

# **A Partnership for Modeling the Marine Environment of Puget Sound, Washington – Ocean Inquiry Project Report**

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## **LONG-TERM GOALS**

Puget Sound, Washington, is both the largest fjord in the lower forty-eight states and closest to the substantial urban centers of Seattle, Tacoma, Everett and surrounding communities. The Sound has seasonally high annual phytoplankton standing stock and primary production, and they support several economically valuable fisheries. Our long-term goals are to develop quantitative understanding of the Sound's circulation and marine ecosystem, and of the sensitivity of the physical and the biological system to natural and human perturbations; and to develop models of Puget Sound that can aid agencies with responsibilities for environmental management in making informed decisions and serve as marine science education tools.

## **OBJECTIVES**

Our partnership will develop, maintain and operate a suite of flexibly linked simulation models of Puget Sound's circulation and ecosystem, a data management system for archiving and exchanging oceanographic data and model results that are accessible to all members of the partnership as well as to the regional and oceanographic community, and an effective delivery interface for the model results and observational data for research, education and policy formulation. Our partnership will conduct scientific research aimed at developing fundamental understanding of the Sound's working, as well as addressing practical questions raised by the regional community concerning management of the Sound and its resources. Our partnership will function as an estuarine research node within the NOPP Ocean Information Commons.

## **APPROACH**

The Partnership for Puget Sound Marine Environment Modeling (PSMEM) consists of five separate organizations: University of Washington (School of Oceanography and College of Education), King County Department of Natural Resources, Washington State Department of Ecology, Puget Sound Naval Shipyard, and Ocean Inquiry Project. The Partnership is administered from the School of Oceanography, University of Washington (UW). The lead P.I., Mitsuhiro Kawase, is responsible for project oversight and coordination. (See separate report filed by Kawase for further details.)

Ocean Inquiry Project personnel include Stahr and Christian Sarason, Program Director. They are involved with the PSMEM Education and Visualization team, consisting of themselves and

investigators from the UW College of Education (W. Winn, Y. Lee, R. Fruland) and UW Human Interface Technology Laboratory (P. Oppenheimer). This team's primary responsibility is developing a simple web interface and associated curriculum for the models and data collected by the Partnership. Stahr coordinates OIP activities regarding curriculum development and Partnership interaction, and Sarason focuses on the development of the model and interface.

## **WORK COMPLETED**

Our Partnership's Education and Visualization Team completed the transition of Virtual Puget Sound (VPS – a dynamic 3D visualization of model data) to desktop PC workstations, as well as making user interface improvements. This made VPS useful for inquiry style learning for as many as 30 students at once. In the fall 2003, instructors (Stahr & Sarason) teaching introductory oceanography classes at the University of Washington and at Seattle Central Community College collaborated to make their courses equivalent, except that the university students used VPS for some exercises while the community college students did the same exercises at sea. A paper regarding this comparison study was submitted to the Journal of Research in Science Teaching.

The Education and Visualization Team participated in the PSMEM workshop in the spring presenting VPS in both summary form and as a participatory exercise during the lunch break. This summer VPS was used in a study of dyslexic children in grades 4-6 at the University of Washington. While the data analysis is incomplete at the time of writing, we found the children learned a great deal about tides, currents and salinity. This past month, we submitted a proposal in response to an RFP from NOAA / University of New Hampshire Coastal Response Research Center to develop an oil spill response model using computer game technology.

OIP gathered in-situ field data for the Partnership on 15 separate cruises on the Sound, engaging over 200 students in the process of marine science. These cruises were funded by student fees and outside grants and donations. This past month, OIP contributed staff and its CTD to help collect data with the Hood Canal Dissolved Oxygen Project (HCDOP).

## **RESULTS**

The fall quarter 2003 comparison of classes using VPS versus an in-situ field experience demonstrated that VPS can be used on a regular basis in a college class. VPS was successful at teaching the basic concepts and principles of estuarine circulation and stratification, provided a context for students who had little prior experience with the ocean, and helped students generalize what they learned from the lecture material. The UW students in the study later used VPS while investigating the best locations for new sewer outfalls for increased populations in Puget Sound (a class exercise). The most interesting result of the study was that those who had no prior background with natural water understood concepts taught with the in-situ field experience better than those with similar background that only used VPS to learn the same concepts.

## **IMPACT/APPLICATIONS**

**Science Education and Communication**—With the aid of suitable visualizations, such as VPS and the basic web interface developed last year, Puget Sound model results will be a valuable tool for learning about the marine environment that can be used in classroom settings as well as by the public at large in museums and through the web.

## **TRANSITIONS**

**Science Education and Communication**—We installed a teaching version of VPS in the School of Oceanography’s Spatial Analysis Laboratory which has been used by a number of instructors in teaching undergraduate classes. This work is still on-going, especially in terms of training and documenting curricula to be used with VPS.

## **RELATED PROJECTS**

The Ocean Inquiry Project ran a workshop in March entitled “Coordinating and Advancing Field-based Marine Science Education in Puget Sound” which was funded by the Russell Family Foundation. It gathered over 80 participants together to discuss what could help further the exposure of students to marine science. The basic result was to suggest the creation (and staffing) of a coordinator position to help link providers and users of field based marine science education. A copy of the final report is available at <http://www.oceaninquiry.org/workshop>.

## **REFERENCES**

- Seeing the Sound: A System for Learning About Puget Sound Using Model Visualizations and In-situ Field Experiences, Sarason, C.P., and F.R. Stahr; Georgia Basin/Puget Sound Research Conference, April 2003, Vancouver, British Columbia, Canada.
- Creating Partnerships Between Researchers, Teachers and Students: Comparing Model Output to Data Collected by Field Trips on Puget Sound; Sarason, C.P., F.R. Stahr, and M. Kawase; Estuarine Research Federation Conference, September 2003, Seattle, Washington.
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