

# 2004-2014 Puget Sound Marine Sediment Monitoring



## Sediment Quality Triad Data Summary

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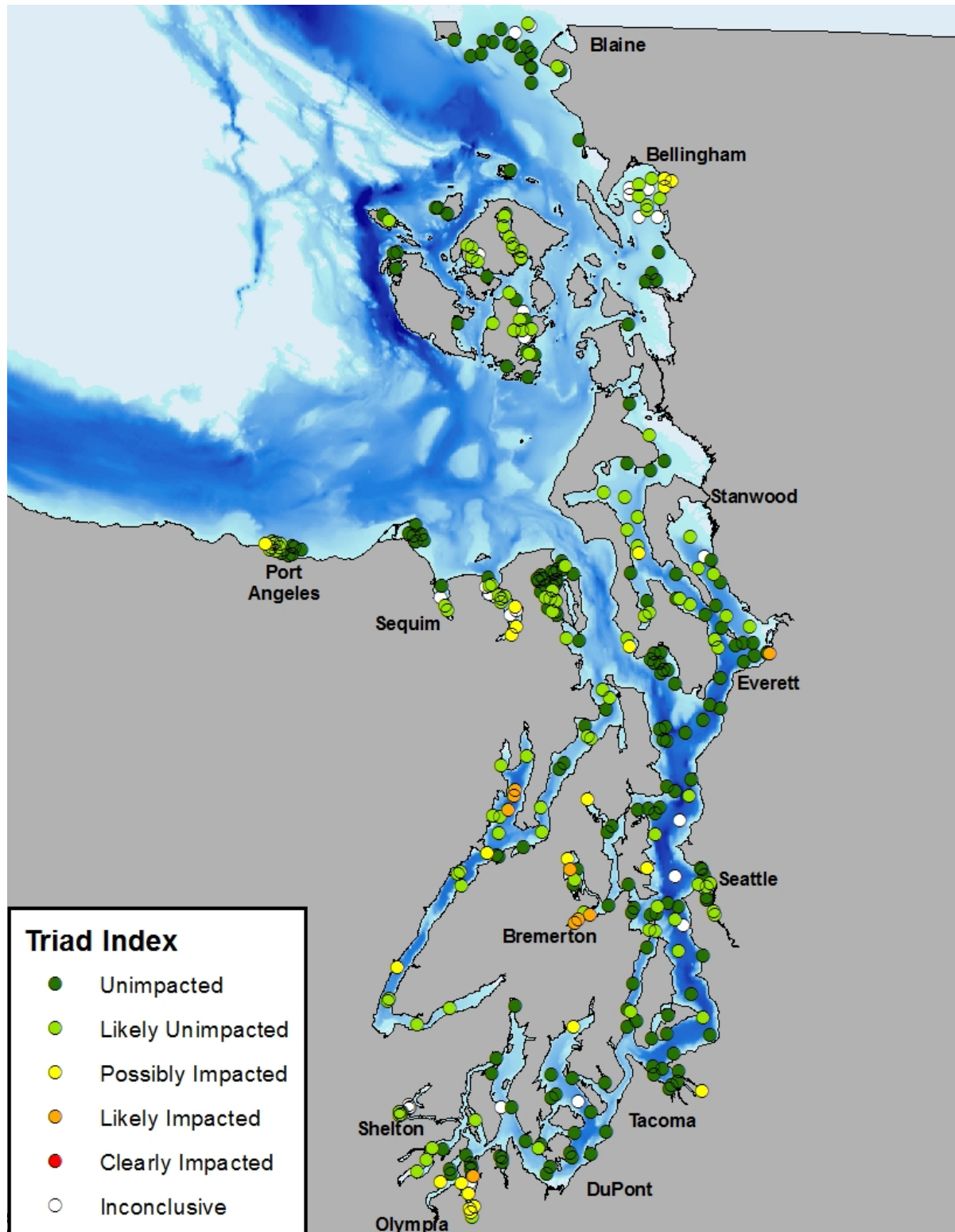
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## Results

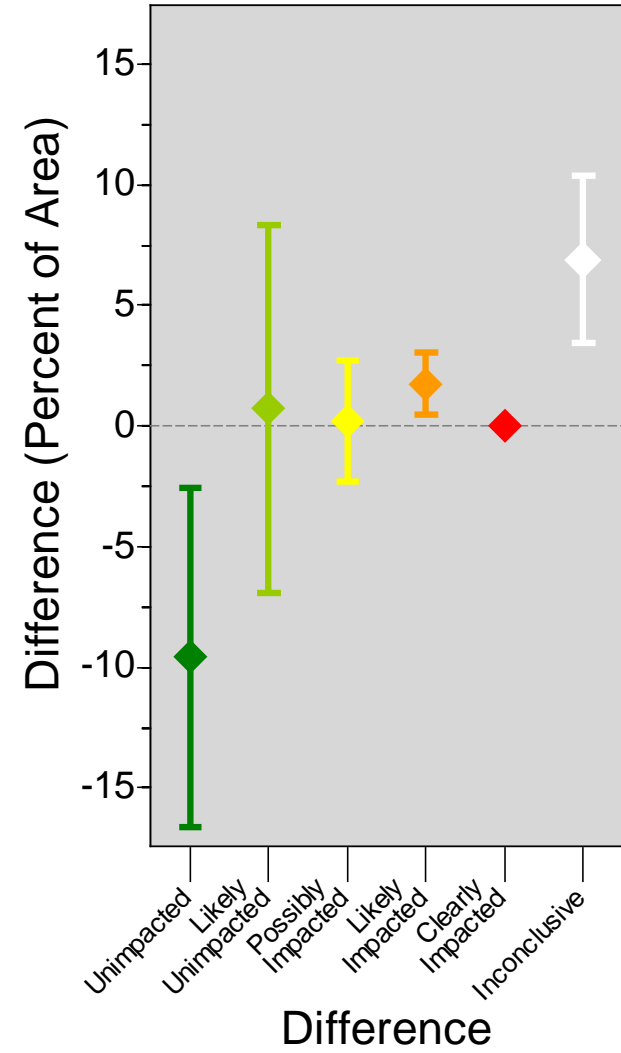
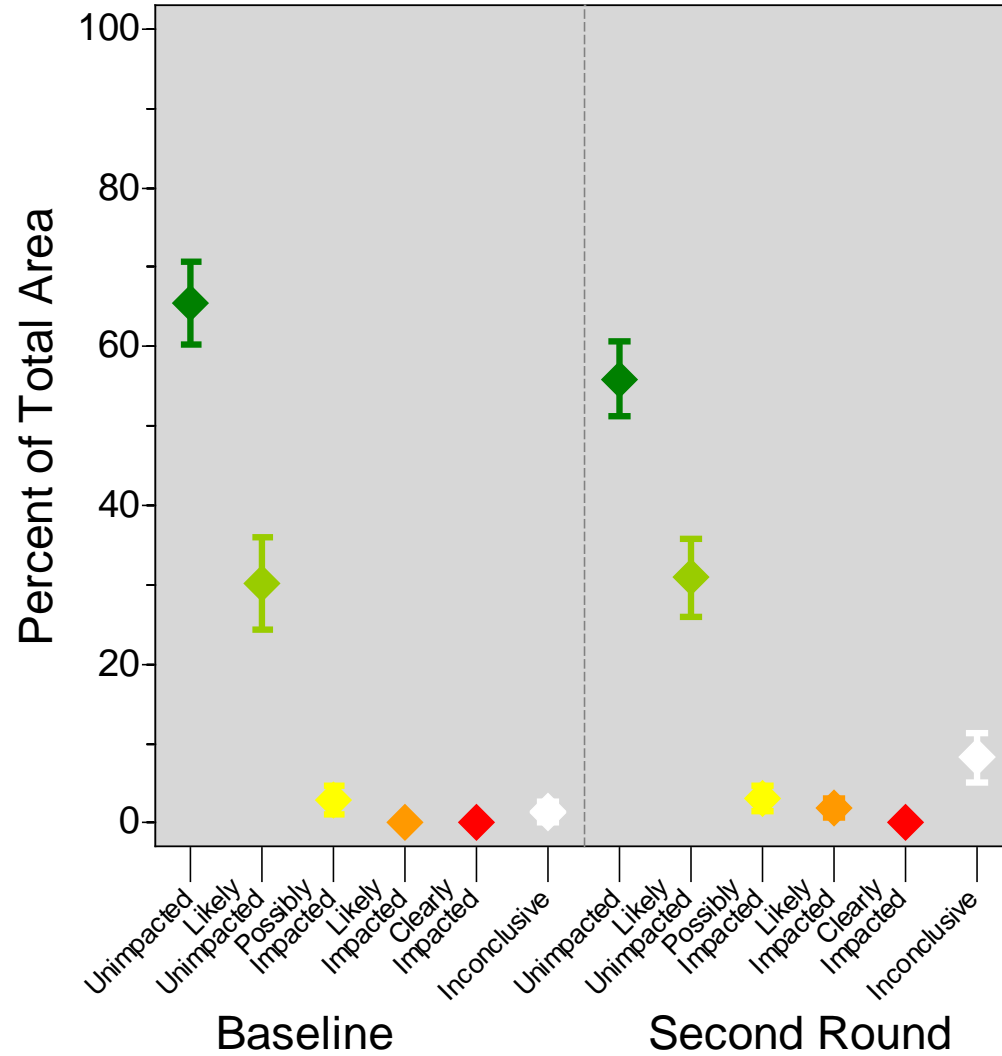


Spatial patterns of sediment condition in the 2004-2014 Puget Sound monitoring survey.

## Comparison of Triad Index Categories by Survey

Estimated spatial extent (percent of area) and 95% confidence intervals for each of the Sediment Quality Triad Index categories (Dutch et al., 2014) from Baseline (1997-2003) to Second Round (2004-2014) in Puget Sound sediments.

Sediment Quality Triad Index Category	Baseline			Second Round			Difference			* = significantly different (Kincaid, 2015, α = 0.05)
	Estimate (% area)	Confidence Limit		Estimate (% area)	Confidence Limit		Estimate (% area)	Confidence Limit		
		Lower	Upper		Lower	Upper		Lower	Upper	
Unimpacted	65.45	60.25	70.65	55.88	51.15	60.61	-9.58	-16.61	-2.54	*
Likely unimpacted	30.17	24.38	35.96	30.03	25.95	35.83	0.72	-6.89	8.33	
Possibly impacted	2.91	1.04	4.78	3.28	1.47	4.76	0.20	-2.28	2.69	
Likely impacted	0.13	0.05	0.21	1.89	0.63	3.15	1.76	0.49	3.02	*
Clearly impacted	0.01	0.00	0.02	0.00	n.a.	n.a.	-0.01	n.a.	n.a.	
Inconclusive	1.33	0.00	2.78	8.92	5.07	11.38	6.90	3.43	10.37	*



## Comparisons of Regions, Strata, and Surveys

Incidence and spatial extent of sediment condition in eight sediment monitoring regions and all of Puget Sound, for each the Baseline (1997-2003) and Second Round (2004-2014) surveys.

Sediment Triad Index Category	Baseline		Second Round	
	Stations		Stations	
	No. (%)	km <sup>2</sup> (%)	No. (%)	km <sup>2</sup> (%)
<b>Strait of Georgia</b>	61 (100.0)	386.9 (100.0)	40 (100.0)	360.6 (100.0)
Unimpacted	51 (83.6)	327.5 (84.6)	21 (52.5)	201.6 (55.9)
Likely unimpacted	7 (11.5)	54.6 (14.1)	8 (20.0)	78.8 (21.9)
Possibly impacted	3 (4.9)	4.8 (1.2)	3 (7.5)	4.6 (1.3)
Likely impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	8 (20.0)	75.6 (21.0)
<b>San Juan Archipelago</b>	30 (100.0)	80.7 (100.0)	40 (100.0)	79.5 (100.0)
Unimpacted	10 (33.3)	26.9 (33.3)	17 (42.5)	33.8 (42.5)
Likely unimpacted	18 (60.0)	48.4 (60.0)	20 (50.0)	39.7 (50.0)
Possibly impacted	1 (3.3)	2.7 (3.3)	0 (0.0)	0.0 (0.0)
Likely impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	1 (3.3)	2.7 (3.3)	3 (7.5)	6.0 (7.5)
<b>E. Strait of Juan de Fuca</b>	30 (100.0)	61.8 (100.0)	40 (100.0)	67.8 (100.0)
Unimpacted	15 (50.0)	22.4 (36.2)	15 (37.5)	24.2 (35.6)
Likely unimpacted	10 (33.3)	25.8 (41.7)	16 (40.0)	24.7 (36.4)
Possibly impacted	2 (6.7)	5.5 (8.8)	4 (10.0)	7.6 (11.1)
Likely impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	3 (10.0)	8.2 (13.3)	5 (12.5)	11.4 (16.8)
<b>Admiralty Inlet</b>	30 (100.0)	69.2 (100.0)	43 (100.0)	66.5 (100.0)
Unimpacted	28 (93.3)	66.1 (95.5)	33 (76.7)	51.1 (76.8)
Likely unimpacted	2 (6.7)	3.1 (4.5)	8 (18.6)	11.6 (17.5)
Possibly impacted	0 (0.0)	0.0 (0.0)	1 (2.3)	2.8 (4.2)
Likely impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	1 (2.3)	1.0 (1.5)
<b>Whidbey Basin</b>	39 (100.0)	338.1 (100.0)	40 (100.0)	353.3 (100.0)
Unimpacted	10 (25.6)	104.8 (31.0)	20 (50.0)	167.7 (47.5)
Likely unimpacted	19 (48.7)	213.0 (63.0)	17 (42.5)	165.7 (46.9)

Sediment Triad Index Category	Baseline		Second Round	
	Stations		Stations	
	No. (%)	Area km <sup>2</sup> (%)	No. (%)	Area km <sup>2</sup> (%)
Possibly impacted	2 (5.1)	0.1 (0.0)	1 (2.5)	11.5 (3.3)
Likely impacted	6 (15.4)	0.6 (0.2)	1 (2.5)	0.3 (0.1)
Clearly impacted	1 (2.6)	0.1 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	1 (2.6)	19.6 (5.8)	1 (2.5)	8.2 (2.3)
<b>Central Sound</b>	<b>128 (100.0)</b>	<b>683.9 (100.0)</b>	<b>80 (100.0)</b>	<b>667.4 (100.0)</b>
Unimpacted	86 (67.2)	636.5 (93.1)	53 (66.3)	480.6 (72.0)
Likely unimpacted	24 (18.8)	40.2 (5.9)	16 (20.0)	126.9 (19.0)
Possibly impacted	11 (8.6)	5.1 (0.7)	4 (5.0)	7.5 (1.1)
Likely impacted	6 (4.7)	1.9 (0.3)	4 (5.0)	5.7 (0.9)
Clearly impacted	1 (0.8)	0.1 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	3 (3.8)	46.7 (7.0)
<b>Hood Canal</b>	<b>21 (100.0)</b>	<b>331.7 (100.0)</b>	<b>30 (100.0)</b>	<b>294.8 (100.0)</b>
Unimpacted	7 (33.3)	106.1 (32.0)	7 (23.3)	64.6 (21.9)
Likely unimpacted	11 (52.4)	186.8 (56.3)	18 (60.0)	178.1 (60.4)
Possibly impacted	3 (14.3)	38.8 (11.7)	2 (6.7)	18.5 (6.3)
Likely impacted	0 (0.0)	0.0 (0.0)	3 (10.0)	33.7 (11.4)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
<b>South Sound</b>	<b>42 (100.0)</b>	<b>341.6 (100.0)</b>	<b>55 (100.0)</b>	<b>317.7 (100.0)</b>
Unimpacted	24 (57.1)	211.2 (61.8)	30 (54.5)	210.2 (66.2)
Likely unimpacted	14 (33.3)	120.2 (35.2)	10 (18.2)	37.3 (11.8)
Possibly impacted	2 (4.8)	9.8 (2.9)	7 (12.7)	19.9 (6.3)
Likely impacted	2 (4.8)	0.5 (0.2)	1 (1.8)	2.1 (0.7)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	7 (12.7)	48.2 (15.2)
<b>Total Study Area</b>	<b>381 (100.0)</b>	<b>2294.1 (100.0)</b>	<b>368 (100.0)</b>	<b>2207.6 (100.0)</b>
Unimpacted	231 (60.6)	1501.4 (65.4)	196 (53.3)	1233.6 (55.9)
Likely unimpacted	105 (27.6)	692.1 (30.2)	113 (30.7)	662.9 (30.0)
Possibly impacted	24 (6.3)	66.7 (2.9)	22 (6.0)	72.4 (3.3)
Likely impacted	14 (3.7)	3.0 (0.1)	9 (2.4)	41.7 (1.9)
Clearly impacted	2 (0.5)	0.2 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	5 (1.3)	30.5 (1.3)	28 (7.6)	197.0 (8.9)



Incidence and spatial extent of sediment condition in five sediment monitoring strata and all of Puget Sound, for each the Baseline (1997-2003) and Second Round (2004-2014) surveys.

Sediment Triad Index Category	Baseline		Second Round	
	Stations		Stations	
	No. (%)	km <sup>2</sup> (%)	No. (%)	km <sup>2</sup> (%)
<b>Basin</b>	42 (100.0)	890.5 (100.0)	72 (100.0)	822.0 (100.0)
Unimpacted	38 (90.5)	738.9 (83.0)	49 (68.1)	552.8 (67.3)
Likely unimpacted	4 (9.5)	151.6 (17.0)	18 (25.0)	204.1 (24.8)
Possibly impacted	0 (0.0)	0.0 (0.0)	2 (2.8)	18.5 (2.3)
Likely impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	3 (4.2)	46.7 (5.7)
<b>Harbor</b>	63 (100.0)	21.1 (100.0)	33 (100.0)	19.7 (100.0)
Unimpacted	21 (33.3)	8.5 (40.2)	9 (27.3)	6.3 (31.9)
Likely unimpacted	17 (27.0)	8.1 (38.3)	11 (33.3)	5.7 (28.9)
Possibly impacted	9 (14.3)	1.3 (6.1)	8 (24.2)	4.0 (20.3)
Likely impacted	14 (22.2)	3.0 (14.2)	4 (12.1)	3.2 (16.2)
Clearly impacted	2 (3.2)	0.2 (0.9)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	1 (3.0)	0.5 (2.5)
<b>Passage</b>	61 (100.0)	491.6 (100.0)	53 (100.0)	467.5 (100.0)
Unimpacted	52 (85.2)	359.9 (73.2)	34 (64.2)	271.1 (58.0)
Likely unimpacted	8 (13.1)	130.7 (26.6)	15 (28.3)	151.1 (32.3)
Possibly impacted	1 (1.6)	1.1 (0.2)	2 (3.8)	14.3 (3.1)
Likely impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	2 (3.8)	31.0 (6.6)
<b>Rural</b>	129 (100.0)	750.5 (100.0)	135 (100.0)	762.2 (100.0)
Unimpacted	57 (44.2)	301.5 (40.2)	60 (44.4)	335.6 (44.0)
Likely unimpacted	58 (45.0)	358.6 (47.8)	50 (37.0)	265.9 (34.9)
Possibly impacted	9 (7.0)	59.9 (8.0)	5 (3.7)	22.2 (2.9)
Likely impacted	0 (0.0)	0.0 (0.0)	3 (2.2)	33.7 (4.4)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	5 (3.9)	30.5 (4.1)	17 (12.6)	104.8 (13.7)
<b>Urban</b>	86 (100.0)	140.3 (100.0)	75 (100.0)	136.2 (100.0)
Unimpacted	63 (73.3)	92.7 (66.1)	44 (58.7)	67.8 (49.8)
Likely unimpacted	18 (20.9)	43.1 (30.7)	19 (25.3)	36.1 (26.5)
Possibly impacted	5 (5.8)	4.4 (3.1)	5 (6.7)	13.4 (9.8)
Likely impacted	0 (0.0)	0.0 (0.0)	2 (2.7)	4.8 (3.5)



Sediment Triad Index Category	Baseline		Second Round	
	Stations	Area	Stations	Area
	No. (%)	km <sup>2</sup> (%)	No. (%)	km <sup>2</sup> (%)
Clearly impacted	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	0 (0.0)	0.0 (0.0)	5 (6.7)	14.1 (10.4)
<b>Total Study Area</b>	<b>381 (100.0)</b>	<b>2294.1 (100.0)</b>	<b>368 (100.0)</b>	<b>2207.6 (100.0)</b>
Unimpacted	231 (60.6)	1501.6 (65.5)	196 (53.3)	1233.6 (55.9)
Likely unimpacted	105 (27.6)	692.1 (30.2)	113 (30.7)	662.9 (30.0)
Possibly impacted	24 (6.3)	66.7 (2.9)	22 (6.0)	72.4 (3.3)
Likely impacted	14 (3.7)	3.0 (0.1)	9 (2.4)	41.7 (1.9)
Clearly impacted	2 (0.5)	0.2 (0.0)	0 (0.0)	0.0 (0.0)
Inconclusive	5 (1.3)	30.5 (1.3)	28 (7.6)	197.1 (8.9)