

From: [McReynolds, Ryan](#)
To: [BrownScott, Jennifer](#)
Cc: [McReynolds, Ryan](#); [Jensen, Martha L](#)
Subject: Re: Jamestown Aquaculture Proposal at DNWR
Date: Friday, March 11, 2016 10:28:18 AM
Attachments: [Some Shellfish Reading.docx](#)
Importance: High

Hi Jennifer,

I'm glad you contacted me yesterday.

I have heard previously about pending proposals for shellfish farming inside the Dungeness Spit, but haven't had much opportunity to engage or talk with others about the issues proximity to a Refuge may raise.

I have looked at the (draft?) JARPA materials provided to you by the Jamestown S'Klallam Tribe, and the photo "descriptions". All of it is really helpful.

However, I see no figures that meaningfully describe and identify where within the DNR lease boundaries the Tribe/Applicant intends to resume ground culture, bag culture, and suspended culture. Maybe the Tribe/Applicant has provided more detailed figures to the Corps more recently?

I see nothing in the (draft?) JARPA that strikes me as unusual or atypical of intertidal aquaculture operations/methods in this region.

However, the description of ground culture clearly indicates a significant role and presence of cover netting and anti-predator netting. The description of ground culture also mentions what I interpret as the use of drift fences or oyster corrals.

For the Refuge, a proposal to resume active farming inside the Spit probably raises some predictable questions: What kind of interactions can we expect between shorebirds/marine waterfowl and the cultured shellfish? What kind of interactions can we expect with the aquaculture gear which would be placed on or suspended over the tidelands? Would resuming on-site farming activities represent an increase to sound and visual disturbance that might actually have implications for shorebirds or marine waterfowl?

These are complicated questions, with a whole bunch of things to consider. For instance, the literature I've become familiar with suggests that responses vary by taxa, by feeding ecology and habit. The setting, and issues of scale, matter too.

I've attached some suggested reading.

I am interested and motivated to continue discussing these proposals with the Refuge, with the Tribe/Applicant, Corps, and DNR.

I believe there can be constructive dialogue on farming methods and best management practices.

I have cc'd my Supervisor, Martha Jensen; she too is well-familiar with aquaculture methods, and a shorebird enthusiast :)

Let's talk again soon,

- Ryan -

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On Thu, Mar 10, 2016 at 11:09 AM, BrownScott, Jennifer <jennifer_brownscott@fws.gov> wrote:

Ryan,
I greatly appreciate our conversation about aquaculture practices and the Shellfish Interagency Permitting Team. The Tribe's proposed activities are on page 5 and 6 of the attached JARPA. I have also attached some photo's of their proposed operations.

Any initial thoughts you could provide on methods as they relate to potential environmental and wildlife impacts would be greatly appreciated.

Thank you for your thoughts,
Jennifer

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~~Dungeness NWR~Protection Island NWR~San Juan Islands NWR~~
~~Copalis NWR~Flattery Rocks NWR~Quillayute Needles NWR~~

[Some Shellfish Reading ... Literature Cited - RM]

- [Birds] Agness, A.M., J.F. Piatt, J.C. Ha, and G.R. Vanblaricom. 2008. Effects of vessel activity on the near-shore ecology of Kittlitz's Murrelets (*Brachyramphus brevirostris*) in Glacier Bay, Alaska. *The Auk* 125(2):346-353.
- Ayers, R.A. 2006. Discarded and abandoned aquaculture clam netting on the Atlantic barrier islands on the Eastern Shore of Virginia (2006 Report). Prepared for the Virginia Eastern Shorekeeper, Eastville, Virginia. 19pp.
- [Birds] Bendell, L.I., and P.C.Y. Wan. 2011. Application of aerial photography in combination with GIS for coastal management at small spatial scales: a case study of shellfish aquaculture. *Journal of Coast Conservation* 15(4):417-431.
- Bostrom, C., E.L. Jackson, and C.A. Simenstad. 2006. Seagrass landscapes and their effects on associated fauna: a review. *Estuarine, Coastal, and Shelf Science* 68:383-403.
- Burger, A.E. 1995a. Inland habitat associations of marbled murrelets in British Columbia. Chapter 16, pp. 151-161 *In* Ralph, C.J., G.L. Hunt Jr., M.G. Raphael, and J.F. Piatt, eds. 1995. Ecology and conservation of the marbled murrelet. U.S. Department of Agriculture, U.S. Forest Service, Pacific Southwest Research Station (Albany, California), Gen Tech. Rep. PSW-GTR-152. 420pp.
- Burger, A.E. 1995b. Marine distribution, abundance, and habitats of marbled murrelets in British Columbia. Chapter 29, pp. 295-312 *In* Ralph, C.J., G.L. Hunt Jr., M.G. Raphael, and J.F. Piatt, eds. 1995. Ecology and conservation of the marbled murrelet. U.S. Department of Agriculture, U.S. Forest Service, Pacific Southwest Research Station (Albany, California), Gen Tech. Rep. PSW-GTR-152. 420pp.
- Burkett, E.E. 1995. Marbled murrelet food habits and prey ecology. Chapter 22, pp. 223-246 *In* Ralph, C.J., G.L. Hunt Jr., M.G. Raphael, and J.F. Piatt, eds. 1995. Ecology and conservation of the marbled murrelet. U.S. Department of Agriculture, U.S. Forest Service, Pacific Southwest Research Station (Albany, California), Gen Tech. Rep. PSW-GTR-152. 420pp.
- Coen, L.D., R.D. Brumbaugh, D. Bushek, R. Grizzle, M.W. Luckenbach, M.H. Posey, S.P. Powers, and S.G. Tolley. 2007. Ecosystem services related to oyster restoration. *Marine Ecology Progress Series* 341:303-307.
- 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(3-4):196-223.
- Dumbauld, B.R., and L.M. McCoy. 2015. Effect of oyster aquaculture on seagrass *Zostera marina* at the estuarine landscape scale in Willapa Bay, Washington (USA). *Aquaculture Environment Interactions* 7:29-47.
- [Birds] Ferriss, B., J. Reum, P.S. McDonald, D. Farrell, and C.J. Harvey. 2015. Evaluating

- trophic and non-trophic effects of shellfish aquaculture in the central Puget Sound food web.** pp. 15-34 *In* Washington Sea Grant. 2015. Shellfish aquaculture in Washington State. Final report to the Washington State Legislature. Seattle, Washington. 84pp.
- Forchino, A.A. 2010. Development and application of a marine biotic index for the evaluation of the **influence of aquaculture activities on the benthic ecosystem** in Mediterranean coastal areas. University of Insubria, Varese, Department of Biotechnology and Molecular Sciences. December 2010. 143pp.
- Forrest, B.M., N.B. Keeley, G.A. Hopkins, S.C. Webb, and D.M. Clement.** 2009. Bivalve aquaculture in estuaries: **review and synthesis of oyster cultivation effects.** *Aquaculture* 298:1-15.
- [Birds] Godet, L., N. Toupoint, J. Fournier, P. Le Maoc, C. Retiere, and F. Olivier.** 2009. Clam farmers and **oystercatchers**: effects of the degradation of *Lanice conchilega* beds by shellfish farming on the spatial distribution of shorebirds. *Marine Pollution Bulletin* 58:589-595.
- Good, T.P., J.A. June, M.A. Etnier, and G. Broadhurst.** 2010. **Derelict fishing nets in Puget Sound and the Northwest Straits: patterns and threats to marine fauna.** *Marine Pollution Bulletin* 60:39-50.
- [Birds] Goss-Custard, J.D., and N. Verboven.** 1993. Disturbance and feeding **shorebirds** on the Exe estuary. *Wader Study Group Bulletin* 68:59-66.
- Gutierrez, J.L., C.G. Jones, J.E. Byers, K.K. Arkema, K. Berkenbusch, J.A. Commito, C.M. Duarte, S.D. Hacker, I.E. Hendriks, P.J. Hogarth, J.G. Lambrinos, M.G. Palomo, and C. Wild.** 2011. **Physical ecosystem engineers and the functioning of estuaries and coasts.** 113pp. *In* Heip, C.H.R., C.J.M. Philippart, and J.J. Middelburg, eds. (Volume 7) *Functioning of estuaries and coastal ecosystems. Treatise on Estuarine and Coastal Science*, Elsevier.
- [Birds] Hilgerloh, G., and L. Young.** 2006. (Symposium 30, Introduction) Interactions between coastal aquaculture, fisheries, and birds. *Acta Zoologica Sinica* 52(Supplement):535.
- [Birds] Kraan, C., J.A. van Gils, B. Spaans, A. Dekinga, A.I. Bijleveld, M. van Roomen, R. Kleefstra, and T. Piersma.** 2009. **Landscape-scale experiment demonstrates that Wadden Sea intertidal flats are used to capacity by molluscivore migrant shorebirds.** *Journal of Animal Ecology* 78:1259-1268.
- Laist, D.W.** 1997. Impacts of marine debris: **entanglement of marine life in marine debris** including a comprehensive list of species with entanglement and ingestion records. Chapter 8, 67pp. *In* Coe, J.M., and D.B. Rogers, eds. 1997. *Marine debris: sources, impacts, and solutions.* Springer-Verlag, New York, Inc.
- Meseck, S.L., Y. Li, M.S. Dixon, K. Rivara, G.H. Wikfors, and G. Luther III.** 2012. Effects of a commercial, **suspended eastern oyster nursery** upon nutrient and sediment chemistry in a temperate, coastal embayment. *Aquaculture Environment Interactions* 3:65-79.

- Mumford, T.F. 2007. Kelp and eelgrass in Puget Sound. Puget Sound Nearshore Partnership Report No. 2007-05. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. 35pp.
- Neckles, H.A., F.T. Short, S. Barker, and B.S. Kopp. 2005. Disturbance of eelgrass *Zostera marina* by **commercial mussel *Mytilus edulis* harvesting** in Maine: dragging impacts and habitat recovery. Marine Ecology Progress Series 285:57-73.
- Newell, R.I.E. 2004. Ecosystem **influences of natural and cultivated populations** of suspension-feeding bivalve molluscs: a review. Journal of Shellfish Research 23(1):51-61.
- [Birds] Norris, K., R.C.A. Bannister, and P.W. Walker. 1998. Changes in the number of **oystercatchers *Haematopus ostralegus*** wintering in the Burry Inlet in relation to the biomass of cockles *Cerastoderma edule* and its commercial exploitation. Journal of Applied Ecology 35:75-85.
- Pacific Coast Shellfish Growers Association (**PCSGA**). 2011. Environmental codes of practice for Pacific coast shellfish aquaculture. (June 14, 2011) Olympia, Washington. 184pp.
- Penttila, D. 2007. Marine forage fishes in Puget Sound. Prepared in support of the Puget Sound Nearshore Partnership. Published by Seattle District, U.S. Army Corps of Engineers, Seattle, Washington. Technical Report 2007-03. 30pp.
- Phillips, R.C. 1984. The ecology of eelgrass meadows in the Pacific Northwest: a community profile. U.S. Department of the Interior, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, FWS/OBS-84/24 (September 1984). 85pp.
- Protect Our Shoreline**. 2015. Wildlife news - **juvenile bald eagle caught in geoduck farm net**, July 23, 2006 (narrative description and photos). Protect Our Shoreline, a member of the Coalition to Protect Puget Sound Habitat. Available On-Line at <<http://protectourshoreline.org>> (Accessed December 15, 2015).
- Rhoads, D.C., and J.D. Germano. 1986. Interpreting **long-term changes in benthic community structure**: a new protocol. Hydrobiologia 142:291-308.
- Ruesink, J.L., and K. Rowell. 2012. Seasonal **effects of clams (*Panopea generosa*) on eelgrass (*Zostera marina*) density but not recovery dynamics** at an intertidal site. Aquatic Conservation: Marine and Freshwater Ecosystems 22: 712-720.
- Rumrill, S.S., and V.K. Poulton. 2004. Ecological role and potential **impacts of molluscan shellfish culture** in the estuarine environment of Humboldt Bay, California. Western Regional Aquaculture Center, Annual Report (November 2004). 44pp.
- Selleck, J.R., C.F. Gibson, S. Shull, and J.K. Gaydos. 2015. Nearshore distribution of Pacific sand lance (*Ammodytes personatus*) in the inland waters of Washington State. Northwestern Naturalist 96(3):185-195.
- Short, F.T., and S. Wyllie-Echeverria. 1996. **Natural and human-induced disturbance of**

- seagrasses. *Environmental Conservation* 23(1):17-27.
- Simenstad**, C.A., and K.L. Fresh. 1995. **Influence of intertidal aquaculture on benthic communities in Pacific Northwest estuaries: scales of disturbance.** *Estuaries* 18(1A):43-70.
- Skinner, M.A., S.C. Courtenay, and C.W. McKindsey. 2013. **Reductions in distribution, photosynthesis, and productivity of eelgrass *Zostera marina* associated with oyster *Crassostrea virginica* aquaculture.** *Marine Ecology Progress Series* 486:105-119.
- Sousa**, R., J.L. Gutierrez, and D.C. Aldridge. 2009. **Non-indigenous invasive bivalves as ecosystem engineers.** *Biological Invasions* 11:2367-2385.
- [Birds] Speckman, S.G., J.F. Piatt, and A.M. Springer. 2004. **Small boats disturb fish-holding marbled murrelets.** *Northwestern Naturalist* 85(1):32-34.
- Speich, S.M., and T.R. Wahl. 1995. **Marbled murrelet** populations of Washington – marine habitat preferences and variability of occurrence. Chapter 30, pp. 313- 326 *In* Ralph, C.J., G.L. Hunt Jr., M.G. Raphael, and J.F. Piatt, eds. 1995. *Ecology and conservation of the marbled murrelet.* U.S. Department of Agriculture, U.S. Forest Service, Pacific Southwest Research Station (Albany, California), Gen Tech. Rep. PSW-GTR-152. 420pp.
- Stick, K.C, and A. Lindquist. 2009. 2008 Washington State herring stock status report. Stock Status Report No. FPA 09-05 (November 2009). Washington Department of Fish and Wildlife, Fish Program, Fish Management Division, Olympia, Washington. 111pp.
- Stick, K.C, A. Lindquist, and D. Lowry. 2014. 2012 Washington State herring stock status report. Stock Status Report No. FPA 14-09 (July 2014). Washington Department of Fish and Wildlife, Fish Program, Fish Management Division, Olympia, Washington. 106pp.
- [Birds] **Stillman**, R.A., J.D. Goss-Custard, A.D. West, S.E.A. Le V. Dit Durell, S. McGrorty, R.W.G. Caldow, K.J. Norris, I.G. Johnstone, B.J. Ens, J. Van Der Meer, and P. Triplet. 2001. **Predicting shorebird mortality and population size under different regimes of shellfishery management.** *Journal of Applied Ecology* 38:857-868.
- [Birds] Stillman, R.A., and J.D. Goss-Custard. 2002. Seasonal changes in the response of **oystercatchers *Haematopus ostralegus*** to human disturbance. *Journal of Avian Biology* 33:358-365.
- Tallis, H.M., J.L. Ruesink, B. Dumbauld, S. Hacker, and L.M. Wiseshart. 2009. **Oysters and aquaculture practices affect eelgrass density and productivity** in a Pacific Northwest estuary. *Journal of Shellfish Research* 28(2):251-261.
- Therriault**, T.W., D.E. Hay, and J.F. Schweigert. 2009. Biological overview and trends in pelagic **forage fish** abundance in the Salish Sea (Strait of Georgia, British Columbia). *Marine Ornithology* 37:3-8.

- Tucker, C.S., and J.A. Hargreaves, eds. 2008. **Environmental best management practices for aquaculture**. John Wiley and Sons, Inc. and Blackwell Publishing, Ames, Iowa. 594pp.
- U.S. Fish and Wildlife Service (**USFWS**). 2009. Biological Opinion - **Nationwide Permit 48** (Ref. No. 13410-F-2008-0461). Prepared by the Washington Fish and Wildlife Office, Lacey, Washington. March 24, 2009. 188pp.
- U.S. Fish and Wildlife Service (**USFWS**). 2012. Report on the **marbled murrelet** Recovery Implementation Team meeting and stakeholder workshop. Western Washington Fish and Wildlife Office, Lacey, Washington. April 17, 2012. 22pp., plus appendices.
- U.S. Fish and Wildlife Service (**USFWS**). 2016. Migratory birds and habitat program - **depredation** frequently asked questions. Pacific Region Migratory Birds and Habitat Program, Portland, Oregon. Available On-Line at < <http://www.fws.gov/pacific/migratorybirds/permits/dprd.html> > (Accessed February 15, 2016).
- Vanblaricom, G.R., J.L. Eccles, J.D. Olden, and P.S. McDonald. 2015. Ecological effects of the **harvest phase of geoduck** (*Panopea generosa* Gould, 1850) aquaculture on infaunal communities in southern Puget Sound, Washington. *Journal of Shellfish Research*, 34(1):171-187.
- [Birds] **Vilchis**, L.I., C.K. Johnson, J.R. Evenson, S.F. Pearson, K.L. Barry, P. Davidson, M.G. Raphael, and J.K. Gaydos. 2014. **Assessing ecological correlates of marine bird declines to inform marine conservation**. *Conservation Biology* 29(1):154-163.
- Wagner, E., B.R. Dumbauld, S.D. Hacker, A.C. Trimble, L.M. Wisheart, and J.L. Ruesink. 2012. **Density-dependent effects of an introduced oyster, *Crassostrea gigas*, on a native intertidal seagrass, *Zostera marina***. *Marine Ecology Progress Series* 468:149-160.
- Washington Sea Grant**. 2013. Geoduck aquaculture research program . Report to the Washington State Legislature. Seattle, Washington. 108pp.
- Washington Sea Grant**. 2015. Shellfish aquaculture in Washington State. Final report to the Washington State Legislature. Seattle, Washington. 84pp.
- Washington State Department of Natural Resources (**DNR**). 2014. Draft Aquatic Lands Habitat Conservation Plan (August 2014). Aquatic Resources Division, Olympia, Washington. XXXpp., plus appendices.
- Washington State Department of Natural Resources (**DNR**). 2014. Technical Memorandum: **Operational Definition of an Eelgrass (*Zostera marina*) Bed**. Appendix J *In* Washington State Department of Natural Resources (DNR). 2014. Draft Aquatic Lands Habitat Conservation Plan (August 2014). Aquatic Resources Division, Olympia, Washington. XXXpp., plus appendices.
- Wisheart, L.M., B.R. Dumbauld, J.L. Ruesink, and S.D. Hacker. 2007. **Importance of eelgrass early life history stages in response to oyster aquaculture disturbance**. *Marine Ecology Progress Series* 344:71-80.

- [Birds] Zydelsis, R., D. Esler, M. Kirk, and W.S. Boyd. 2009. **Effects of off-bottom shellfish aquaculture on winter habitat use by molluscivorous sea ducks**. *Aquatic Conservation: Marine and Freshwater Ecosystems* 19(1):34-42.
- [Birds] Zydelsis, R., C. Small, and G. French. 2013. The **incidental catch** of seabirds in gillnet fisheries: a global review. *Biological Conservation* 162: 76-88.