

Statement Regarding Proposed Geoduck Aquaculture at the Longbranch Shellfish Geoduck Farm in Pierce County

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The Longbranch Shellfish Geoduck Farm: Parcel Nos. 0020253008, 0020253020, 0020253021 (Longbranch site)

The unique importance of this site begins with the high bank habitat above the beach. Numerous large trees are growing from the top of the bank down to the high tide mark where vegetation is under-cut by incoming saltwater, providing shade and organic debris to the uppermost beach. These factors improve spawning, foraging and other activities for species of forage fish and out-migrating salmon.

A small stream flows down through a valley and crosses the beach. Streams of this size sometimes go dry during the warmest, driest weeks of the year but they are still important features because they shape the land and provide seasonal ecological function.

Aerial photos of the area clearly show a broad tide flat which has formed over centuries from sediments deposited by the stream. Although located on Drayton Passage where the tide rushes in and out, the site is around the corner from and partially protected by Devils Head. Areas like this are typically characterized by eddies that can even run contrary to tidal direction. In such places we often find sand spits and other features that further shield a location from the full force of the tide. There is a large sand spit immediately south and inland from the site consistent with this tendency.

The beach is littered with many varied shells indicating the presence of a variety of infaunal shellfish species. There are also jointed tube worms, red algae and other biota.

The Longbranch site is a uniquely beautiful place with a high level of ecological function. It is important that we understand this function to the full extent of our abilities before altering it.

Ecosystem Based Management

Marine environments are fluid, difficult to observe, wild places. Natural marine ecosystems are productive, resilient and easy to maintain. A 2003 study by the Pew Oceans Commission, a 2004 report by the US Commission on Ocean Policy and numerous academics and policy experts have called for Ecosystem Based Management, an environmental management approach that recognizes the full array of interactions within an ecosystem, including humans, rather than considering issues, species or ecosystem services in isolation. The Washington State threshold determination process (WAC 197-11-330) concurs that we should consider "physical features, water chemistry" and "plants and animals" or in other words, physical, chemical and biological parameters.

The Washington Sea Grant Interim Report from the Geoduck Aquaculture Research Program contains some data pertaining to possible ecological effects of aquaculture but it's far from complete but it did find a range of post-harvest effects to geoduck aquaculture including significantly lower sediment organic content. A spillover effect was also detected, a decrease in size, density and biomass of plants close to the site boundary.

Plants: Eelgrass and Seaweed

The County states that "eelgrass has not been observed at the site... It would appear that this issue has been resolved". (Booth 2006) Much of Puget Sound is not well suited for the growth of eelgrass due to structure and summer desiccation. But eelgrass does grow in places in South Puget Sound and industrial and other development has placed pressure on eelgrass abundance for many years (Cornell

2010) (PSSU 2010) (Waddell 1964). The extent to which eelgrass has been impacted is unknown because accurate records have only been kept beginning recently. Eelgrass areas in Puget Sound are divided into flats, shallow beds along fresh water inputs and fringe habitats, narrow areas along the shoreline that characterize much of South Puget Sound (PSSU 2010). The proposed site is representative of both flats with a freshwater input and fringe habitat. Eelgrass has been documented immediately to the north and east of the proposed site (PSSU 2010).

A variety of seaweed has been observed at the site. Seaweed is the primary food source for nearshore invertebrates. Seaweed has been impacted by human development and the impacts of this loss throughout the food web can be sizable and widespread (Duggins et al 1989). Seaweed is important for numerous species and for numerous reasons and its harvest for personal use has been limited. RCW 79.135.410 states "The maximum daily wet weight harvest or possession of seaweed for personal use from all state-owned aquatic lands and all privately owned tidelands is ten pounds per person. The department in cooperation with the Department of Fish and Wildlife may establish seaweed harvest limits of less than ten pounds for conservation purposes."

### Ghost Shrimp

Burrowing shrimp provide valuable ecological functions. They are filter feeders and food for many species. They have been a problem for shellfish cultivation and may be a problem where geoduck aquaculture is concerned. This is an issue that should be addressed before reaching conclusions regarding the projects probable impacts.

### Herring

Herring are one of several keystone species that occupy unique niches between the bottom of the food web and the top. Puget Sound's herring feed on copepods and other small marine invertebrates and in turn are preyed upon by salmon, sea birds and large predators. No other species occupies the exact same position in the food web. The entire Puget Sound ecosystem is dependent on herring. (Bowman 2007). Not observing herring spawn doesn't guarantee that it isn't there in minute quantities or that herring wanting to spawn won't arrive in the future. Herring spawn on types of macro algae that have been found at the site (Hardwick 1973)(ADF&G 2010)

### Birds

Diving ducks are apex predators. They're important indicator species. Diving ducks are generally declining in South Puget Sound but two species, Surf Scoters and Western Grebes are declining especially rapidly. According to the Puget Sound Ambient Monitoring Project and a Washington Sea Grant study, Surf Scoters have declined 50% to 70% over the past 40 years and Western Grebes have declined 71% to 95%. Carcass counts indicate that some local stressor is to blame. Surf Scoters and Western Grebes share a unique reliance on mollusks and crustaceans, such as young shellfish and ghost shrimp.

### Sand Lance

The proposal states that all culture and harvest activities will be separated from the lowest spawning habitat thus ensuring the avoidance of impacts to both spawning habitat and adjacent dispersal areas (Risvold 2010).

After hatching, sand lance larvae migration (dispersal) is generally away from shore, i.e. through the project area. Some larvae will no doubt move around the site but larvae from neighboring areas will move onto the site. In the very shallow waters of incoming and outgoing tides, geoducks may draw larva down their siphons to be sorted and either eaten or ejected as pseudo feces.

Sand lances spawn along 130 miles of Puget Sound shorelines. The total length of Puget Sound shoreline is 2500 miles. Spawning occurs in 1/20th of the total so this area is significant for spawning. Sand lance may universally, as in this case, prefer areas for spawning that favor geoducks. Even though geoduck aquaculture may ultimately only occupy 1/20th of the linear shoreline, it could conceivably occupy 100% of the linear shoreline used by sand lance for spawning.

The County states that the “location of your project near forage fish habitat and within Critical Marine Habitat obviously increases our level of concern over impacts. These concerns are tempered somewhat by the fact that your site constitutes and relatively small portion of a much larger, unbroken, length of shoreline (roughly 650 feet of shoreline within an 8500 foot section of open shoreline)” (Risvold 2009)( Pierce County 2009). This break in connectivity might better be considered a negative impact than a positive one. And the comparatively small scale of the operation should not be a determining factor because precedent will be established and the scale of this decision may be magnified over time.

### Sand Dollars

Sand dollar beds are uncommon and may be declining in Puget Sound. Sand dollars are key species for the regulation of local communities and may serve as refuges for young Dungeness crabs. They don't readily return to beaches when lost (Dethier 2007). Moving sand dollars may cause mortality of the sand dollars, species that were relying on them in their previous location and species on which they are placed in their new location.

### Ecological Structure Space and Time

Geoduck aquaculture entails three major disturbances. The first is when the geoducks are planted. There will probably be some removal of epibenthic flora and fauna. The removal changes the physical, chemical and biological parameters of the site. The place where this flora and fauna are removed to is also altered. Tubes are driven into the substrate which effects movement and survival of benthic organisms. The tubes hold water as the tide goes out altering hydrology and species composition. Species composition is also changed when both flora and fauna utilize the structures in unnatural concentrations and ways. The second disturbance occurs when the gear is removed and all the biota that moved in as a response to the first disturbance are suddenly exposed. This biota either perishes and rots or moves into neighboring areas and impacts biota there. The third disturbance is harvest in which the bottom is liquefied. Frequency and repetition of disturbance have cumulative impacts.

Species richness and abundance patterns change between harvested and unharvested areas. The SEPA Environmental Checklist states that a “beneficial effect of using tubes is that they provide protection from predation for a variety of species including cockles (Longbranch 2010). It may be true that “Geoduck structures may attract species not frequently observed in un-farmed situations” (Risvold 2010) but this diversity is not consistent with historical reality and the long-term interrelationship with other organisms and the surrounding environment. Attracting species, excluding species and denying food to species can have unpredicted impacts on ecosystem function.

There don't appear to be any studies of gut samples from intertidal geoducks and subtidal areas are not a good comparison. And gut samples don't include pseudo feces, material that's drawn in and not ingested. If geoduck aquaculture impacts zooplankton, this raises additional issues of predation on at-risks stocks and species and upsetting the microscopic balance of plants and animals.

The potential importance of the site as unstructured estuarine tide flats and a mixing zone with persistent circulation patterns and larval retention have not been fully investigated. Because of this freshwater Type N2 water outfall, the stream “adds to the ecological function being provided to the nearshore area, particularly regarding juvenile salmonids.” (Larrabee 2008)

The environmental checklist states that "The site is not a significant migration stop for birds or fish". All of Puget Sound is a significant migration stop for numerous of species of birds and fish, especially areas designated as Critical Habitat. The location of this site, tucked behind a sand spit on Drayton Passage, would seemingly make it a highly significant migration stop.

"As noted in the Department of Interior Bio-Opinion, this plume (from hydraulic harvest) can affect "migratory and social behavior as well as foraging opportunities". The Bio-Opinion goes on, however, to note that the significance of this varies according to a number of factors including the magnitude of the harvest, the location of the site and the natural level of sediment suspension as a result of wind and wave action". "Given these conclusions... concern of sediment suspension impacts appear to be negligible... given scale and location." (Risvold 2010) The scale of the operation should not be a determining factor because precedent will be established and the scale of this decision may be magnified over time.

The Pierce County DNS claims that "The likelihood or potential of impacts would appear to be less than if the site was in a low energy environment." (such as a cove) This may be true of turbidity which will still be significant but not necessarily changes in grain size variability, the vertical distribution of sediments and changes in shoreline topography. A high energy shoreline will be more impacted.

Surf smelt were found in beach seine sets. Why no other mention of them? Because the site is located in a forage fish spawning ground, it's protected under the Pierce County Critical Areas Development Regulations Title 18E. The area is also designated as Marine Shoreline Critical Salmon Habitat. (Lewis 2006)

Recruitment of some species of shellfish is facilitated by the presence of adults of the same species through the release of chemical attractants and by changes in basic texture and chemistry of surface sediments. (Goodwin & Pease 1989)(Goodwin and Shaw 1979)(Dethier 2007). Removal of some species and dramatic increases in geoduck concentrations might result in alterations in soil structure and chemistry. This might impact future wild geoduck recruitment by attracting larvae to where they won't survive. It may also repel species that would survive.

One of the basic tenets of Ecosystem Based Management is to "maintain historical levels of native biodiversity", not manufactured, artificial levels of biodiversity or unnatural forms of species composition. Assessments shouldn't only consider the space that is actively worked but adjoining spaces and spaces throughout the region. They should assess not only what is observed during planting, harvest or some other stage of activity but what occurred historically and what is likely to occur in the future.

The Pest Management Strategic Plan for Bivalves in Oregon and Washington lists bivalve pests and management options. Pests include burrowing shrimp including ghost shrimp and mud shrimp, cockles, crabs including Dungeness, Rock, Green and Graceful crabs, horse clams, moon snails, sand dollars, sea stars (starfish), "weeds" including *Ulva flexuosa* (filamentous algae) and *Ulva lactuca* (sea lettuce), grasses including *Zostera marina* (native eelgrass), perch and other fishes and waterfowl including scoter ducks. All of the above are native species. Controls include physical removal and exclusion, chemicals including insecticides and herbicides and harassment and hunting when depredation permits can be obtained (De Francisco 2010). Exactly how pest management will be handled in geoduck aquaculture isn't clearly established but there appear to be many options on the table.

The Longbranch site is a perfect example of how nutrients from land are dealt with in a natural marine environment. Natural estuaries have evolved the means, over millions of years, to deal with nutrient input. Vast populations of phytoplankton consume nutrients and a vast network of secondary producers digest the phytoplankton and move energy up the food web. Macroalgae does its work alongside. These processes happen best in shallow waters in the presence of abundant sunlight and atmospheric oxygen. Sediments coming from the same fresh water sources shape these shallows.

## Conclusion

There are reasons why geoducks don't normally exist in the intertidal zone in great concentrations. Predation, desiccation and other influences keep their density in intertidal areas very low. The geoduck (*Panope generosa*) is the world's largest burrowing clam. A 75% survival rate at the Longbranch site would be 245,025 adults. At two pounds apiece the total increase in biomass is nearly a half million pounds. That seems to leave little room for anything else.

What are the impacts of seaweed removal, followed by seaweed over-growth, followed by seaweed removal? What are the cumulative impacts of these disturbances?

How will species recruitment change? Will larvae dispersal be impacted?

Such major alterations in such a pristine environment are probably going to have significant environmental impacts. There are concerns and unanswered questions regarding geoduck aquaculture at this location. In my opinion, an Environmental Impact Statement should be required.

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