2012 San Juan Islands Marine Sediment Monitoring

Physical Sediment Characteristics Data Summary

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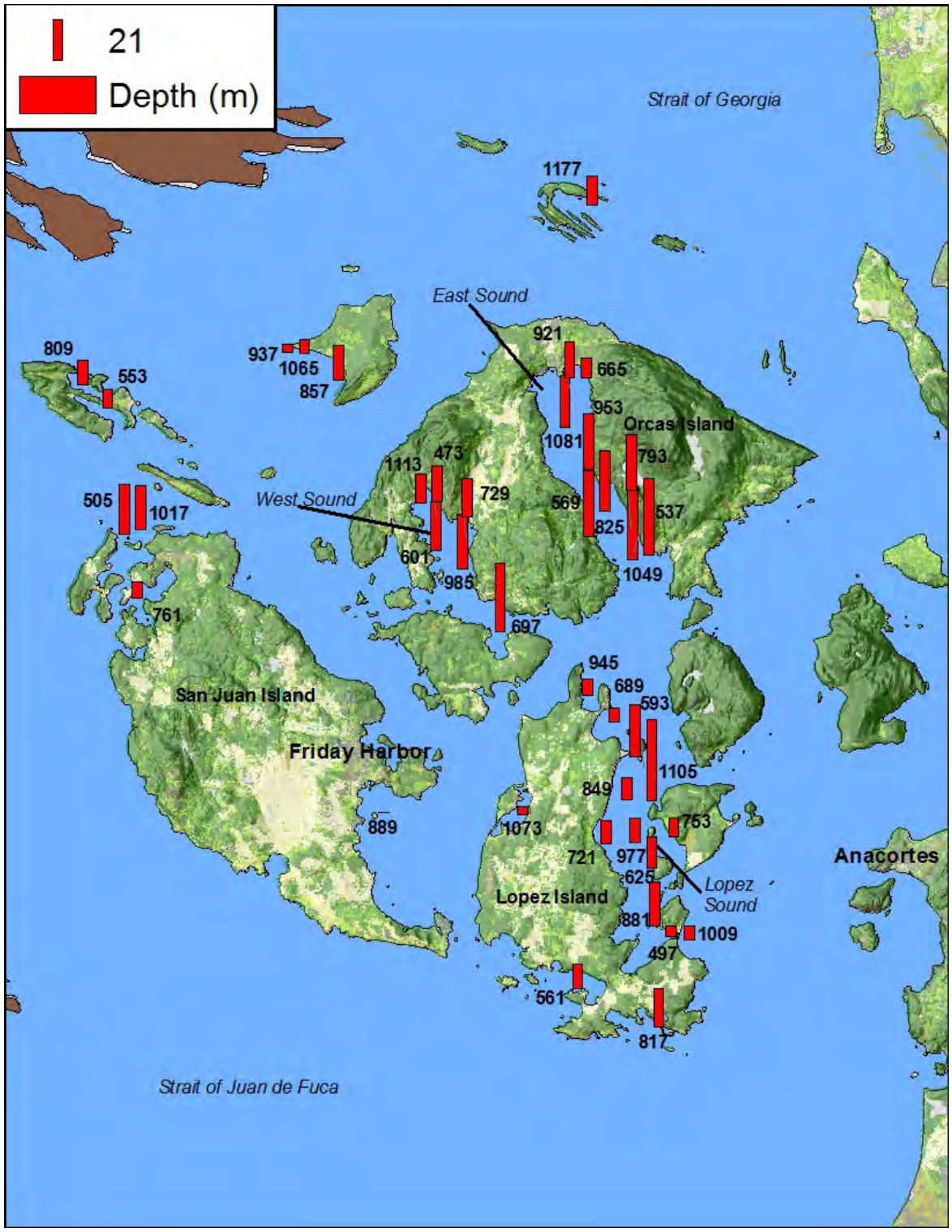
Depth



Water depths at 40 sediment stations sampled for the 2012 San Juan Islands survey. *The numbers on the map are the station identifications.*

Total Organic Carbon

Results of Total Organic Carbon analyses of sediments collected in the 2012 survey of the San Juan Islands.

Station	Location	Stratum type	Percent Total Organic Carbon			
			Sample	Field duplicate	Lab duplicate	Lab triplicate
473	West Sound and Massacre Bay	Rural	2.14		2.13	2.13
497	Lopez Sound, Hunter and Mud Bay	Rural	1.2		1.19	1.19
505	Roche Harbor	Rural	0.62			
537	East Sound	Rural	2.22			
553	Reid Harbor	Rural	1.46			
561	Mackaye Harbor and Outer Bay	Rural	0.65			
569	East Sound	Rural	2.55	2.59		
593	Lopez Sound, Hunter and Mud Bay	Rural	1.46			
601	West Sound and Massacre Bay	Rural	2.05			
625	Lopez Sound, Hunter and Mud Bay	Rural	1.6			
665	East Sound	Rural	0.23			
689	Swifts Bay	Rural	1.56			
697	Blind Bay	Rural	1.25			
721	Lopez Sound, Hunter and Mud Bay	Rural	1.45			
729	West Sound and Massacre Bay	Rural	1.64			
753	Lopez Sound, Hunter and Mud Bay	Rural	1.22			
761	Westcott Bay	Rural	0.79			
793	East Sound	Rural	2.07			
809	Prevost Harbor	Rural	0.72			
817	Aleck, Hughes and McArdle Bay	Rural	0.73			
825	East Sound	Rural	2.51			
849	Lopez Sound, Hunter and Mud Bay	Rural	1.39			
857	West of Wadron	Rural	0.42			

Station	Location	Stratum type	Percent Total Organic Carbon			
			Sample	Field duplicate	Lab duplicate	Lab triplicate
	Island, North and Cowlitz Bay					
881	Lopez Sound, Hunter and Mud Bay	Rural	0.73			
889	Griffin and North Bay	Rural	0.36			
921	East Sound	Rural	2.98	3		
937	West of Waldron Island, North and Cowlitz Bay	Rural	0.14			
945	Shoal Bay	Rural	1.23			
953	East Sound	Rural	2.84			
977	Lopez Sound, Hunter and Mud Bay	Rural	1.41			
985	West Sound and Massacre Bay	Rural	1.56			
1009	Shoal Bight	Rural	1			
1017	Roche Harbor	Rural	1.43			
1049	East Sound	Rural	2.35			
1065	West of Waldron Island, North and Cowlitz Bay	Rural	0.51			
1073	Fisherman Bay	Rural	0.39			
1081	East Sound	Rural	3.3	3.26	3.31	3.33
1105	Lopez Sound, Hunter and Mud Bay	Rural	1.39			
1113	West Sound and Massacre Bay	Rural	2.45			
1177	Echo and Fossil Bay	Rural	1.16			

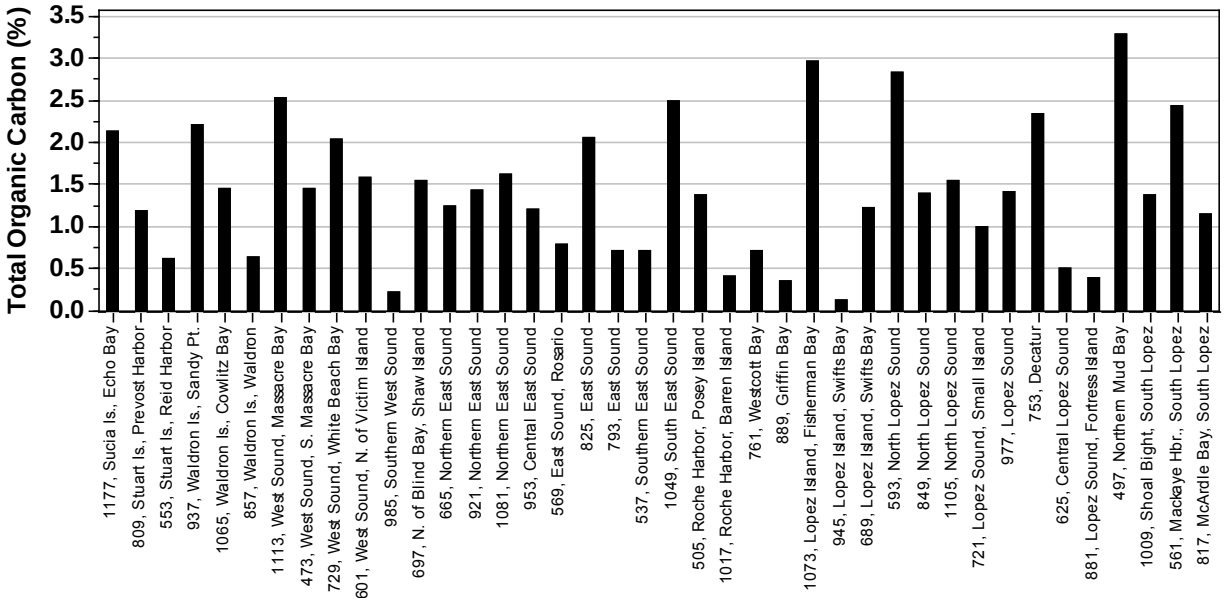
Summary statistics for concentrations of total organic carbon in sediments collected for the 2012 San Juan Islands survey**.**

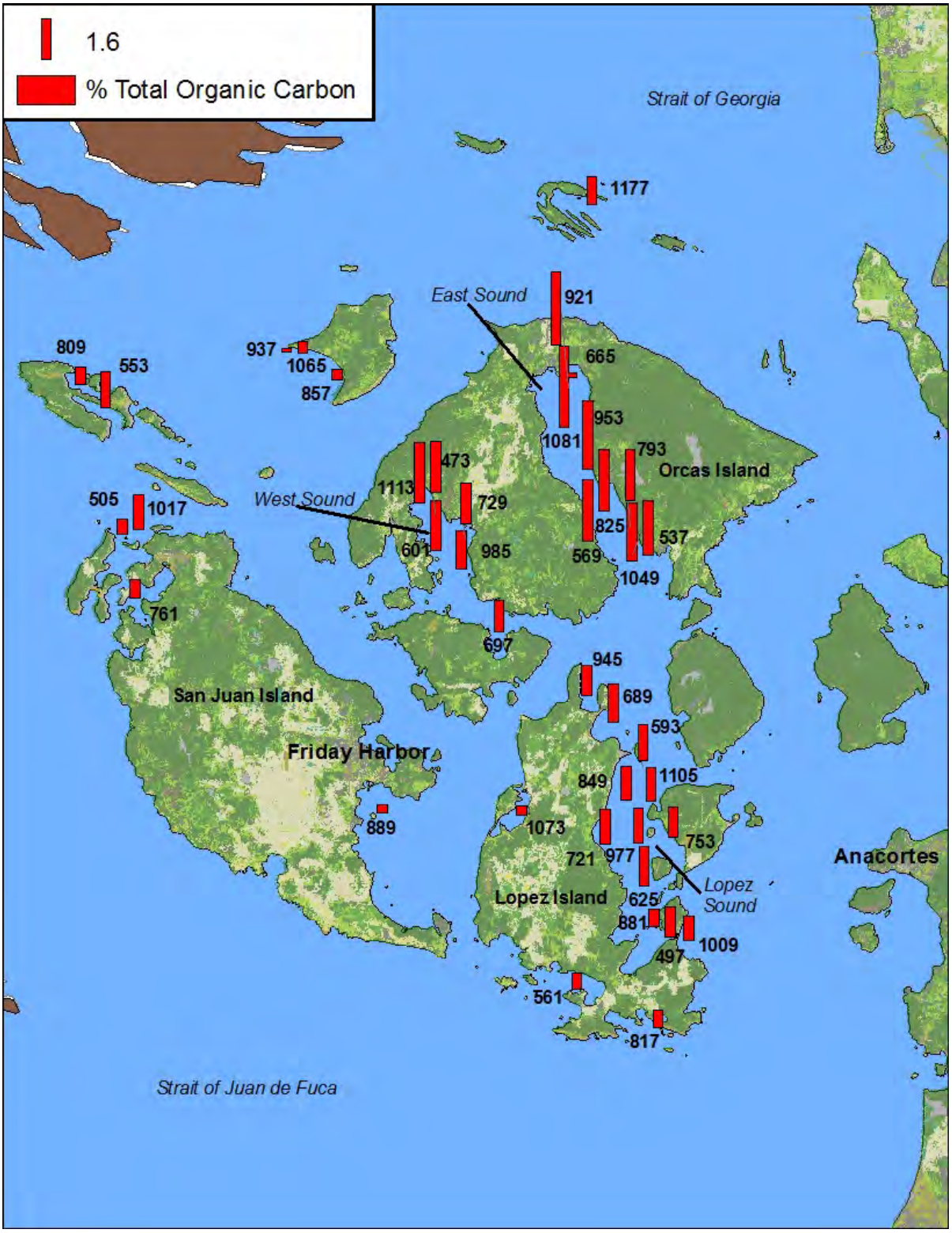
Chemical	Mean	Median	Minimum	Maximum	N	No. of un-detected	Percent detected
Total Organic Carbon (70°)	1.43	1.40	0.14	3.30	40	0	100
Total Organic Carbon (104°)	1.44	1.41	0.14	3.35	40	0	100

Summary statistics for TOC concentrations (70º) by sediment monitoring stratum in the 2012 San Juan Islands survey.

Stratum Type	N	Minimum	Maximum	Mean	Standard Deviation	Median
San Juan Islands						
Rural	40	0.14	3.30	1.43	0.80	1.40

Concentrations of total organic carbon in the sediment samples are displayed graphically below. Qualified (estimated) and undetected results are indicated. Stations are ordered approximately north to south.





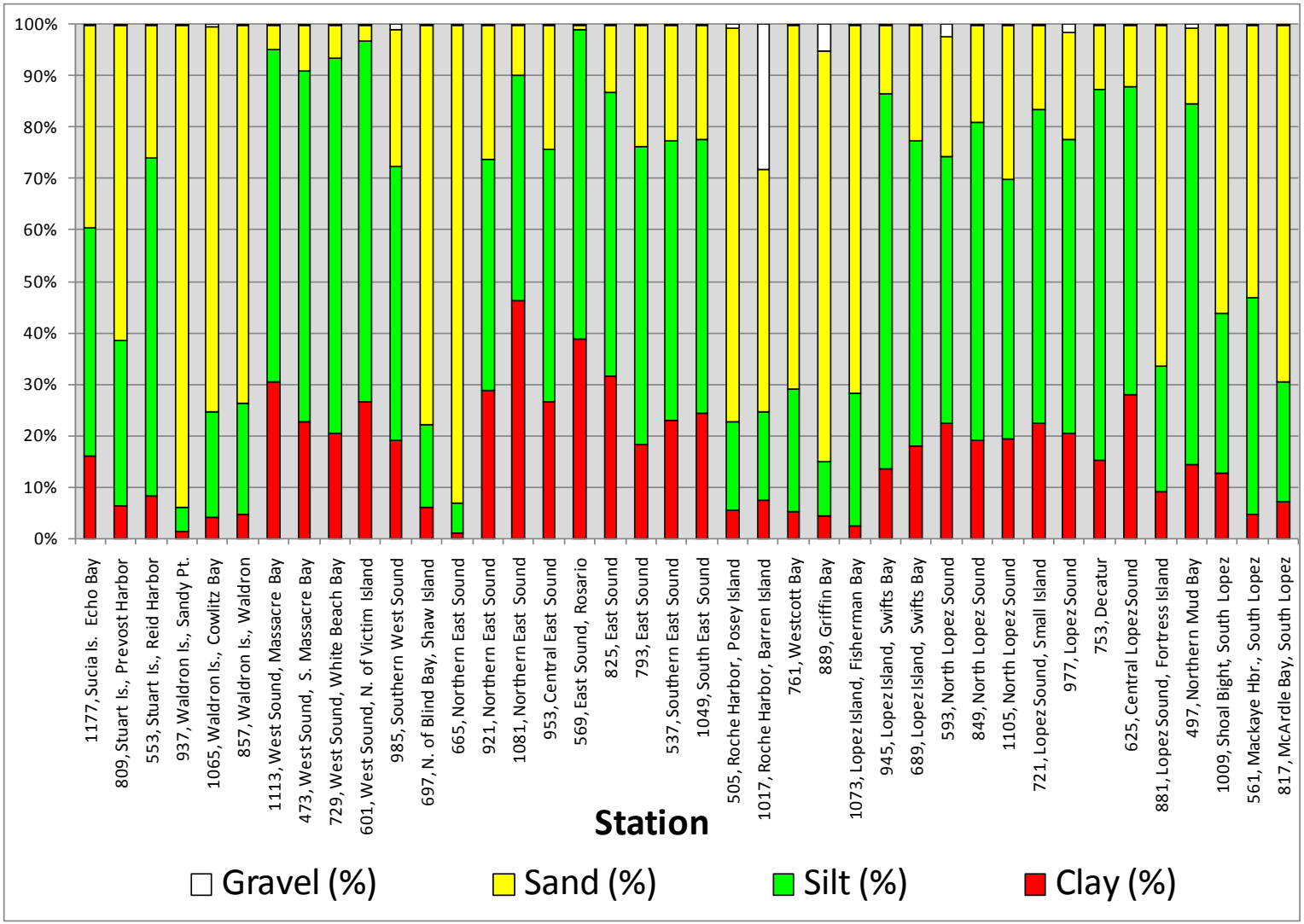
Spatial patterns for total organic carbon for the 2012 San Juan Islands survey.
The numbers on the map are the station identifications.

Grain Size

Results of grain size analyses of sediments collected for the 2012 San Juan Islands survey.

Station	Location	Field Replicate	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Total Sand	Total Clay	Total Silt	Total Fines
473	West Sound, S. Massacre Bay	1	0.1	2.4	3.2	1.4	0.8	1.1	9.0	22.8	68.2	91.0
497	Northern Mud Bay	1	0.8	0.2	0.8	1.1	2.4	10.0	14.5	14.4	70.2	84.6
505	Roche Harbor, Posey Island	1	0.7	0.6	2.8	23.1	20.9	29.3	76.7	5.6	17.0	22.6
537	Southern East Sound	1	0.1	9.9	5.9	2.9	1.8	2.2	22.6	23.1	54.3	77.4
553	Stuart Is., Reid Harbor	1	0.1	0.4	1.1	2.7	6.7	15.0	25.9	8.3	65.8	74.1
561	Mackaye Hbr., South Lopez	1	0.1	0.1	0.4	0.9	10.7	41.1	53.2	4.6	42.2	46.8
569	East Sound, Rosario	1	0.1	0.1	0.1	0.2	0.3	0.3	0.8	38.9	60.2	99.1
		2	0.1	4.0	4.9	3.8	2.0	1.7	16.4	31.9	51.7	83.6
593	North Lopez Sound	1	2.3	0.3	0.7	0.8	2.2	19.3	23.3	22.4	52.0	74.4
601	West Sound, N. of Victim Island	1	0.1	0.1	0.3	0.6	0.5	1.7	3.1	26.7	70.2	96.9
625	Central Lopez Sound	1	0.1	0.4	0.6	0.4	1.1	9.4	11.9	28.0	60.1	88.1
665	Northern East Sound	1	0.1	2.0	10.0	34.3	39.4	7.3	93.0	1.0	5.9	6.9
689	Lopez Island, Swifts Bay	1	0.1	2.0	3.6	3.5	2.3	11.2	22.6	18.1	59.2	77.3
697	N. of Blind Bay, Shaw Island	1	0.1	0.7	1.5	8.6	50.3	16.7	77.8	6.1	16.0	22.1
721	Lopez Sound, Small Island	1	0.1	1.1	1.6	2.0	2.9	8.9	16.6	22.5	61.0	83.5
729	West Sound, White Beach Bay	1	0.1	0.3	0.8	1.2	1.0	3.2	6.5	20.4	73.1	93.5
753	Decatur	1	0.1	0.2	0.8	0.9	2.8	8.0	12.7	15.2	72.1	87.3
761	Westcott Bay	1	0.1	0.5	1.0	2.9	32.3	34.3	71.1	5.1	23.9	29.0
793	East Sound	1	0.1	14.0	4.6	2.1	1.3	1.7	23.7	18.2	58.2	76.4
809	Stuart Is., Prevost Harbor	1	0.1	0.4	1.6	4.7	11.9	43.0	61.6	6.2	32.2	38.4
817	McArdle Bay, South Lopez	1	0.1	0.3	1.0	2.3	15.7	50.2	69.5	7.2	23.2	30.4

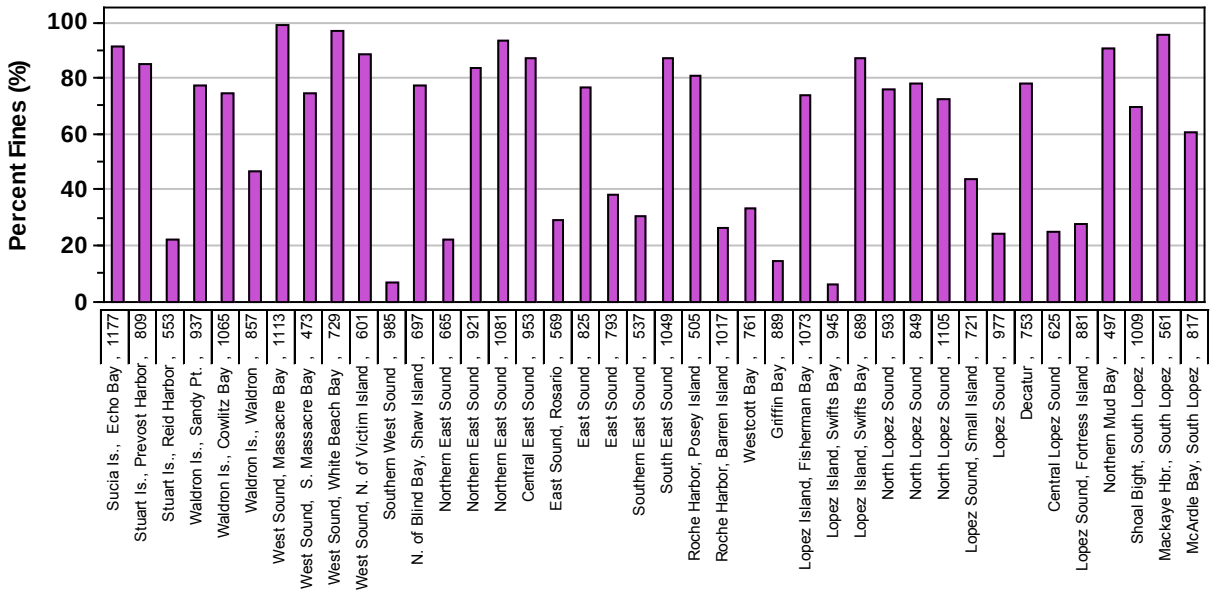
Station	Location	Field Replicate	Gravel	Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Total Sand	Total Clay	Total Silt	Total Fines
825	East Sound	1	0.1	0.8	3.1	4.5	2.6	2.1	13.1	31.7	55.2	86.9
849	North Lopez Sound	1	0.1	0.2	1.3	2.7	3.3	11.6	19.0	19.0	62.0	81.0
857	Waldron Is., Waldron	1	0.1	0.1	0.7	10.5	33.6	28.8	73.7	4.8	21.6	26.4
881	Lopez Sound, Fortress Island	1	0.2	0.6	2.5	15.6	34.2	13.2	66.1	9.0	24.6	33.6
889	Griffin Bay	1	5.2	0.5	2.6	29.6	36.8	10.3	79.9	4.3	10.6	14.9
921	Northern East Sound	1	0.1	8.7	5.7	3.8	2.4	5.5	26.2	28.8	45.0	73.8
		2	0.1	10.0	5.8	4.3	2.5	5.5	28.1	28.2	43.7	71.9
937	Waldron Is., Sandy Pt.	1	0.1	7.2	18.4	30.5	34.6	3.2	93.9	1.4	4.7	6.1
945	Lopez Island, Swifts Bay	1	0.2	1.0	1.4	1.1	1.2	8.5	13.2	13.5	73.2	86.7
953	Central East Sound	1	0.1	11.1	5.9	3.7	2.1	1.6	24.4	26.6	49.1	75.7
977	Lopez Sound	1	1.6	1.7	1.6	2.6	3.9	10.9	20.7	20.5	57.2	77.7
985	Southern West Sound	1	1.0	2.1	1.7	4.3	4.7	13.7	26.6	19.0	53.5	72.5
1009	Shoal Bight, South Lopez	1	0.1	2.7	5.5	12.3	20.8	15.0	56.2	12.8	31.0	43.8
1017	Roche Harbor, Barren Island	1	28.3	7.9	9.5	12.4	5.0	12.2	47.2	7.3	17.2	24.5
1049	South East Sound	1	0.1	6.9	5.5	4.7	2.7	2.4	22.2	24.4	53.4	77.8
1065	Waldron Is., Cowlitz Bay	1	0.4	1.0	4.9	27.4	23.2	18.5	74.9	4.0	20.7	24.7
1073	Lopez Island, Fisherman Bay	1	0.1	0.3	0.7	3.5	15.9	51.5	71.8	2.5	25.6	28.1
1081	Northern East Sound	1	0.1	1.7	2.9	3.3	1.1	0.9	9.9	46.4	43.7	90.1
		2	0.1	22.5	5.3	2.6	1.6	1.1	33.1	30.2	36.7	66.9
1105	North Lopez Sound	1	0.2	0.4	1.0	1.1	5.5	21.9	30.0	19.5	50.4	69.9
1113	West Sound, Massacre Bay	1	0.1	1.0	1.1	1.0	0.7	1.3	4.9	30.5	64.6	95.1
1177	Sucia Is. Echo Bay	1	0.1	0.2	0.9	1.1	4.2	33.2	39.6	16.0	44.3	60.3



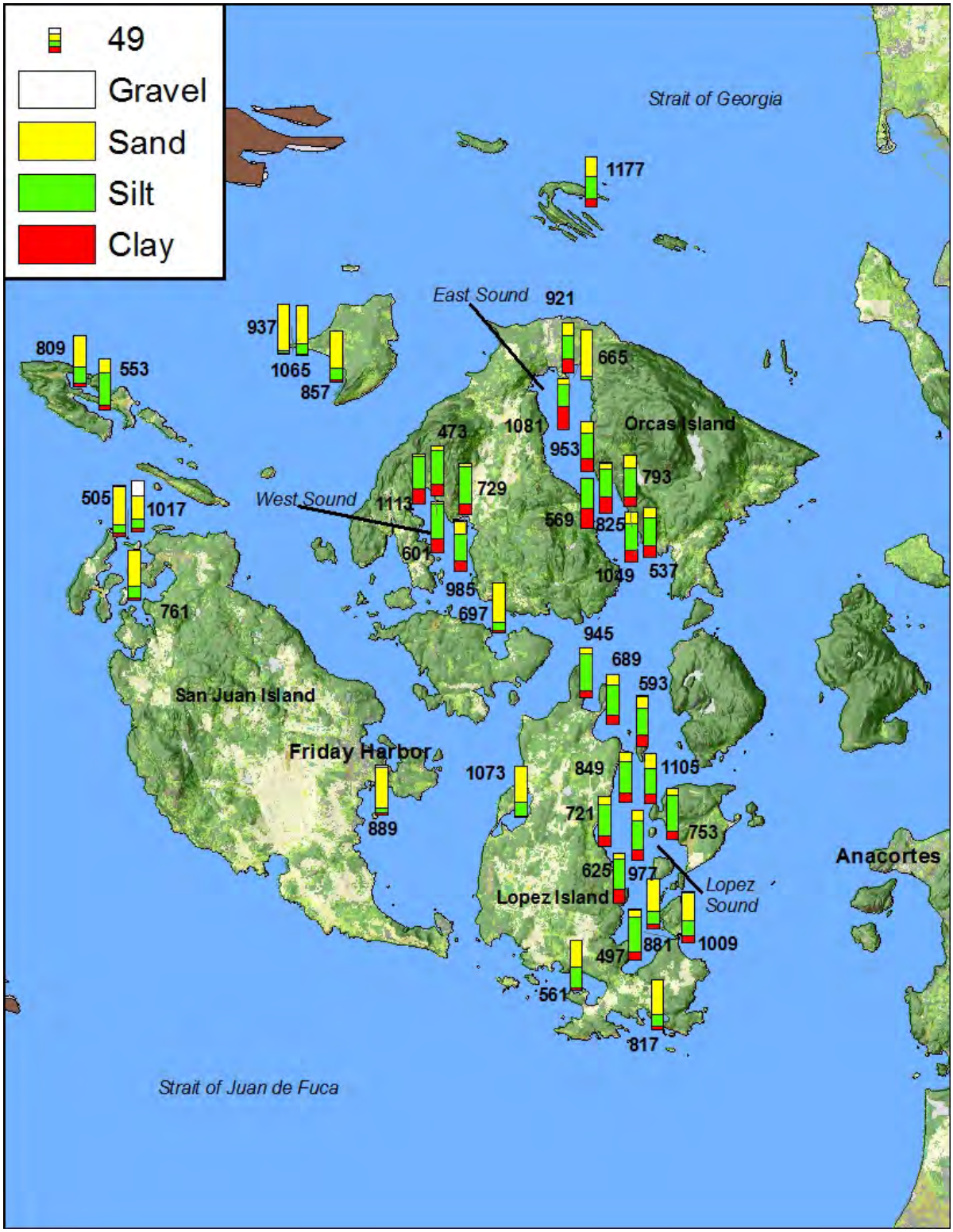
Grain size distribution in sediments collected from the 2012 San Juan Islands Survey (grain size fraction in percent). *Stations are ordered approximately north to south.*

Sediment types characterizing 40 samples collected for the 2012 San Juan Islands survey.

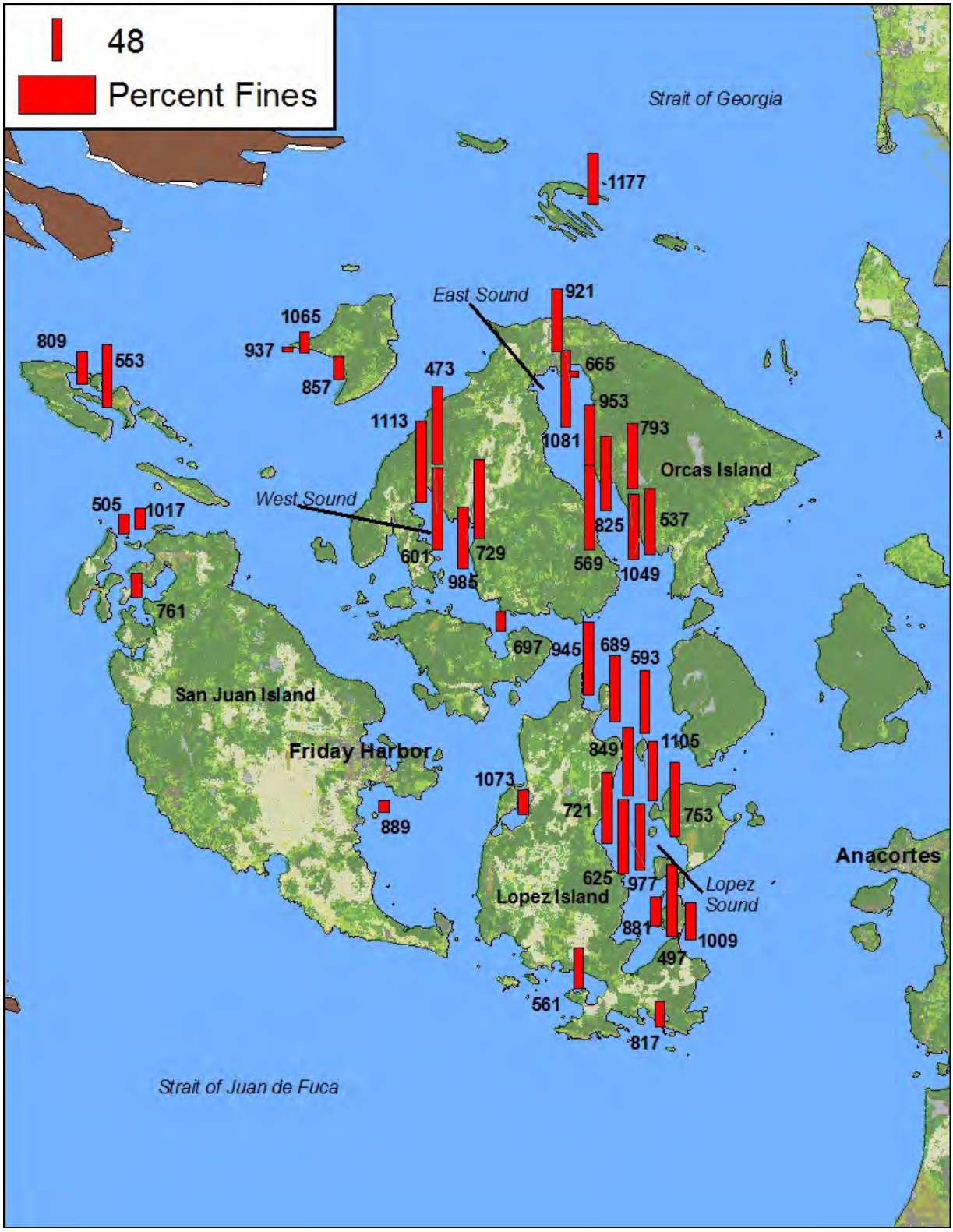
Sediment type	Percent sand	Percent Silt + clay	Range of Percent gravel for sediment type	No. of stations with this sediment type	Area (km^2)	Percent of total study area
Sand	> 80	< 20	0.1 - 5.2	3	6.0	7.5
Silty sand	60 - 80	20 - 40	0.1 - 28.3	10	19.9	25.0
Mixed	20 - <60	>40 - 80	0.1 - 0.8	14	27.8	35.0
Silt + clay	< 20	> 80	0.1 - 2.3	13	25.8	32.5



Silt-clay content (percent fines) in the sediment samples are displayed graphically below. Stations are ordered approximately north to south.



Spatial patterns for particle size classes (percent gravel, sand, silt and clay) for the 2012 San Juan Islands survey. *The numbers on the map are the station identifications.*



Spatial patterns for percent fines for the 2012 San Juan Islands survey.
The numbers on the map are the station identifications.

Comparisons with 2002 - 2003

Changes in TOC and Percent Fines from 2002-2003 to 2012.

↑ = increase, ↓ = decrease, -- = no change, ? = significant only at α = 0.10.

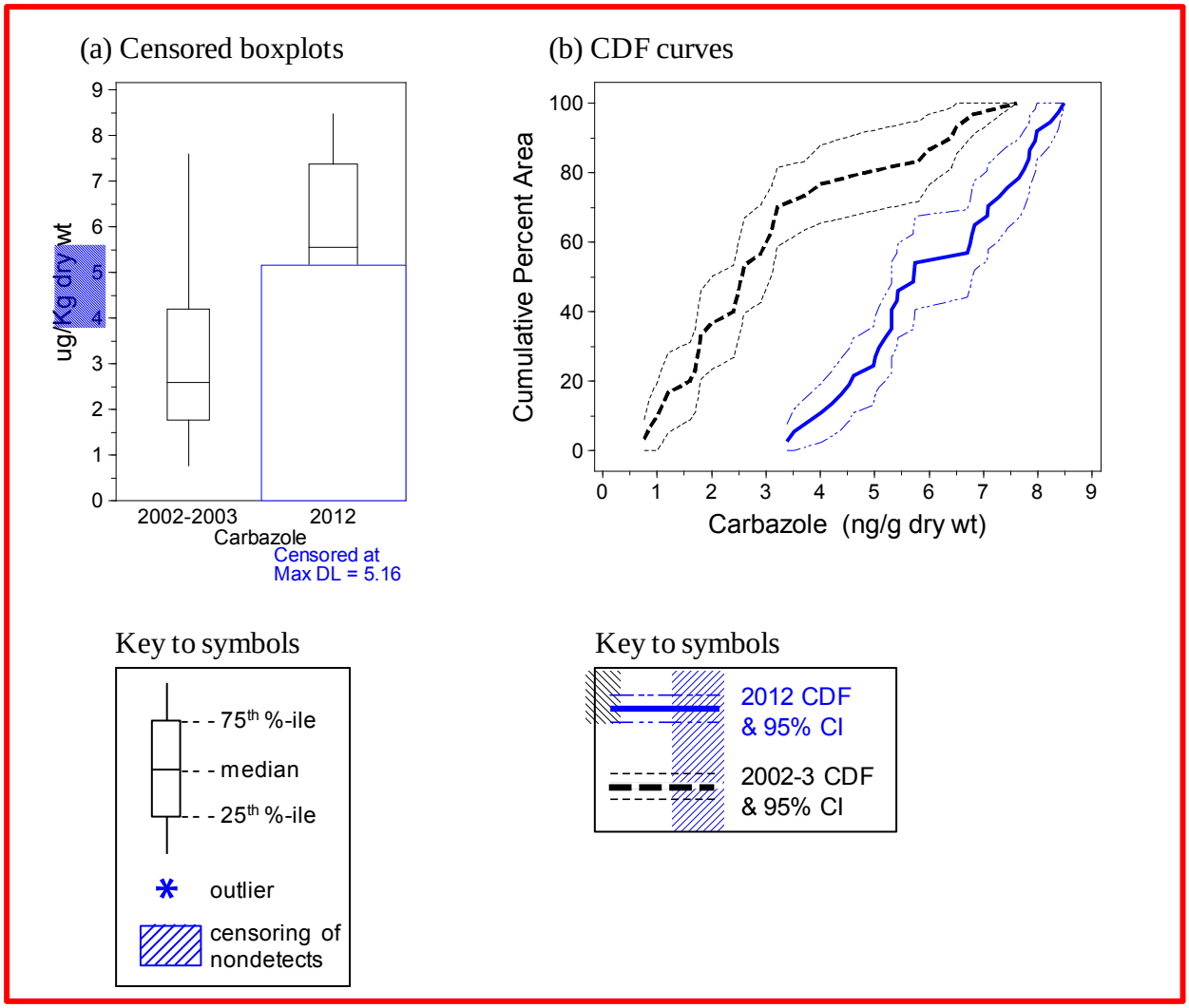
Parameter	Change from 2002-2003 to 2012
TOC	--
Fines	↑

Comparison of total organic carbon and fines (silt-clay) in sediments sampled in the 2002-2003 and 2012 surveys of the PSEMP Sediment Component San Juan Islands region.

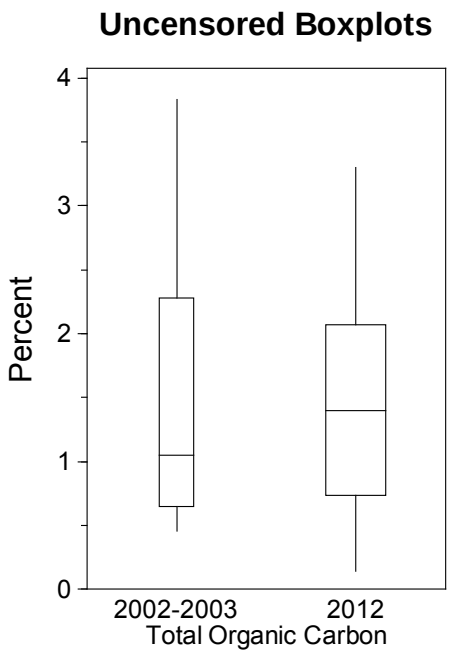
The graphical displays include two types of graphs:

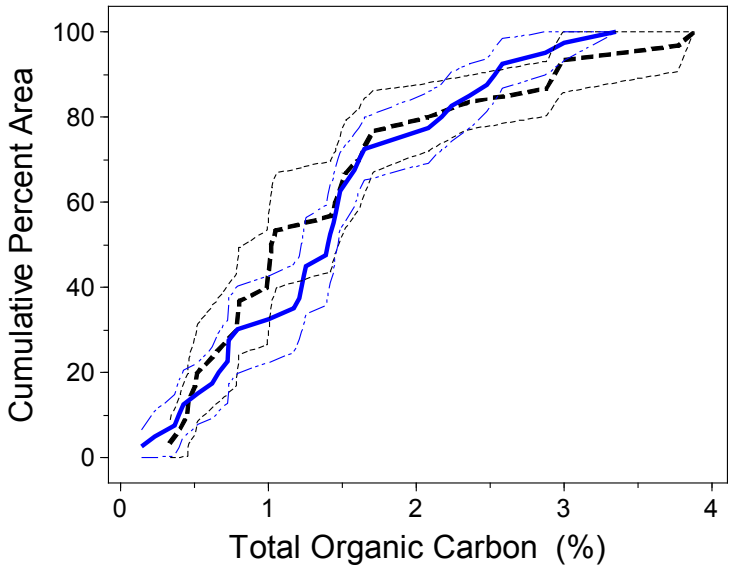
(a) Censored boxplots display the distributions of the data unweighted by sample area.
(b) Cumulative distribution function (CDF) curves display the cumulative distributions of the data weighted by sample area. CDFs are not given when there were too few detected values.

Note: 95% confidence intervals (CI) are shown in both graph types. Non-overlapping confidence intervals indicate statistically significant differences. P-values from the Wald F test that are ≤0.05 indicate that CDFs are statistically significantly different.

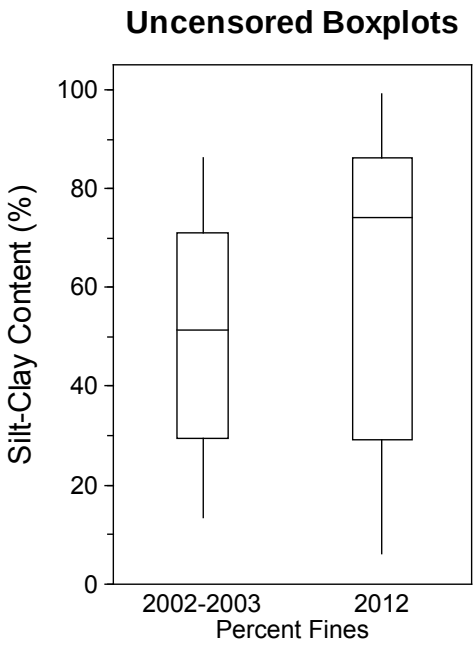


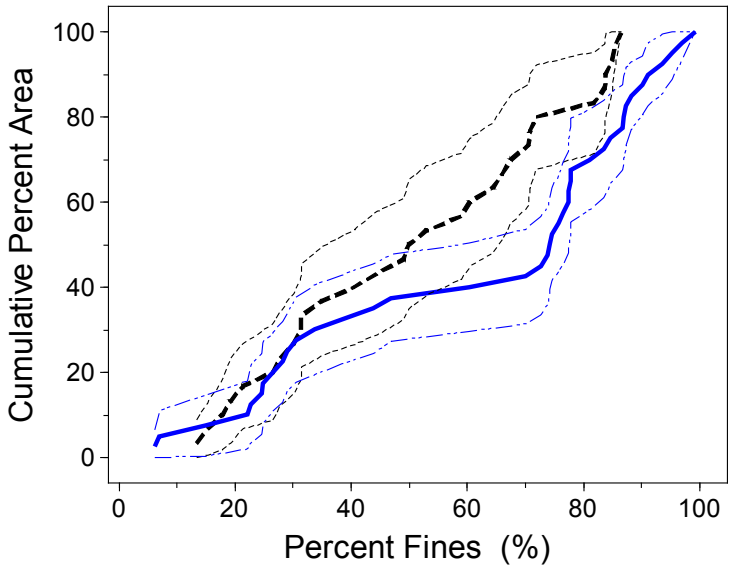
TOC





Percent Fines





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Field Notes

Field notes for the 2012 San Juan Islands survey.

Station	Location	Strata type	Meter Wheel Depth	Pene-tration	Overlying Sediment Color	Underlying Sediment Color	Comp-osition	Odor	Odor intensity	Shell Hash	Wood Fragments	Salinity (ppt)	Sediment Temp-erature (c°)	Sheen
473	West Sound, S. Massacre Bay	Rural	18	17	Olive	Gray	Silt/Clay	H	Slight	No	No	31	9.3	No
497	Northern Mud Bay	Rural	5	12	Olive Gray	Gray	Silt/Clay	None	None	Yes	No	30	9.5	No
505	Roche Harbor, Posey Island	Rural	25	6.5	Gray Brown	Gray Brown	Sand	NR	NR	NR	NR	31	8.9	No
537	Southern East Sound	Rural	38	17	Olive Gray	Gray	Silt/Clay	H	Slight	Yes	No	30	9.3	No
553	Stuart Is., Reid Harbor	Rural	9	17	Olive Gray	Olive Gray	Sand with Fines	H	Slight	No	No	31	9	No
561	Mackaye Hbr., South Lopez	Rural	12	17	Olive Gray	Gray	Silt/Clay	None	None	No	No	30	9.1	No
569	East Sound, Rosario	Rural	33	17	Gray	Gray	Silt/Clay	H	Strong	Yes	No	30	9.2	No
593	North Lopez Sound	Rural	26	17	Gray	Gray	Silt/Clay	None	None	No	No	30	9.4	No
601	West Sound, N. of Victim Island	Rural	24	17	Olive	Gray	Silt/Clay	None	None	No	No	31	9.4	No
625	Central Lopez Sound	Rural	16	15	Olive	Gray	Silt/Clay	None	None	No	No	30	9.5	No

Station	Location	Strata type	Meter Wheel Depth	Pene-tration	Overlying Sediment Color	Underlying Sediment Color	Comp-osition	Odor	Odor intensity	Shell Hash	Wood Fragments	Salinity (ppt)	Sediment Temp-erature (c°)	Sheen
665	Northern East Sound	Rural	10	8	Brown	Brown	Sand	None	None	No	No	30	9.3	No
689	Lopez Island, Swifts Bay	Rural	7	17	Olive Brown	Brown	Silt/Clay	H	Moderat e	No	No	31	9.7	No
697	N. of Blind Bay, Shaw Island	Rural	34	12	Gray	Gray	Sand with Fines	None	None	No	No	31	9.5	No
721	Lopez Sound, Small Island	Rural	12	9	Olive Gray	Gray	Silt/Clay	None	None	Yes	No	30	9.2	No
729	West Sound, White Beach Bay	Rural	19	17	Olive	Gray	Silt/Clay	None	None	No	No	30	9.5	No
753	Decatur	Rural	9	14	Olive Gray	Gray	Silt/Clay	None	None	Yes	No	30	9.5	No
761	Westcott Bay	Rural	8	9	Olive Gray	Gray	Sand with Fines	None	None	No	No	31	9.2	No
793	East Sound	Rural	28	-99	Olive	Olive	Silt/Clay	None	None	No	No	30	9.3	No
809	Stuart Is., Prevost Harbor	Rural	12	16	Olive Gray	Olive Gray	Sand with Fines	None	None	No	No	30	9	No
817	McArdle Bay, South Lopez	Rural	19	12	Gray	Gray	Silt/Clay	None	None	No	No	30	9.1	No
825	East Sound	Rural	30	17	Gray	Gray	Silt/Clay	H	Strong	Yes	No	30	9.2	No
849	North Lopez Sound	Rural	11	17	Gray	Gray	Silt/Clay	None	None	No	No	30	9.4	No
857	Waldron Is., Waldron	Rural	17	14	Gray	Gray	Sand with Fines	None	None	No	No	31	8.9	No

Station	Location	Strata type	Meter Wheel Depth	Pene-tration	Overlying Sediment Color	Underlying Sediment Color	Comp-osition	Odor	Odor intensity	Shell Hash	Wood Fragments	Salinity (ppt)	Sediment Temp-erature (c°)	Sheen
881	Lopez Sound, Fortress Island	Rural	22	8	Olive Gray	Gray	Sand with Fines	None	None	Yes	No	30	9.6	No
889	Griffin Bay	Rural		6.5	Brown	Brown	Sand	None	None	Yes	No	30	9	No
921	Northern East Sound	Rural	18	17	Olive Gray	Gray	Silt/Clay	H	Moderate	Yes	No	30	9.3	No
937	Waldron Is., Sandy Pt.	Rural	4	8	Gray Brown	Gray Brown	Sand	H	Moderate	No	No	31	9.1	No
945	Lopez Island, Swifts Bay	Rural	8	16	Gray	Gray	Silt/Clay	None	None	Yes	No	31	9.5	No
953	Central East Sound	Rural	28	17	Olive Gray	Gray	Silt/Clay	H	Moderate	No	No	30	9.3	No
977	Lopez Sound	Rural	12	15	Olive Gray	Gray	Silt/Clay	None	None	Yes	No	30	9.2	No
985	Southern West Sound	Rural	27	17	Olive	Gray	Silt/Clay	H	Moderate	No	No	31	9.4	No
1009	Shoal Bight, South Lopez	Rural	7	15	Gray	Gray	Silt/Clay	None	None	No	No	30	9.4	No
1017	Roche Harbor, Barren Island	Rural	22	8	Gray Brown	Gray	Mixed	None	None	No	No	31	8.9	No
1049	South East Sound	Rural	36	17	Olive	Gray	Silt/Clay	H	Moderate	Yes	No	30	9.2	No
1065	Waldron Is., Cowlitz Bay	Rural	7	7	Gray Brown	Gray Brown	Sand with Fines	None	None	No	No	30	9	No
1073	Lopez Island, Fisherman Bay	Rural	4	9	Brown	Brown	Sand	None	None	No	No	31	10.1	No

Station	Location	Strata type	Meter Wheel Depth	Pene-tration	Overlying Sediment Color	Underlying Sediment Color	Comp-osition	Odor	Odor intensity	Shell Hash	Wood Fragments	Salinity (ppt)	Sediment Temp-erature (c°)	Sheen
1081	Northern East Sound	Rural	26	17	Gray	Gray	Silt/Clay	H	Strong	No	No	30	9.2	No
1105	North Lopez Sound	Rural	41	16	Gray	Gray	Silt/Clay	None	None	No	No	30	9.5	No
1113	West Sound, Massacre Bay	Rural	14	17	Olive	Gray	Silt/Clay	H	Moderat e	No	Yes	30	9.7	No
1177	Sucia Is. Echo Bay	Rural	15	17	Olive Gray	Gray	Silt/Clay	H	Moderat e	No	No	27	9.2	No

Case Narratives

2012 Grain Size Case Narratives

VO84_WDOE_PSSM_pkg.pdf

VO85_Puget_Sound_Sed_pkg.pdf

VO86_Puget_Sound_Sed_pkg.pdf

VO87_VO88_Puget_Sound_Sedi_pkg.pdf

VO90_Puget_Sound_Sed_pkg.pdf

2012 TOC Case Narrative.pdf