2021 South Sound Science Symposium Project Summary

Title: When Modeling Meets Policy: Human Nutrient Impacts on Puget Sound DO

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Additional links to presentations, publications, posters:
Puget Sound Nutrient Forum materials:
https://www.ezview.wa.gov/DesktopDefault.aspx?alias=1962&pageid=37106
Salish Sea modeling - Washington State Department of Ecology:
https://ecology.wa.gov/Research-Data/Data-resources/Models-spreadsheets/Modeling-the-environment/Salish-Sea-modeling
Puget Sound Nutrient Source Reduction Project: Salish Sea Model Results (arcgis.com):
https://waecy.maps.arcgis.com/apps/webappviewer/index.html?id=2a5d5e519a9d40df8a88f6910786c51f
Nitrogen in Puget Sound (arcgis.com):
https://waecy.maps.arcgis.com/apps/MapSeries/index.html?appid=907dd54271f44aa0b1f08efd7efc4e30

Project Summary: Excess anthropogenic point and nonpoint nutrient source to Washington waters of the Salish Sea contribute to not meeting dissolved oxygen (DO) water quality standards in many parts of Puget Sound. Washington State Department of Ecology (Ecology) is using science and policy to help a growing region reduce nutrient discharges from both point and nonpoint sources. Ecology uses the Salish Sea Model (Khangaonkar, 2018) to isolate and evaluate the impacts of human nutrient loads on DO. Pacific Northwest National Laboratory developed the model, in collaboration with Ecology, and with funding from the USEPA. The Puget Sound Nutrient Forum, a collaborative stakeholder group hosted by Ecology, meets regularly to discuss the science, modeling, and potential implementation actions.

Salish Sea Model results published by Ecology in 2019 confirmed that regional human nutrient loads are contributing to DO depletions below water quality standards and days not meeting, or noncompliant with, marine DO standards (Ahmed et al, 2019). For model years 2006, 2008, and 2014, DO depletions extend from many weeks to months, often occurring in bays and inlets with relatively long residence times (figure). These areas include biologically important habitats that support key life history stages of aquatic species like salmonids, forage fish, shellfish, and crustaceans.

Ecology is preparing a summary of the next set of modeling results, including runs focused on South Sound. It will describe recent improvements and updates to model inputs and results of scenarios, including:

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- Local impacts of watershed nutrient loads on DO in Puget Sound
- Local effects of WWTPs
- Annual versus seasonal nutrient reduction from WWTPs
- DO impacts from estimated future WWTP loadings due to projected population growth
- Combinations of WWTP and watershed inflow reductions

Salish Sea Model results indicate that cumulative reductions from both WWTPs and watershed inflows are necessary to meet marine DO standards. Ecology will use these new results to design another round of model scenarios to identify a range of options for nutrient reduction targets to guide regulatory decisions. Results will be discussed at the Forum in early summer 2021.

Ecology will also seek input on the next round of Salish Sea Model scenarios at the Nutrient Forum this summer. Over the next several years, the Forum will be a venue to discuss elements of the Puget Sound Nutrient Plan including strategic actions to reduce nutrient loads from point and nonpoint sources in watersheds. Both model results and Forum feedback will inform development of the Puget Sound Nutrient Reduction Plan and the Puget Sound Nutrient General Permit.

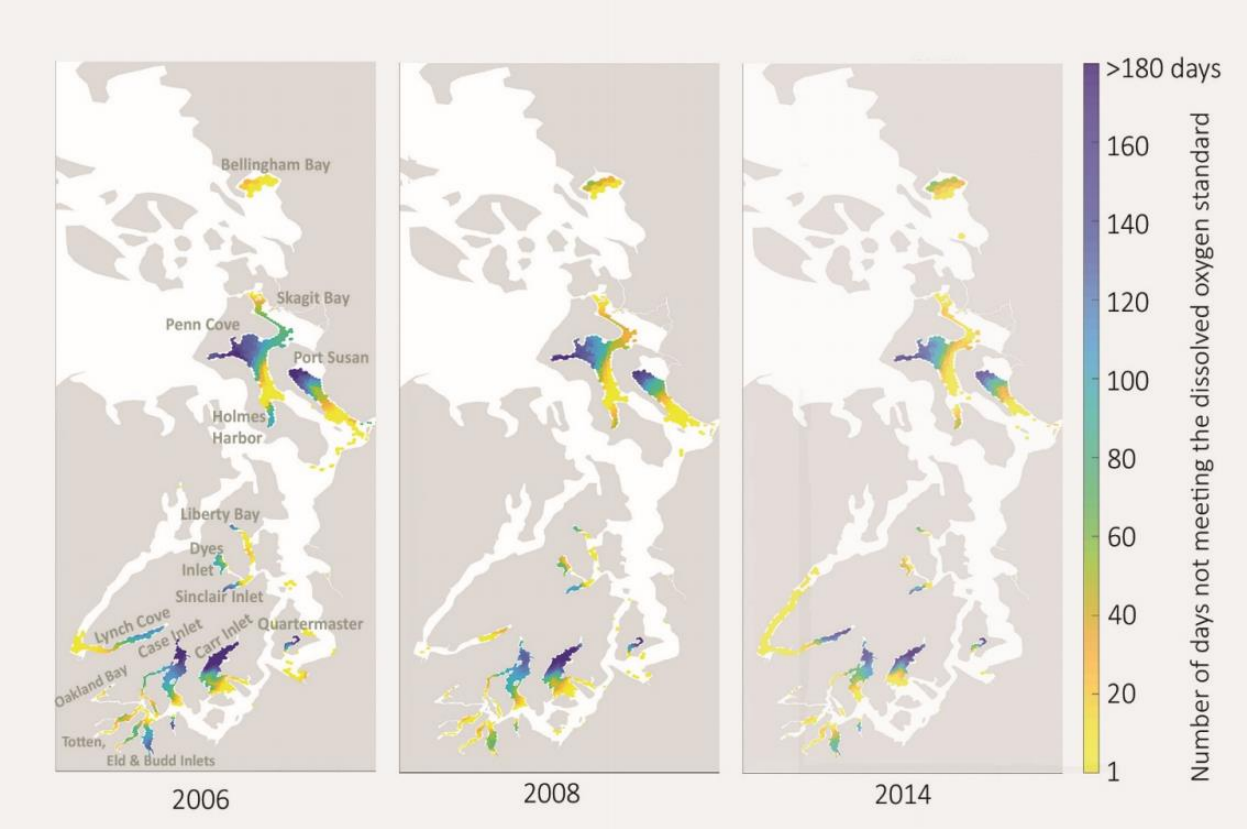

Figure. Number of days not meeting the dissolved oxygen water quality standards for the years 2006, 2008, and 2014. (Table ES2 excerpted from Ahmed et al, 2019).

References:

Ahmed, A., Figueroa-Kaminsky, C. Gala, J., Mohamedali, T., Pelletier, G., and McCarthy, S. 2019. Puget Sound Nutrient Source Reduction Project. Volume 1: Model Updates and Bounding Scenarios. Washington Department of Ecology, Publication 19-03-001. https://fortress.wa.gov/ecy/publications/SummaryPages/1903001.html

Khangaonkar, T., A. Nugraha, W. Xu, W. Long, L. Bianucci, A. Ahmed, T. Mohamedali, and G. Pelletier. 2018. Analysis of hypoxia and sensitivity to nutrient pollution in Salish Sea. Journal of Geophysical Research: Oceans 123: 4735-4761. http://doi.org/10.1029/2017JC013650.