduck farm. The idea of restoration is not to sequester the restored eelgrass in a little box where it was originally planted, but to allow it to grow unimpeded across the entire Cove and beyond, as stated by Mr. Gaeckle. This is what all the money is for: "restoration."

The restoration of eelgrass has not only environmental benefits, but also economic benefits related specifically to the increase in Puget Sound salmon.

If the restoration of eelgrass is indeed as important to the restoration of Puget Sound as our government officials and scientists claim it to be, then Thurston County should make every effort to protect this native eelgrass and to decline ANY activity that could compete with or diminish the possibility of the restored eelgrass growing across the entire Cove and beyond. Based on the nationally funded eelgrass restoration project, for which Zangle Cove is a thriving site, the project permit should be denied.

We request a written response from Thurston County to the above concerns about the Sohn proposed permit.

Sincerely,

Patrick and Kathryn Townsend
Protect Zangle Cove

Cc:
Jessica Jensen, Attorney at Law
Cindy Wilson, Thurston County Senior Planner
Jeremy Davis, Thurston County Senior Planner
Michael Kain, Thurston County Planning Manager
Scott McCormick, Thurston County Associate Planner
Pamela Sanguinetti, Army Corps of Engineers, Seattle Regional Office
Jay Inslee, Governor State of Washington
Sally Toteff, Washington State Department of Ecology

Protect Zangle Cove

Letter to Tony Kantas, Thurston County,

February 23, 2016

Attachment A through Attachment E

Attachment A
Aerial photo of Zangle Cove at extreme low tide May 2014.

White arrow points to the Sohn property.

Attachment B
Photos of Eelgrass in Zangle Cove 2006

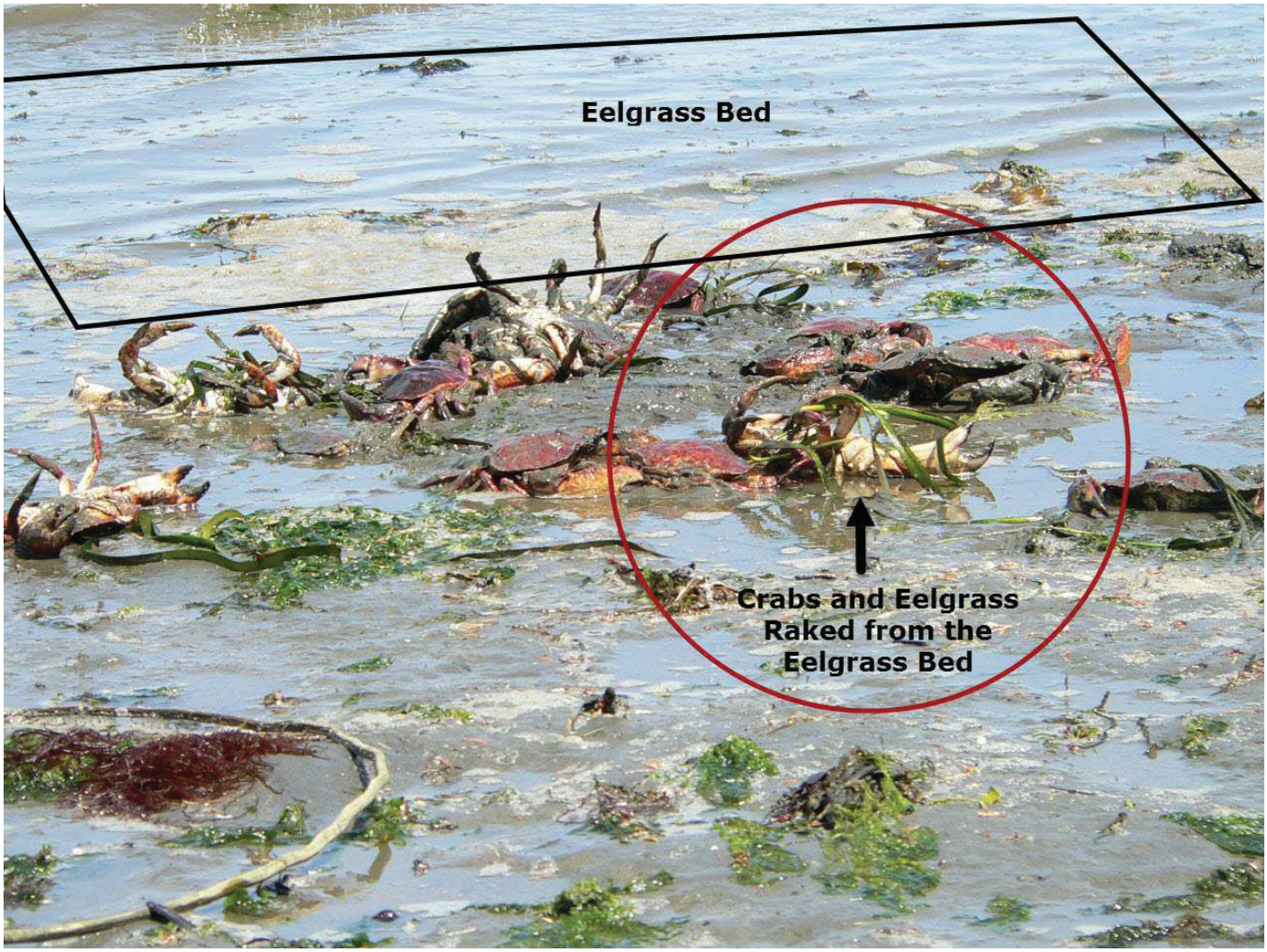
#1 Larger patch, west of stream tributary

Attachment B, cont.

#2 Smaller patch, much further east than patch #1, on or adjacent to Sohn tideland

These patches of eelgrass were documented by DNR by GPS coordinates in 2007

Attachment C
Crabs and eelgrass raked from the 2nd eelgrass patch by Mr. and Mrs. Sohn on or adjacent to their tideland.



2006 Crabs and eelgrass raked from the eelgrass bed on or adjacent to the Sohn Tideland.

Attachment D
Photos of four patches of eelgrass in Zangle Cove in 2008 at extreme low tide.

#1 Largest patch of eelgrass, approx. 25 sq meters, identified by J. Gaeckle, DNR, in 2007.
Photo taken in 2008.

#2 Smaller patch of eelgrass, approx. 8 sq meters, identified by J. Gaeckle, DNR, in 2007.
Photo taken in 2008

#3 New patch of eelgrass found by neighbors in 2008

#4 New patch of eelgrass found by neighbors in 2008

Attachment E

Tribal (or other) Fishermen Hauling in Salmon adjacent to the Sohn tideland on September 24, 2015

Attachment F

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands

To: Patrick and Kathryn Townsend
From: Jeffrey Gaeckle, Seagrass Ecologist
Date: 25 July 2007
RE: 2007 Zangle Cove *Zostera marina* L. Survey

The following summary provides details of two site visits to document the presence of the native eelgrass, *Zostera marina* L. in Zangle Cove, WA. In the spring of 2006, scientists in the WA DNR Nearshore Habitat Program were informed that a citizen based organization, Protect Our Shoreline, had pictures of eelgrass growing in Zangle Cove on their website (http://www.protectourshoreline.org/index.html). Zangle Cove is located southwest of Dana Passage and northeast of Boston Harbor, WA (Figure 1).

It is generally believed that there is a limited distribution of eelgrass in South Sound and the presence of eelgrass in Zangle Cove is of interest to the Nearshore Habitat Program (http://www.dnr.wa.gov/htdocs/aqr/nshr/index.html) and of particular interest to the Submerged Vegetation Monitoring Project. The Submerged Vegetation Monitoring Project monitors the abundance and depth distribution of eelgrass throughout Puget Sound but the sampling effort does not focus on waters south of Dana Passage due to the lack of known eelgrass presence at the time the project was initiated.

Washington DNR Nearshore Habitat Program scientists Pete Dowty and Jeff Gaeckle visited Zangle Cove on 19 September 2006 to confirm whether the seagrass was *Zostera marina* (native eelgrass) or *Zostera japonica* (non-native eelgrass). Pete and Jeff accessed Zangle Cove through Jon Vanek's property (638 77th Ave. NE, Olympia, WA, 98506, 360.786.8076) and were accompanied to the beach by Jon Vanek and Kathy Knight. The site visit confirmed that two patches of seagrass in Zangle Cove were *Zostera marina* L.

Jeff later contacted Patrick and Kathryn Townsend (7700 Earling St. NE, Olympia, WA, 98506) to make an additional visit to collect GPS coordinate data for the two patches of *Z. marina* in Zangle Cove. A site visit was arranged on 3 June 2007. GPS coordinate data were collected by walking the perimeter of each *Z. marina* patch using a Trimble Pocket PC 2003 (PPC) with ArcPad GPS system at a -0.67 m Mean Lower Low Water (MLLW) tide. A polygon of each *Z. marina* patch was logged on the ArcPad GPS unit (Figure 2).

The location and area of each *Z. marina* patch was determined from the GPS coordinate data collected on 3 June 2007. The larger patch of *Z. marina* is located at N 47° 08.689925, W 122° 53.5454562 (degrees decimal minutes) and its area is estimated at 25.2 m^2 (Figures 3 – 5). Vegetative and reproductive *Z. marina* shoots were present at the time of the visit (Figure 5).

The small patch was 67.1 m east northeast (ENE) of the large patch and located at N 47° 08.6950010, W 122° 53.4928324 (deg. dec. min.). The area of the small patch is estimated at 8.4 m^2. No photos of the small eelgrass patch in Zangle Cove were taken during the visit on 3 June 2007.

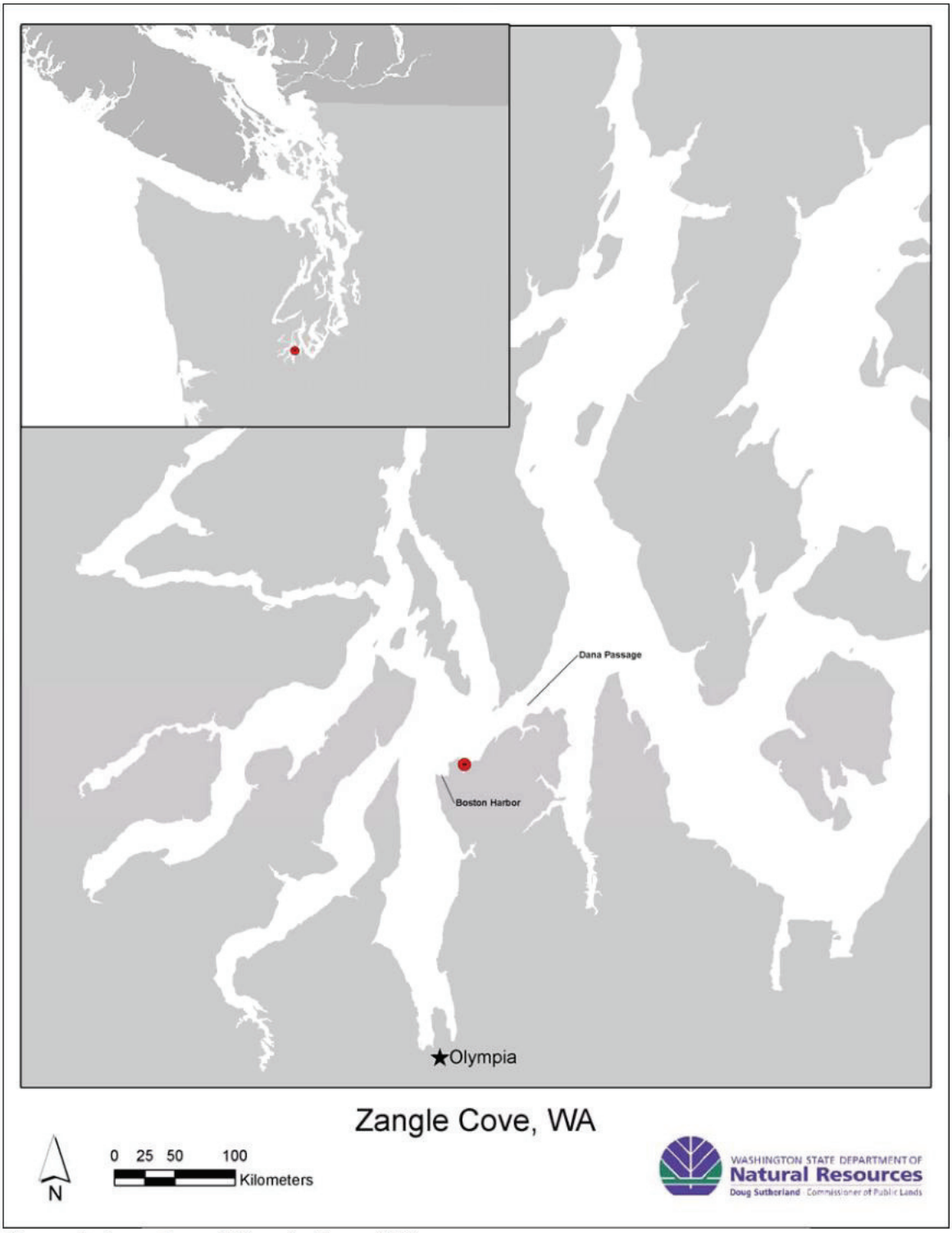


Figure 1. Location of Zangle Cove, WA.

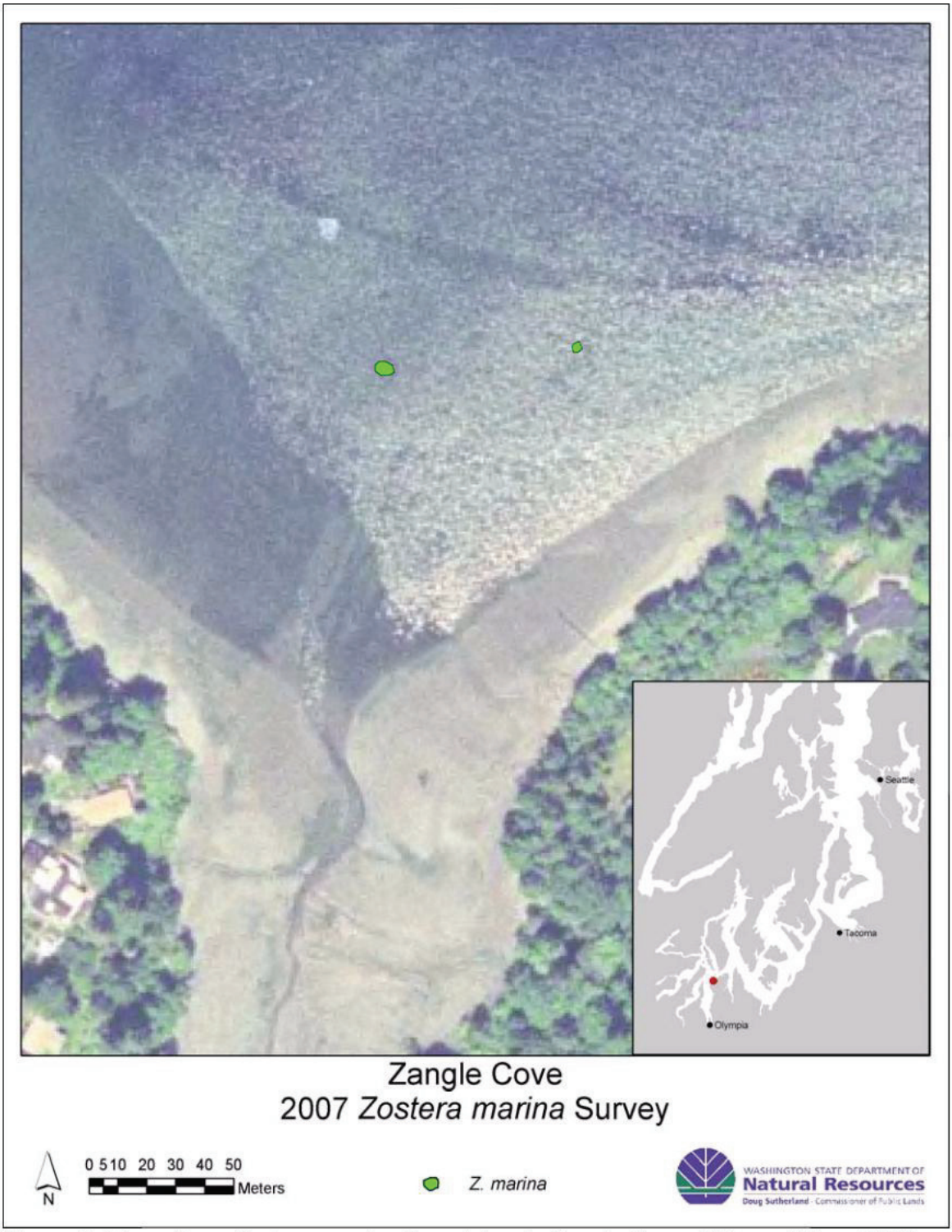


Figure 2. Map of two *Zostera marina* L. patches in Zangle Cove, WA, on 3 June 2007. The area of the small and large patch is estimated at 8.4 m^2 and 25.2 m^2 respectively.

Figure 3. Large patch of *Zostera marina* (outlined in white) in Zangle Cove (3 June 2007).

Figure 4. Large patch of *Z. marina* (outlined in white) in Zangle Cove (3 June 2007).

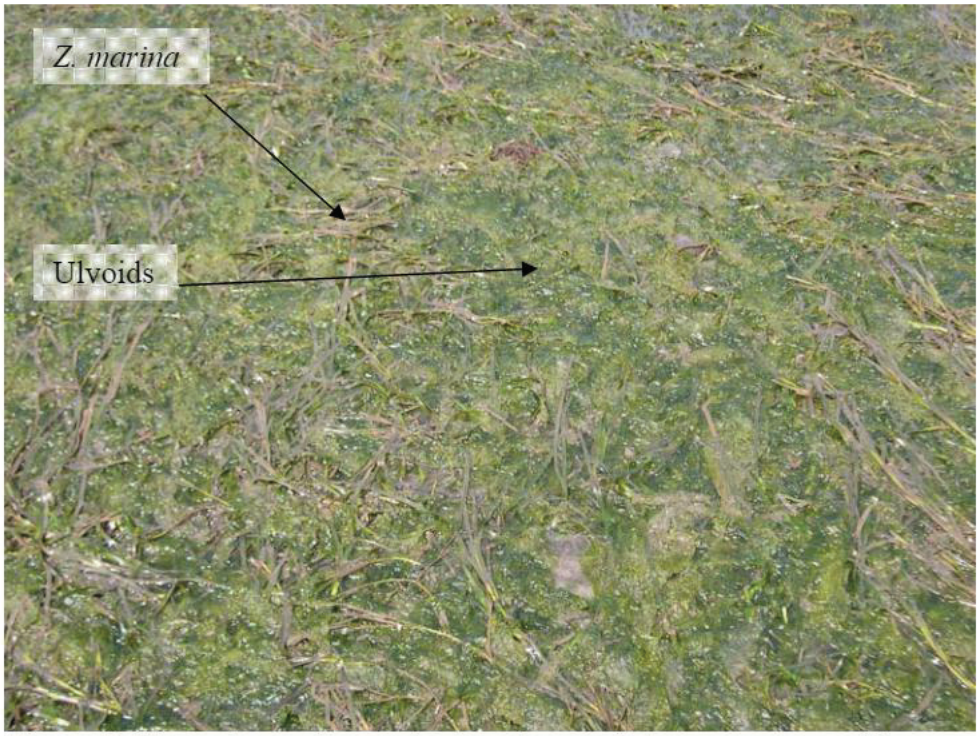


Figure 5. Vegetative and reproductive shoots of *Zostera marina* with ulvoids in Zangle Cove (3 June 2007).

Protect Zangle Cove
Post Office Box 1786
Olympia, WA 98507
Email: protectzanglecove@gmail.com
Web: http://protectzanglecove.org

In coalition with:
Coalition to Protect Puget Sound Habitat
APHETI
Washington Sierra Club - Aquaculture
Friends of Anderson Island Shoreline
Friends of Burley Lagoon
Case Inlet Shoreline Association
Citizens of Harstine Island and Shine Beach

Attachment G

Analysis of geoduck farm obstruction and visibility during summer daylight hours from Memorial Day weekend to Labor Day, 2007, Olympia, WA

If there are also oyster bags and manila clam nets on the beach, these are at a much higher tidal elevation so will present an obstruction and be visible every day during the summer. Geoduck tubes stick up 3-4 inches from the sediment, so this is a conservative estimate.

The industry says that geoduck operations are planted on a rotational basis, so in any one vicinity there may be tubes obstructing the water and visible on a yearly basis, not just the 1-2 years that tubes are in place for a particular area.

According to the Geoduck Growers Environmental Codes of Practice[1], "a length of pipe is pushed into the substrate in the intertidal zone from approximately the -2 tidal elevation to the +3 tidal elevation (MLLW) about 12 inches apart. About 3-4 inches of the PVC pipe is left above the substrate."

This information is derived from the dariki.org tide table for Olympia, Washington.[2]

Date 2007	Daylight Hours	Plant to <=+2	Days Seen	Plant to <=+3	Days Seen
26-May		0.00		0.00	
27-May		1.50	1.00	1.50	1.00
28-May		3.00	1.00	3.00	1.00
29-May		3.50	1.00	3.50	1.00
30-May		4.50	1.00	4.50	1.00
31-May		4.50	1.00	4.50	1.00
1-Jun	15.50	5.00	1.00	5.50	1.00
2-Jun		5.00	1.00	5.50	1.00
3-Jun		5.00	1.00	5.50	1.00
4-Jun		4.50	1.00	5.00	1.00
5-Jun		4.50	1.00	5.00	1.00
6-Jun		4.00	1.00	4.50	1.00
7-Jun		3.00	1.00	3.50	1.00
8-Jun		0.00		0.00	
9-Jun		0.00		0.00	
10-Jun		2.00	1.00	3.00	1.00
11-Jun		4.00	1.00	4.50	1.00

[1] Geoduck Growers Environmental Codes of Practice, http://www.protectourshoreline.org/taylor/8GeoduckCodesOfPractice.pdf

[2] http://www.dairiki.org/tides/monthly.php/oly

Date 2007	Daylight Hours	Plant to <=+2	Days Seen	Plant to <=+3	Days Seen
12-Jun		4.50	1.00	5.00	1.00
13-Jun		5.00	1.00	5.50	1.00
14-Jun		5.00	1.00	5.50	1.00
15-Jun		5.00	1.00	5.50	1.00
16-Jun		5.00	1.00	5.50	1.00
17-Jun		4.50	1.00	5.00	1.00
18-Jun		4.50	1.00	5.00	1.00
19-Jun		4.50	1.00	5.00	1.00
20-Jun		2.50	1.00	3.50	1.00
21-Jun		0.00		2.00	1.00
22-Jun	16.00	0.00		0.00	
23-Jun		0.00		0.00	
24-Jun		0.00		2.50	1.00
25-Jun		2.50	1.00	3.00	1.00
26-Jun		3.50	1.00	4.00	1.00
27-Jun		4.50	1.00	5.00	1.00
28-Jun		4.50	1.00	5.00	1.00
29-Jun		5.00	1.00	5.50	1.00
30-Jun		5.00	1.00	5.50	1.00
1-Jul	16.00	5.00	1.00	5.50	1.00
2-Jul		5.00	1.00	5.50	1.00
3-Jul		4.50	1.00	5.00	1.00
4-Jul		4.00	1.00	4.50	1.00
5-Jul		3.00	1.00	4.00	1.00
6-Jul		0.00		2.00	1.00
7-Jul		0.00		1.50	1.00
8-Jul		2.00	1.00	3.50	1.00
9-Jul		3.50	1.00	4.00	1.00
10-Jul		4.50	1.00	5.00	1.00
11-Jul		5.00	1.00	5.50	1.00
12-Jul		5.00	1.00	5.50	1.00
13-Jul		5.00	1.00	5.50	1.00
14-Jul		5.00	1.00	5.50	1.00
15-Jul	15.50	5.00	1.00	5.50	1.00
16-Jul		4.50	1.00	5.00	1.00
17-Jul		4.00	1.00	4.50	1.00
18-Jul		3.00	1.00	4.00	1.00
19-Jul		1.00	1.00	2.50	1.00
20-Jul		0.00		0.00	
21-Jul		0.00		0.00	
22-Jul		0.00		2.00	1.00
23-Jul		1.00	1.00	3.50	1.00
24-Jul		3.00	1.00	4.00	1.00
25-Jul		3.50	1.00	4.00	1.00
26-Jul		4.00	1.00	4.50	1.00
27-Jul		4.50	1.00	5.00	1.00
28-Jul		4.50	1.00	5.00	1.00
29-Jul		4.50	1.00	5.00	1.00
30-Jul		5.00	1.00	5.00	1.00
31-Jul		4.50	1.00	4.75	1.00
1-Aug	15.00	4.00	1.00	4.25	1.00
2-Aug		3.00	1.00	3.50	1.00

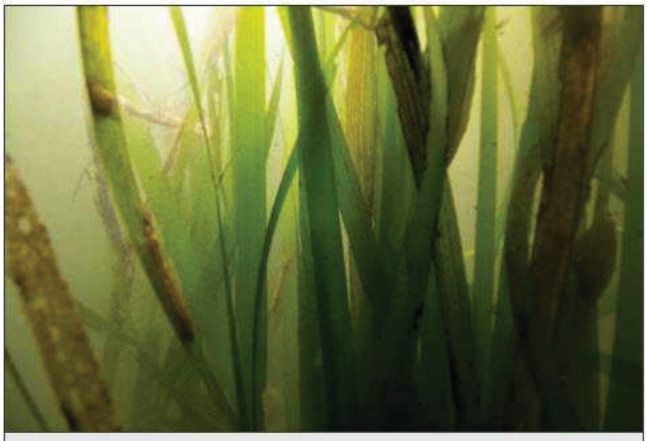
Analaysis of Geoduck Farm Visibility
August 20, 2007

Date 2007	Daylight Hours	Plant to <=+2	Days Seen	Plant to <=+3	Days Seen
3-Aug		0.00		2.00	1.00
4-Aug		0.00		0.00	
5-Aug		0.00		1.50	1.00
6-Aug		2.00	1.00	2.75	1.00
7-Aug		4.00	1.00	4.25	1.00
8-Aug		5.00	1.00	5.50	1.00
9-Aug		5.00	1.00	5.50	1.00
10-Aug		5.00	1.00	5.50	1.00
11-Aug		4.50	1.00	5.00	1.00
12-Aug		4.00	1.00	4.50	1.00
13-Aug		4.00	1.00	4.50	1.00
14-Aug		3.00	1.00	4.00	1.00
15-Aug		3.00	1.00	3.50	1.00
16-Aug		0.00		2.25	1.00
17-Aug		0.00		0.00	
18-Aug		0.00		0.00	
19-Aug		0.00		0.00	
20-Aug		0.00		1.00	1.00
21-Aug		1.00	1.00	2.00	1.00
22-Aug		2.50	1.00	3.50	1.00
23-Aug		3.50	1.00	4.50	1.00
24-Aug		3.50	1.00	4.50	1.00
25-Aug		4.00	1.00	4.50	1.00
26-Aug		4.00	1.00	4.50	1.00
27-Aug		4.00	1.00	4.50	1.00
28-Aug		3.50	1.00	4.00	1.00
29-Aug		3.00	1.00	3.50	1.00
30-Aug		2.00	1.00	2.50	1.00
31-Aug	14.00	0.00		1.50	1.00
1-Sep		0.00		0.00	
2-Sep		0.00		0.00	
3-Sep		0.00		0.50	1.00
==========	=======	======	======	=======	=======
Total	**92.00**	**300.50**		**363.25**	
Avg per day	15.33	2.98		3.60	
Avg Percent per day		19.40%		23.46%	
Tot Days		101.00		101.00	
Days under water		24.00		13.00	
Days above water*		77.00		88.00	
% Days above water*		76%		87%	

*All or portion of geoduck farm above water

Shedding new light on eelgrass recovery

Scientists say eelgrass, an unassuming flowering plant found just off shore in Puget Sound, is vital to the health of the ecosystem. They also say the plant is declining. New and increasingly urgent efforts to restore it brought a group of researchers to the 2014 Salish Sea Ecosystem Conference.



Inside the Eelgrass beds. Photo: Eric Heupel (CC BY-NC 2.0)
https://www.flickr.com/photos/eclectic-echoes/7654885752

Key takeaways

- Many species including salmon, Pacific herring, Dungeness crabs and even killer whales rely on eelgrass for survival.
- Eelgrass is declining in parts of Puget Sound.
- Declines may be linked to a wide variety of factors including nitrogen pollution that diminishes available light that plants need for growth.
- Scientists propose planting more eelgrass in suitable areas to meet recovery targets set by the state.
- State and federal agencies recently launched the Puget Sound Eelgrass Recovery Strategy to evaluate progress toward recovery goals.

SSEC 2014
Salish Sea Currents
Sponsored by:
EPA United States Environmental Protection Agency
PUGETSOUND PARTNERSHIP
2014 Salish Sea Ecosystem Conference

About this article

ARTICLE TYPE:
Magazine

AUTHOR:
Katie Harrington

POSTED IN EOPS:
08/08/2014

EDITOR:
Charles Simenstad & Jeff Rice

TAGS:
Biology, Marine habitat, Estuarine habitat, Plants, Water quality, Mammals, Nearshore habitat, Species and food webs, Fishes, Salish Sea Ecosystem Conference, Invertebrates, Salish Sea Currents (series), Salmonids, Forage fish, Shellfish, Shoreline armoring

Related Resources

Printable 2-page flyer of this story (PDF)
Puget Sound Vital Signs: Eelgrass
2014/2015 Action Agenda for Puget Sound
Are Puget Sound herring limited by loss of eelgrass?

It harbors as much life as an old growth or tropical forest, and it hides in the waters just off shore. Without it, scientists say, there would be precious few salmon or herring, and little prey for orcas. It means hundreds of millions—perhaps billions—to the local economy, and chances are, most Puget Sound residents have never heard of it. It is eelgrass, and there may be no plant more central to Puget Sound's environmental wellbeing.

"Eelgrass is critical to what we know and love about Puget Sound," says Ron Thom, a biologist working on eelgrass restoration at the Pacific Northwest National Laboratory.

Like most scientists who study the plant, Thom is something of an eelgrass evangelist. He ticks off just a few of the plant's benefits: Eelgrass protects young salmon and shellfish such as Dungeness crabs. It stymies coastline erosion with its root and shoot system, and is central to the food web. Its narrow, olive-colored leaves house millions of tiny organisms that will in turn feed larger invertebrates, and eventually, the fish we catch and the birds and whales we watch.

In short, healthy eelgrass (*Zostera marina*) indicates a healthier Puget Sound, which is why Thom and a group of scientists were out on the water last summer planting some unusual garden plots. Studies show that eelgrass is in decline in significant areas of Puget Sound, and scientists are looking for ways to bring it back to its historical levels. In a very literal way, they hope to plant the seeds of Puget Sound recovery.

Selecting plants from donor cultures. Credit: Ron Thom and John Vavrinec

Eelgrass fact sheet from WA Dept of Ecology

Padilla Bay National Estuarine Research Reserve

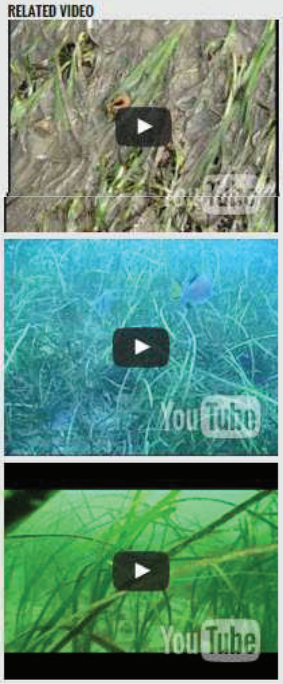
Seagrasses as "the marine equivalent of tropical rain forests." (Smithsonian)

Host demography influences the prevalence and severity of eelgrass wasting disease

The Role of Eelgrass in Marine Community Interactions and Ecosystem Services: Results from Ecosystem-Scale Food Web Models

Impacts of Terrestrial and Shoreline Stressors on Eelgrass in Puget Sound: An Expert Elicitation

RELATED VIDEO



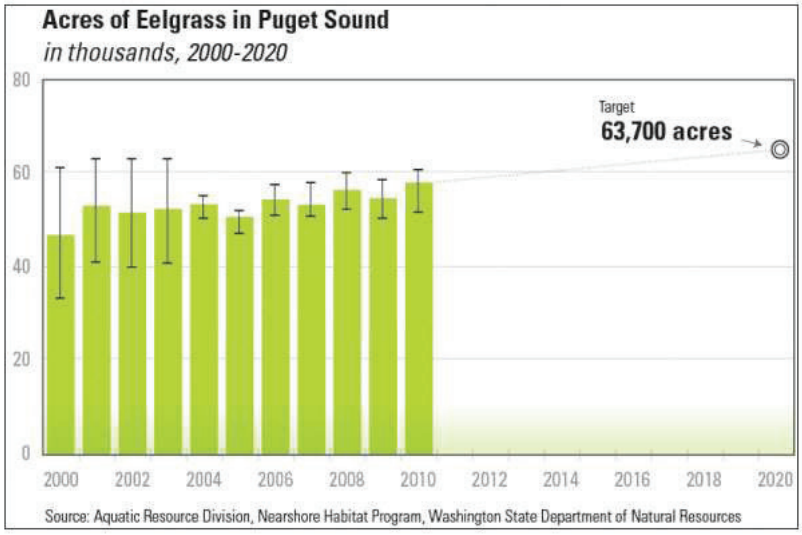
Related Species

Eelgrasses (Zostera)

Eelgrass (Zostera marina)

Why not just plant more?

One of the goals set by the state's Puget Sound Action Agenda is to add 20 percent more eelgrass to the region by 2020. But three years into the effort, there's been little or no progress, and growing perplexity. Studies show that some eelgrass beds are increasing while others are in decline. Several sessions at the 2014 Salish Sea Ecosystem Conference featured new research and possible new directions for recovery efforts.

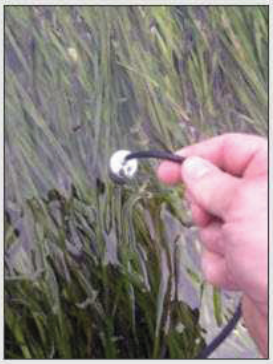


If eelgrass is declining, why not just plant more of it? That's one of the ideas under consideration by state and federal agencies. Last summer, divers planted nine experimental plots at five sites in Puget Sound, including sites of unexplained eelgrass loss.

As part of the process, Thom, along with his colleagues at the Washington State Department of Natural Resources and the Environmental Protection Agency, unveiled a computer model that identifies areas in Puget Sound where eelgrass could potentially thrive. The model compiles instrument readings from across the Sound, including light availability, salinity, temperature, and depth. When the right measurements align, the model suggests a planting site.

Light in particular is key, says Thom. It turns out that getting enough of that precious resource can be a challenge. Eelgrass evolved as a shade-adapted plant, able to thrive in the region's relatively low light. But other, human-caused factors appear to be changing conditions beyond the plant's tolerance.

The sound of photosynthesis



Wade out into the shallows of Puget Sound on a warm, sunny day and put your ear close to the water. You might catch the faint, champagne-like bubbling of eelgrass. A hydrophone captures the sound of oxygen bubbling from eelgrass leaves as the plant absorbs and photosynthesizes the sun's rays.

Listen to a recording of oxygen bubbling in eelgrass (Credit: Jeff Rice):

1:00

Blog post: The voice of eelgrass

The pollution factor

One of those factors is increased nitrogen. While eelgrass needs nitrogen to survive, too much of it sends phytoplankton, the plant's algal neighbors into a frenzied growth that blocks sunlight. Without the light, eelgrass can't harvest energy through photosynthesis. Fred Short of Washington's Department of Natural Resources, has been studying this phenomenon, and says it is localized in certain areas of Puget Sound with higher pollution.

"It's an issue in parts of Puget Sound, not all of Puget Sound," he says, but where it occurs the evidence is fairly obvious. "Stick your camera under the water and take a picture and it's just green [with phytoplankton]," says Short.

An underwater photo of eelgrass in Dumas Bay shows the green tinge of phytoplankton. Photo courtesy of DNR.

Related: Nitrogen as an Eelgrass Stressor in Puget Sound

Short first noticed the problem of decreasing light for eelgrass on the East Coast and has been testing whether the same situation exists in Puget Sound. As on the East Coast, eelgrass is "not growing as deep as it used to grow," he says, "which is a good indicator of decreasing water clarity." Potential causes include stormwater runoff, failing septic tanks and sewage treatment discharge. Runoff from dairy and meat production also boost nitrogen.

The planting model seems to support that idea. It predicts less success for eelgrass near places like southern Puget Sound, where higher nitrogen levels occur. Most of the experimental plantings followed the model's predictions, while a few struggled for unknown reasons. Last summer's work was a first step in what researchers expect to be an ongoing process.

Adapting to unknowns

If nitrogen pollution is a significant barrier to eelgrass recovery, then scientists are not without hope. Water quality *can* get better, they say.

"We can enhance the [eelgrass] productivity of the Sound and prevent it from degrading further," says Short, who points to solutions like improving sewage treatment plants and filtering stormwater and agricultural runoff.

Even so, scientists acknowledge that many other threats to eelgrass remain, from heavy metals to shoreline development, damage from boat propellers and dredging and even emerging concerns like eelgrass wasting disease. They also point to the specter of climate change. Paradoxically, ocean acidification, the result of increased carbon dioxide absorption from the atmosphere into Puget Sound waters, could actually benefit eelgrass because it would increase carbon dioxide used by the plant; but as the oceans warm and sea levels rise, climate change also threatens fragile habitat.

Scientists say the key for them will be to adapt as conditions change and as new information becomes available.

Eelgrass bed. Photo: Susannah Anderson (CC BY-NC-ND 2.0)
https://www.flickr.com/photos/wanderin_weeta/4603026110

Next steps

One strategy is to take a so-called portfolio approach. Some argue that responding to every single threat to eelgrass, while desirable in theory, might not be practical and could take huge amounts of resources. A May 2014 article in the journal *Coastal Management* reviewed comments from 19 scientists who study eelgrass in the region, and suggests narrowing efforts to several areas with the most potential for eelgrass restoration.

The article points to overwater structures, nitrogen pollution and shoreline armoring as key focus points, and scientists are looking at how this might apply to local management actions.

Just weeks before the Salish Sea Ecosystem Conference, representatives from multiple agencies including the Department of Natural Resources, Puget Sound Partnership, Department of Ecology, the University of Washington's Puget Sound Institute, NOAA, the Samish Tribe, the Washington Association of Counties and other groups, met to launch the Puget Sound Eelgrass Recovery Strategy.

The group will examine why eelgrass recovery has faltered, and will keep an eye on experiments like those by Thom and others searching for new breakthroughs.

"Every time you do a restoration project, it's an experiment," says Thom. "We need to be clear about linking the action to the response in a systematic way and learning from it. If we're seeing an improvement, we can better predict what we need to do in the future to make it work for [eelgrass] to come back."

Maury - Vashon Island Low Tide Celebration. Photo: Kyle Murphy/DNR (CC BY-NC-ND 2.0)
https://www.flickr.com/photos/wastatednr/6003660420

A billion-dollar plant?

Successful eelgrass recovery efforts would mean a boon for the ecosystem, but also for the Puget Sound economy.

Achieving the state goal of a 20 percent increase in eelgrass by the year 2020 would increase the number of fish available for commercial and recreational fishing in the Sound, according to a 2012 study published in the journal *Ecosystems* by researchers at the Northwest Fisheries Science Center. In all, the study looked at 37 different cases where eelgrass provided ecosystem services "of either provisioning or cultural value," from benefits to salmon and commercial geoduck harvests to recreational fishing of rockfish and lingcod.

Take into account eelgrass as an overall anchor for the nearshore ecosystem, and the dollar return is significant. Salmon alone infuse hundreds of millions of dollars per year into the local economy, as do Pacific herring and shellfish, such as Dungeness crabs. Iconic, tourist-friendly wildlife like seabirds and killer whales also depend on eelgrass for their survival, directly or indirectly.

"Killer whales don't eat eelgrass, but they *do* eat salmon, and salmon grow up in the eelgrass," says biologist Fred Short.

Photo gallery

View images of the eelgrass planting program. Photos provided by Ron Thom and John Vavrinec.





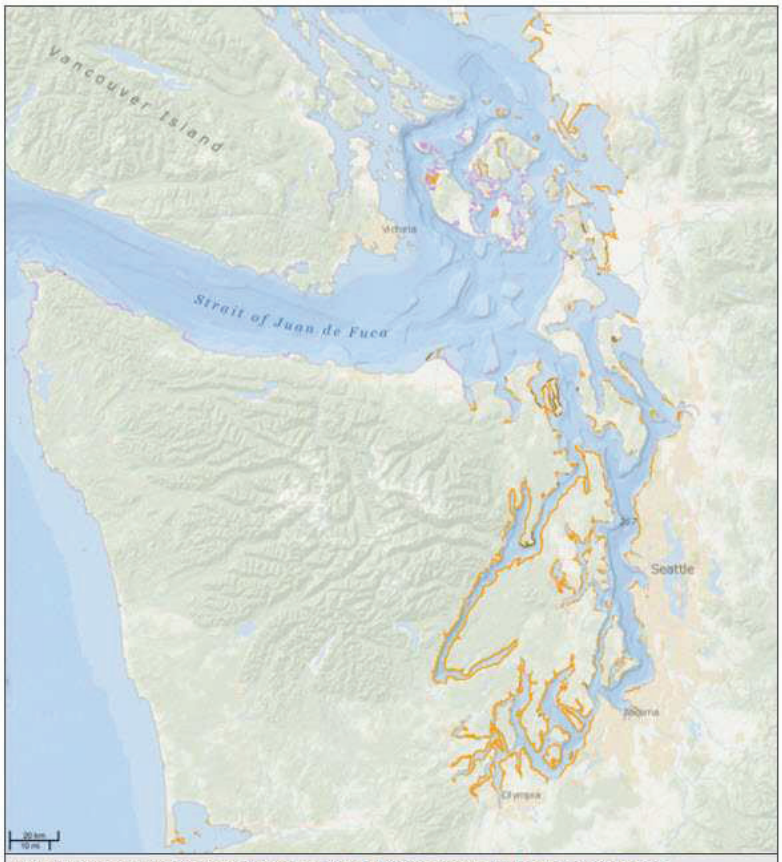


Learn more

Where does eelgrass grow? | Puget Sound Vital Signs | About the scientists

Where does eelgrass grow?

Eelgrasses (Zostera, Zostera marina) are commonly found in 17 distinct marine and esturine habitats in Washington state. These habitats comprise 951 miles (31%) of the 3,066-mile Washington shoreline. View this interactive map on ERMA®.



Map showing 17 Washington state shoreline habitats commonly home to eelgrasses.

About the Author:

Katie Harrington writes with the goal of exciting public interest in local research and conservation efforts from her home base in San Francisco. When she's not scribbling notes about science and nature, she's working aboard sailing research vessels or bicycle touring in foreign countries.