

## Marlene Meaders

---

**From:** P. Sean McDonald <psean@uw.edu>  
**Sent:** Monday, November 28, 2016 9:57 AM  
**To:** Marlene Meaders  
**Cc:** Bridget E. Ferriss; Jonathan Reum - NOAA Affiliate; Chris Harvey - NOAA Federal; Dara Farrell  
**Subject:** memorandum: Response to Public Comments Related to the Ferriss et al. (2015) Article  
**Attachments:** Confluence letter.docx

Dear Ms. Meaders -

Please find attached a memorandum discussing the ICES Journal of Marine Science article titled: "Evaluating trophic and non-trophic effects of shellfish aquaculture in a coastal estuarine foodweb". The authors of the article (cc'd here) have reviewed the memorandum and agree that the understanding and application of the article (Ferriss et al. 2015), as presented in the memorandum, is accurate.

Feel free to contact me with any questions or concerns.

Best,

Sean

\*\*\*\*\*

P. Sean McDonald, PhD  
 Lecturer/Capstone Instructor - PoE  
 Research Scientist - SAFS  
 University of Washington  
 Box 355679  
 Seattle, WA 98195-5679

15D Wallace Hall [[map](#)]  
 PoE office: 206-616-2186  
[pseanmcdonald.com](http://pseanmcdonald.com)  
 Twitter: @pseanmc

Appointment schedule: <http://tinyurl.com/pseanmcdonald>

\*\*\*\*\*



To: Bridget Ferriss, University of Washington, Radiology

Jonathan Reum, Washington Sea Grant

P. Sean McDonald, University of Washington School of Aquatic and Fishery Science

Dara Farrell, University of Washington Department of Mechanical Engineering

Chris Harvey, National Marine Fisheries Service, Northwest Fisheries Science Center

cc: Diane Cooper and Bill Dewey, Taylor Shellfish Farms

From: Marlene Meaders, Chris Cziesla, and Grant Novak, Confluence Environmental Company

Dr. Daphne Munroe, Rutgers University, Haskin Shellfish Research Laboratory

Date: November 28, 2016

**Re: Response to Public Comments Related to the Ferriss et al. (2015) Article: Evaluating Trophic and Non-Trophic Effects of Shellfish Aquaculture in a Coastal Estuarine Foodweb**

---

This memorandum is being provided to the authors of the ICES Journal of Marine Science article titled: "Evaluating trophic and non-trophic effects of shellfish aquaculture in a coastal estuarine foodweb."

The article reports findings of an EcoPath with EcoSim (EwE) model that attempts to discern potential ramifications of increasing geoduck aquaculture in central Puget Sound. This effort, conducted by researchers at the University of Washington, Washington Sea Grant, and the National Marine Fisheries Service, and administered by Washington Sea Grant with state and federal funding, reported that the model indicated a 120% increase in the current level of geoduck culture would result in increases in biomass densities of surfperch, nearshore demersal fish, and small crabs, and decreases in great blue herons, bald eagles, seabirds, flatfish, and certain invertebrates (e.g. predatory gastropods and small crustaceans) (Ferriss et al. 2015).

The conclusions presented in the Ferriss et al. (2015) article have been reported in the media in a manner that has resulted in it being misinterpreted by the general public and resource agencies, which appear to be unfamiliar with the appropriate application and constraints of models such as EwE. This misinterpretation has led to attempts by the public and local jurisdictions to limit geoduck aquaculture throughout Puget Sound (e.g., Bainbridge Island 2016), citing this article, and the reported implications to higher trophic organisms, as evidence for why a geoduck limitation is valid. We do not believe that the quantitative results of the modeling exercise or conclusions in the article were intended to be used in a regulatory setting. We would like to confirm that the authors of the study agree that the results are not intended to be exact quantitative measures but, rather, indications of the trend in species abundance based on current scientific understanding and assumptions included in the model. We seek

the author's input in helping to clear up misinterpretation and misapplication of the study results by the general public and regulators.

## **PUBLIC COMMENTS RELATED TO THE FERRISS ET AL. (2015) ARTICLE**

The Ferriss et al. (2015) article was intended for an audience that is generally familiar with modeling and understands the accepted limitations of model results. When individuals that are not familiar with "modeling reality" use this information, it can result in misinterpretations. The following is a sub-set of comments and statements that have been articulated since the Ferriss et al. (2015) article was published. These comments are followed by our response:

**Comment:** "The study also found that under one scenario, geoduck farming in the main basin of Puget Sound could more than double before the ecosystem would feel significant impacts." – Ma 2015

**Response:** A 120% increase in geoduck aquaculture was used in the model as that level of increase produced observable changes in species' biomass, which could be used to identify sensitive species and priorities for future research. These were not described as "significant impacts". The 120% value represents a general increase in production but the value does not directly translate to the real Puget Sound ecosystem due to the many model assumptions and uncertainty surrounding some of the data.

**Comment:** "A University of Washington has been published which confirms that both bird and salmon habitat can be casualties of the shellfish aquaculture geoduck industry." – Patrick and Kathryn Townsend 2016

**Response:** Ferriss et al. (2015) do not confirm that bird and salmon habitat can be casualties of the shellfish aquaculture geoduck industry. The authors used a quantitative model to understand sensitivities and species' trends in response to the increase of geoduck biomass and associated aquaculture gear. The model identified groups of species potentially sensitive to increased geoduck aquaculture and recommend additional empirical research to determine if the model predictions are valid.

**Comment:** "We would like to point out that between the date of this calculation of 120% and today, it is likely that the geoduck farms in Central Puget Sound have already increased by 120%, meaning that based on the study, all future geoduck farms in the Central Basin should be precluded as a matter of course, because the tipping point, based on the study, has already been reached." – Patrick and Kathryn Townsend 2016

**Response:** The 120% value was not intended to identify a cap for geoduck aquaculture in central Puget Sound. A 120% increase in geoduck aquaculture was used in the model as that level of increase produced observable changes in species' biomass, which could be used to identify sensitive species and priorities for future research. The 120% value represents a general increase in production but the value does not directly translate to the real Puget Sound ecosystem due to the many model assumptions and uncertainty surrounding some of the data. Stated more clearly by

McDonald (pers. comm., 2015), "the primary objective [of the model] is to provide guidance for monitoring and to identify areas for future research."

In addition, the term "tipping point" has specific ecological importance, and is not appropriate in this context. This term is defined as "where systems shift radically and potentially irreversibly into a different state" (Brook 2013). Identifying a tipping point was not a concept that was explored in the Ferriss et al. (2015) model.

## **APPROPRIATE INTERPRETATION AND USE OF THE FERRISS ET AL. (2015) ARTICLE**

Shortly after publication of the Ferris et al. (2015) article, the authors recognized that there was confusion over the information in the article, most prominently about the 120% value and how it should be interpreted. The authors identified the following three key points "for putting this paper in context" (McDonald, pers. comm. 2015).

- The objective of this modeling effort was not to identify a "cap" on geoduck aquaculture. In fact, the primary objective was to provide guidance for monitoring and to identify areas for future research. In particular, we [the authors] use the model to identify a short list of species that would be prime candidates for additional monitoring and study.
- This is a model and thus represents "model reality". We don't focus on exact quantities of increase or decrease. Instead, we focus on general patterns and relative increase/decrease to identify sensitivities. For example, small crabs are sensitive to changes in geoduck aquaculture in the model because their response is strongly positive.
- The model should not be used predictively. It would be inappropriate for anyone to make a statement like "a 120% increase in aquaculture will result in a XX% decrease in eagles, herons, or salmon". The results only suggest that these species are sensitive within the model framework such that we need more information about them. Thus these species should be targeted for monitoring and additional study.

## **SUMMARY**

The authors of this memorandum, and the authors of the Ferriss et al. (2015), agree that this ecosystem model is best employed as a guide rather than a predictive tool. The Ferris et al. (2015) model uses patterns of ecological interaction as a way to increase scientific understanding on how geoduck aquaculture relates to the surrounding environment, highlight interactions where additional scientific information would be most useful, and guides future research. One of the authors, Dr. McDonald (pers. comm., 2015), indicated that the EwE model should not be used for regulatory decisions, such as creating a "cap" on geoduck aquaculture. The goal of this technical memorandum is to identify, in consultation with the authors of the Ferriss et al. (2015) article, an appropriate interpretation of their study results so that this information is not misused in regional decision-making processes. We request that the authors provide confirmation that the understanding and application of the Ferris et al. (2015) article as discussed in this memorandum is accurate.

## REFERENCES

- Bainbridge Island (City of Bainbridge Island). 2016. Ordinance No. 2016-06: An Ordinance of the City of Bainbridge Island, Washington, relating to aquaculture policies and regulations; amending the City's Shoreline Master Program and amending Sections 16.12.030-1, 16.12.030-2, 16.12.040 and 16.12.080 of the Bainbridge Island Municipal Code (BIMC). July 15, 2016.
- Brook, B.W., E.C. Ellis, M.P. Perring, A.W. Mackay, and L. Blomqvist. 2013. Does the terrestrial biosphere have planetary tipping points? *Trends in Ecology & Evolution* 28(7):396-401.
- Ferriss, B.E., J.C.P. Reum, P.S. McDonald, D.M. Farrell, and C.J. Harvey. 2015. Evaluating trophic and non-trophic effects of shellfish aquaculture in a coastal estuarine foodweb. *ICES Journal of Marine Science*. doi:10.1093/icesjms/fsv173
- Ma, M. 2015. Gear, not geoducks, impacts ecosystem if farming increases. *UWToday*, University of Washington, Seattle, Washington. October 21, 2015.
- McDonald, P.S. 2015. Personal communication with Vicki and Steve Wilson. University of Washington. [psean@uw.edu](mailto:psean@uw.edu). November 5, 2015.
- Townsend, P. and K. Townsend. 2016. Cumulative Impacts: Comments on Confluence Environmental Company response to public comments. Case No. 2014108800. January 20, 2016.