

# 2009 Bainbridge Basin Marine Sediment Monitoring



## Sediment Quality Triad Data Summary

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## Results

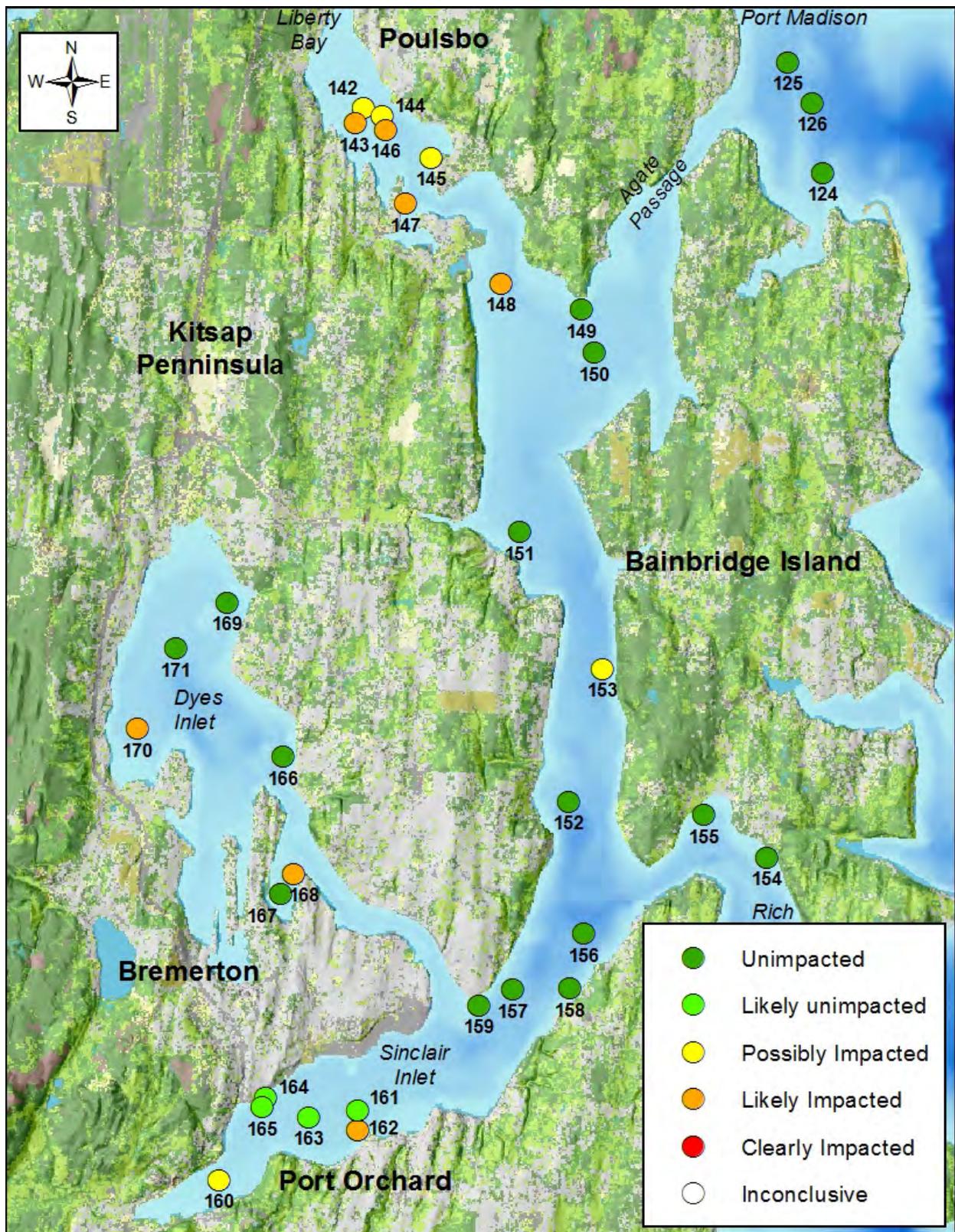
Sediment Triad Quality Index categories identified for stations in the 2009 Bainbridge Basin survey.

Sample	Location	SCI Category	Toxicity Category	Benthos Hit	SQTI Category
124	Port Madison	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
125	Port Madison	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
126	Port Madison	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
142	Liberty Bay	Minimum exposure	Moderate	Adversely affected	Possibly impacted
143	Liberty Bay	Minimum exposure	High	Adversely affected	Likely impacted
144	Liberty Bay	Minimum exposure	Moderate	Adversely affected	Possibly impacted
145	Liberty Bay	Minimum exposure	Moderate	Adversely affected	Possibly impacted
146	Liberty Bay	Minimum exposure	High	Adversely affected	Likely impacted
147	Liberty Bay	Low exposure	High	Adversely affected	Likely impacted
148	Southeast of Keyport	Minimum exposure	High	Adversely affected	Likely impacted
149	North Port Orchard Pt.Bolin	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
150	North Port Orchard	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
151	North Port Orchard E. of Brownsville	Minimum exposure	Low	Unaffected	Unimpacted
152	Port Orchard Illahee	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
153	Port Orchard	Low exposure	Low	Adversely affected	Possibly impacted
154	Rich Pass Pleasant Beach	Minimum exposure	Low	Unaffected	Unimpacted
155	Rich Pass Lynwood Center	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
156	South Port Orchard	Low exposure	Non-Toxic	Unaffected	Unimpacted
157	South Port Orchard East Bremerton	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
158	South Port Orchard	Low exposure	Non-Toxic	Unaffected	Unimpacted
159	South Port Orchard Pt.Herron	Low exposure	Low	Unaffected	Unimpacted
160	Sinclair Inlet	Low exposure	Low	Adversely affected	Possibly impacted
161	Sinclair Inlet	Low exposure	Moderate	Adversely affected	Likely impacted

Sample	Location	SCI Category	Toxicity Category	Benthos Hit	SQTI Category
162	Sinclair Inlet	Low exposure	Non-Toxic	Adversely affected	Likely unimpacted
163	Sinclair Inlet	Low exposure	Non-Toxic	Adversely affected	Likely unimpacted
164	Sinclair Inlet	Low exposure	Non-Toxic	Adversely affected	Likely unimpacted
165	Sinclair Inlet	Low exposure	Non-Toxic	Adversely affected	Likely unimpacted
166	Dyes Inlet Tracyton	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
167	Phinney Bay	Low exposure	Non-Toxic	Unaffected	Unimpacted
168	Phinney Bay	Low exposure	Moderate	Adversely affected	Likely impacted
169	Dyes Inlet SE of Silverdale	Minimum exposure	Non-Toxic	Unaffected	Unimpacted
170	Dyes Inlet North Chico Bay	Low exposure	Moderate	Adversely affected	Likely impacted
171	Dyes Inlet	Low exposure	Non-Toxic	Unaffected	Unimpacted

Spatial extent of Sediment Triad Quality Index categories for the 2009 Bainbridge Basin survey.

SCI Category	STI Category	Interim SBI Category	SQTI Category	Spatial Extent (% of Area)
Minimum exposure	Non-Toxic	Unaffected	Unimpacted	47.6%
Minimum exposure	Low toxicity	Unaffected	Unimpacted	8.2%
Low exposure	Non-Toxic	Unaffected	Unimpacted	12.5%
Low exposure	Low toxicity	Unaffected	Unimpacted	2.4%
Low exposure	Non-Toxic	Adversely affected	Likely unimpacted	5.4%
Minimum exposure	Moderate toxicity	Adversely affected	Possibly impacted	2.7%
Low exposure	Low toxicity	Adversely affected	Possibly impacted	5.4%
Minimum exposure	High toxicity	Adversely affected	Likely impacted	7.2%
Low exposure	Moderate toxicity	Adversely affected	Likely impacted	7.3%
Low exposure	High toxicity	Adversely affected	Likely impacted	1.2%



Spatial patterns of sediment condition in the 2009 Urban Waters Initiative sediment survey. *The numbers on the map are the station identifiers.*

Incidence and spatial extent of sediment condition, as measured by the Sediment Quality Triad Index, in the 2009 Urban Waters Initiative sediment survey.

Sediment Triad Index Category	Stations		Area	
	No.	(%)	km <sup>2</sup>	(%)
Sinclair Inlet/Bainbridge Basin	33	(100.0)	81.85	(100.0)
Unimpacted	17	(51.5)	57.96	(70.8)
Likely unimpacted	4	(12.1)	4.38	(5.4)
Possibly impacted	5	(15.2)	6.64	(8.1)
Likely impacted	7	(21.2)	12.87	(15.7)
Clearly impacted	0	(0.0)	0.0	(0.0)
Inconclusive	0	(0.0)	0.0	(0.0)

## Comparisons with 1998

Changes in incidence and spatial extent of Sediment Quality Triad Index results from 1998 to 2009, for Sinclair Inlet and the Bainbridge Basin.

↑ = increase, ↓ = decrease, -- = no change.

SQTI Category	1998		2009			
	Incidence (# of stations)	Spatial Extent (% of area)	Incidence (# of stations)	Change? <sup>1</sup>	Spatial Extent (% of area)	Change? <sup>2</sup>
Unimpacted	25	89.60	17	--	70.81	↓
Likely unimpacted	6	7.88	4	--	5.35	--
Possibly impacted	1	1.30	5	--	8.11	--
Likely impacted	1	1.23	7	↑	15.73	↑
Clearly impacted	0	0.00	0	*	0.00	*
Inconclusive	0	0.00	0	*	0.00	*

<sup>1</sup> Likelihood ratio test,  $\alpha = 0.05$

<sup>2</sup> Olsen et al. (in prep.),  $\alpha = 0.05$

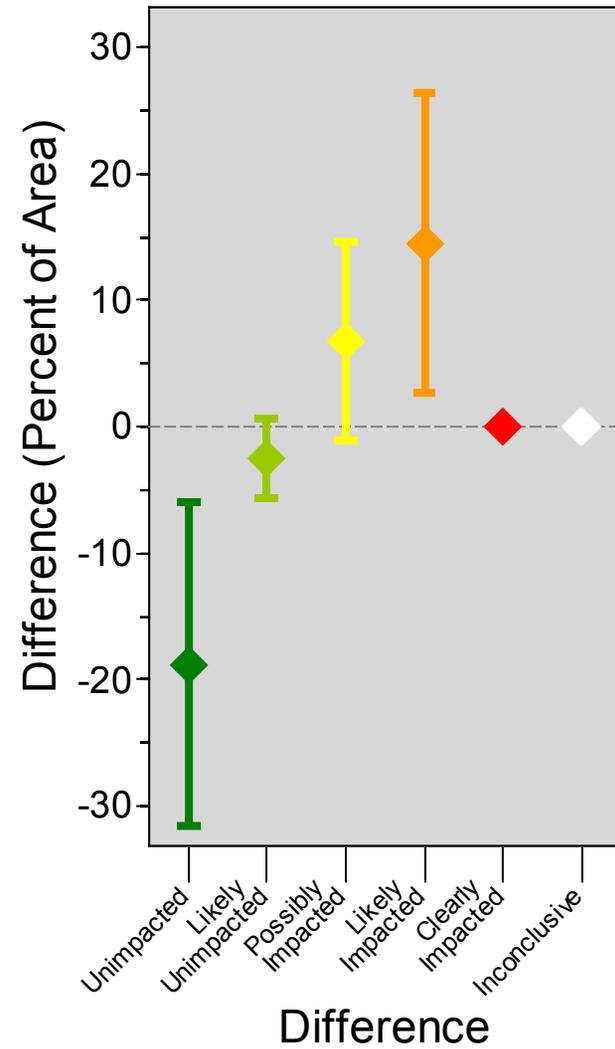
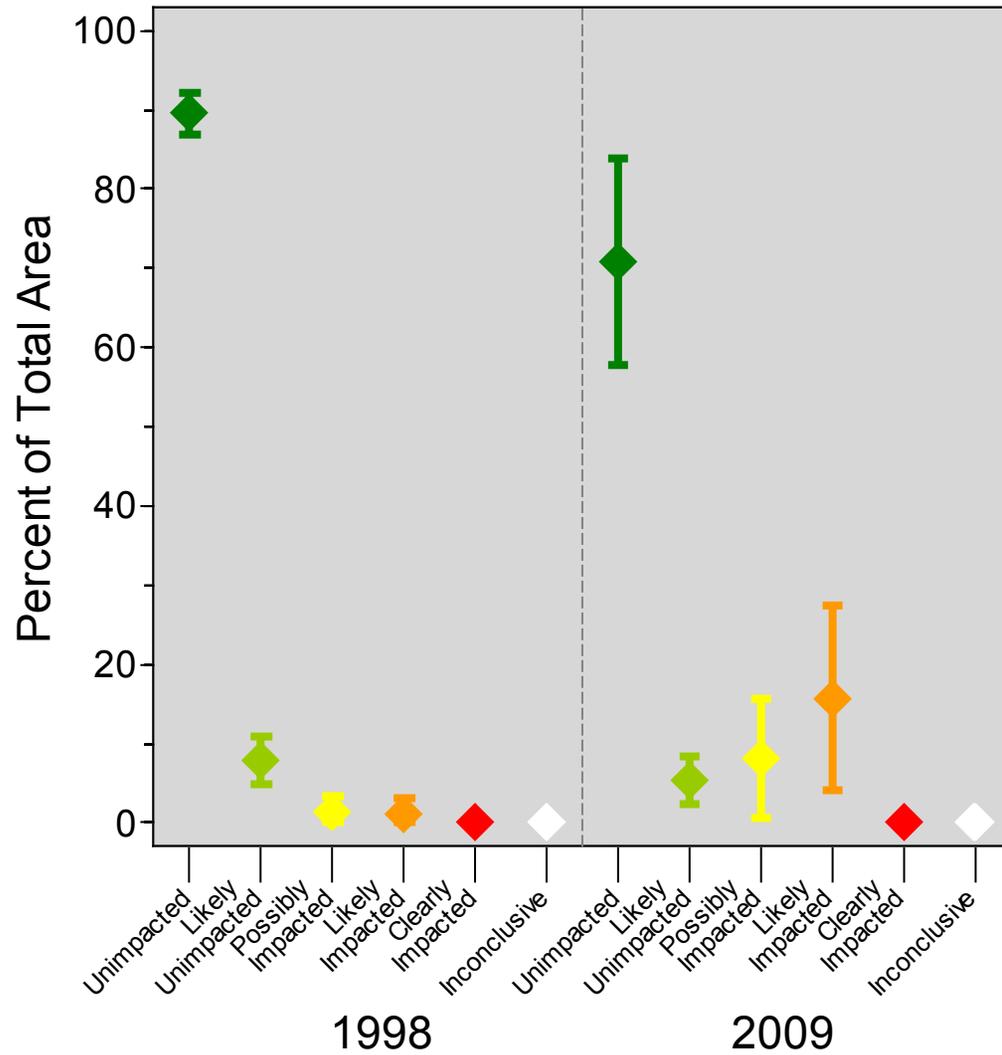
\* Too few samples in these categories to conduct test.

## Comparison of Sediment Quality Triad Index Categories by Year

Estimated spatial extent (percent of area) and 95% confidence intervals for each of the SQTI categories for Sinclair Inlet and the Bainbridge Basin in 2009, compared to 1998. The differences between the years for the unimpacted and likely impacted categories are statistically significant, as indicated by the difference confidence intervals *not* containing the value zero. The differences for the other categories are not statistically significant, as indicated by the difference confidence intervals containing the value zero.

Sediment Quality Triad Index Category	1998			2009			Difference (2009-1998)			* = significantly different (alpha=0.05)
	Estimate	Confidence Limit		Estimate	Confidence Limit		Estimate	Confidence Limit		
		Lower	Upper		Lower	Upper		Lower	Upper	
Unimpacted	89.60	86.98	92.21	70.81	57.84	83.78	-18.79	-31.59	-5.98	*
Likely unimpacted	7.88	4.77	10.99	5.35	2.28	8.43	-2.52	-5.61	0.56	
Possibly impacted	1.30	0.00	3.47	8.11	0.57	15.65	6.81	-1.03	14.66	
Likely impacted	1.23	0.00	3.23	15.73	4.05	27.40	14.50	2.61	26.39	*
Clearly impacted	0.00	n.a.	n.a.	0.00	n.a.	n.a.	0.00	n.a.	n.a.	
Inconclusive	0.00	n.a.	n.a.	0.00	n.a.	n.a.	0.00	n.a.	n.a.	

\* Olsen et al. (in prep.),  $\alpha = 0.05$



## Comparison with the Region

Incidence and spatial extent of sediment quality in the Bainbridge Basin, Central Sound monitoring region, and all of Puget Sound, as measured with the Sediment Quality Triad Index.

Sediment Quality Triad Index Category	Regional Baseline		Second Baseline	
	Stations		Stations	
	No.	(%)	No.	(%)
Bainbridge Basin	33	(100.0)	81.9	(100.0)
Unimpacted	25	(75.8)	73.3	(89.6)
Likely unimpacted	6	(18.1)	6.4	(7.9)
Possibly impacted	1	(3.0)	1.1	(1.3)
Likely impacted	1	(3.0)	1.0	(1.2)
Clearly impacted	0	(0.0)	0.0	(0.0)
Inconclusive	0	(0.0)	0.0	(0.0)
Central Sound	128	(100.0)	683.9	(100.0)
Unimpacted	76	(59.4)	633.3	(92.6)
Likely unimpacted	34	(26.6)	43.4	(6.4)
Possibly impacted	11	(8.6)	5.1	(0.7)
Likely impacted	6	(4.7)	1.9	(0.3)
Clearly impacted	1	(0.8)	0.1	(0.02)
Inconclusive	0	(0.0)	0.0	(0.0)
<b>Total Study Area</b>	<b>381</b>	<b>(100.0)</b>	<b>2294.1</b>	<b>(100.0)</b>
Unimpacted	221	(58.0)	1498.3	(65.3)
Likely unimpacted	115	(30.2)	695.3	(30.3)
Possibly impacted	24	(6.3)	72.15	(3.1)
Likely impacted	16	(4.2)	3.15	(0.1)
Clearly impacted	2	(0.5)	0.2	(0.0)
Inconclusive	3	(0.8)	24.98	(1.1)

Available after 2014