Focus on **Hood Canal**

from the Environmental Assessment Program

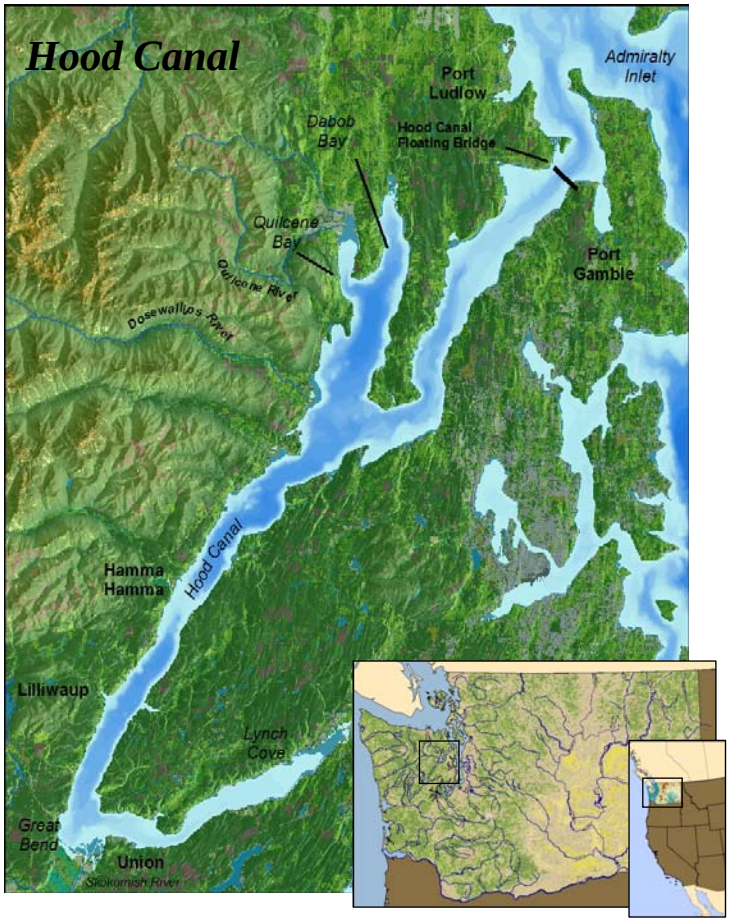
Relationships Between Sediment Quality, Dissolved Oxygen, and Benthic Invertebrates in Hood Canal

A Retrospective Data Analysis

As part of the Hood Canal Dissolved Oxygen Program, scientists from the Washington Department of Ecology and Western Washington University analyzed data from Hood Canal studies conducted from 1932 to 2005.

Data included measures of sediment quality, water column dissolved oxygen (DO) levels, and the numbers and kinds of sediment-dwelling invertebrates. These are small marine animals without backbones, such as worms, crabs, and clams, known as *benthic infauna*.

These data were examined to evaluate their relationship to each other and to respond to the question "How do low dissolved oxygen levels affect the benthic infauna in Hood Canal?"



A History of Low Dissolved Oxygen in Hood Canal

Seasonal episodes of low DO in the waters of Hood Canal have increased in duration, frequency, and area since scientists first began taking measurements in the 1930s. Recent episodes of low DO have triggered fish and invertebrate kills in southern Hood Canal and have become a focus of concern for scientists and the general public (www.hoodcanal.washington.edu). While most of the attention has been on the effects of low DO on fish and larger invertebrates such as crab, shrimp, squid, and octopus, little has been done to assess the effects of low DO on the less well known benthic infauna.

Why Do We Care About the Benthic Infauna?

Positioned near the bottom of the food chain, the benthic infauna include a wide variety of invertebrates that live on or in marine sediments. The infauna cycle nutrients through the sediments and serve as an important food source for bottom-dwelling fish, larger surface-dwelling invertebrates, and many marine birds and mammals (including gray whales). An abundant and diverse benthic infaunal community is one sign of a healthy ecosystem. Communities composed of relatively few individuals and species can be an indicator of either human-related or natural stresses to the ecosystem.

December 2007 Publication No. 07-03-048

What Does This Study Tell Us?

Analysis of available Hood Canal sediment quality, DO, and benthic infauna data suggests the following:

- Generally, chemical contamination and toxicity levels were low and confined to Port Ludlow, Port Gamble, and Dabob Bay. These factors appeared to have a very limited influence on benthic community structure in Hood Canal.
- Water quality data showed a steady decline over time in DO content and an increase in the area affected by low DO, especially in southern Hood Canal.
- In all but a few northern locations, benthic infaunal communities in Hood Canal generally were less abundant and diverse than communities found in other parts of Puget Sound.
- Nine unique benthic communities were distinguished throughout Hood Canal, adapted to the particular sediment and DO characteristics found in each area.
- The total number and variety of benthic infauna declined, and several stress-tolerant invertebrate species became dominant, from north to south along the canal's main axis.
- Benthic communities changed as: (1) sediment texture became finer-grained (that is, as silt-clay content increased), (2) DO levels near the bottom decreased, (3) nutrient content (measured as percent total organic carbon) in the sediments increased, and (4) depth increased.
- Noticeable changes in community structure occurred as DO levels decreased from >10 mg/L to >3-6 mg/L and then to $\leq$1 mg/L. Various benthic infauna responded differently, with either increased or decreased abundance, to changes in the range of near-bottom DO levels.
- Further analysis indicated that there was little change in northern Hood Canal benthic infauna that could be attributed to declining oxygen levels. However, between 1991 and 1999, changes in benthic community structure at a location near the Great Bend were consistent with declining DO concentrations.

Results suggest that sediment-dwelling invertebrates were likely to be sensitive to natural and human-caused changes to sediment grain size and organic content, as well as to levels of DO in bottom waters of Hood Canal. The full report (www.ecy.wa.gov/biblio/0703040.html) describes initial steps to develop critical DO thresholds which can be used to determine when benthic infauna are at risk. Additional information and research needed to develop better thresholds are also identified.

For More Information

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This work was funded, in part, by the Hood Canal Dissolved Oxygen Program, and conducted in partnership with Western Washington University and the Puget Sound Assessment and Monitoring Program.

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