Infaunal Invertebrate Assemblage Structure in Hood Canal, WA (1989 – 2005)

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I. Findings

- Few increasing or decreasing trends in benthic indices were seen over time.
- Infaunal abundance and taxa richness decreased from north to south.
- Unique infaunal assemblages were distinguished for nine sub-regions of Hood Canal.
- Hood Canal benthic assemblages were less abundant and diverse than elsewhere in Puget Sound.
- Percent fines, percent total organic carbon (TOC), mean SQS metals, station depth, and near-bottom dissolved oxygen (DO) co-vary with each other, and with total taxa abundance and richness, jointly influencing benthic infaunal assemblage structure.

II. Introduction

The composition of the benthos, or sediment-dwelling invertebrate assemblages, in Hood Canal was examined by Ecology's Marine Sediment Monitoring Team to assess relationships between sediment quality, water column dissolved oxygen (DO) levels, and benthic community structure in Hood Canal.

Existing benthos data generated from 1989 – 2005 for the Puget Sound Assessment and Monitoring Program's (PSAMP) Sediment Component were assembled.

Data analyses included generation of summary statistics and geographical displays of benthos data to understand their spatial distribution and temporal variation. Benthos data were also correlated with sediment quality and near-bottom water column DO data to determine relationships between invertebrate assemblage structure and these environmental parameters.

Examination of these data revealed a number of spatial patterns in benthic assemblage structure in Hood Canal.

III. Spatial and Temporal Variation in Benthic Assemblage Structure

A temporal cycle of increasing and decreasing mollusc and annelid abundance was seen at one long-term station in northern Hood Canal, while no such changes in major taxa or total abundance were observed for the other stations (Figure 1). There were no obvious temporal changes between stations sampled in 1999 and 2004 (Figure 2 and Figure 3).

There was a spatial pattern of decreasing total abundance from north to south in the six PSAMP temporal stations and in the 1999 and 2004 Spatial surveys. Stress-tolerant annelids and molluscs persisted while less tolerant arthropods, echinoderms, and miscellaneous taxa generally became rare or absent from north to south and at depth.

General information and all data generated during this survey will be available in:

Long, ER, ME Dutch, S Aasen, KI Welch, VA Partridge, and DH Shull, *in draft*. Relationships between the Composition of the Benthos and Sediment and Water Quality Parameters in Hood Canal, WA. Task IV – Hood Canal Dissolved Oxygen Program. Washington State Department of Ecology, Olympia, WA and Western Washington University, Bellingham, WA.

and at Ecology's Marine Sediment Monitoring Website:

http://www.ecy.wa.gov/programs/eap/psamp/index.htm

This poster was prepared for the 2007 Georgia Basin/Puget Sound Research Conference, Vancouver, BC; and the 2007 Pacific Northwest SETAC Conference, Pt Townsend, WA.

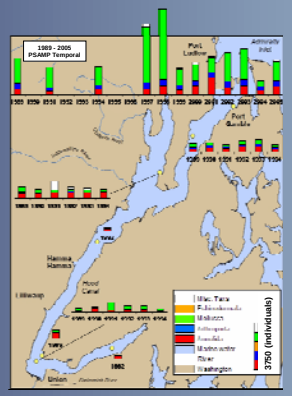

Figure 1. Major taxa and total abundance measured at each station in Hood Canal for the PSAMP Temporal surveys (1989-2005).

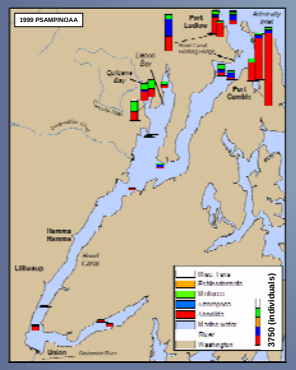

Figure 2. Major taxa and total abundance measured at each station in Hood Canal for the 1999 PSAMP/NOAA Monitoring Program.

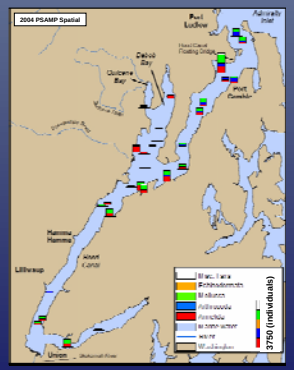

Figure 3. Major taxa and total abundance measured at each station in Hood Canal for the 2004 PSAMP Spatial Monitoring Program.

IV. Nine Biotic Subregions Identified in Hood Canal

Examination of 9 benthic indices, depth, percent fines, and percent TOC values measured at each station suggests the presence of 9 biotic subregions in Hood Canal (Figure 4).

Stations in northern Hood Canal and in shallow, nearshore locations with relatively low percent fines and TOC values had the most diverse assemblages, with a well-balanced mix of annelids, arthropods, and bivalves.

Less stress-tolerant arthropods, echinoderms, and miscellaneous taxa generally became rare or absent from north to south, and in the deepest locations and terminal inlets, while more stress-tolerant polychaetes and several ubiquitous bivalves (*Axinopsida serricata*, *Macoma carlottensis*, and *Macoma* sp.) became dominant (Figures 1 - 4).

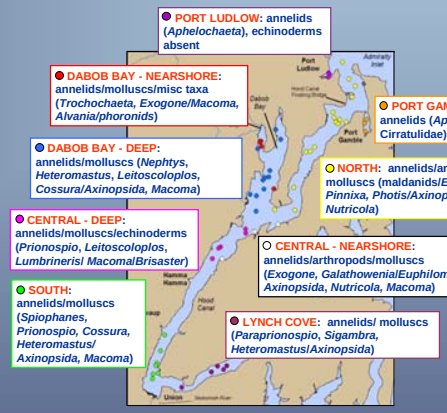

Figure 4. Nine subregions with distinct benthos in 1989-2005 PSAMP sediment monitoring surveys. Dominant taxa listed.

V. Hood Canal Benthos Differ from the Puget Sound 1997-2003 Baseline

Forty-two (42) of the 58 stations sampled in Hood Canal from 1989 through 2005 had "affected" benthos[1] (Figure 5).

In general, Hood Canal benthic assemblages were less abundant and diverse than elsewhere in Puget Sound. Stations without "affected" benthos were all located in northern Hood Canal in shallow and near shore stations with low percent fines and TOC.

Classification as "affected" vs. "unaffected" did not change over time for the long-term (temporal) stations (Figure 5). The percent of "affected" stations was slightly higher (77%), and appeared to extend further north in 2004 than in 1999 (71%).

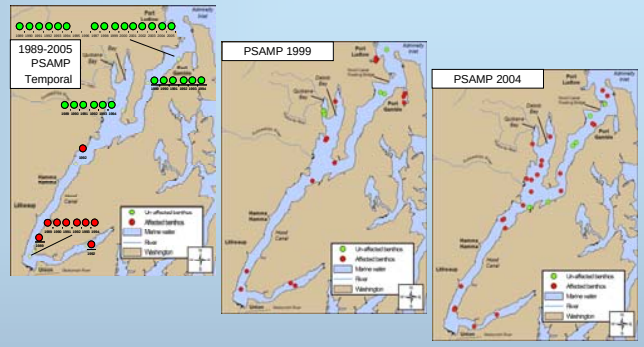

Figure 5. Hood Canal stations with affected benthos[1] collected for the 1989-2005 PSAMP Temporal Monitoring Program.

[1] affected benthos - A "reference envelope" of 80% confidence limits was generated for the median of each benthic index calculated for the 1997-2003 Puget Sound baseline infauna data set.

Hood Canal stations with the majority (≥5 of 9) of benthic indicators below the reference envelope or with large numbers of stress-tolerant taxa were considered to differ from the Puget Sound baseline, possibly "affected" by natural or anthropogenic stressors.

Stations with the majority of benthic index values ≥ the reference envelope were considered "unaffected", having benthic assemblages similar to or more abundant and diverse than the Puget Sound baseline.

VI. Correlations

Percent fines, percent TOC, mean SQS metals, station depth, and near-bottom DO measured at sediment stations in Hood Canal were strongly correlated with one another and with total abundance and taxa richness. Scatter plots of these data exhibited suites of similar patterns, suggesting that parameters co-vary with one another and jointly influence the structure of benthic infaunal assemblages in Hood Canal (Figure 6).

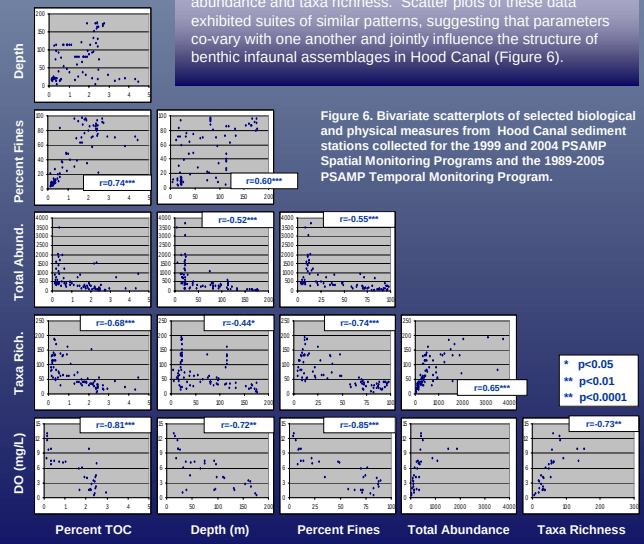

Figure 6. Bivariate scatterplots of selected biological and physical measures from Hood Canal sediment stations collected for the 1999 and 2004 PSAMP Spatial Monitoring Programs and the 1989-2005 PSAMP Temporal Monitoring Program.