Using Models to Compare and Prioritize Actions in Puget Sound– Who's Modeling What and Why?

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Computer models are helping to unravel what makes Puget Sound tick in critical areas like Hood Canal and South Puget Sound.

What are models?

- Mathematical tools to represent water systems as virtual worlds.
- Computer software that helps us:
  - Understand how water moves around and what factors may be responsible for water quality problems.
  - Plan a course of action to fix the problems.

Why more than one model of Puget Sound?

- We need a variety of models to diagnose Puget Sound just as we need a variety of medical doctors to diagnose our health problems:
  - General practitioners– Circulation models are needed for most problems because how water moves around influences many other processes.
    - If a pollutant spill occurs, where will it go? How fast? How far? How large an area?
    - If shellfish larvae are released, where will they go? How fast? How far? How large an area?
  - Specialists– Ecosystem models, such as water quality and food web models, are designed to address specific questions.
    - Do nutrient (e.g., nitrogen) sources in one location cause low dissolved oxygen levels somewhere else?
    - If we reduce the discharges of PCBs to the water, what levels will remain in Puget Sound marine mammals in 2030?
    - The same model could not address both questions.
- Second opinions are valuable. When multiple models confirm similar findings, our confidence in the results increases. When models conflict, often they identify areas of greatest uncertainty.
- Many marine modelers in the Puget Sound region cooperate through an ad hoc group called the Puget Sound Marine Environmental Modeling Consortium (PSMEM-C). The group's goal is to exchange information and tools to improve modeling in Puget Sound.

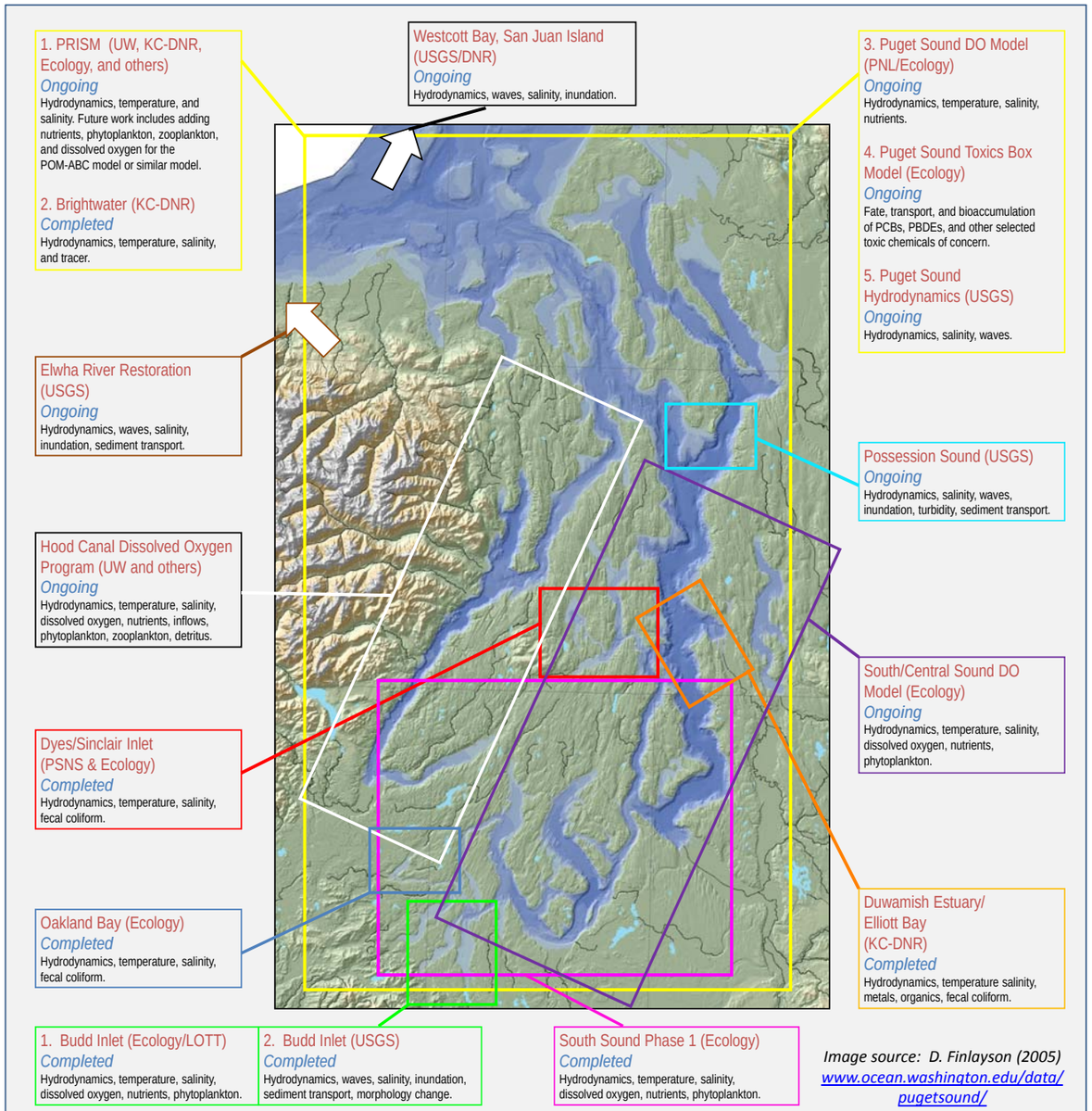

Image source: D. Finlayson (2005)
www.ocean.washington.edu/data/pugetsound/

Why bother modeling?

- Models provide virtual laboratories to test alternative management strategies.
- Models are the only way to determine whether management actions would benefit Puget Sound.
- We cannot afford to invest in strategies that do not result in the improvements expected.
- We have no other way to tease out the effect of humans vs. natural conditions for many parameters like dissolved oxygen.
- Modeling can help prioritize management actions by providing a quantitative measure of the benefits to Puget Sound.

Why not just collect data?

- Modeling complements monitoring programs, but neither substitutes for the other
- We cannot monitor all parameters at all places and at all times
- Monitoring programs take the pulse of Puget Sound
- If monitoring data indicates low or high pulse rates, models can help unravel why

How can models help with data collection and analysis?

- Monitoring data are required to drive the models and to test how well the models describe current conditions.
- However, models also can provide context to monitoring programs—
  - Is a monitoring station in a stagnant region or is it affected by a particular river?
  - Are two stations so similar in the water they represent that one could be eliminated?

Why different size boxes?

- *Domain* refers to the total area of interest, which might be all of Puget Sound or only Oakland Bay, depending on the question.
- *Scale* refers to the smallest critical size within the domain, like a specific shellfish bed area.
- If the question is how fecal coliform bacteria move in Oakland Bay, there is no need to model other parts of Puget Sound.
- Both large domain and small domain models are needed.

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For further information

PSMEM-C web page: www.psmemc.org
Focus on Modeling in Puget Sound:
www.ecy.wa.gov/biblio/0803006.html

About the Puget Sound Marine Environmental Modeling Consortium

The Consortium (PSMEM-C) of 11 academic, governmental, and private non-profit organizations develops and applies predictive models of the circulation, water quality, and ecosystem of Puget Sound. The group's goals are to:

- **Operate** and maintain a system of flexibly linked simulation models and a data management system for archiving and exchanging oceanographic data and model results.
- **Share** resources among PSMEM-C members and the regional and oceanographic community for research, education, and policy formulation.
- **Engage** in research activities to develop a fundamental understanding of the workings of Puget Sound.
- **Address** practical questions concerning the management of the Sound and its diverse resources.

Acronyms and Abbreviations

DNR – Washington State Dept. of Natural Resources; DO – dissolved oxygen; Ecology - Washington State Dept. of Ecology; KC-DNR – King County Dept. of Natural Resources; LOTT – Lacey, Olympia, Tumwater, Thurston County; PNL – Pacific Northwest Laboratory; POM-ABC – Princeton Ocean Model Aquatic Biogeochemical Cycling; PRISM – Puget Sound Regional Synthesis Model (UW); PSNS – Puget Sound Naval Shipyard; USGS – U.S. Geological Survey; UW – University of Washington.

This poster on the web

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