

Sediment Quality in the Bays and Inlets of the San Juan Islands, Eastern Strait of Juan De Fuca, and Admiralty Inlet

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Publication No. 09-03-023. www.ecy.wa.gov/biblio/0903023.html. May 2009.

Summary of Findings

- ❖ Sediment chemistry, toxicity, and invertebrate communities were evaluated at 90 stations in the San Juan Islands, the eastern Strait of Juan de Fuca, and Admiralty Inlet.
- ❖ Highest sediment quality was measured in Admiralty Inlet (69% of area), while the majority of sediments in the San Juan Islands and the eastern Strait of Juan de Fuca were of intermediate quality (70 and 72% of each area, respectively).
- ❖ No sediments were of degraded quality in any of the three regions.
- ❖ The 1997-2003 eight-region, Puget Sound-wide sediment quality data baseline is complete.
- ❖ Periodic re-evaluation of embayment, regional, and Puget Sound-wide sediment quality provides information on change over time, useful in adaptive management.



Olympic Mountains, Eastern Strait of Juan de Fuca Photo by C.M. Eaton, Bio-Marine Enterprises

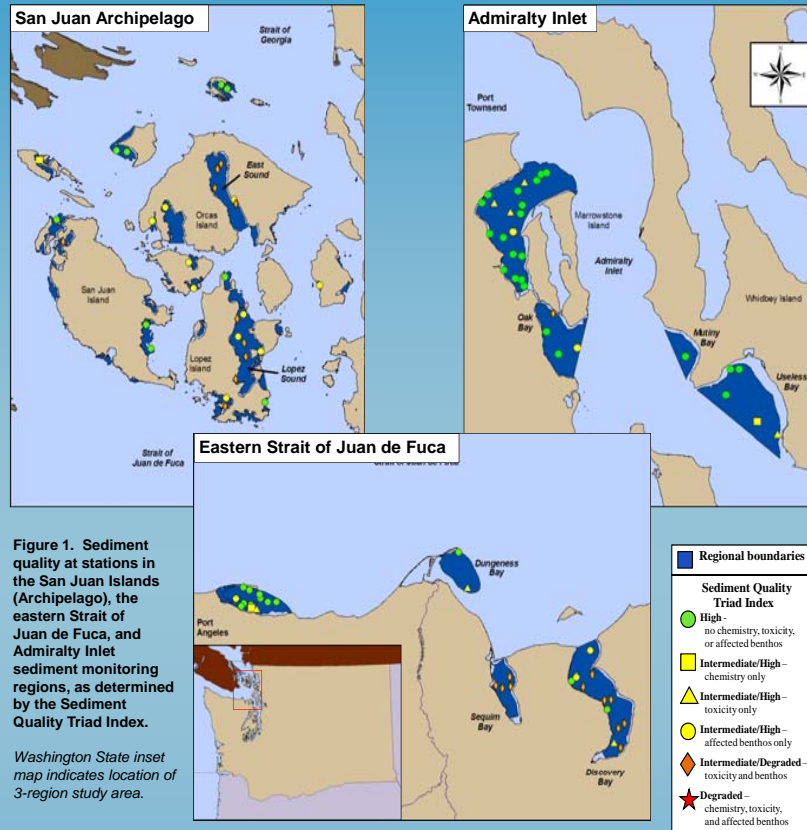


Figure 1. Sediment quality at stations in the San Juan Islands (Archipelago), the eastern Strait of Juan de Fuca, and Admiralty Inlet sediment monitoring regions, as determined by the Sediment Quality Triad Index.

Washington State inset map indicates location of 3-region study area.

I. Sediment Quality Assessment of Three Puget Sound Monitoring Regions

The Washington State Department of Ecology (Ecology) conducted a sediment quality survey of 90 stations in the bays, coves, and inlets of the San Juan Islands, eastern Strait of Juan de Fuca, and Admiralty Inlet during June of 2002 and 2003. This survey was part of the Puget Sound Assessment and Monitoring Program (PSAMP).

Sediment Survey objectives were to (1) measure levels of chemical contaminants and sediment toxicity, and (2) determine the condition of sediment-dwelling invertebrate communities.

Using the *Sediment Quality Triad* of indicators (Long et al., 2004), Ecology determined the number and percent of stations and the size (km²) and percent of the study area with high, intermediate, or degraded sediment quality for each region.



Ecology staff sampling sediments in the San Juan Islands. Photo by C.M. Eaton, Bio-Marine Enterprises

II. The Sediment Quality Triad Index (SQTI)

The chemistry, toxicity, and benthos data were compiled using the Sediment Quality Triad Index (Long et al., 2004) to classify the overall sediment quality at each station (Table 1).

High quality sediments were most prevalent in the Admiralty Inlet region (69% of the study area).

Stations classified as *intermediate/degraded*, the poorest quality encountered in this survey, represented 43% and 33% of the eastern Strait of Juan de Fuca and San Juan Islands regions, respectively, as compared to 5% of the Admiralty Inlet region.

None of the sediments were classified as *degraded*.

Overall, the data indicated that sediment quality was highest in Admiralty Inlet, poorer in the San Juan Islands, and poorest in the eastern Strait of Juan de Fuca.

A. Chemical Contamination

Over 120 chemicals and sediment properties were analyzed for each station. Two samples out of the 90 collected had chemicals exceeding Washington State Sediment Quality Standards (SQS): di-n-butylphthalate in Prevost Harbor, and fluoranthene in Port Angeles Harbor (Figure 1)

Mean Effects Range Median and SQS quotients were low, ranging from 0.02 - 0.24 and 0.02 - 0.37, respectively. These indices are calculated for each sample to account for the presence and concentrations of selected chemicals, and range from <0.1 - >4.0 in Puget Sound.

B. Sediment Toxicity

Four toxicity tests were run on each sediment sample: (1) the amphipod 10-day survival test in solid phase sediments; (2) the sea urchin fertilization; (3) Microtox[®] bioluminescence tests in sediment pore water extracts; and (4) the echinoderm larval abnormality/mortality test in sediment/water elutriates.

There were 30 samples (33% of total) in which at least one toxicity test response was statistically significant (Figure 1). These samples represented a total of 80 km² or about 38% of the total study area. Both the percent of stations and area affected by toxicity were highest in the eastern Strait of Juan de Fuca (47% and 59%, respectively), lower in the San Juan Islands (33% and 33%, respectively), and lowest in Admiralty Inlet (20% and 23%, respectively).

C. Sediment-Dwelling Invertebrates

Among the 90 stations, benthos were classified as *adversely affected* in 37 stations: 20 in the San Juan Islands, 14 in the eastern Strait of Juan de Fuca, and 3 in Admiralty Inlet (Figure 1). *Adversely affected* indicates lower total abundance and number of species, higher numbers of stress-tolerant species, and lower numbers of stress-sensitive species as compared with average values for Puget Sound benthos.

Table 1. Estimated incidence and spatial extent of degraded sediments in the 2002-2003 PSAMP monitoring regions, as measured with the Sediment Quality Triad Index.

Sediment Quality Triad Index Category	Incidence		Spatial extent	
	No. (%) of stations		km ² (%)	
San Juan Islands	30 (100)		81 (100)	
High	9 (30)		24 (30)	
Intermediate/high	11 (37)		30 (37)	
Intermediate/degraded	10 (33)		27 (33)	
Degraded	0 (0)		0 (0)	
Eastern Strait of Juan de Fuca	30 (100)		62 (100)	
High	12 (40)		18 (28)	
Intermediate/high	7 (23)		14 (23)	
Intermediate/degraded	11 (37)		30 (49)	
Degraded	0 (0)		0 (0)	
Admiralty Inlet	30 (100)		69 (100)	
High	22 (73)		48 (69)	
Intermediate/high	7 (23)		18 (26)	
Intermediate/degraded	1 (3)		4 (5)	
Degraded	0 (0)		0 (0)	

High quality = No parameters impaired

Intermediate/high quality = One parameter impaired (chemistry, toxicity, or benthos)

Intermediate/degraded quality = Two parameters impaired (chemistry, toxicity, and/or benthos)

Degraded quality = Three parameters impaired (chemistry, toxicity, and benthos)

III. Completion of Sediment Quality Baseline and use of the SQTI as a Management Tool

The 2002-2003 data have been merged with previously collected (1997-1999) data. This completes an eight-region, Puget Sound-wide baseline sediment quality data set collected for the PSAMP Sediment Component.

Re-evaluation of sediments and the Sediment Quality Triad Index (SQTI) on a chosen cycle (e.g., 5-10 years) will allow evaluation of change in sediment quality over time. Adaptive management strategies can then be developed and implemented to facilitate improvement in sediment quality for: (1) selected embayments, (2) regions, (3) strata, and (4) Puget Sound-wide.

References

Long, E., M. Dutch, S. Aasen, and K. Welch, 2004. Sediment Quality Triad Index in Puget Sound. Washington State Department of Ecology, Olympia, WA. Publication No. 04-03-008. www.ecy.wa.gov/biblio/0403008.html.



Sediment sampling in the eastern Strait of Juan de Fuca. Photo by C.M. Eaton, Bio-Marine Enterprises

This poster is a summary of Washington State Department of Ecology Publications www.ecy.wa.gov/biblio/0903030.html and www.ecy.wa.gov/biblio/0903031.html

General information and all data generated for this report can be accessed from Ecology's Marine Sediment Monitoring website: www.ecy.wa.gov/programs/eap/psamp/index.htm

This poster was prepared for the February 2009 Georgia Basin/ Puget Sound Research Conference, Seattle, WA.