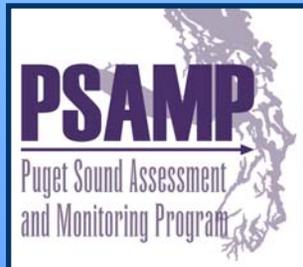
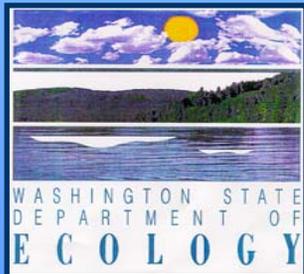


Relationships between Benthos, Sediment Quality, and Dissolved Oxygen in Hood Canal

Maggie Dutch, Ed Long, Sandy Aasen,
Kathy Welch, Valerie Partridge

*Washington State Department of Ecology
Olympia, WA*



*Georgia Basin-Puget Sound
Research Conference
Vancouver, BC 3/29/07*

HCDOP Task 4: Marine Life Studies

Assess effects of low DO on biota

- ❖ Compile existing benthos, sediment quality, and water column DO data
 - ❖ Examine patterns and relationships between parameters
 - ❖ Identify critical values/thresholds of DO and effects on biota
 - ❖ Identify data gaps
 - ❖ Develop recommendations for future work
-

Data Compilation

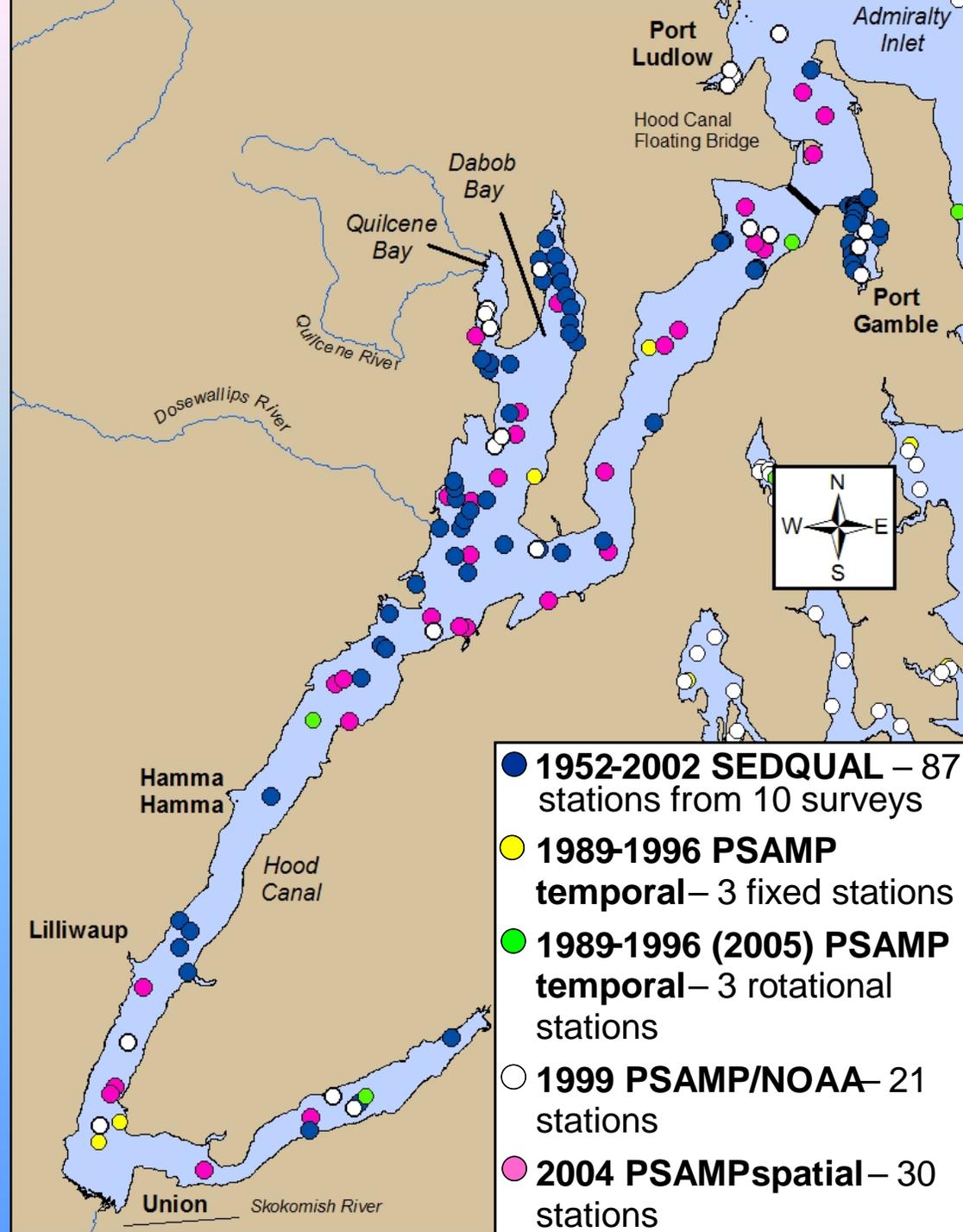
Sediment Data Available 1952-2005

Parameters

Habitat and Chemistry –
depth, grain size, TOC,
180+ metals and
organics

Toxicity – 6 tests

Benthos – count and
identify sediment-dwelling
invertebrates; 9 benthic
indices calculated



Water Column Data Available 1932-2005

Parameters

Dissolved Oxygen

Sampling Depth

Temperature

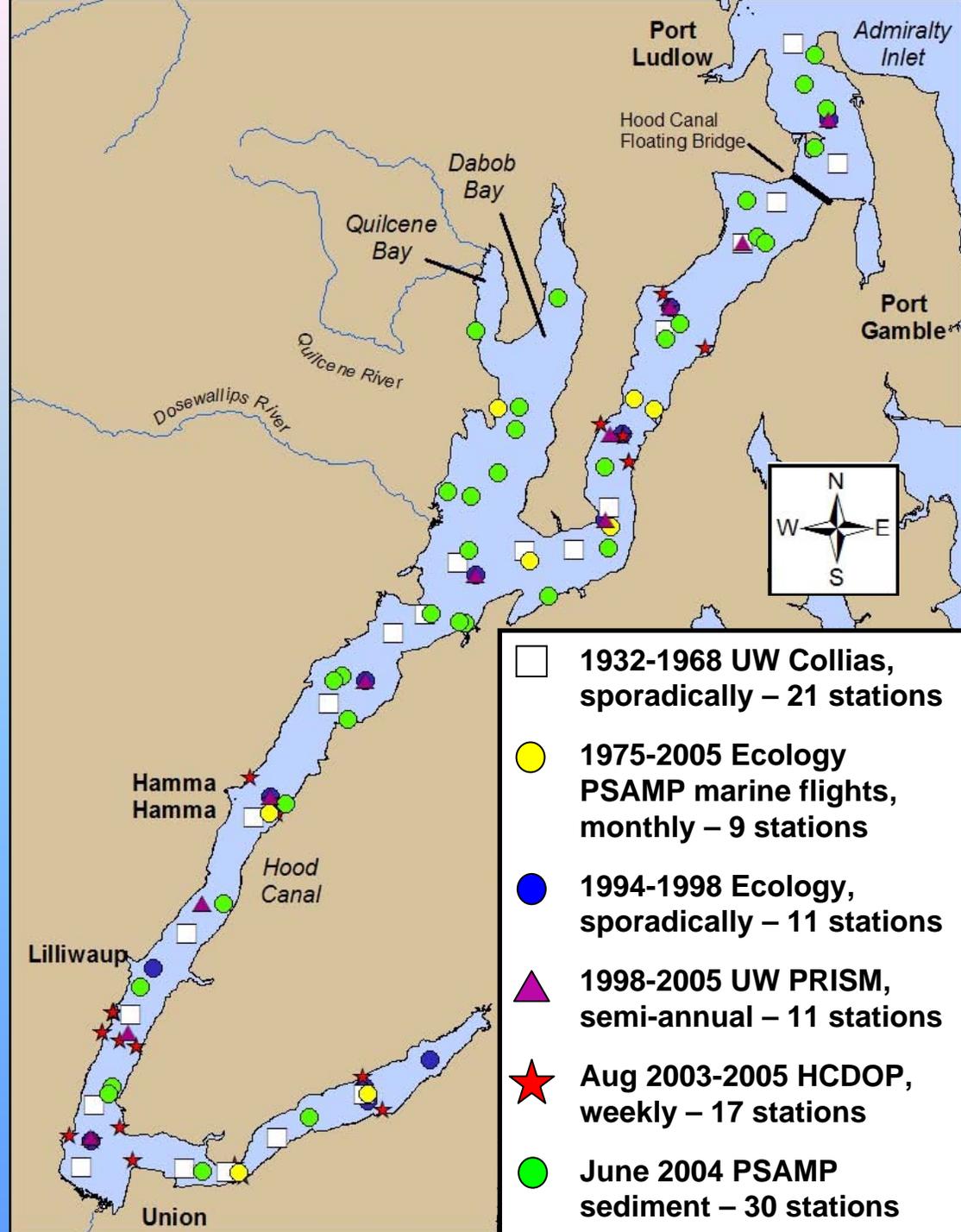
Salinity

Density

pH

Fluorescence

Par

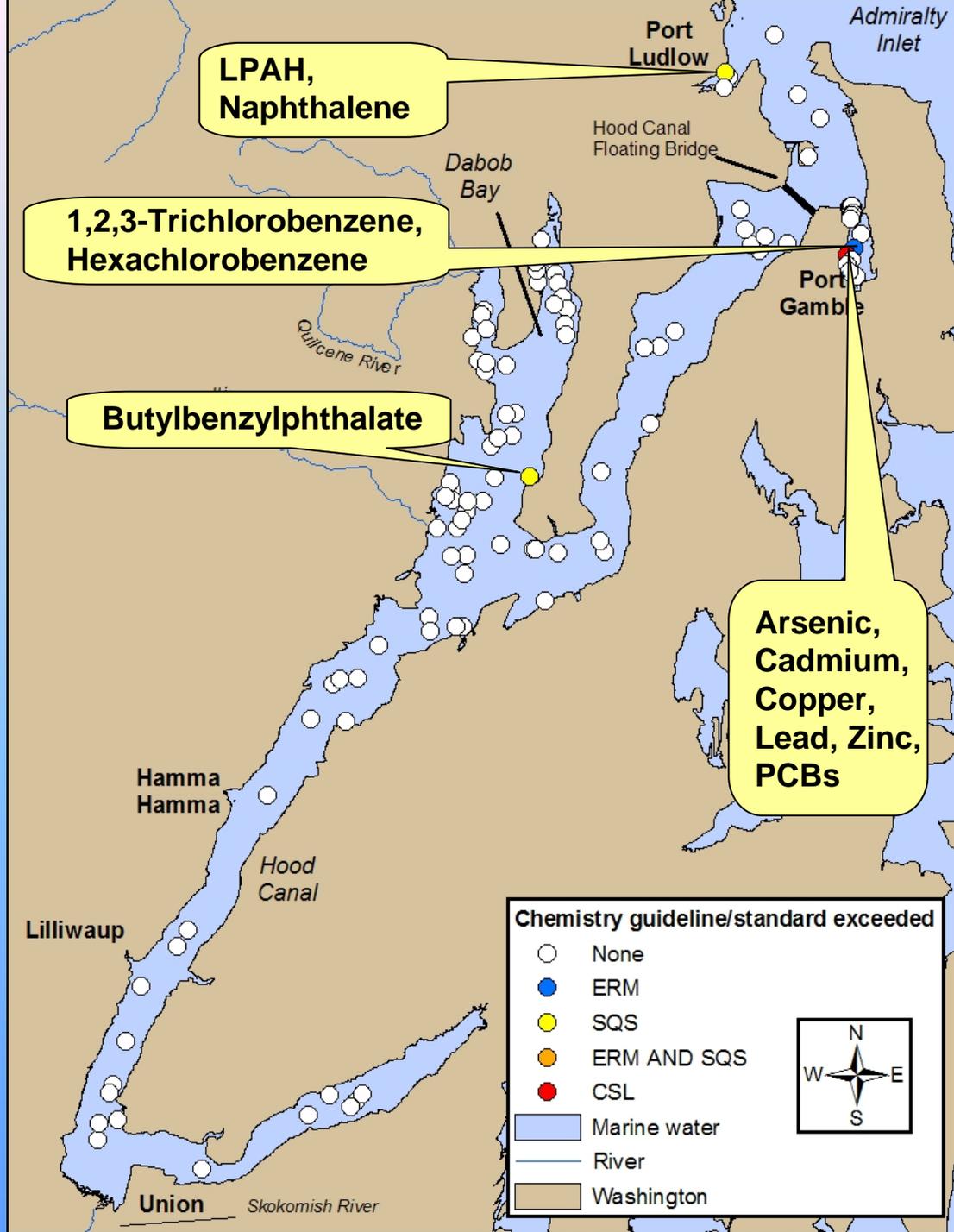


Spatial Patterns



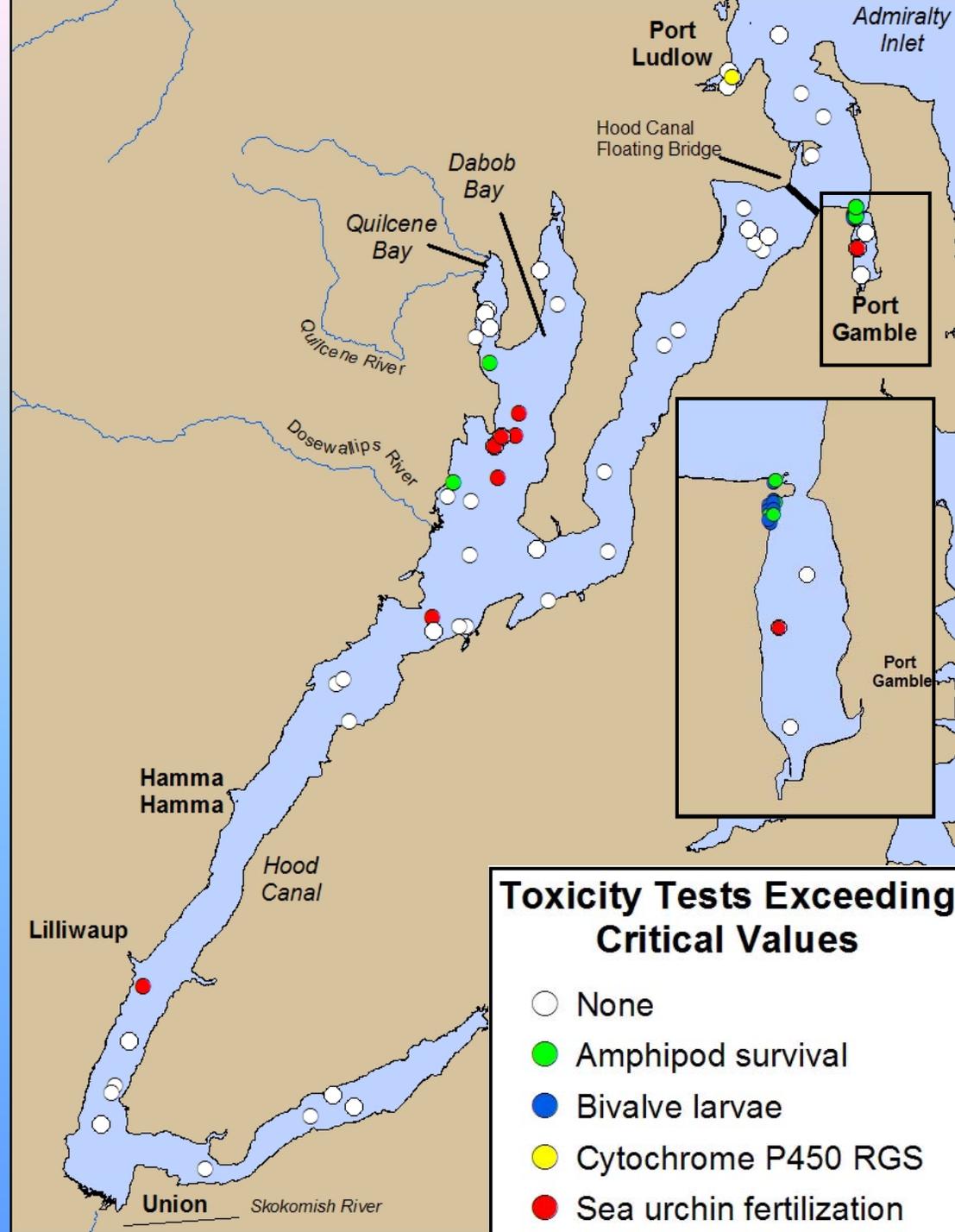
Sediment Chemistry

Parameter	Average % Detected
<u>Inorganics</u>	
Ancillary Metals	100.0
Priority Pollutant Metals	81.1
<u>Organics</u>	
HPAHs	77.0
LPAHs	74.4
Miscellaneous Extractables	40.3
PBDEs	14.0
Phthalate Esters	4.1
Polychlorinated Biphenyls	3.5
Chlorinated Pesticides	2.6
Organotin, Butyl tin	0.0
All other organics	0.0-11.3



Sediment Toxicity

Toxicity Test Conducted	No. (%) Samples Exceeding Critical Values
Amphipod survival	7/42 (17)
Neanthes growth	0/17 (0)
Bivalve larvae normal development/survival	15/17 (88)
Sea urchin fertilization	8/51 (16)
Microtox luminescence	0/21 (0)
Cytochrome P450 RGS	1/21 (5)

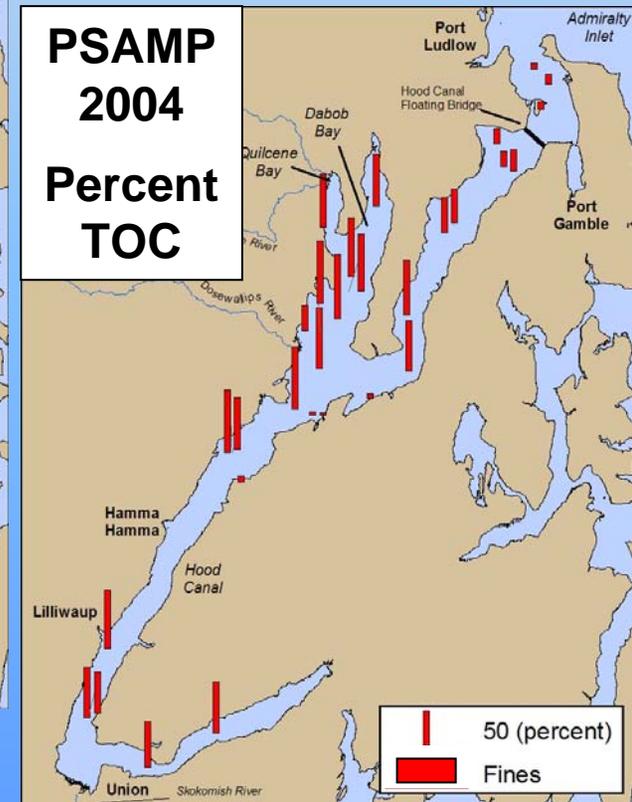
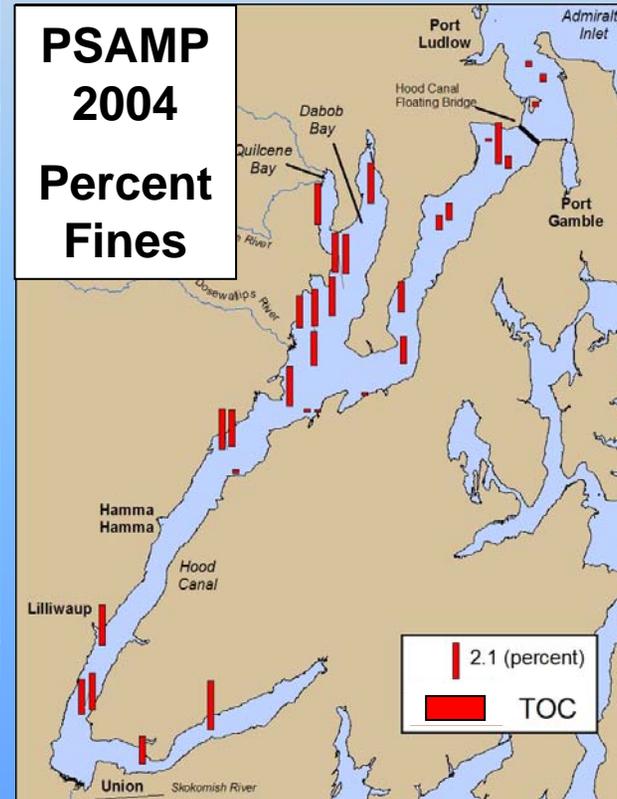
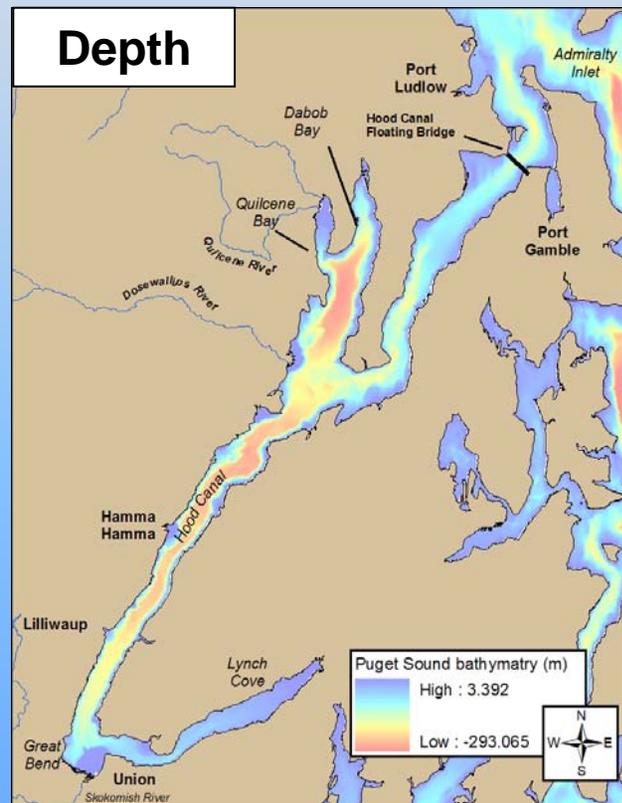


Toxicity Tests Exceeding Critical Values

- None
- Amphipod survival
- Bivalve larvae
- Cytochrome P450 RGS
- Sea urchin fertilization

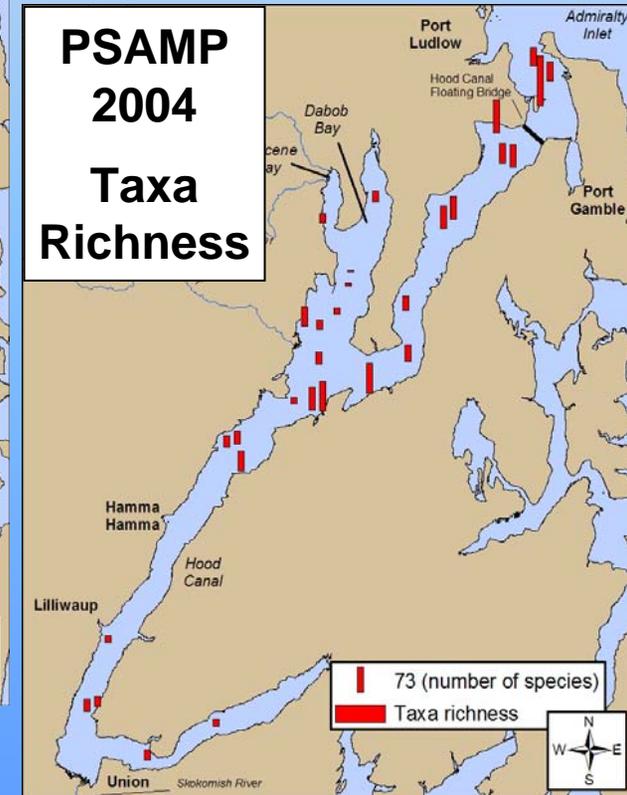
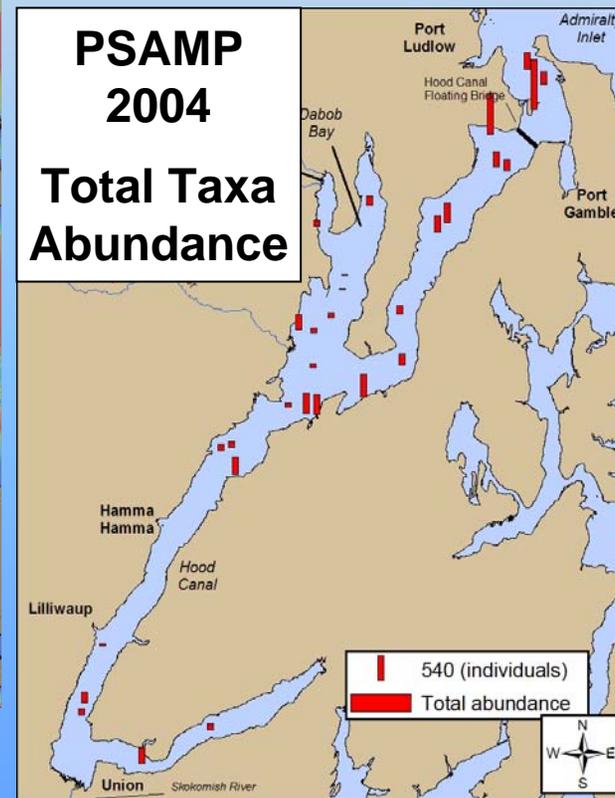
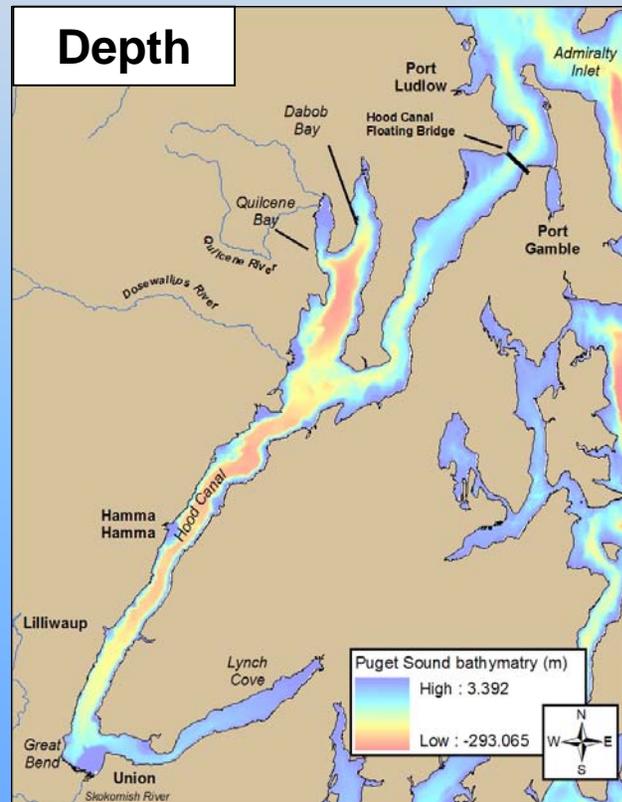
Percent Fines and Percent TOC

- Increased from north to south
 - Increased from shallow to deep
 - Highest in central channel and inlets



Total taxa abundance and richness

- Decreased from north to south
 - Decreased from shallow to deep
 - Inversely related to % fines, TOC



Nine Biotic Subregions Identified

Based on:

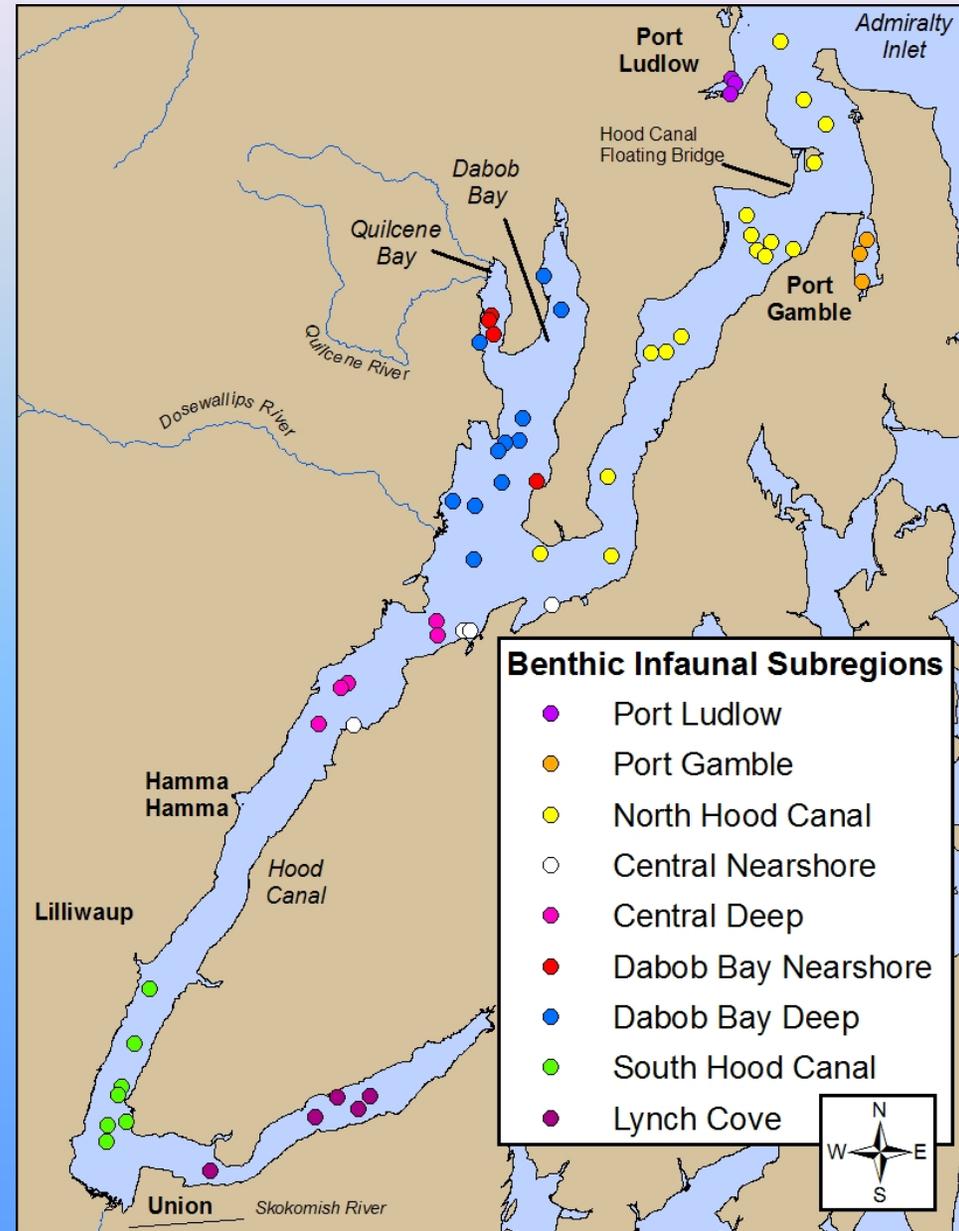
- 9 benthic indices, dom. taxa
- % fines, %TOC, depth

North, nearshore:

- Annelids, arthropods, bivalves dominant; echinoderms, other taxa present

South, deep, inlets:

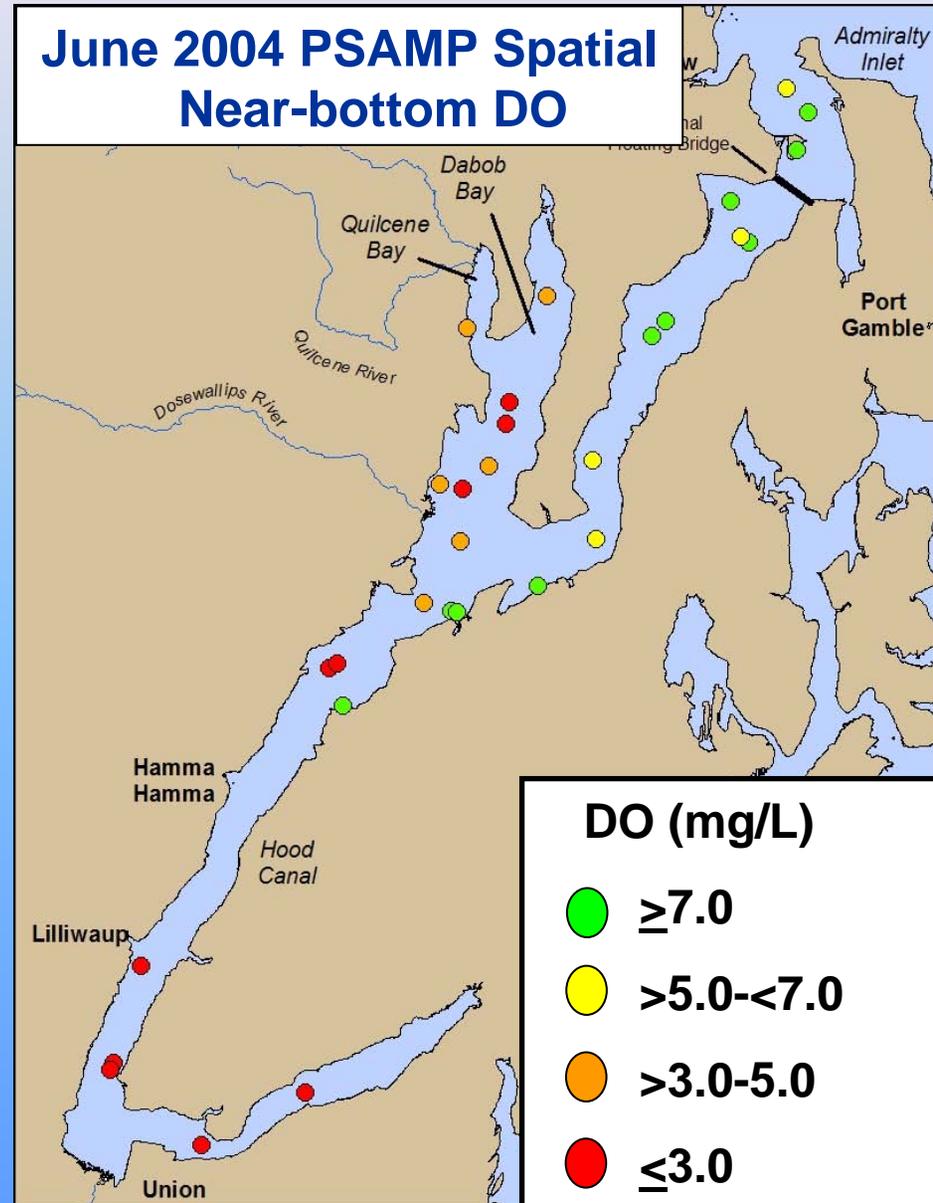
- Tolerant annelids, bivalves dominant (sensitive arthropods, echinoderms, misc. taxa rare or absent)
- Opportunistic, widespread taxa dominant



Dissolved Oxygen in Hood Canal

1932-2005

- Minimum DO critical to biota
- Minimum DO:
 - decreased from north to south, shallow to deep along main axis
 - decreasing, extending northward over time (esp. 1990's-2005)
- South and deep stations below critical levels for biota



Relationships Between Variables

Benthos/Sediment/DO Correlations

Pearson correlation coefficients (r) and significance levels (p)

	% TOC	Depth	% Fines	Total Abundance	Taxa Richness
Depth	0.35 ns				
% Fines	0.74 (<0.0001)	0.60 (<0.0001)			
Total Abundance	-0.40 ns	-0.52 (<0.0001)	-0.55 (<0.0001)		
Taxa Richness	-0.68 (<0.0001)	-0.44 (0.02)	-0.74 (<0.0001)	0.65 (<0.0001)	
DO	-0.81 (<0.0001)	-0.72 (0.002)	-0.85 (<0.0001)	0.58 ns	0.73 (0.001)

Summary

- ❖ Chemistry and toxicity generally low, hits in Pt Ludlow, Pt Gamble, Dabob Bay. May influence biota distribution there, but not elsewhere in HC.
 - ❖ Spatial patterns indicate benthos becomes less numerous and taxa rich from north to south, shallow to deep, and in inlets, as % fines, %TOC, and (sometimes) depth increase and minimum DO levels decrease.
 - ❖ 9 biotic subregions were identified, shaped by % fines, %TOC, depth, and DO.
 - ❖ % fines, % TOC, depth, DO are correlated and co-vary to influence taxa abundance and richness
-

Other Findings

- ❖ Hood Canal benthic index values generally lower than Puget Sound baseline values (72% of stations).
- ❖ No (few) obvious increasing or decreasing trends in benthic indices were seen over time.
- ❖ Critical DO thresholds suggested at $>3-6$ mg/L & <1 mg/L, where major changes in structure of benthos occur.
- ❖ Multivariate analyses – Dr. David Shull, WWU
- ❖ 11 data gaps identified/recommendations made.

Reporting

- ❖ Draft available for review through April at HCDOP and ECY websites.
 - ❖ Final completed by June 2007.
 - ❖ Posters at this conference:
 - ❖ Levels of Chemical Contamination and Toxicity in Hood Canal Sediments (1952 – 2005)
 - ❖ Infaunal Invertebrate Assemblage Structure in Hood Canal, WA (1989 – 2005)
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