Appendix C to Department of Ecology Publication 18-03-004

2004-2014 Puget Sound Marine Sediment Monitoring

Sediment Chemistry Data Summary

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Results and Statistical Summaries

Summary statistics for concentrations of metals and organic compounds from sediments collected for the 2004-2014 survey of Puget Sound.

ND = nondetect; RL = reporting limit; * = estimated by regression on ordered statistics (ROS) when nondetects are present.

Parameter	N	# Detects	# ND	# ND > highest detect	Mean*	Std. Dev.*	Median*	Minimum*	Maximum (detected)	Max RL (ND)	Notes (see bottom)
Total Organic Carbon (70°C)	338	328	10		1.4992	1.099	1.435	0.0639	7.19	0.1	
Total Organic Carbon (104°C)	368	358	10		1.515	1.097	1.47	0.0625	7.27	0.1	
Metals (mg/kg dry weight)											
Arsenic	368				6.217	2.991	5.87	0.865	31.2	31.2	1
Cadmium	368	339	29		0.4364	0.487	0.278	0.0194	3.2	0.1	
Chromium	368				37.433	16.8	34.5	8.86	127	127	1
Copper	368				25.57	21.01	21.55	3.09	195	195	1
Lead	368				11.103	8.921	9.555	1.4	62.6	62.6	1
Mercury	368	364	4		0.0839	0.104	0.0616	0.00387	0.797	0.0064	
Nickel	368				32.45	20.7	28	5.69	142	142	1
Selenium	368	251	117		0.6867	0.454	0.5285	0.0939	2.37	0.501	
Silver	368	248	120		0.1408	0.137	0.11	0.012	1.15	0.1	
Tin	368				63.7	36.81	61.35	16.1	492	492	1
Zinc	368	363	5		0.9386	0.888	0.75	0.1065	5.66	0.2	
Organic Compounds (µg/kg dry weight)											
Polycyclic Aromatic Hydrocarbons (PAH)											
LPAH											
1,6,7-Trimethylnaphthalene	368	348	20		15.049	13.27	11.5	0.49	73.3	5.87	
1-Methylnaphthalene	368	329	39		24.74	21.5	19.1	0.16	126	10	
1-Methylphenanthrene	288	275	13		27.02	38.93	17	0.5	269	1.04	
2,6-Dimethylnaphthalene	368	362	6		57.48	51.22	46.5	0.39	339	3.14	
2-Methylnaphthalene	368	321	47		33.64	33.12	27.15	0.54	257	8.5	

Parameter	N	# Detects	# ND	# ND > highest detect	Mean*	Std. Dev.*	Median*	Minimum*	Maximum (detected)	Max RL (ND)	Notes (see bottom)
Acenaphthene	368	259	109		8.44	21.96	3	0.13	268	10.6	
Acenaphthylene	368	313	55		13.83	27.66	5.58	0.15	322	2	
Anthracene	368	337	31		25.68	68.35	10	0.2	887	1.7	
Biphenyl	368	281	87		12.217	15.13	8.35	0.94	153	19.8	
Dibenzofuran	368	323	45		20.83	52.88	12.35	0.45	888	12.1	
Dibenzothiophene	368	331	37		7.188	13.77	4.735	0.33	204	2	
Fluorene	368	316	52		16.24	31.04	9.64	0.37	436	19	
Naphthalene	367	310	57		71.24	155.6	30.4	0.67	1480	53	
Phenanthrene	368	348	20		82.08	134.7	57	0.78	1460	11.9	
Retene	368	360	8		85.27	160.5	41	0.81	2150	5.1	
HPAH											
Benzo(a)anthracene	368	357	11		35.39	84.32	16.35	0.2	1220	1.02	
Benzo(a)pyrene	368	352	16		41.88	87.44	20.2	0.41	1020	2.04	
Benzo(b)fluoranthene	368	363	5		61.03	137.2	28.2	0.28	1460	2.04	
Benzo(g,h,i)perylene	367	358	9		38.54	74.93	20.7	0.22	841	1.02	
Benzo(k)fluoranthene	368	358	10		36.57	56.39	23	0.51	512	1.02	
Benzo[e]pyrene	368	348	20		32.45	67.11	15.7	0.34	626	2.06	
Chrysene	368	363	5		62.69	145.8	32	0.41	1910	1.02	
Dibenzo(a,h)anthracene	368	294	74		7.059	12.46	3.88	0.232	129	2.2	
Fluoranthene	368	367	1		111.7	299.3	53.4	0.5	4300	0.952	
Indeno(1,2,3-c,d)pyrene	368	355	13		33.42	61.22	17.65	0.51	677	1.02	
Perylene	368	365	3		70.84	66.82	62	0.69	621	1.02	
Pyrene	368	363	5		107.6	250.5	49.1	0.6	3250	2.04	
Base/Neutral/Acid (BNA)											
Semivolatile Compounds											
Chlorinated Alkenes											

Parameter	N	# Detects	# ND	# ND > highest detect	Mean*	Std. Dev.*	Median*	Minimum*	Maximum (detected)	Max RL (ND)	Notes (see bottom)
Hexachlorobutadiene	367	4	363	363						33	3, 4
Chlorinated and Nitro substituted Phenols											
Pentachlorophenol	368	9	359	55	33.69	29.2	26.46	8.37	250	1300	3
Chlorinated Aromatic Compounds											
1,2,4-Trichlorobenzene	368									33	2
1,2-Dichlorobenzene	367									33	2
1,3-Dichlorobenzene	368									33	2
1,4-Dichlorobenzene	368	1	367							33	5
2-Chloronaphthalene	368	3	365		0.1893	0.808	0.0585	0.0016	11	11	
Hexachlorobenzene	368	3	365	10	1.0442	1.763	0.6018	0.0685	25	33	3
Miscellaneous Extractable Compounds											
Benzoic Acid	368	177	191		475.1	502.8	258.9	43.4	3900	1670	
Benzyl Alcohol	241	26	215	19	24.2	32.52	14.94	3.18	281	600	
Beta-coprostanol	264	146	118		401.8	594	173.9	25.8	5000	1400	
Carbazole	367	264	103		6.73	12.45	4.09	0.383	173	6.23	
Cholesterol	282	255	27		3952	6892	2275	104	94000	6330	
Isophorone	338	118	220		24.33	47	8.09	0.66	434	390	
Organonitrogen Compounds											
Caffeine	368	4	364	268	3.329	1.273	3.102	1.69	11	65	3
N-Nitrosodiphenylamine	317									60	2
Phenols											
2,4-Dimethylphenol	298	49	249	19	40.14	25.77	30.97	11.75	150	330	3
2-Methylphenol	368	73	295	6	30.84	28.19	20.99	5.05	270	330	3
4-Methylphenol	368	156	212		55.77	104.5	26.94	2.77	1500	330	
Phenol	368	59	309		161.7	401.5	23.5	1.2	3380	650	
P-nonylphenol	368	2	366	184						400	3, 5

Parameter	N	# Detects	# ND	# ND > highest detect	Mean*	Std. Dev.*	Median*	Minimum*	Maximum (detected)	Max RL (ND)	Notes (see bottom)
Phthalate Esters											
Bis(2-Ethylhexyl)phthalate	367	33	334		18.92	78.47	2.74	0.14	950	840	
Butylbenzylphthalate	368	3	365	143	3.343	3.818	2.426	0.553	41	130	3
Diethylphthalate	367	1	366	310						557	5 3
Dimethylphthalate	367	12	355		8	31.5	1.49	0.05	258	65	
Di-N-Butylphthalate	368	12	356		25.4	216.2	0	0	2990	698	
Di-N-Octyl Phthalate	360	3	357	86	0.864	6.759	0.094	0.003	95	630	3
Chlorinated Pesticides and herbicides - all others not detected											
2,4'-DDD	368	4	364	1	0.0228	0.147	0.00208	0.00001	2.6	2.9	3
2,4'-DDE	368									3.1	2
2,4'-DDT	368	1	367	216						2.9	5 3
4,4'-DDD	368	31	337		0.3264	0.678	0.2139	0.0326	12	1.8	
4,4'-DDE	368	33	335		0.3209	0.584	0.2495	0.0533	11	2.6	
4,4'-DDT	368	26	342	1	0.357	0.585	0.2214	0.0214	8.7	14	3
Aldrin	368									2.9	2
Cis-chlordane (Alpha-chlordane)	368	2	366	2						2.9	5 3
Dieldrin	368									2.9	2
Endosulfan I	356	2	354	39						4.5	3 5
Endosulfan II	368									20	2
Endosulfan Sulfate	368	2	366	2						43	3 5
Endrin	368	2	366	42						2.9	3 5
Endrin Aldehyde	356									2.9	2
Endrin Ketone	368									2.9	2
Gamma-BHC (Lindane)	411	10	401	44	0.0929	0.179	0.04206	0.00215	1.9	20	3
Heptachlor	368									2.9	2
Heptachlor Epoxide	368									2.9	2

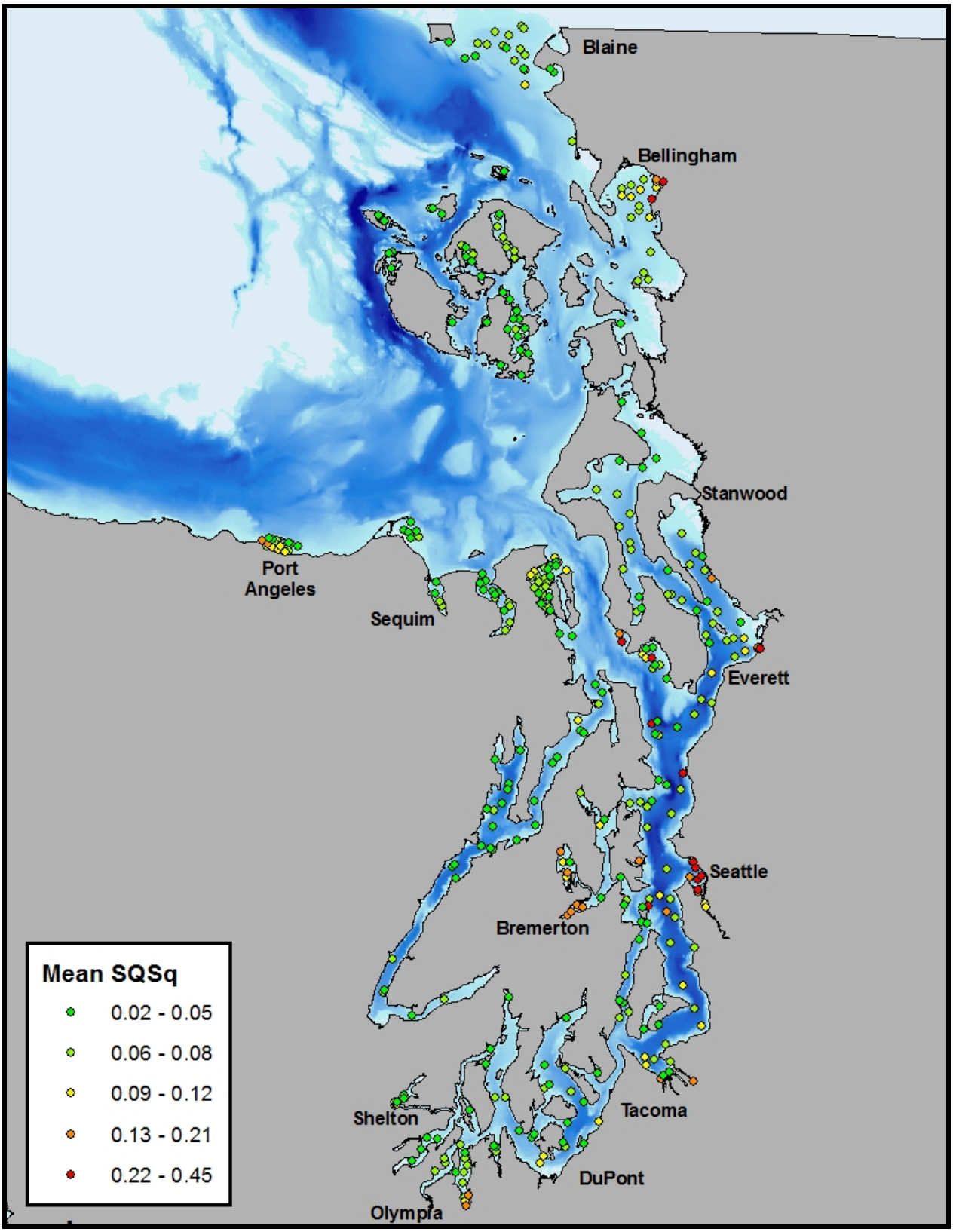
Parameter	N	# Detects	# ND	# ND > highest detect	Mean*	Std. Dev.*	Median*	Minimum*	Maximum (detected)	Max RL (ND)	Notes (see bottom)
Hexachlorobenzene (Pest)	175	11	164	1	0.1328	0.319	0.0427	0.0021	2.5	9.9	3
Mirex	368									2.9	2
Oxychlordane	368									2.9	2
Toxaphene	368	6	362	7	1.314	3.002	0.493	0.013	34	69	3
Trans-Chlordane (Gamma)	368	2	366	15						2.9	5 3
Polychlorinated Biphenyls (PCB)											
PCB Congeners											
PCB Congener 8	368	8	360		0.075	0.591	0.0056	0	11	2.9	
PCB Congener 18	368	6	362	5	0.3831	0.146	0.35597	0.13696	1.2	2.9	3
PCB Congener 28	368	17	351	1	0.2601	0.28	0.1772	0.022	2.4	2.9	3
PCB Congener 44	368	13	355	1	0.202	0.261	0.12	0.0102	2.5	2.9	3
PCB Congener 52	368	18	350		0.1841	0.448	0.0551	0.0012	4.4	2.9	
PCB Congener 66	368	23	345		0.2901	0.353	0.1835	0.0187	3.7	2.9	
PCB Congener 77	368	13	355		0.123	0.41	0.0227	0.0002	4.2	2.9	
PCB Congener 101	368	38	330		0.3554	1.059	0.0701	0.0009	14	2.9	
PCB Congener 105	368	22	346		0.2087	0.458	0.0796	0.0029	5.6	2.9	
PCB Congener 118	368	52	316		0.5121	1.158	0.2112	0.0103	14	2.9	
PCB Congener 126	368	1	367	219						2.9	3 5
PCB Congener 128	368	9	359		0.2076	0.349	0.1063	0.0064	4	2.9	
PCB Congener 138	368	64	304		0.6446	1.745	0.2336	0.0097	20	2.9	
PCB Congener 153	368	68	300		0.6586	1.64	0.2405	0.0108	17	2.9	
PCB Congener 169	368									4.3	2
PCB Congener 170	368	16	352		0.2757	0.552	0.1212	0.0057	5.4	2.9	
PCB Congener 180	368	24	344		0.25	0.913	0.0268	0.0002	9.5	2.9	
PCB Congener 187	368	18	350		0.3509	0.561	0.1869	0.0129	5.8	2.9	
PCB Congener 195	368									2.9	2

Parameter	N	# Detects	# ND	# ND > highest detect	Mean*	Std. Dev.*	Median*	Minimum*	Maximum (detected)	Max RL (ND)	Notes (see bottom)
PCB Congener 206	368	14	354		0.1303	0.36	0.0445	0.0012	5.6	2.9	
PCB Congener 209	368	10	358	3	0.1614	0.417	0.0585	0.002	6.2	10	3
PCB Aroclors											
PCB Aroclor 1016	368									41	2
PCB Aroclor 1221	368									20	2
PCB Aroclor 1232	368									41	2
PCB Aroclor 1242	368	15	353	1	2.263	2.123	1.659	0.266	20	41	3
PCB Aroclor 1248	368	25	343		3.411	3.482	2.729	0.662	51	40	
PCB Aroclor 1254	368	108	260		6.211	13.51	2.399	0.114	160	14	
PCB Aroclor 1260	368	37	331		2.854	9.468	0.354	0.003	89	18	
PCB Aroclor 1262	338									69	2
PCB Aroclor 1268	338									21	2
Polybrominated Diphenylethers (PBDE)											
PBDE- 47	368	225	143		0.2795	0.377	0.1886	0.0489	5.8	1.3	
PBDE- 49	338	21	317		0.1565	0.225	0.106	0.0155	3.3	0.6	
PBDE- 66	338									0.6	2
PBDE- 71	338									0.6	2
PBDE- 99	368	77	291		0.2104	0.305	0.1548	0.0326	5.3	2.9	
PBDE-100	368	5	363	1	0.1597	0.096	0.14018	0.04077	1.3	2.9	3
PBDE-138	338									1.2	2
PBDE-153	368	4	364	293	0.2455	0.079	0.22888	0.1229	0.52	2.9	3
PBDE-154	368	3	365	296	0.2372	0.076	0.22183	0.11946	0.52	2.9	3
PBDE-183	338	6	332		0.2568	0.156	0.22136	0.06111	1.7	1.2	
PBDE-184	338	8	330	286	0.3074	0.125	0.2776	0.1476	0.74	1.2	3
PBDE-191	338	5	333	298	0.5244	0.06	0.51302	0.43134	0.7	1.2	3
PBDE-209	338	65	273		2.376	8.217	0.999	0.087	120	11	

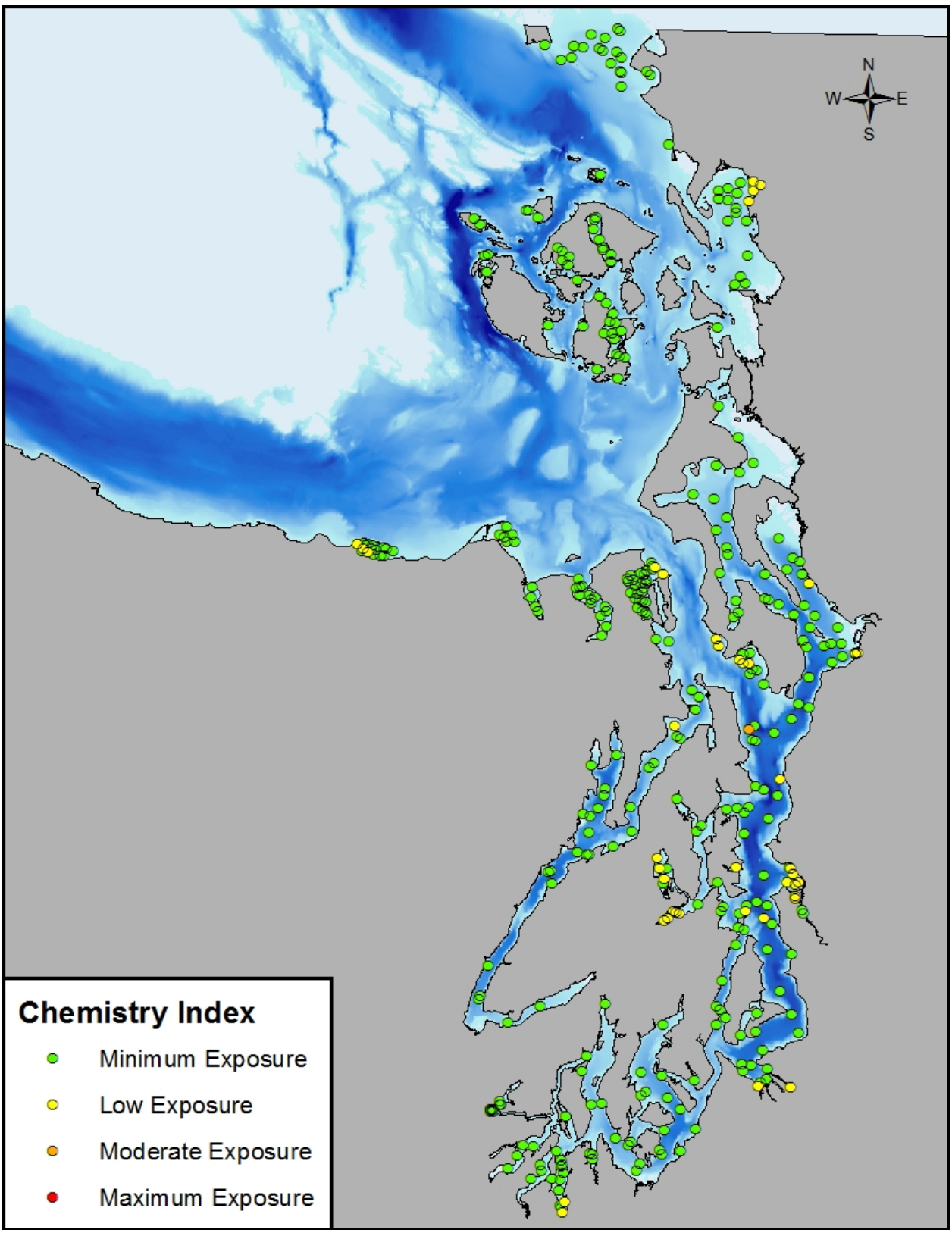
Notes

1: All values detected (no nondetects).
2: All nondetect.
3: Nondetects higher than the maximum detect are set to missing values.
4: All nondetects are higher than the maximum detect.
5: Too few detected observations for regression.

Chemical Contamination



Spatial patterns for mean SQS quotients (SQSq) in the 2004-2014 survey of Puget Sound.



Spatial patterns of chemical contamination in the 2004-2014 Puget Sound Sediment Monitoring Program as measured with the Chemistry Index (Dutch et al., 2014).

Chemistry Index

Incidence and spatial extent of chemical contamination in the 2004-2014 survey of Puget Sound, as measured with the Sediment Chemistry Index (Dutch et al., 2014).

The 2004-2014 Puget Sound study area had no samples in the *Maximum exposure* category.

Region Strata	Second Round							
	Minimum exposure				Low exposure		Moderate exposure	
	Station		Area		Station	Area	Station	Area
	No.	(%)	km^2	(%)	No. (%)	km^2 (%)	No. (%)	km^2 (%)
Strait of Georgia	36	(90.0)	352.3	(97.7)	4 (10.0)	8.3 (2.3)	0 (0.0)	0.0 (0.0)
Basin	13	(100.0)	86.2	(100.0)	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Harbor	1	(33.3)	0.5	(33.3)	2 (66.7)	0.9 (66.7)	0 (0.0)	0.0 (0.0)
Passage	8	(100.0)	124.1	(100.0)	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Rural	7	(100.0)	115.8	(100.0)	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Urban	7	(77.8)	25.8	(77.8)	2 (22.2)	7.4 (22.2)	0 (0.0)	0.0 (0.0)
San Juan Archipelago	40	(100.0)	79.5	(100.0)	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Rural	40	(100.0)	79.5	(100.0)	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
E. Strait of Juan de Fuca	37	(92.5)	65.5	(96.6)	3 (7.5)	2.3 (3.4)	0 (0.0)	0.0 (0.0)
Harbor	3	(60.0)	2.1	(60.0)	2 (40.0)	1.4 (40.0)	0 (0.0)	0.0 (0.0)
Rural	24	(100.0)	54.7	(100.0)	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Urban	10	(90.9)	8.7	(90.9)	1 (9.1)	0.9 (9.1)	0 (0.0)	0.0 (0.0)
Admiralty Inlet	36	(83.7)	50.4	(75.8)	7 (16.3)	16.1 (24.2)	0 (0.0)	0.0 (0.0)
Passage	8	(61.5)	22.5	(61.5)	5 (38.5)	14.1 (38.5)	0 (0.0)	0.0 (0.0)
Urban	28	(93.3)	27.9	(93.3)	2 (6.7)	2.0 (6.7)	0 (0.0)	0.0 (0.0)
Whidbey Basin	36	(90.0)	344.4	(97.5)	4 (10.0)	8.9 (2.5)	0 (0.0)	0.0 (0.0)
Harbor	0	(0.0)	0.0	(0.0)	3 (100.0)	0.8 (100.0)	0 (0.0)	0.0 (0.0)
Passage	15	(100.0)	172.8	(100.0)	0 (0.0)	0.0 (0.0)	0 (0.0)	0.0 (0.0)
Rural	21	(95.5)	171.6	(95.5)	1 (4.5)	8.2 (4.5)	0 (0.0)	0.0 (0.0)

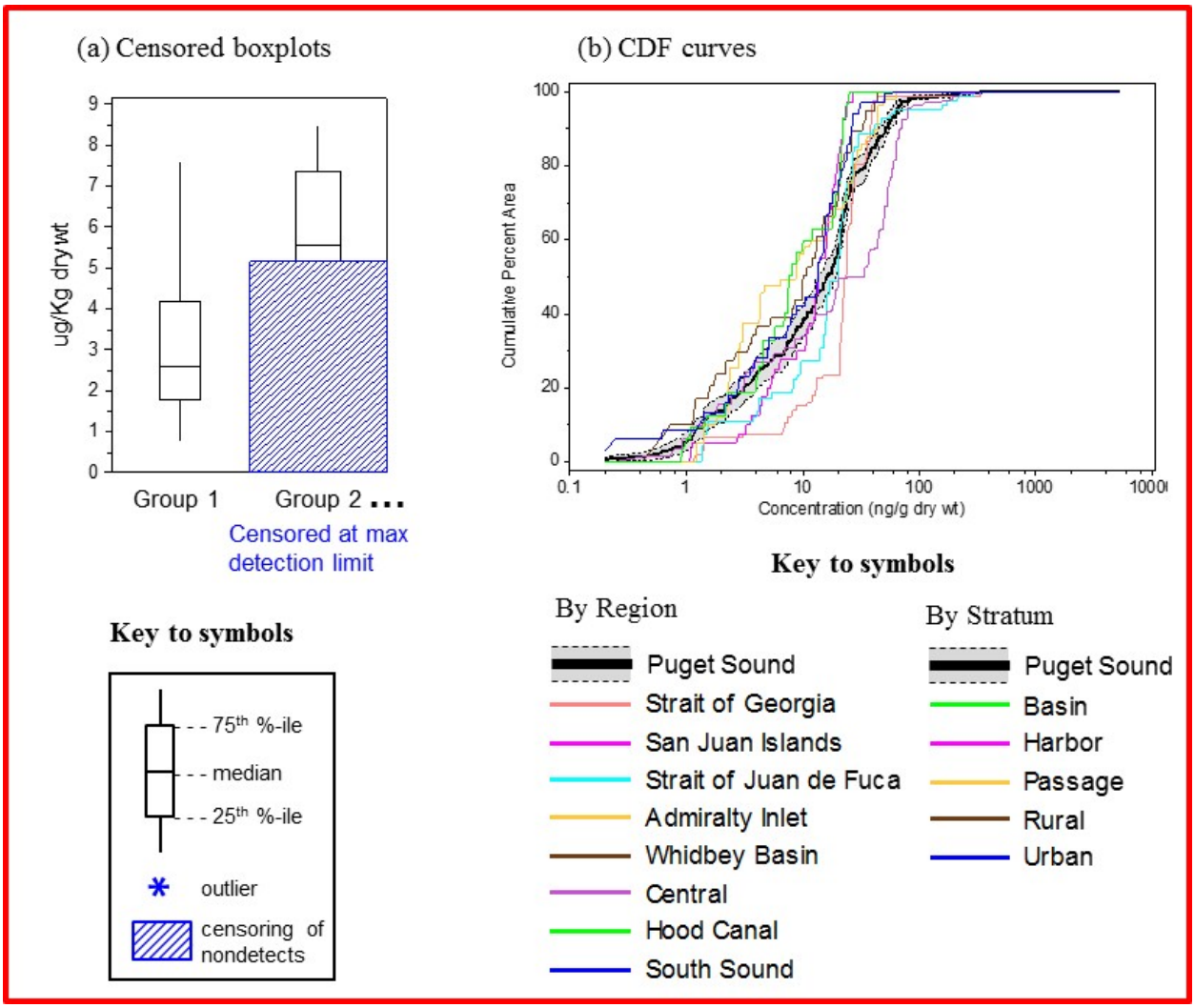
Region Strata	Second Round									
	Minimum exposure				Low exposure				Moderate exposure			
	Station		Area		Station		Area		Station		Area	
	No.	(%)	km^2	(%)	No.	(%)	km^2	(%)	No.	(%)	km^2	(%)
Central	58	(72.5)	583.2	(87.4)	21	(26.3)	68.6	(10.3)	1	(1.3)	15.6	(2.3)
Basin	27	(90.0)	419.9	(90.0)	2	(6.7)	31.1	(6.7)	1	(3.3)	15.6	(3.3)
Harbor	3	(23.1)	3.0	(23.1)	10	(76.9)	9.9	(76.9)	0	(0.0)	0.0	(0.0)
Passage	10	(100.0)	86.3	(100.0)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Rural	9	(90.0)	49.1	(90.0)	1	(10.0)	5.5	(10.0)	0	(0.0)	0.0	(0.0)
Urban	9	(52.9)	24.9	(52.9)	8	(47.1)	22.2	(47.1)	0	(0.0)	0.0	(0.0)
Hood Canal	29	(96.7)	285.6	(96.9)	1	(3.3)	9.2	(3.1)	0	(0.0)	0.0	(0.0)
Basin	20	(95.2)	184.6	(95.2)	1	(4.8)	9.2	(4.8)	0	(0.0)	0.0	(0.0)
Rural	9	(100.0)	101.0	(100.0)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
South Sound	53	(96.4)	317.5	(99.9)	2	(3.6)	0.3	(0.1)	0	(0.0)	0.0	(0.0)
Basin	8	(100.0)	75.4	(100.0)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Harbor	7	(77.8)	0.9	(77.8)	2	(22.2)	0.3	(22.2)	0	(0.0)	0.0	(0.0)
Passage	7	(100.0)	47.7	(100.0)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Rural	23	(100.0)	176.9	(100.0)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Urban	8	(100.0)	16.6	(100.0)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Puget Sound	325	(88.3)	2078.3	(94.1)	42	(11.4)	113.7	(5.2)	1	(0.3)	15.6	(0.7)
Basin	68	(94.4)	766.1	(93.2)	3	(4.2)	40.3	(4.9)	1	(1.4)	15.6	(1.9)
Harbor	14	(42.4)	6.5	(32.8)	19	(57.6)	13.3	(67.2)	0	(0.0)	0.0	(0.0)
Passage	48	(90.6)	453.4	(97.0)	5	(9.4)	14.1	(3.0)	0	(0.0)	0.0	(0.0)
Rural	133	(98.5)	748.5	(98.2)	2	(1.5)	13.6	(1.8)	0	(0.0)	0.0	(0.0)
Urban	62	(82.7)	103.8	(76.2)	13	(17.3)	32.4	(23.8)	0	(0.0)	0.0	(0.0)

Comparisons between Regions and between Strata

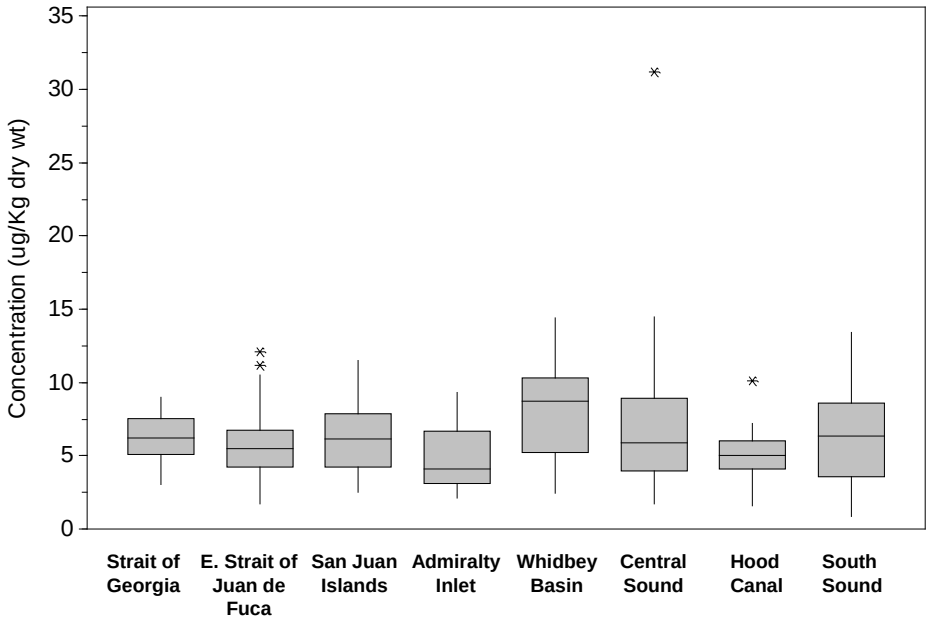
Comparison of chemical concentrations in sediments sampled in Puget Sound sampling regions and strata.

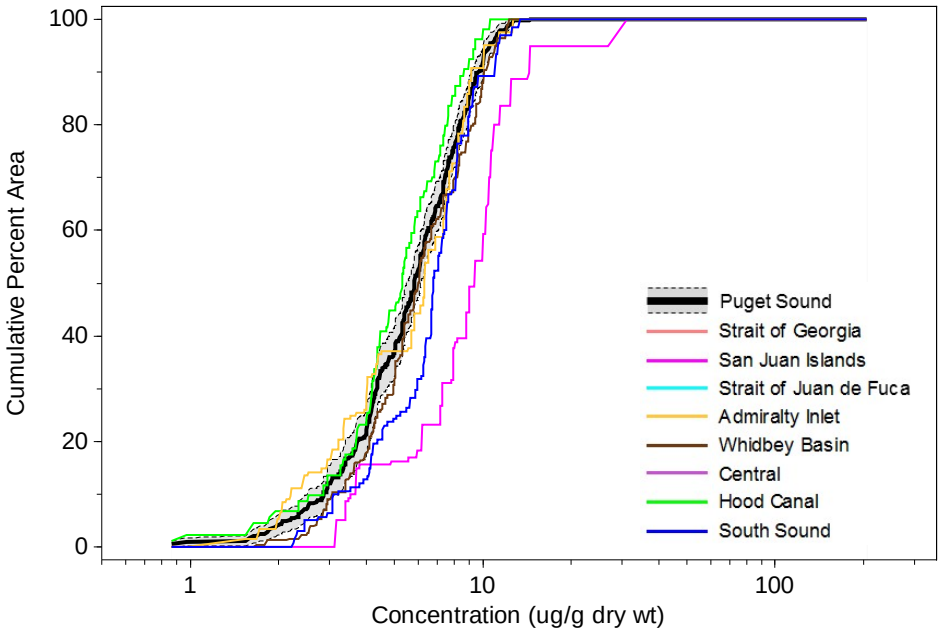
The graphical displays include two types of graphs:

(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. A 95% confidence interval is given for the whole-Sound CDF. CDFs are not given when there were too few detected values.

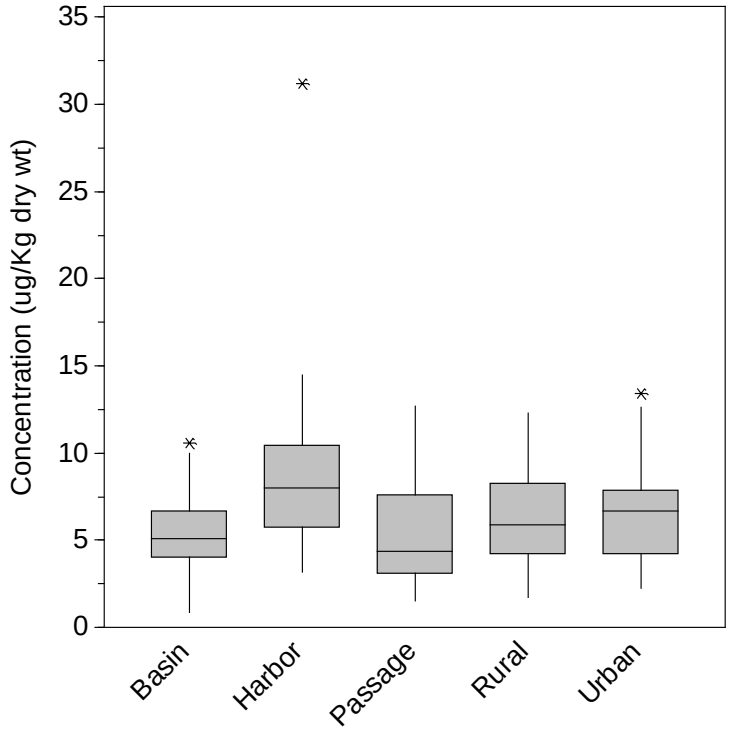


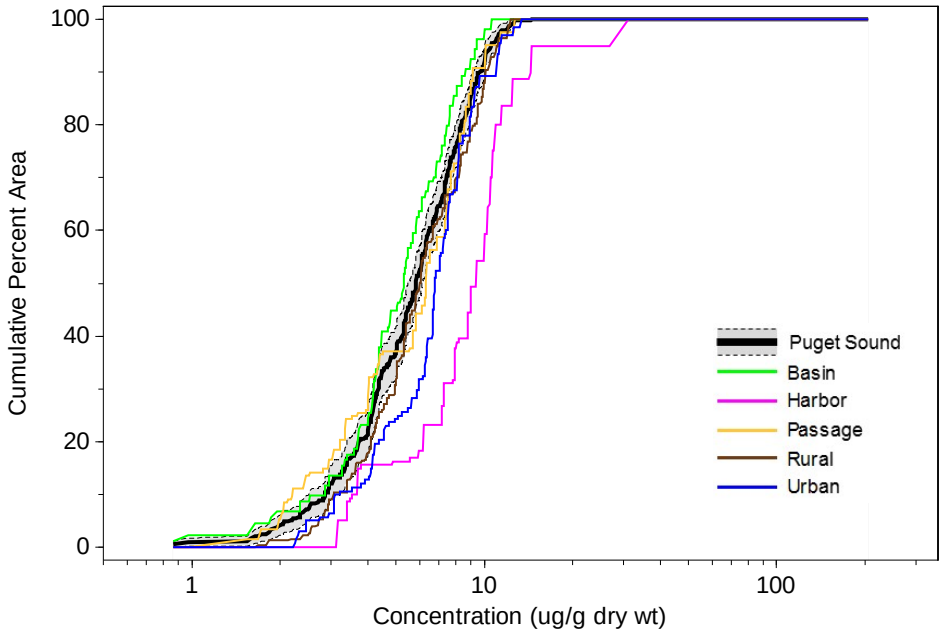
Arsenic
by region



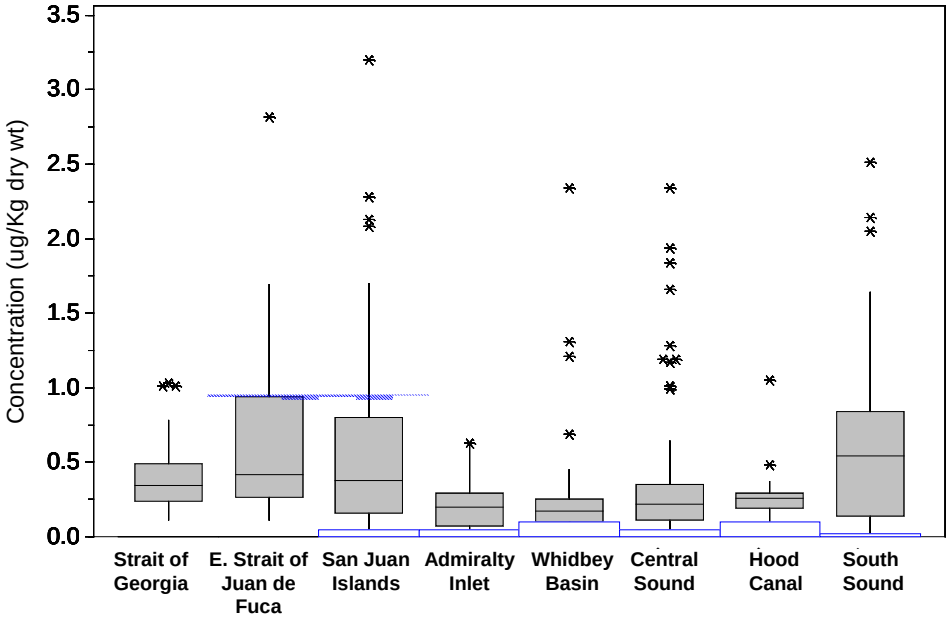


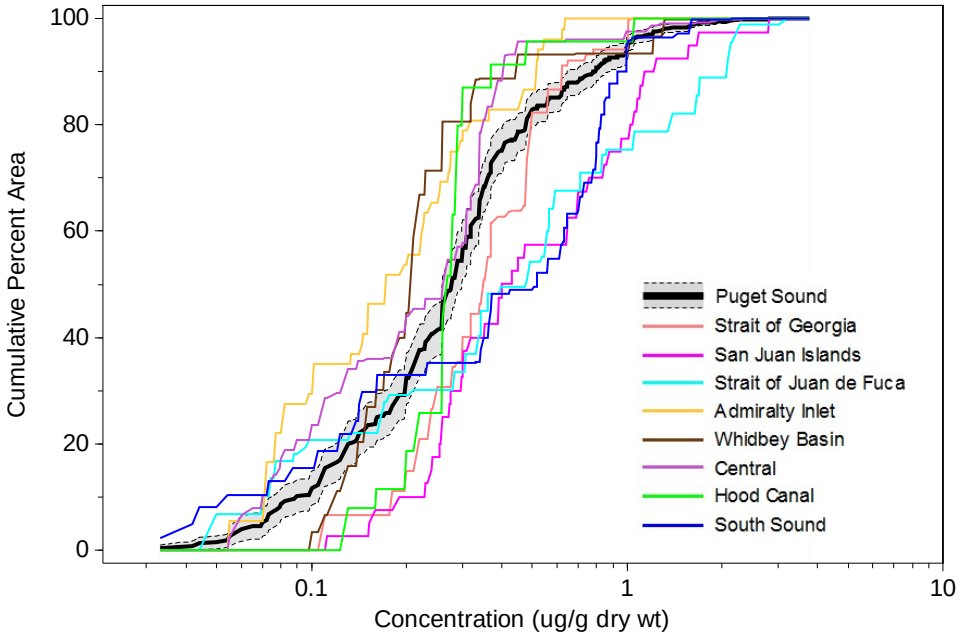
Arsenic
by Stratum



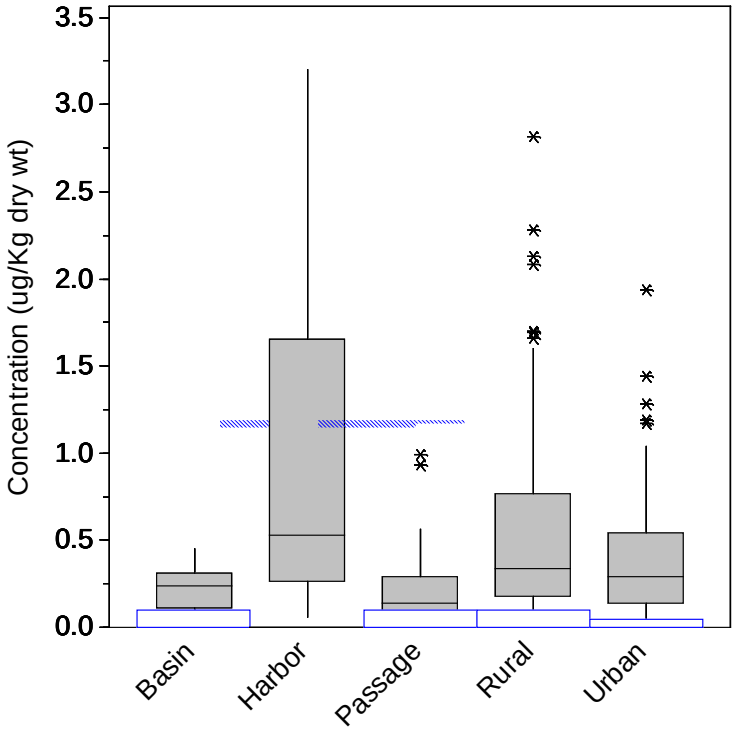


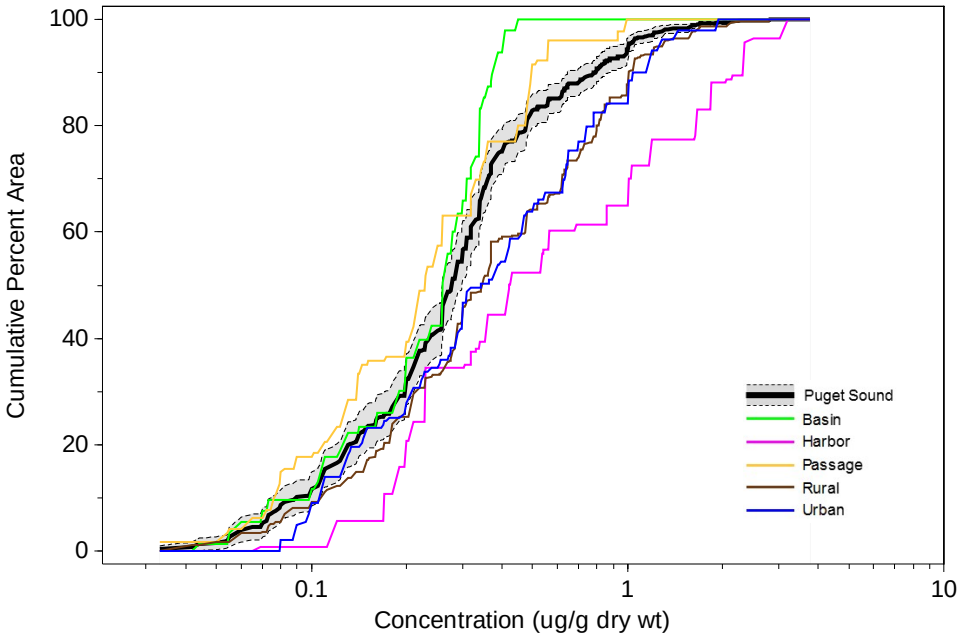
Cadmium
by Region



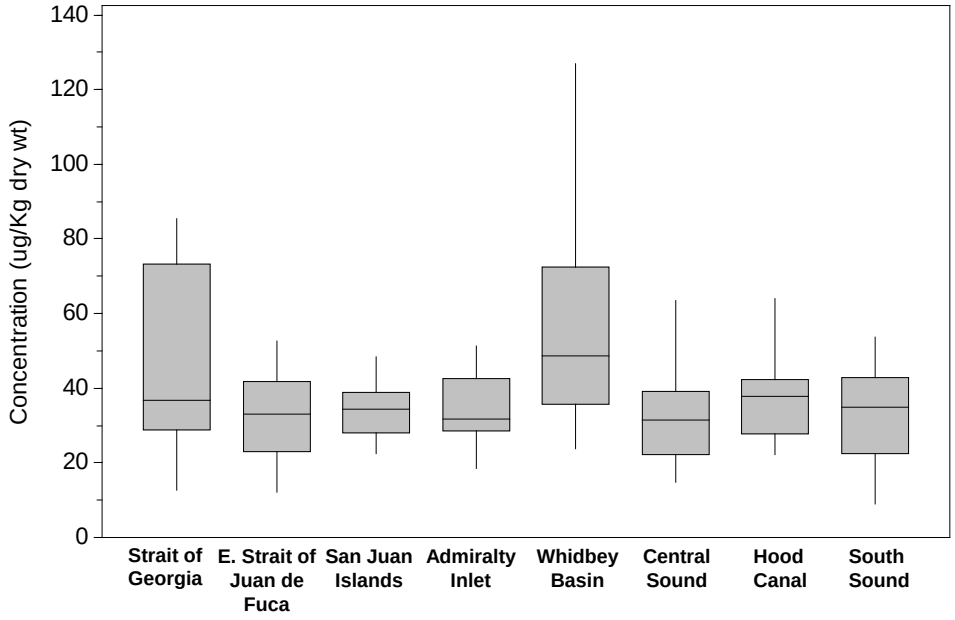


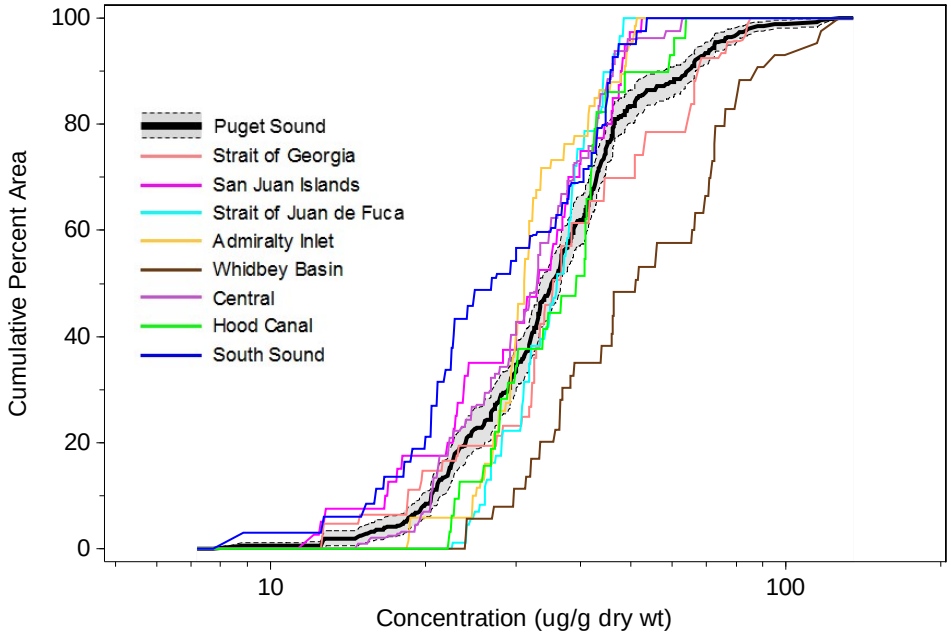
Cadmium
by Stratum



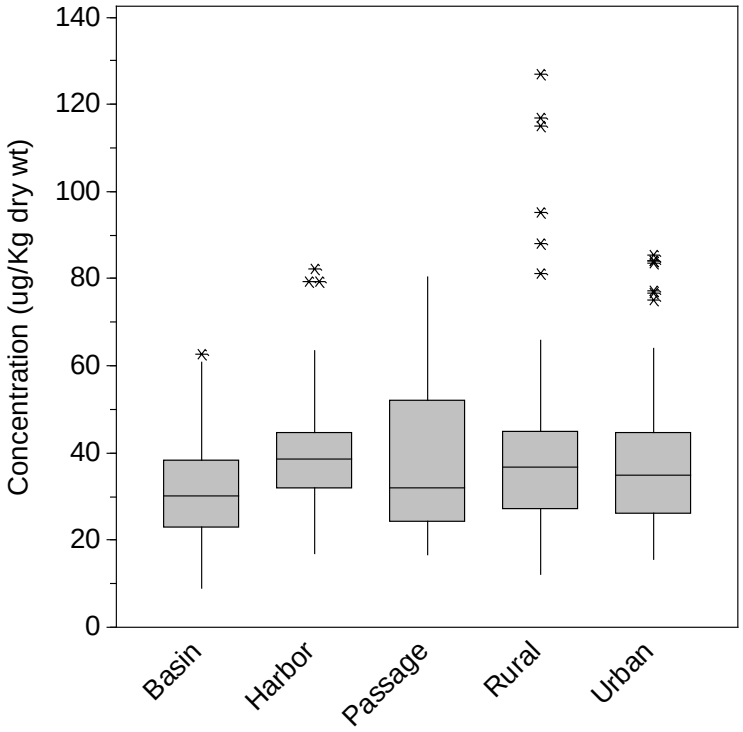


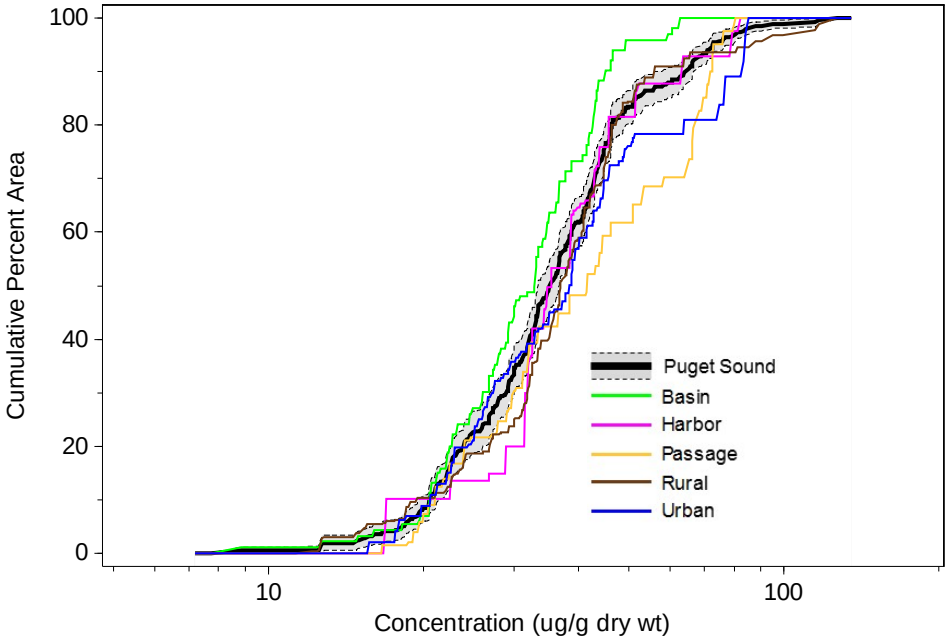
Chromium
by Region



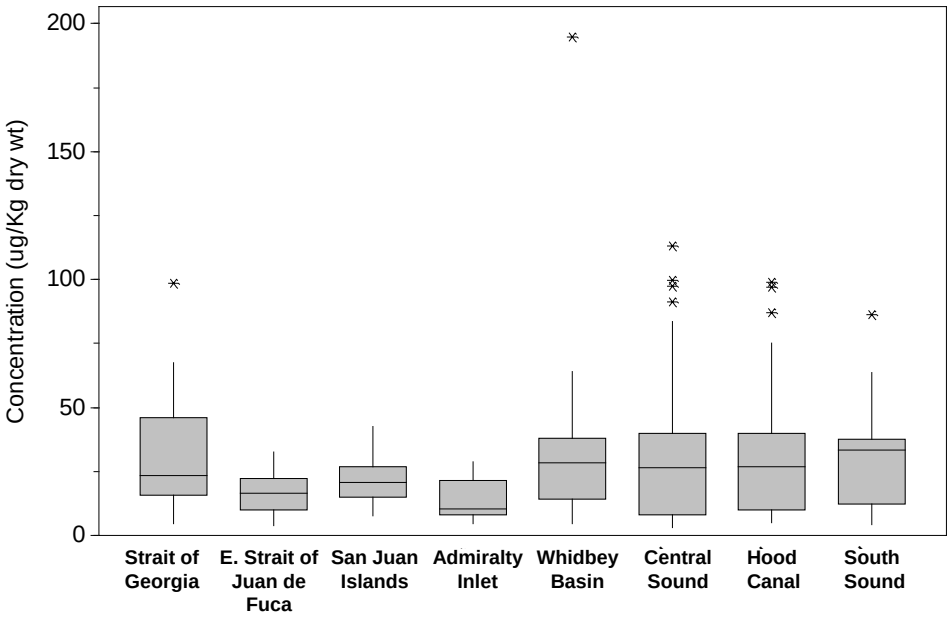


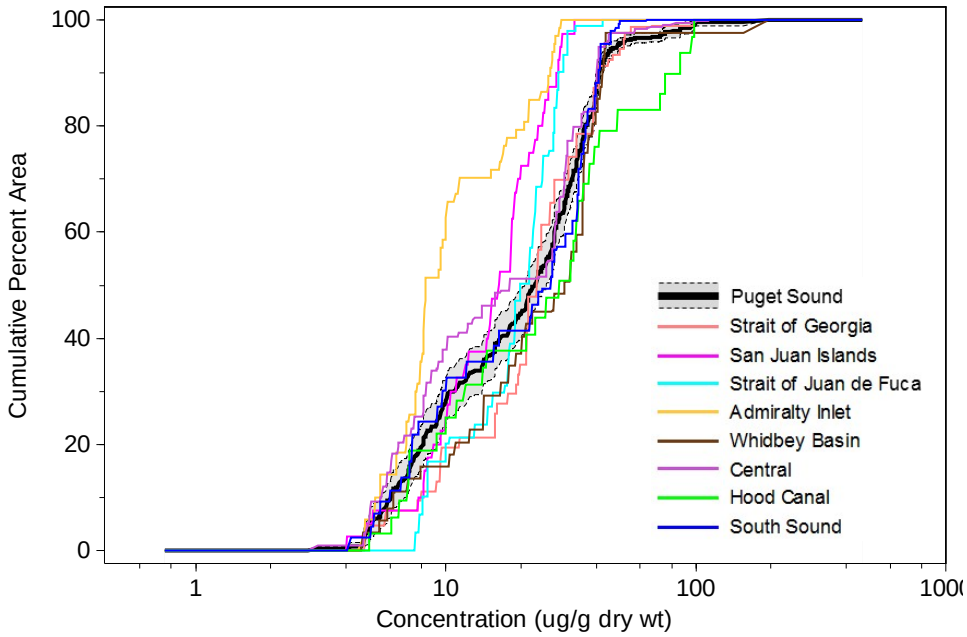
Chromium
by Stratum



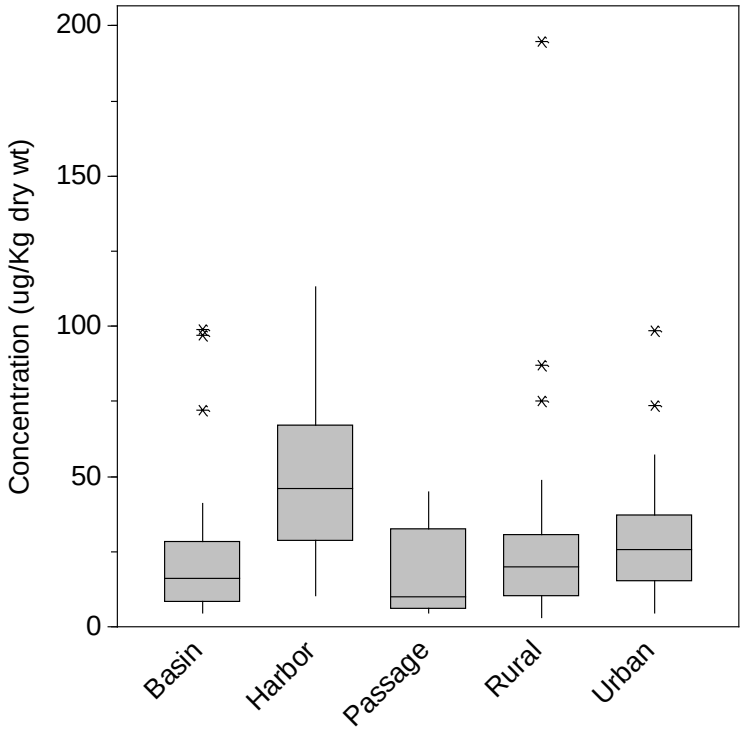


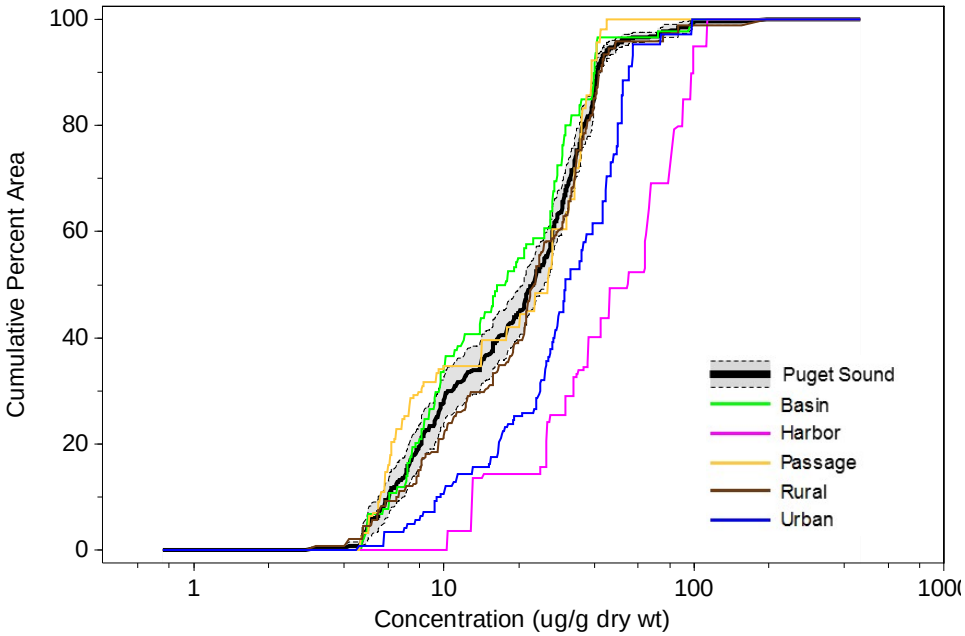
Copper
by Region





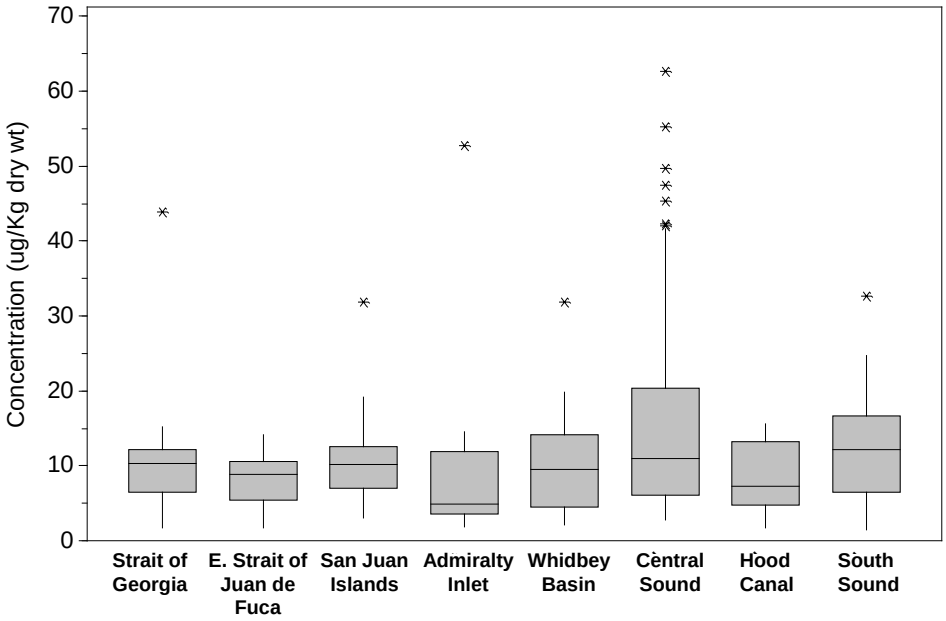
Copper
by Stratum

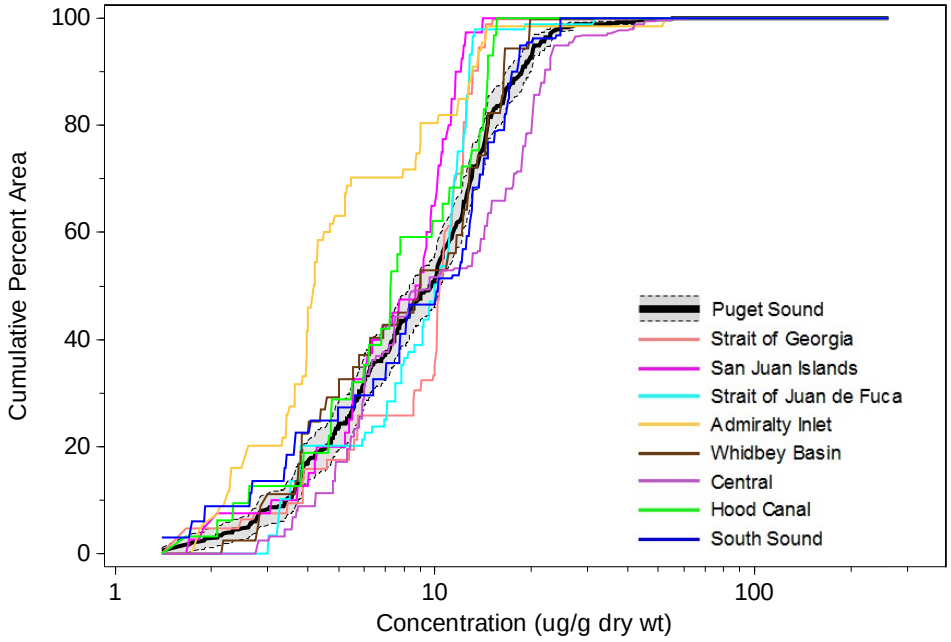




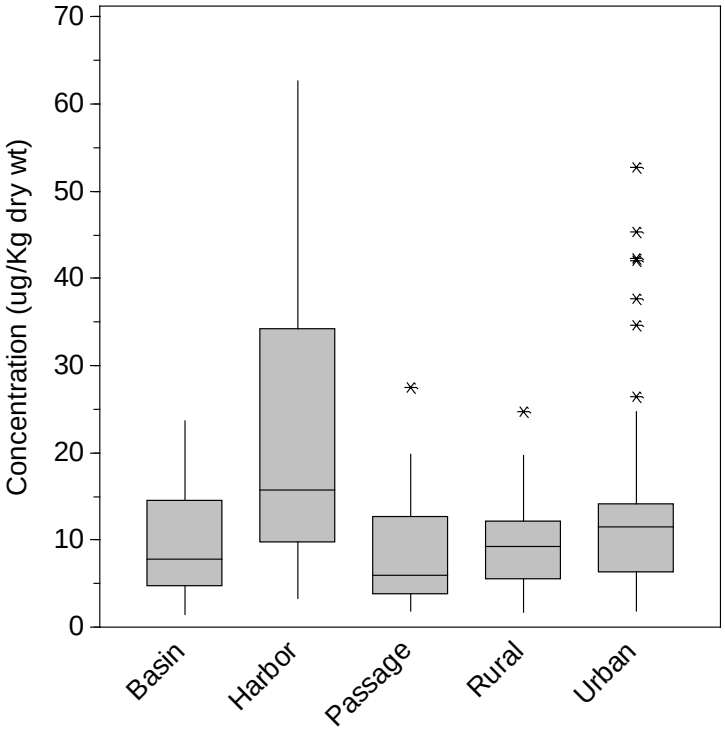
Lead

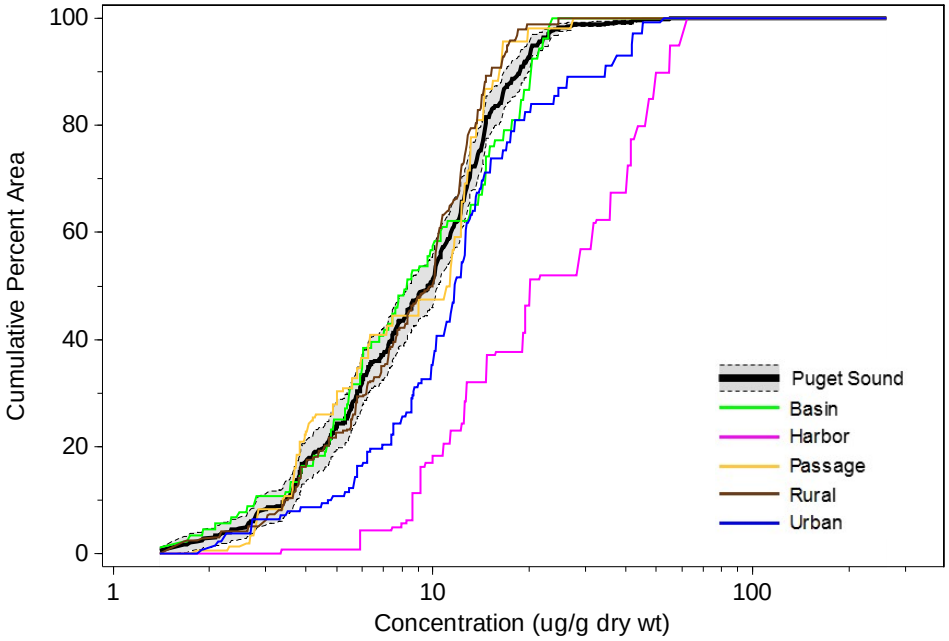
by Region



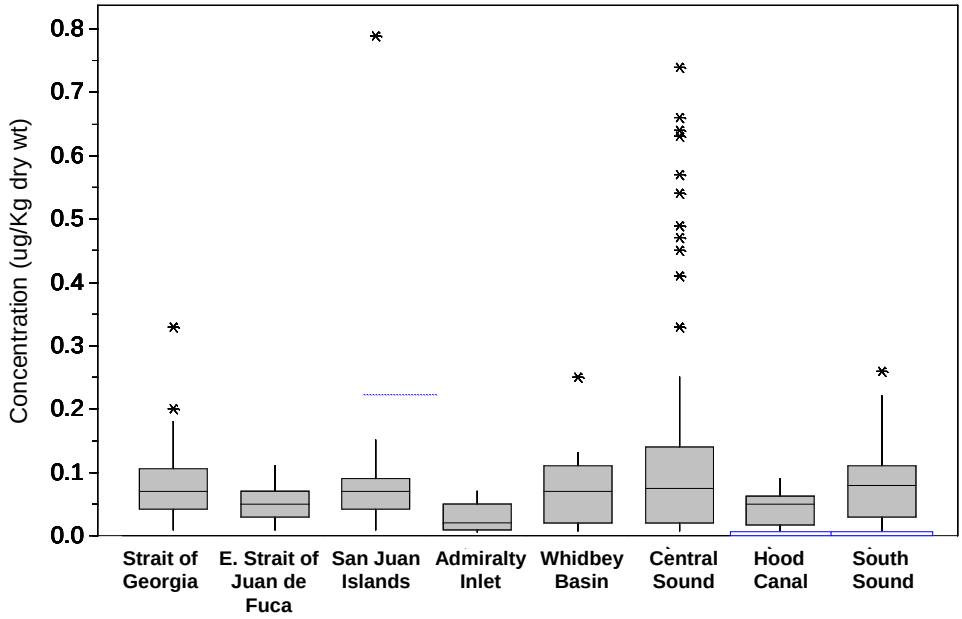


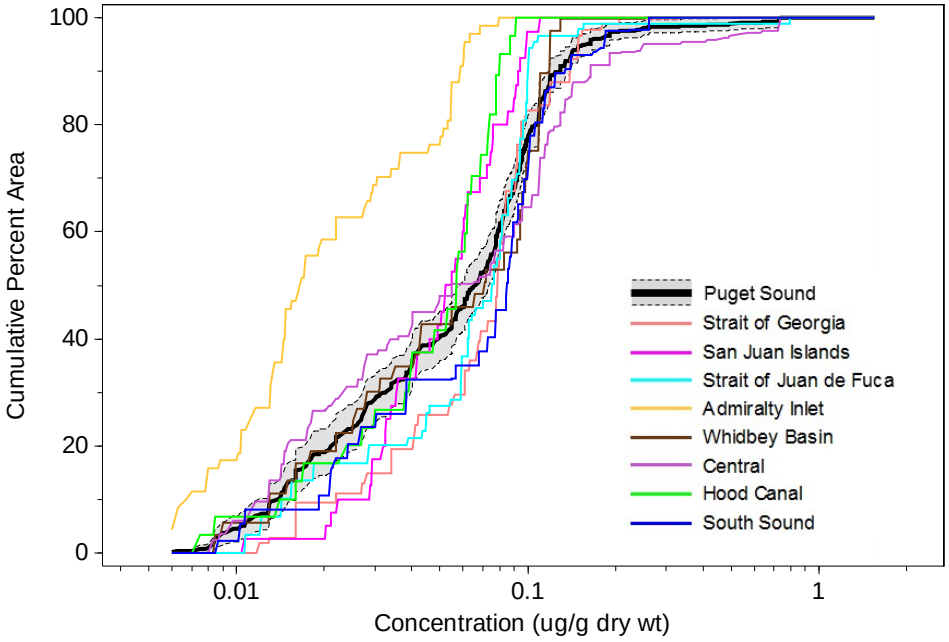
Lead
by Stratum



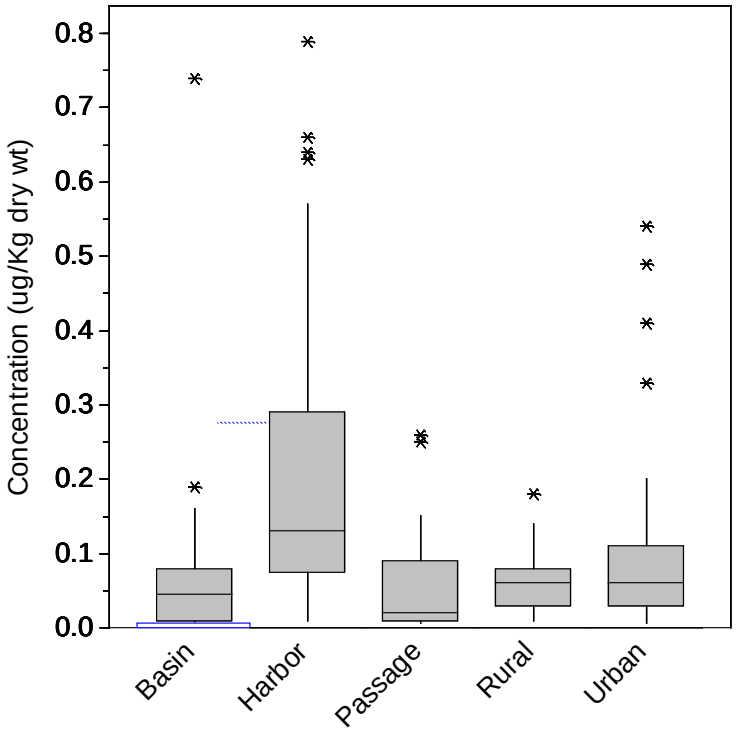


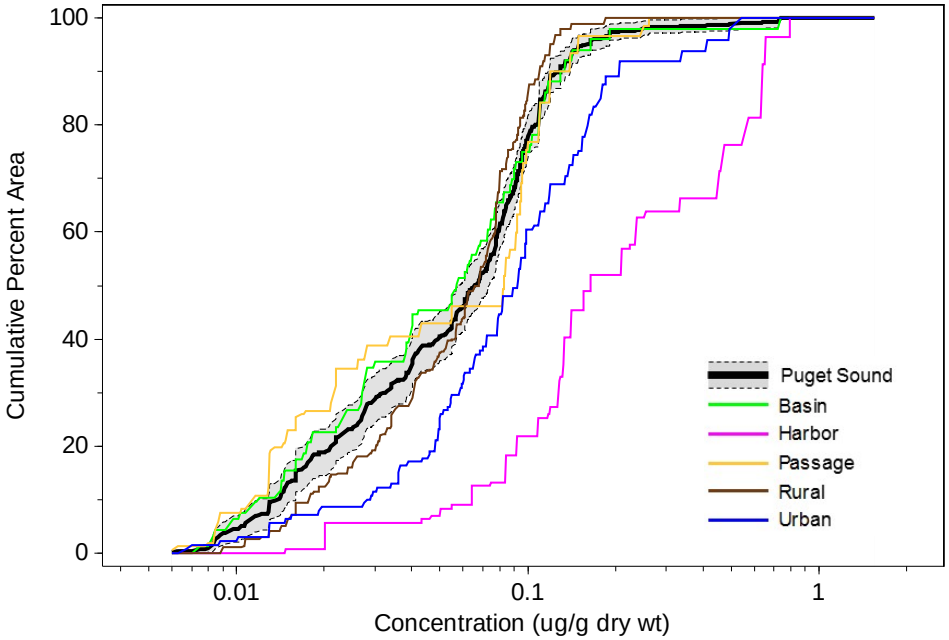
Mercury
by Region





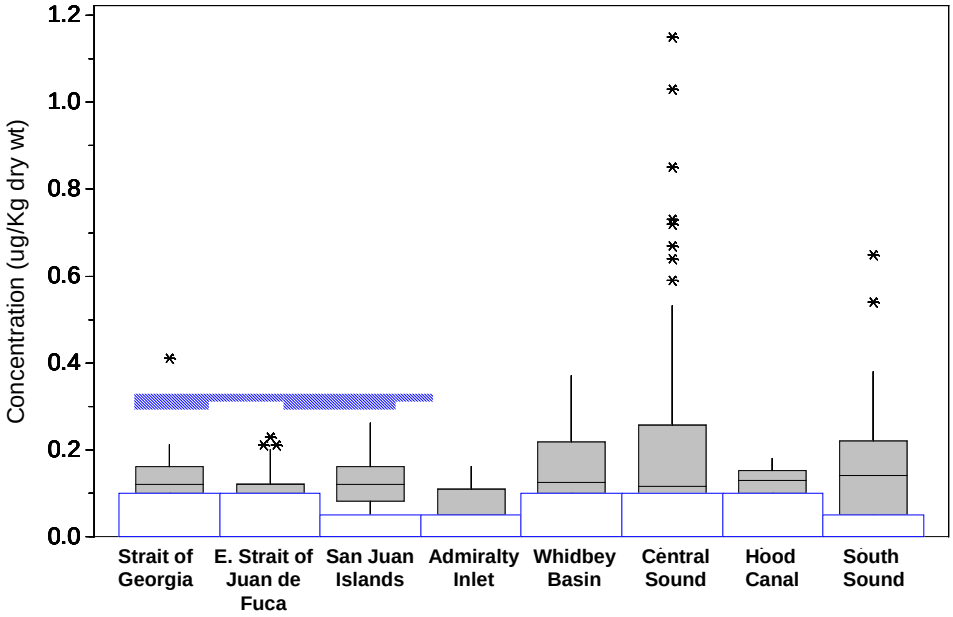
Mercury
by Stratum

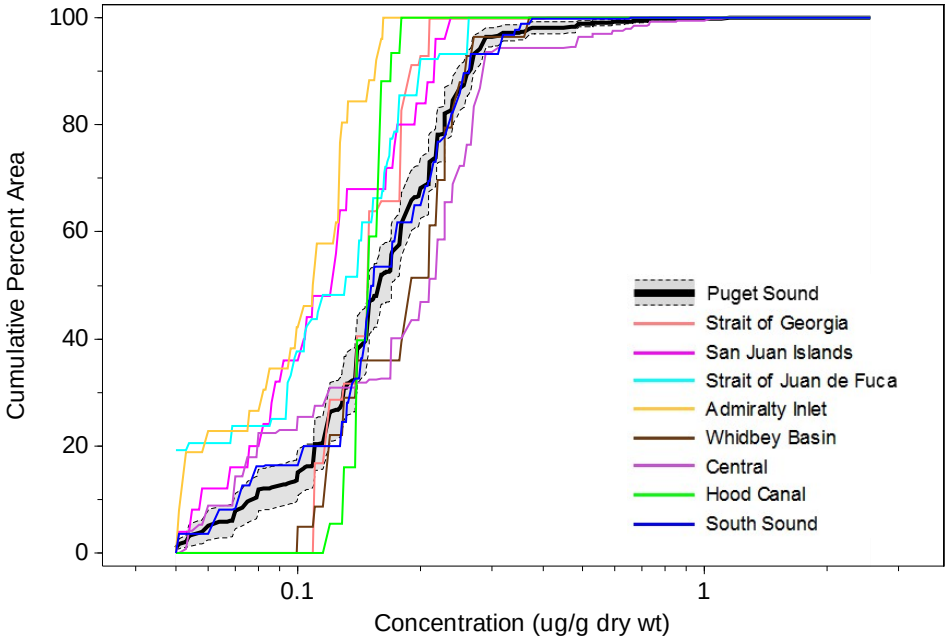




Silver

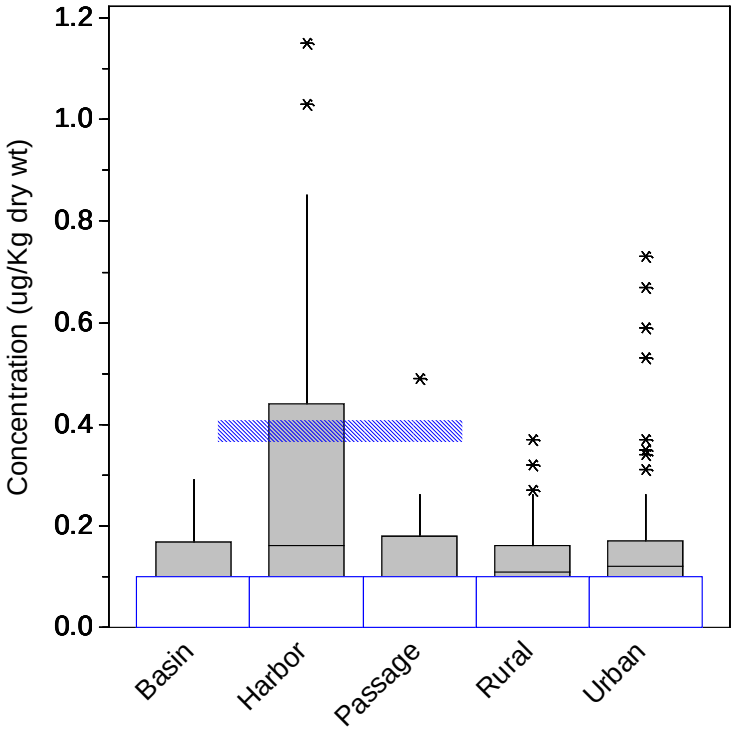
by Region

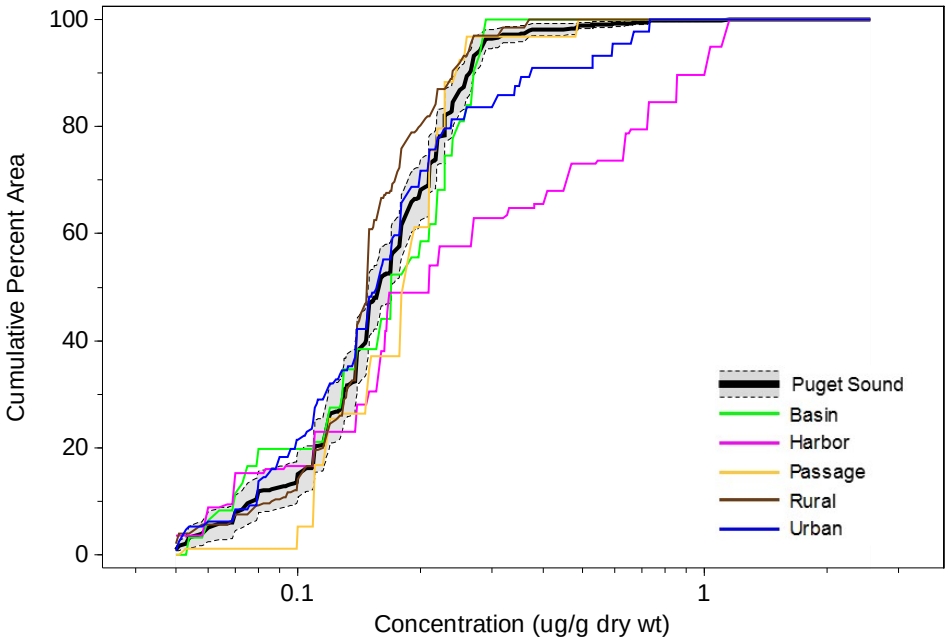




Silver

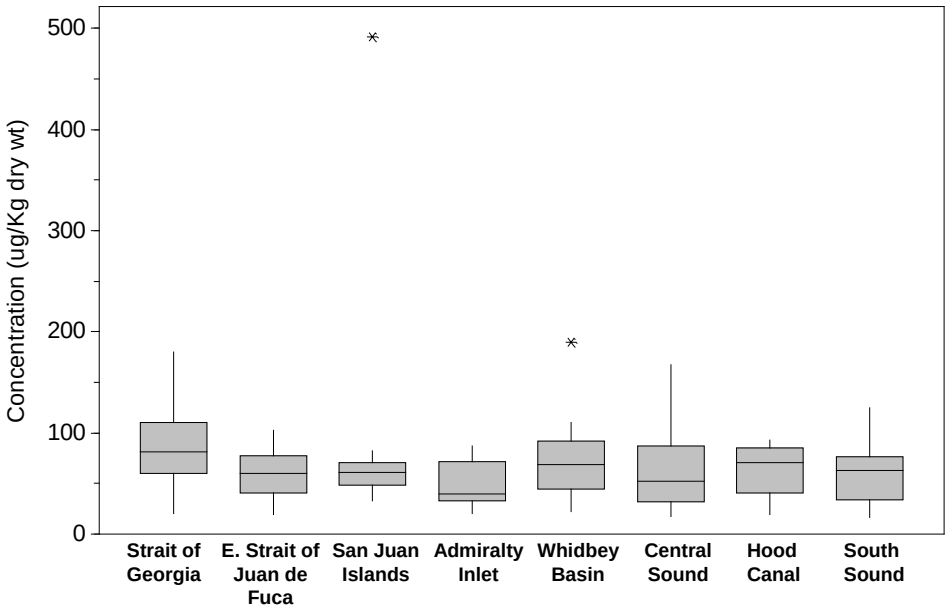
by Stratum

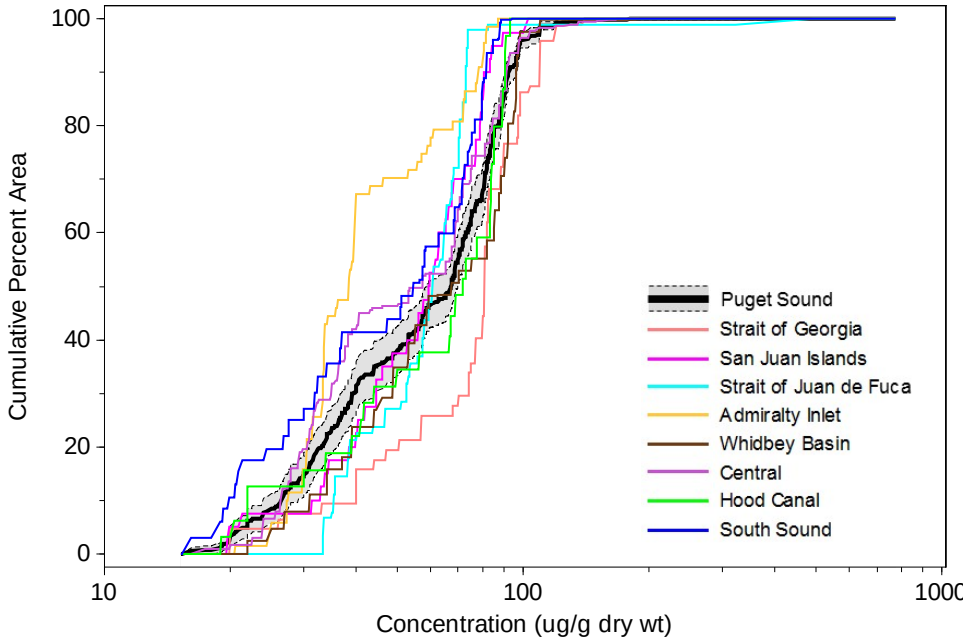




Zinc

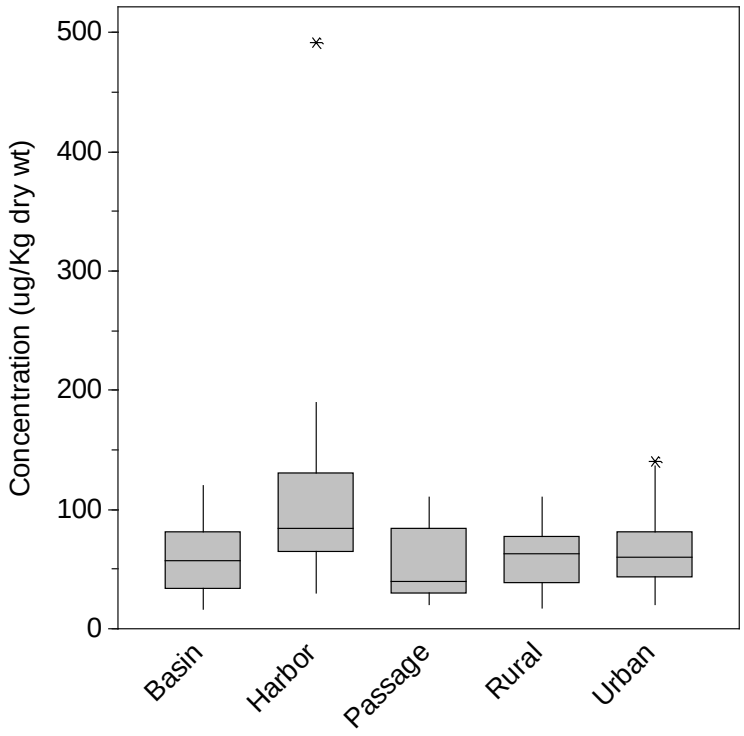
by Region

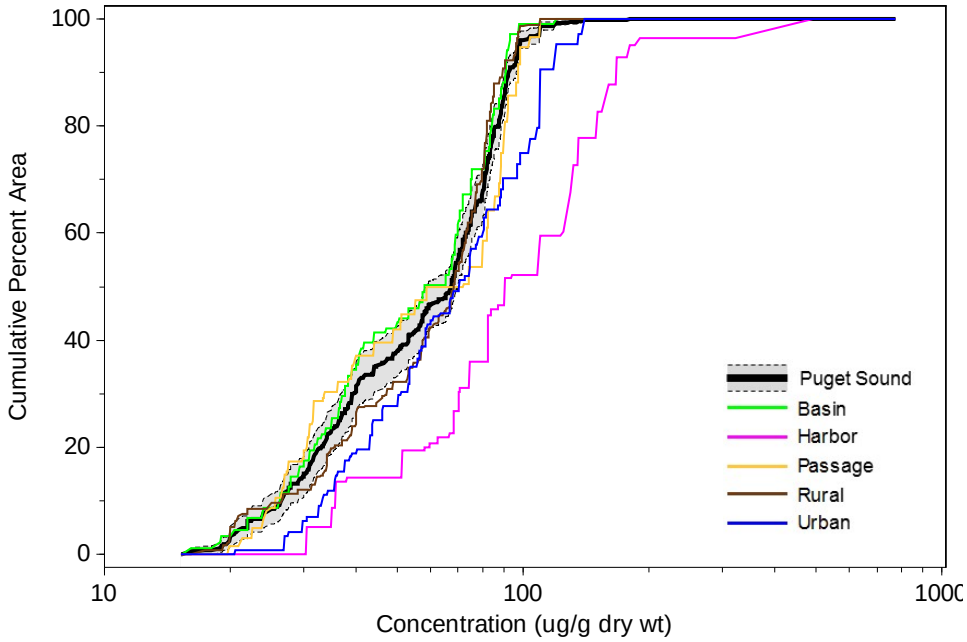




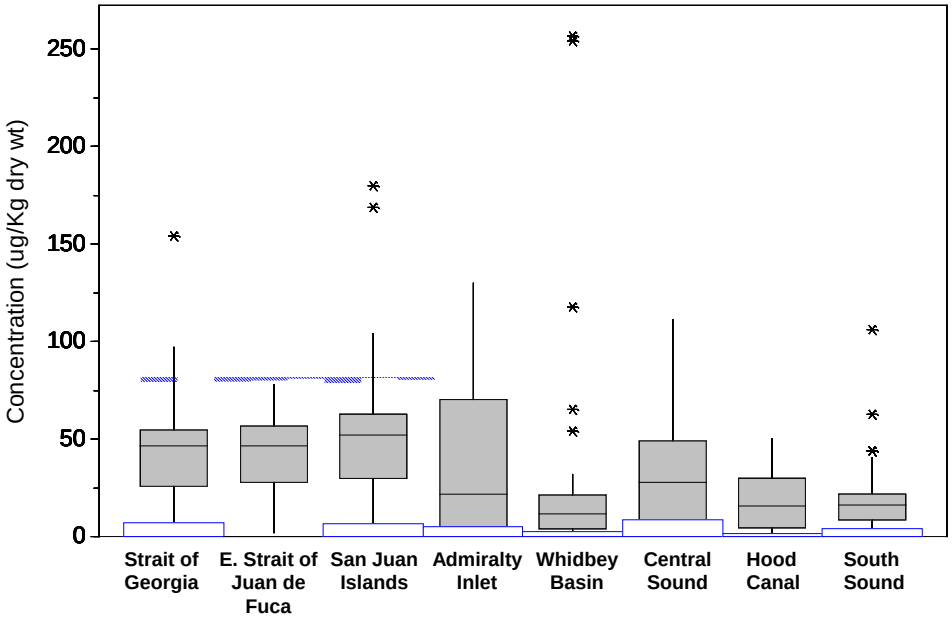
Zinc

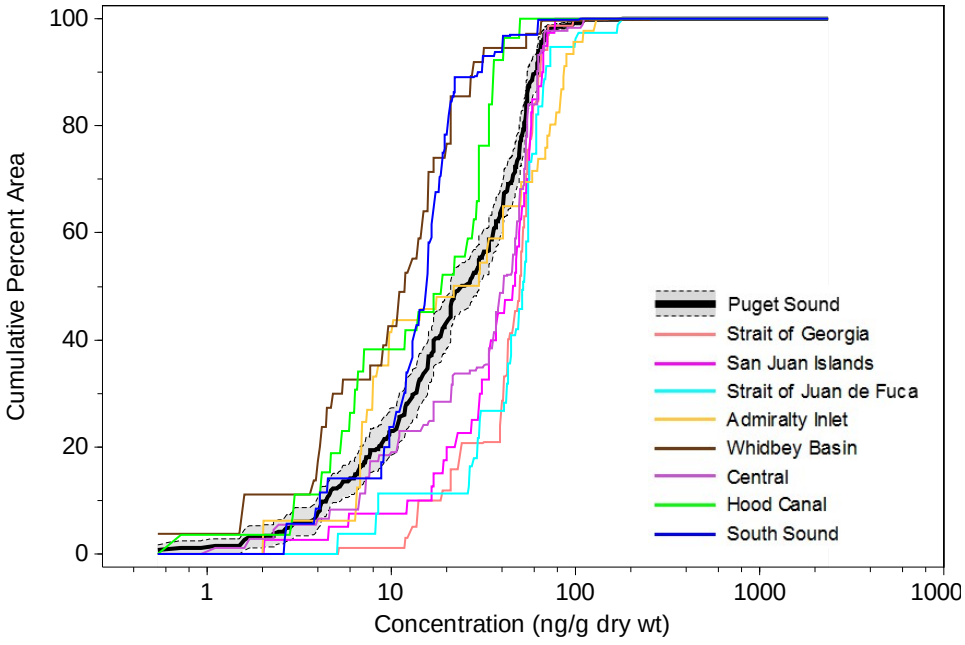
by Stratum



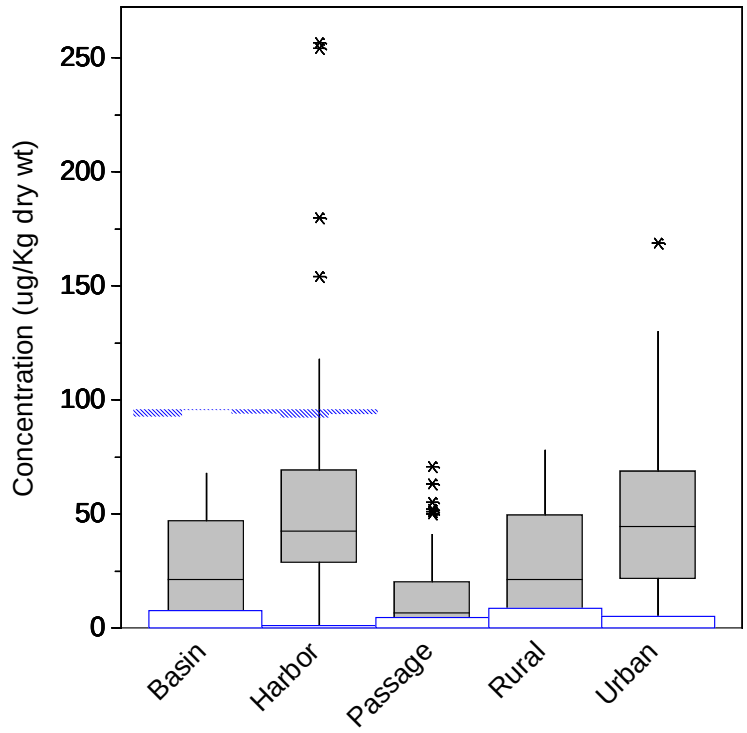


2-Methylnaphthalene by Region

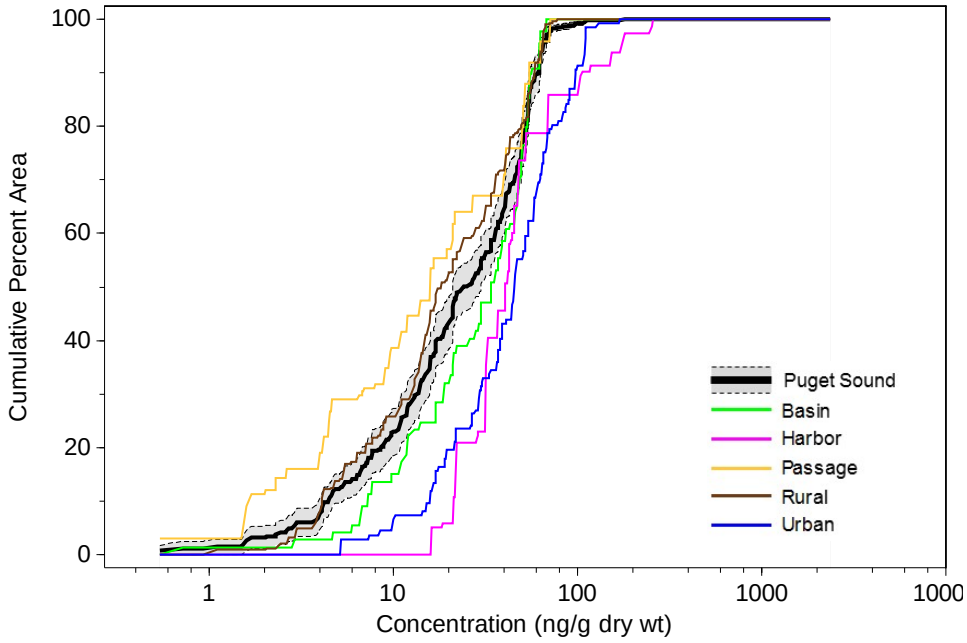




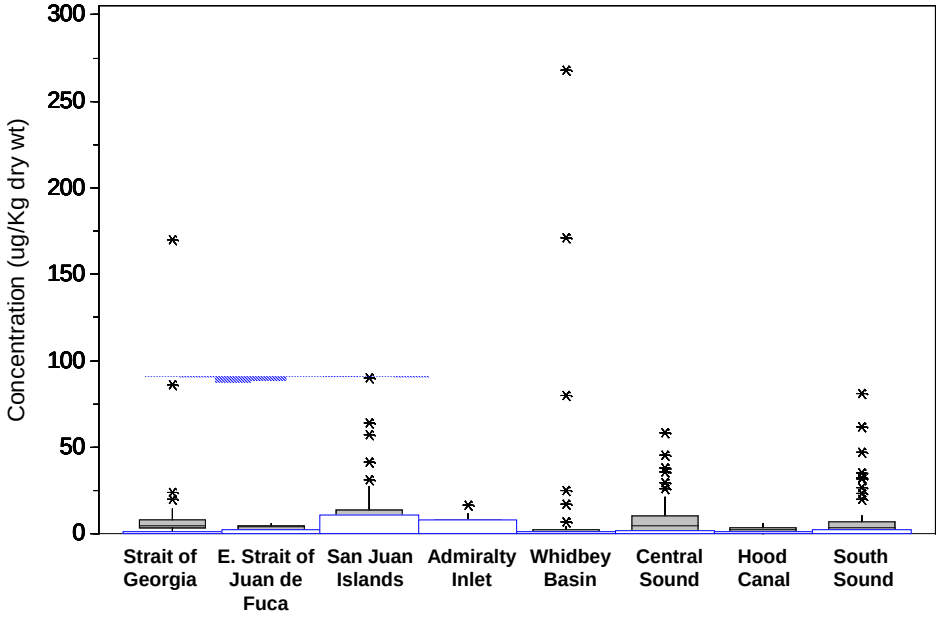
2-Methylnaphthalene by Stratum



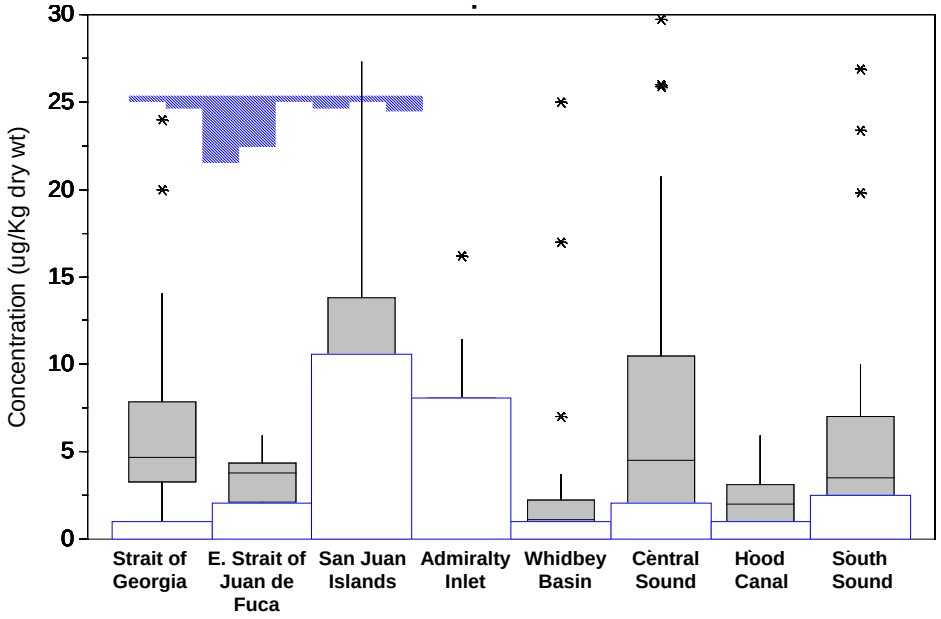
Zoomed in

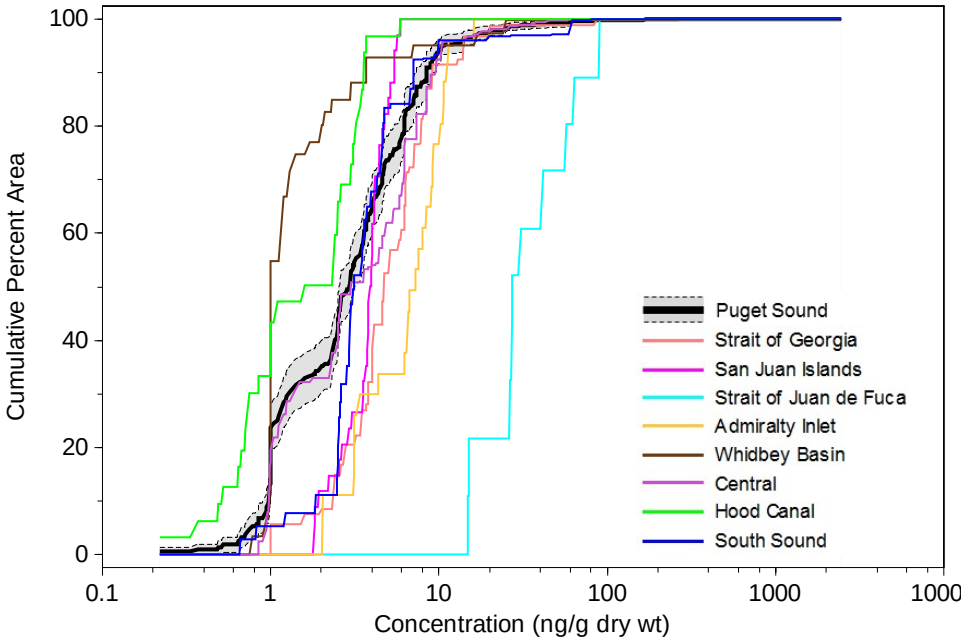


Acenaphthene by Region

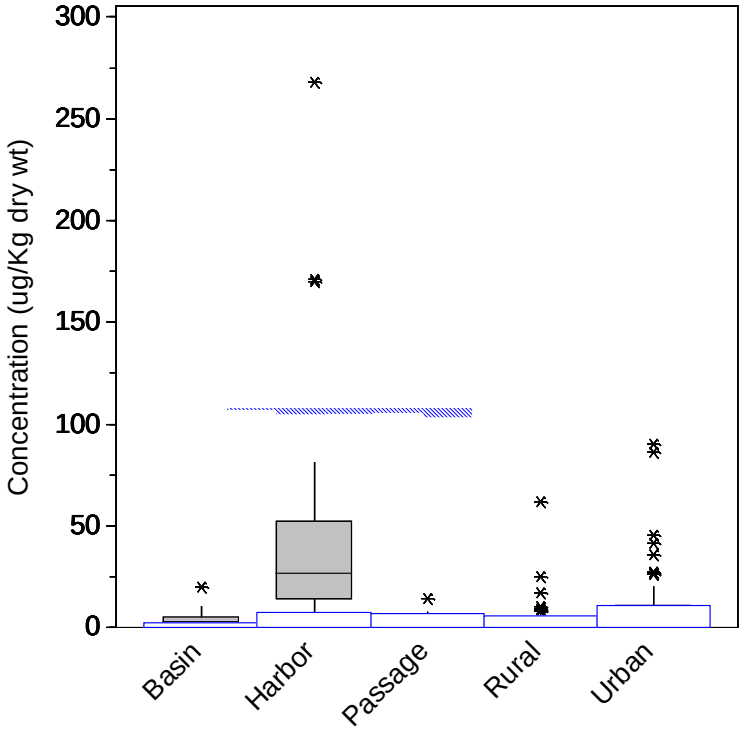


Zoomed in

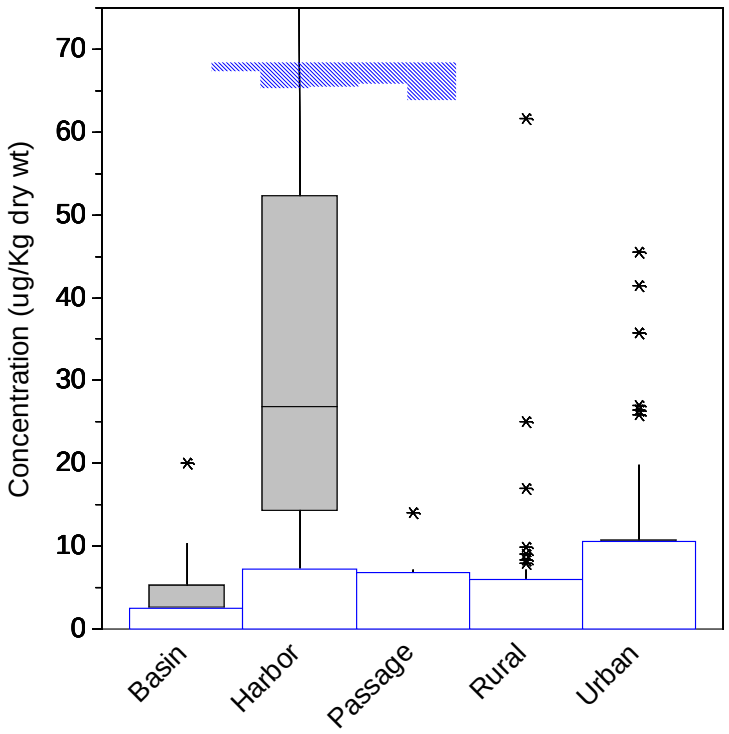


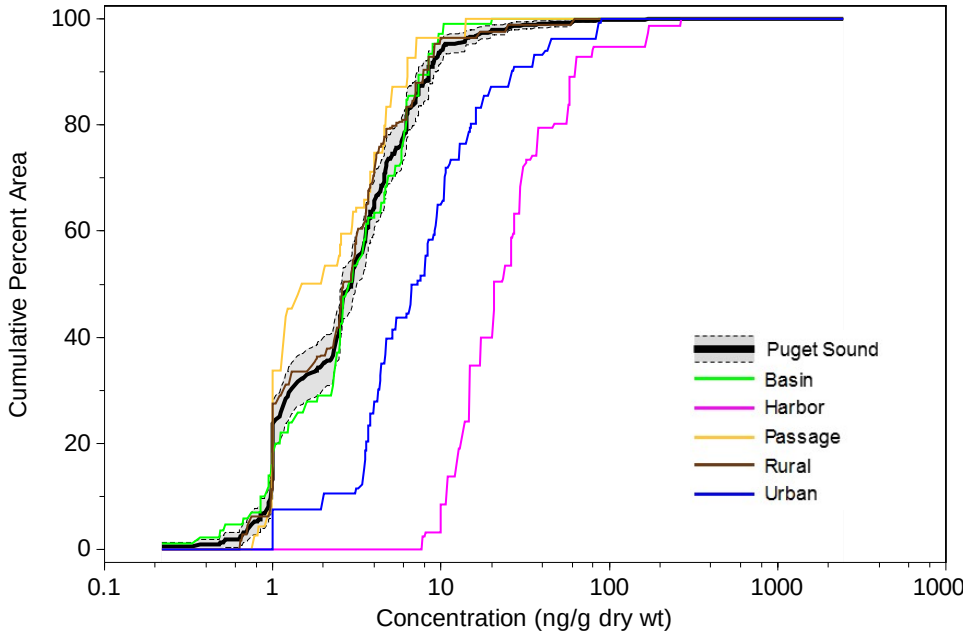

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Acenaphthene
by Stratum

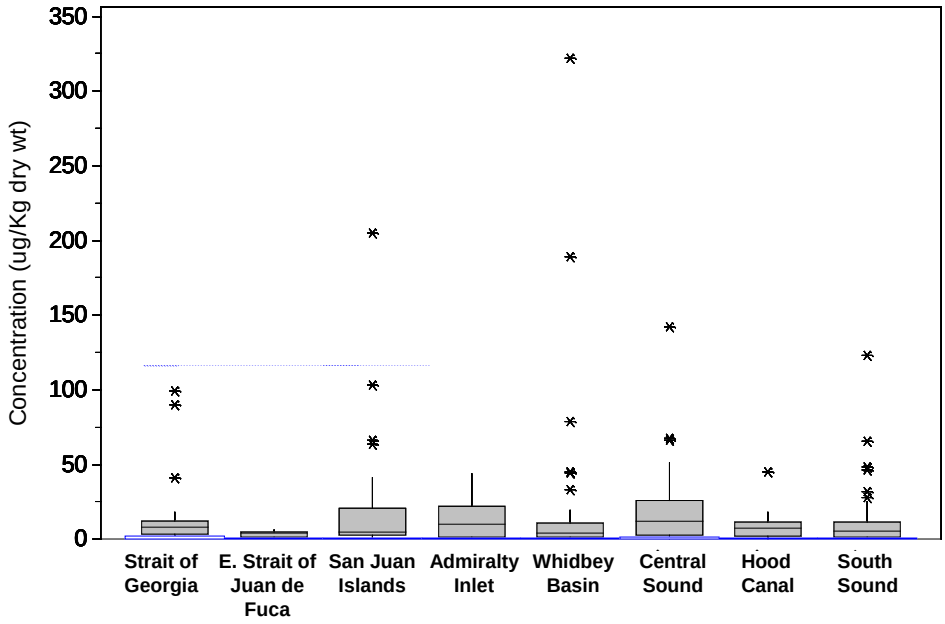


Zoomed in

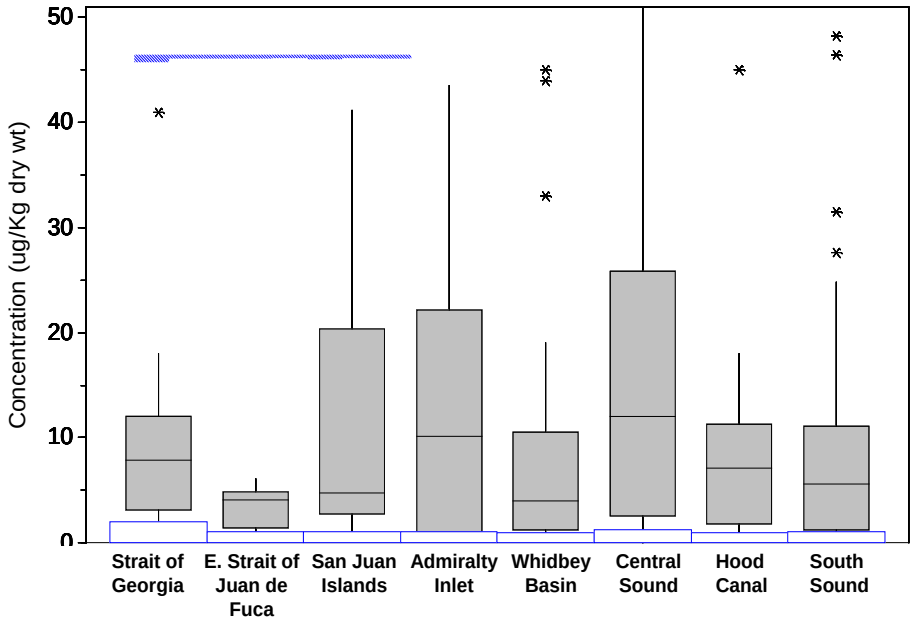


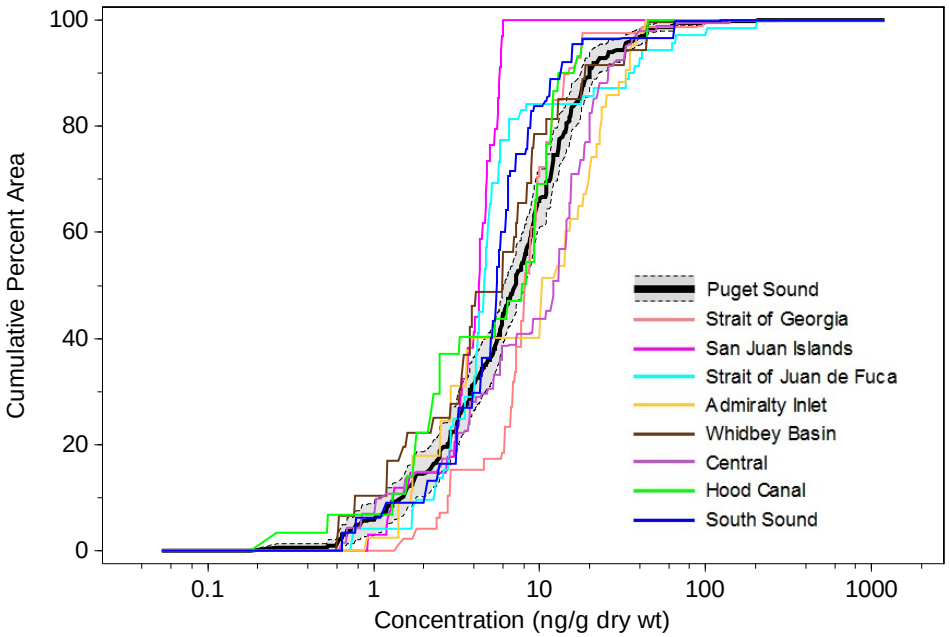

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Acenaphthylene by Region

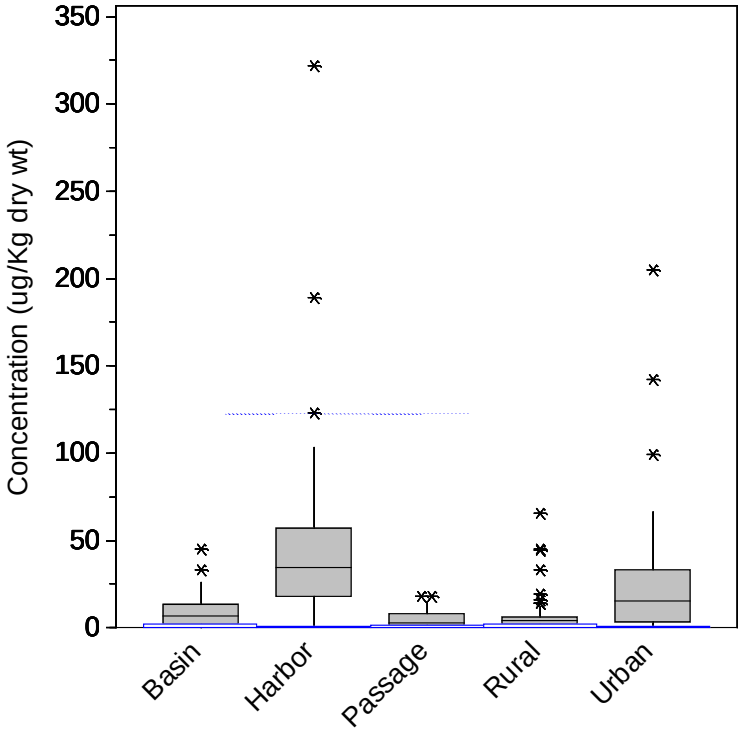


Zoomed in

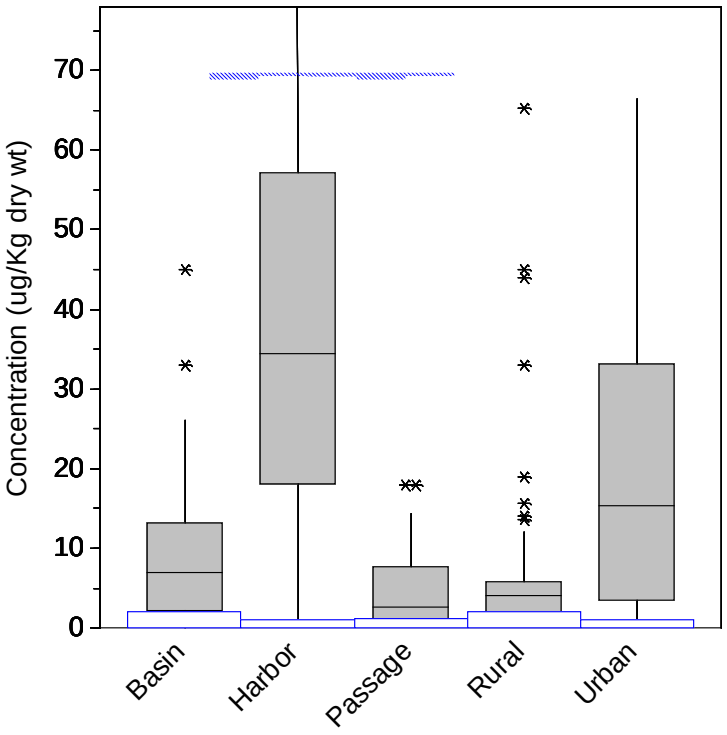


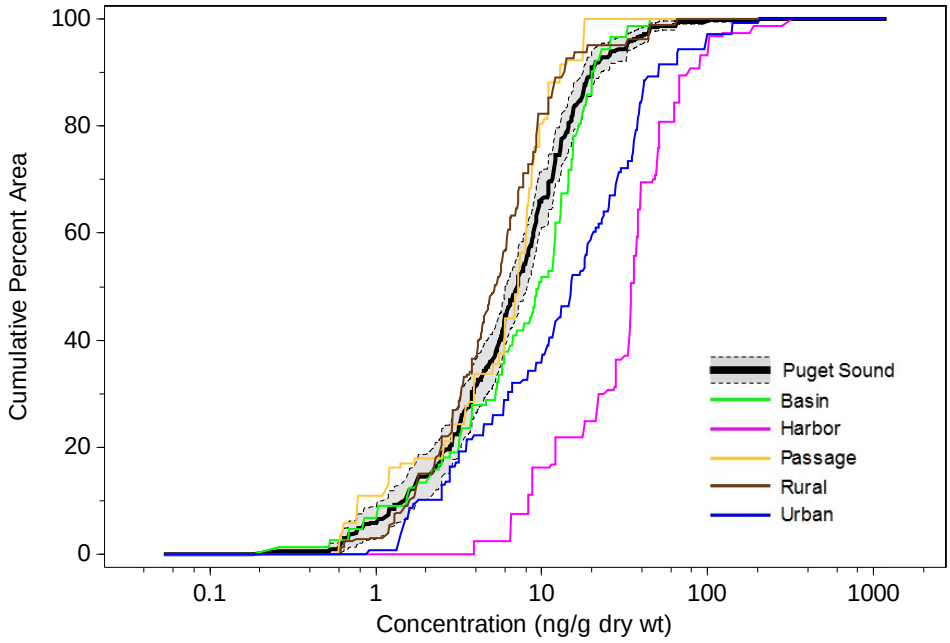

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Acenaphthylene by Stratum

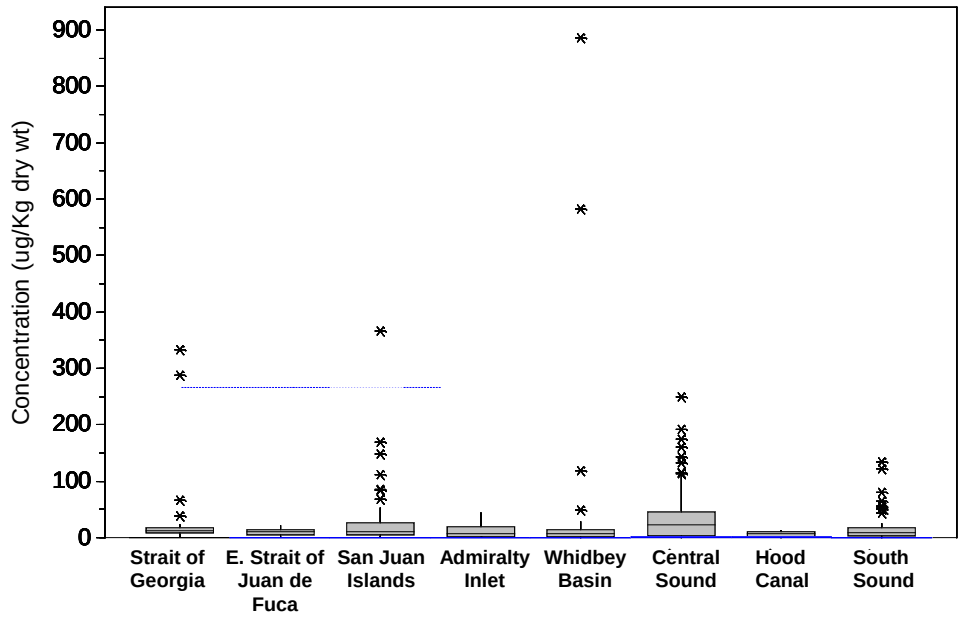


Zoomed in

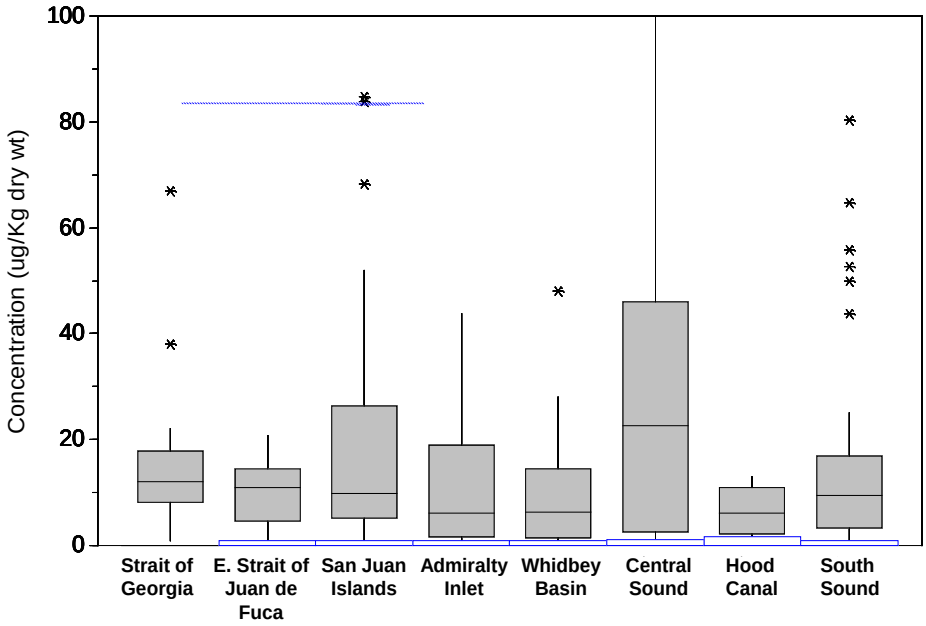


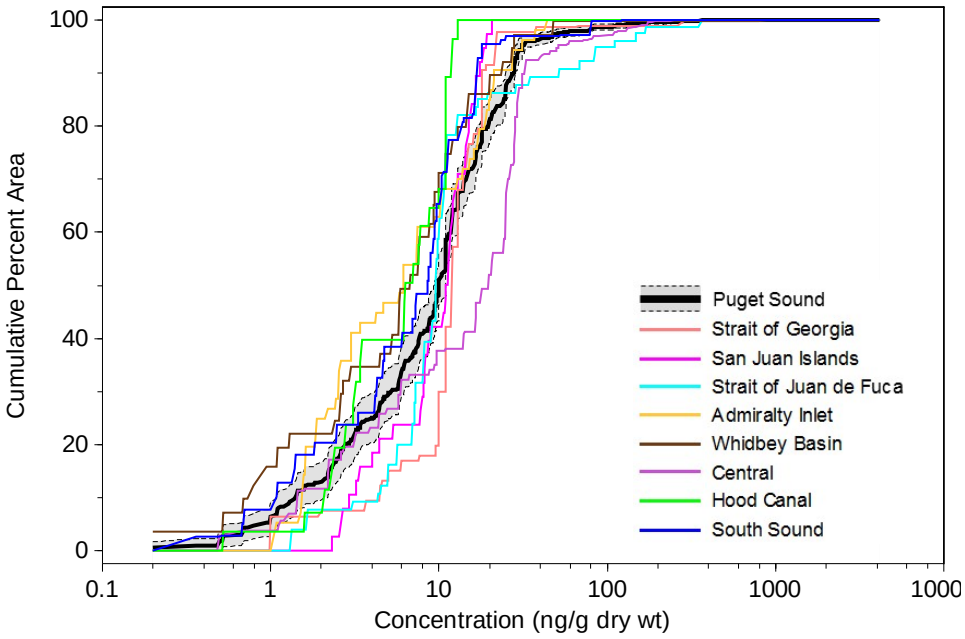

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Anthracene
by Region

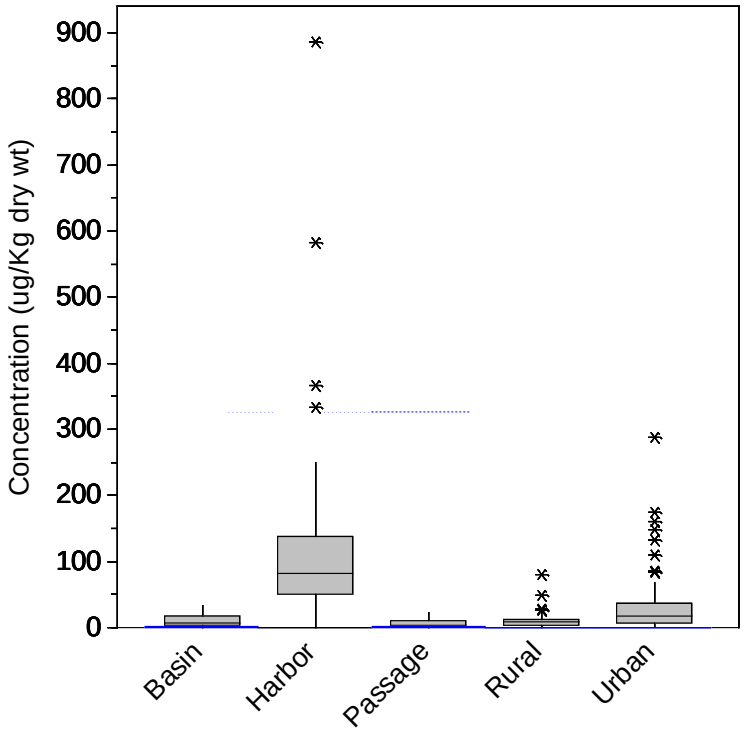


Zoomed in

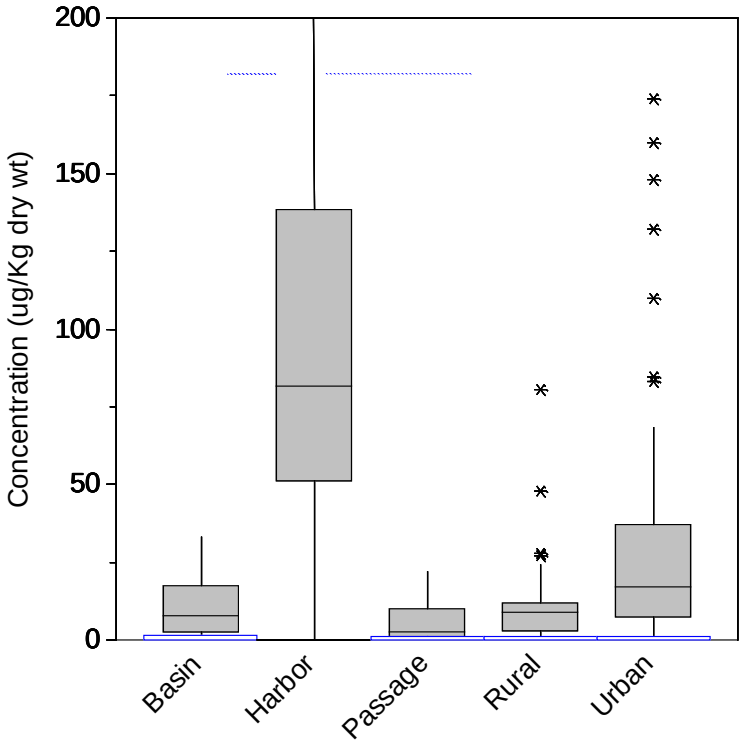


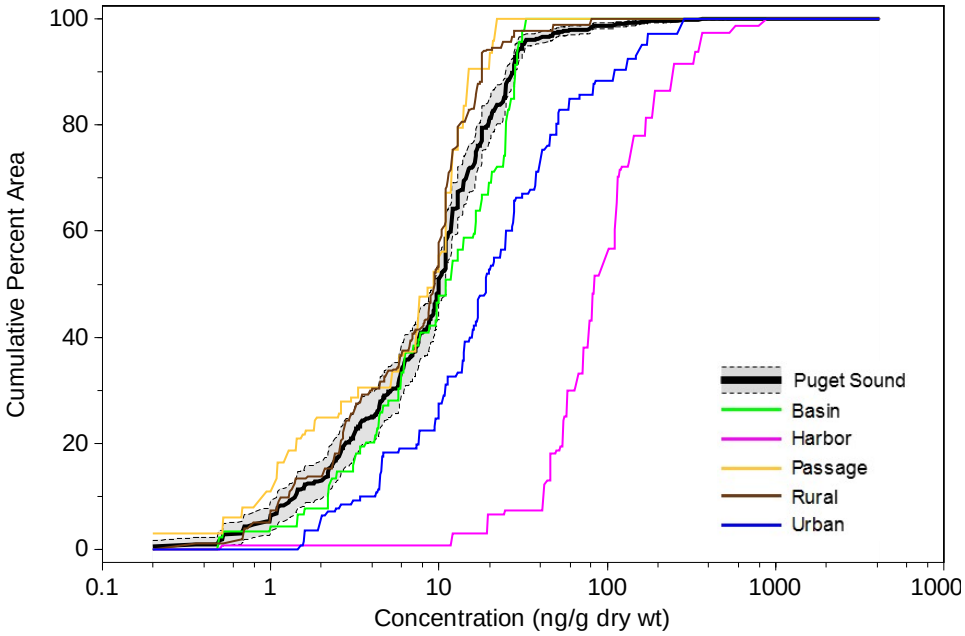

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Anthracene
by Stratum

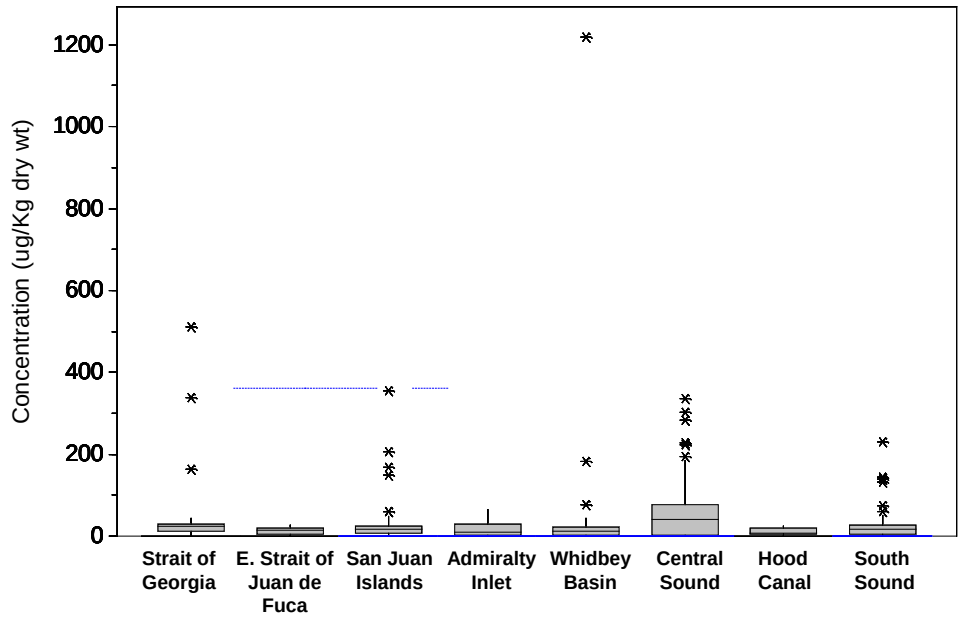


Zoomed in

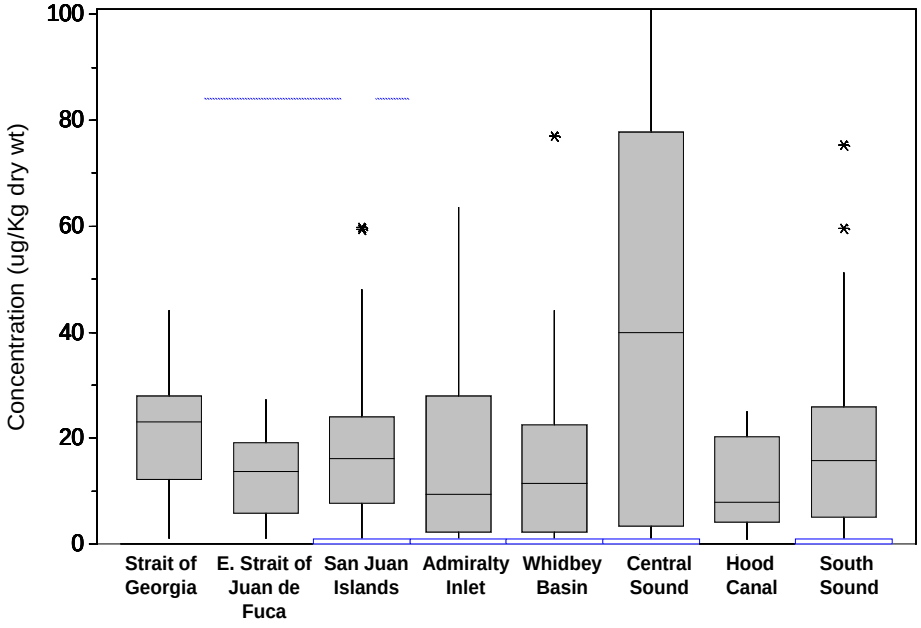


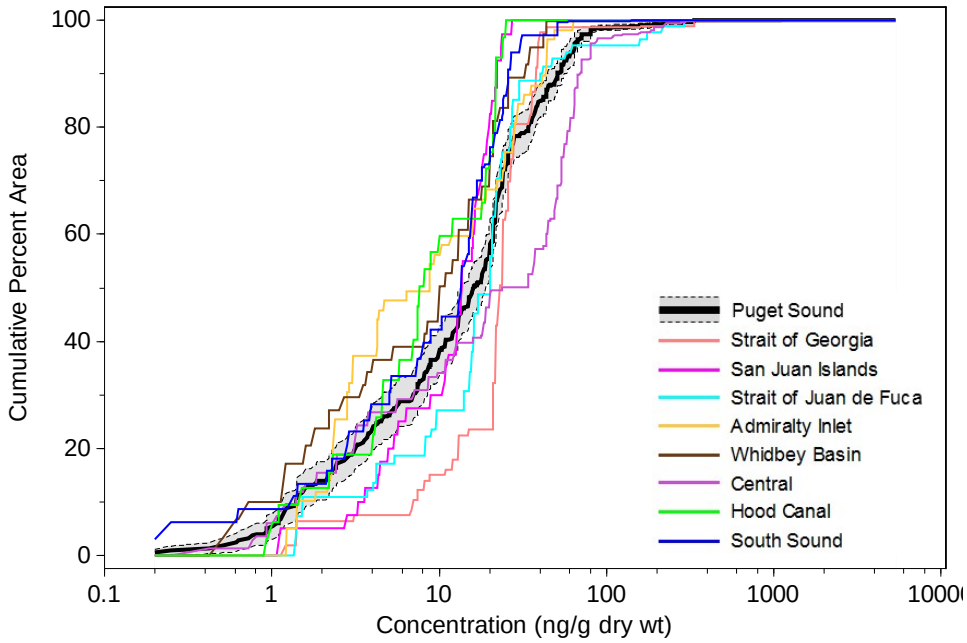

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Benzo(a)anthracene by Region

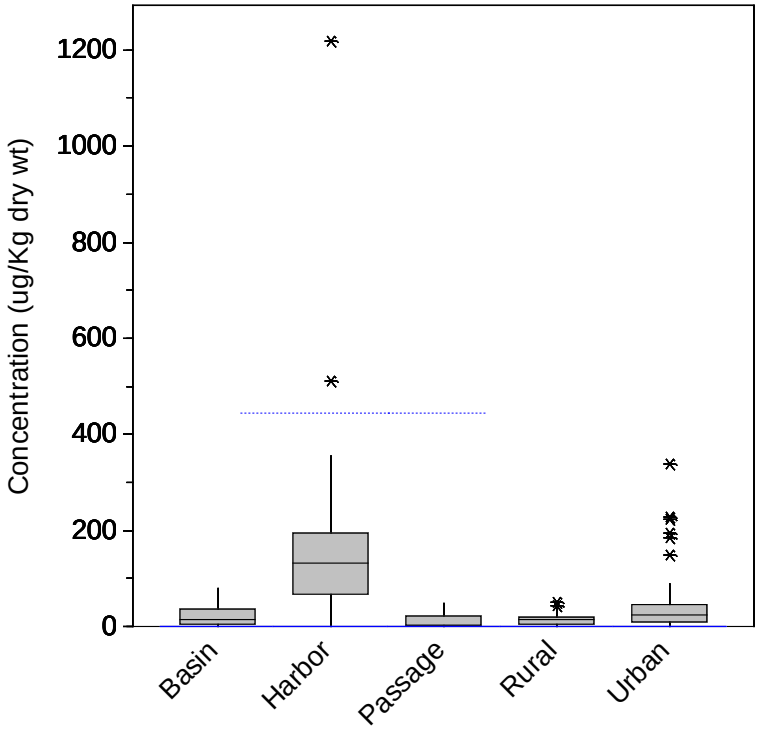


Zoomed in

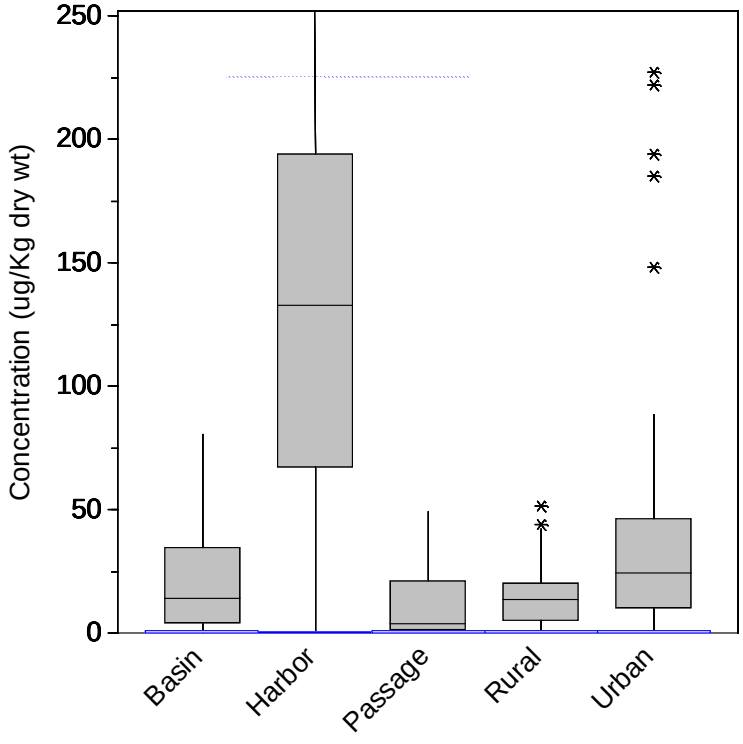


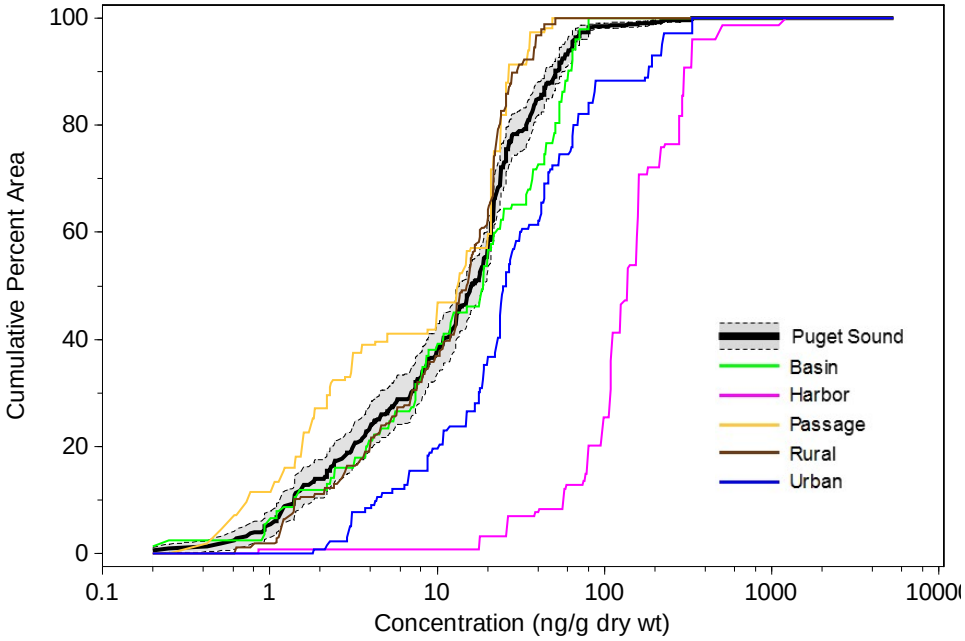

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Benzo(a)anthracene by Stratum

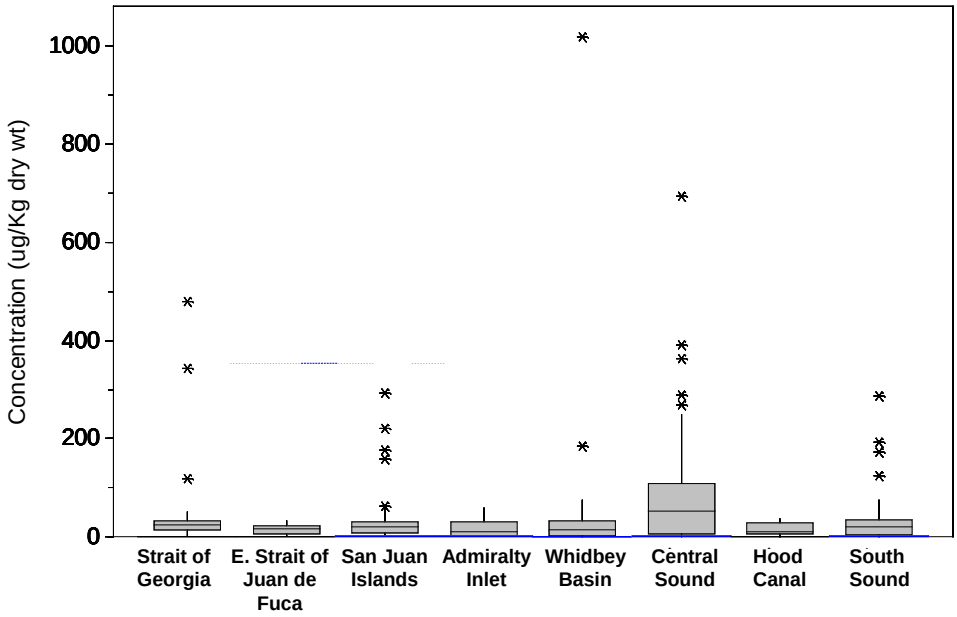


Zoomed in

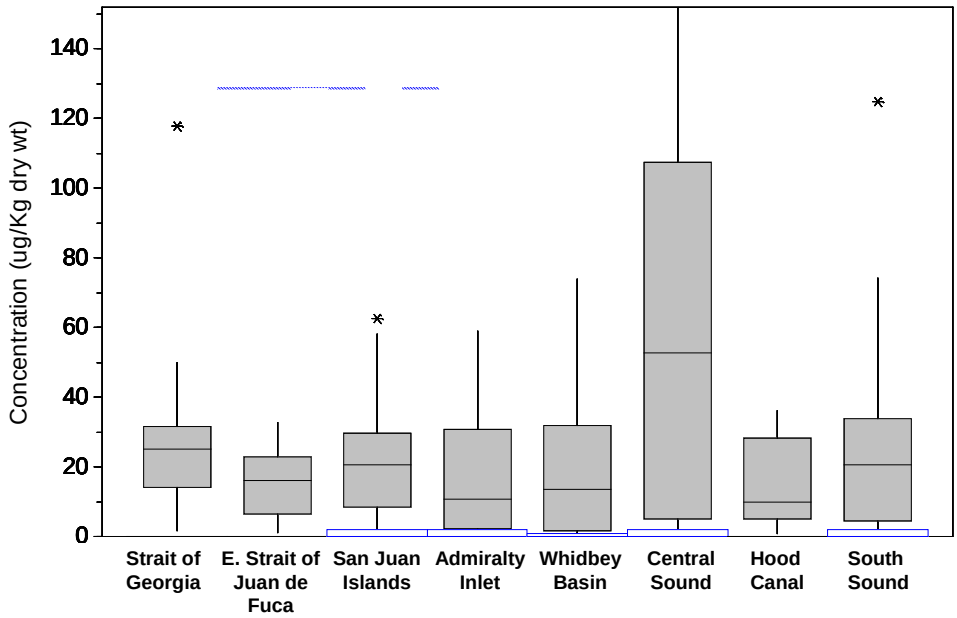


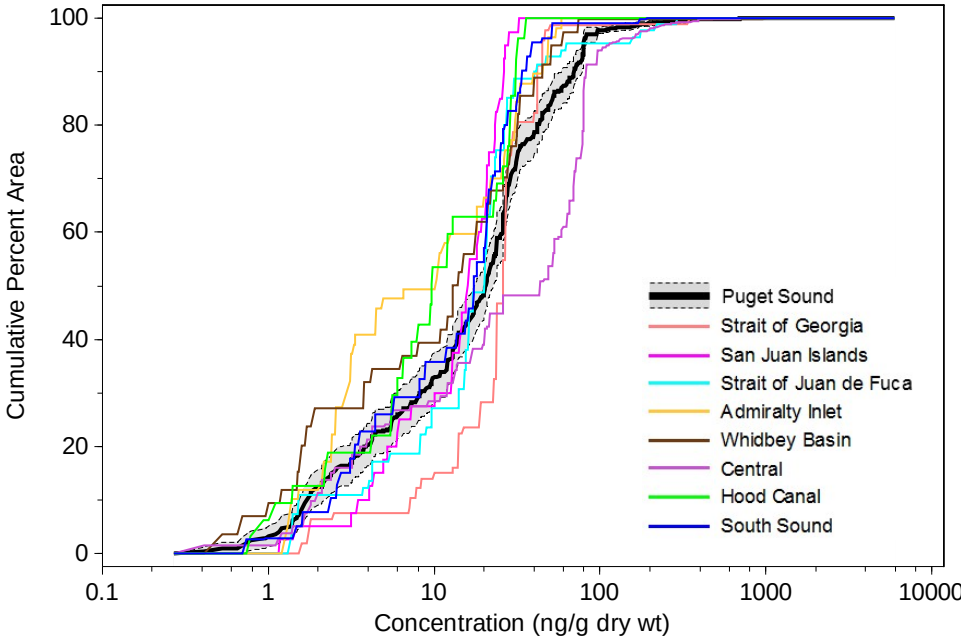

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Benzo(a)pyrene by Region

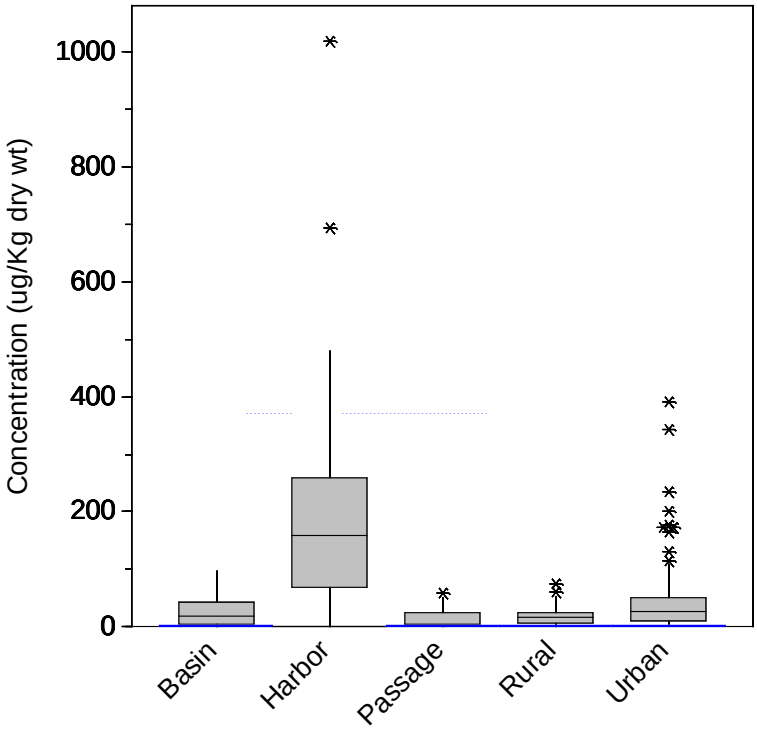


Zoomed in

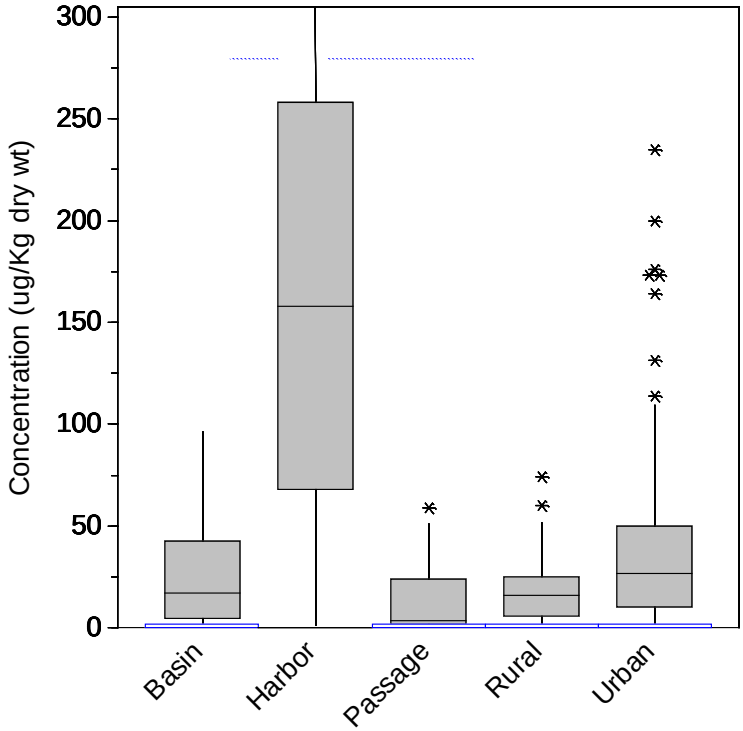


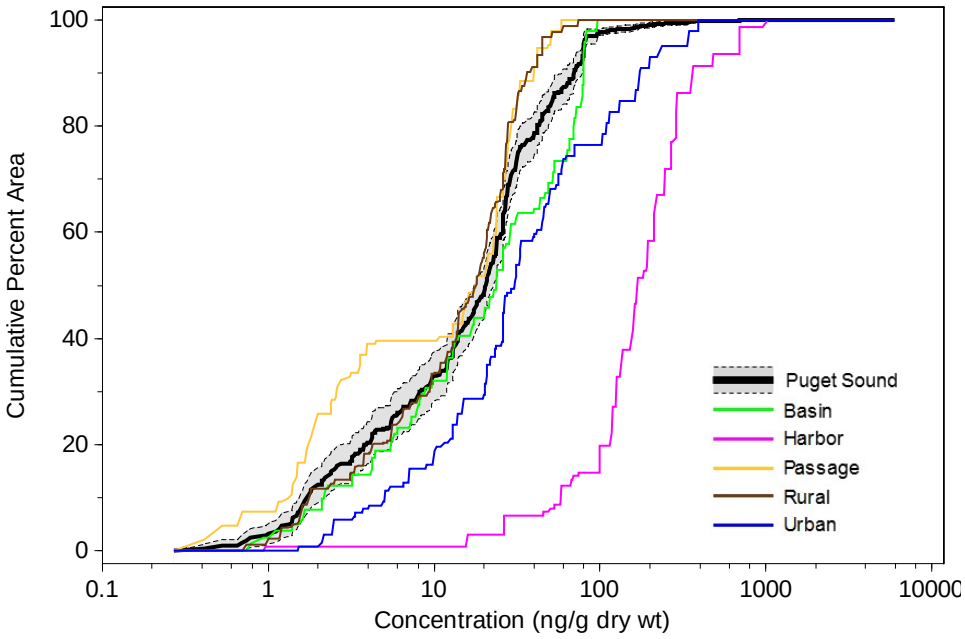

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Benzo(a)pyrene by Stratum

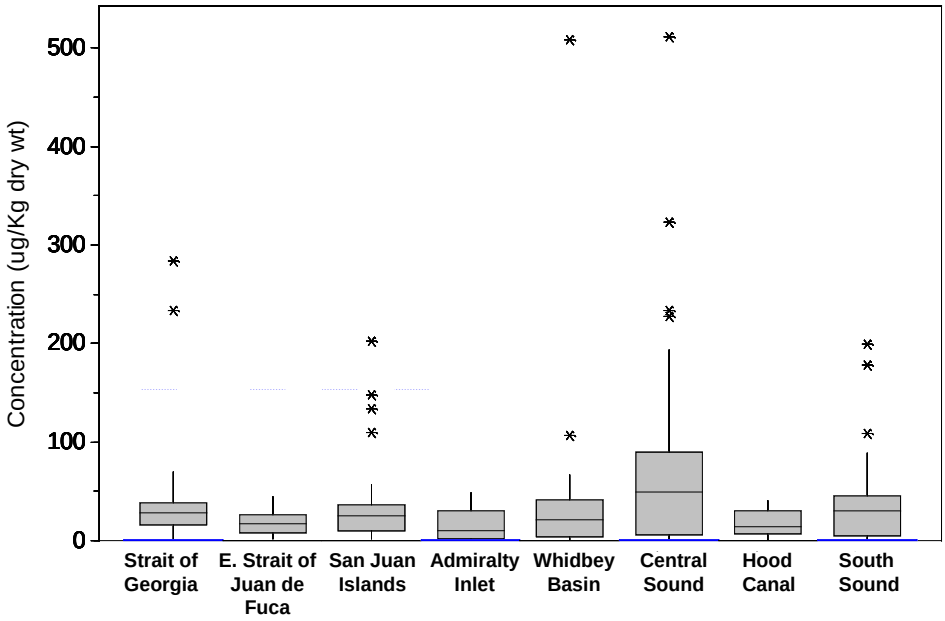


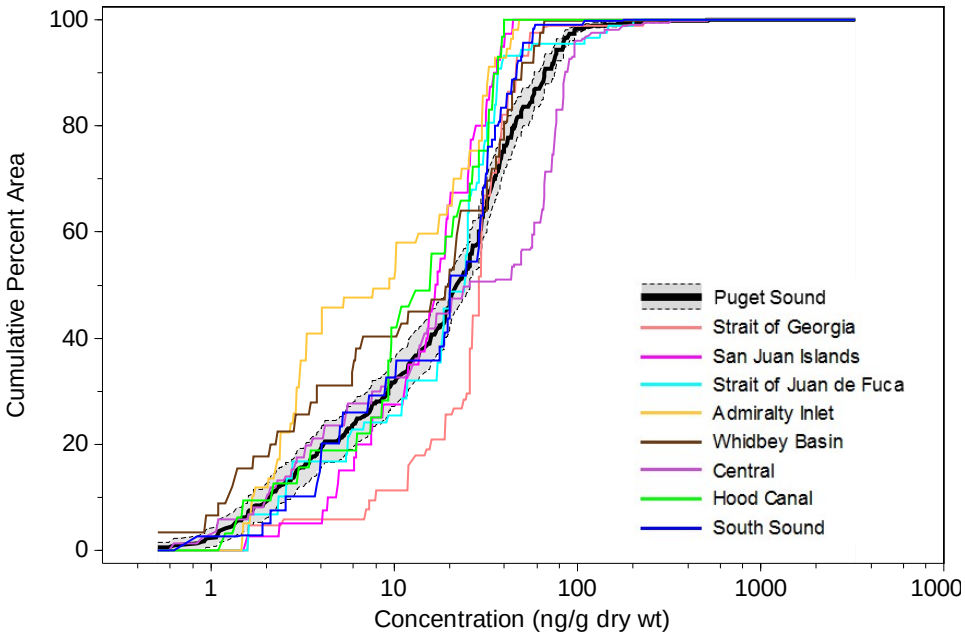
Zoomed in



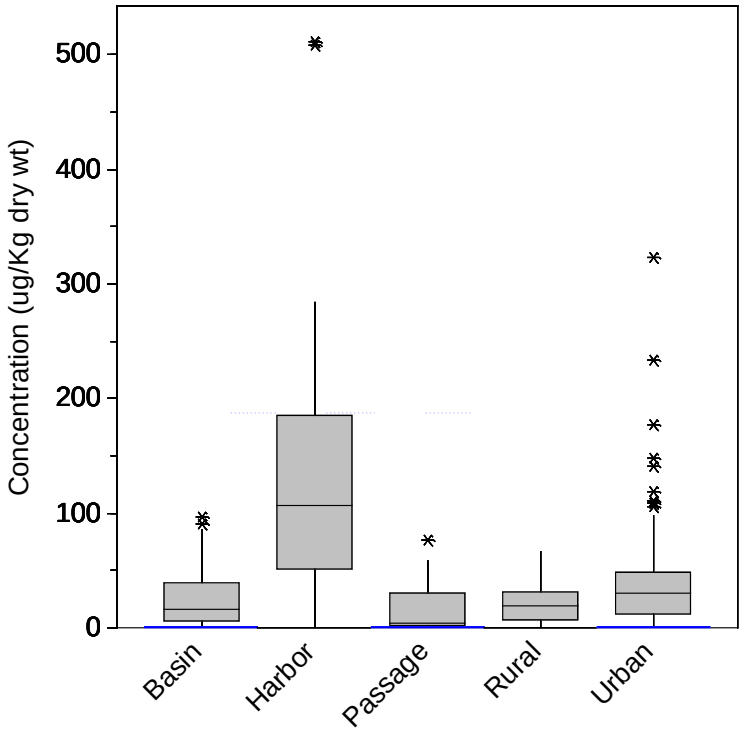

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

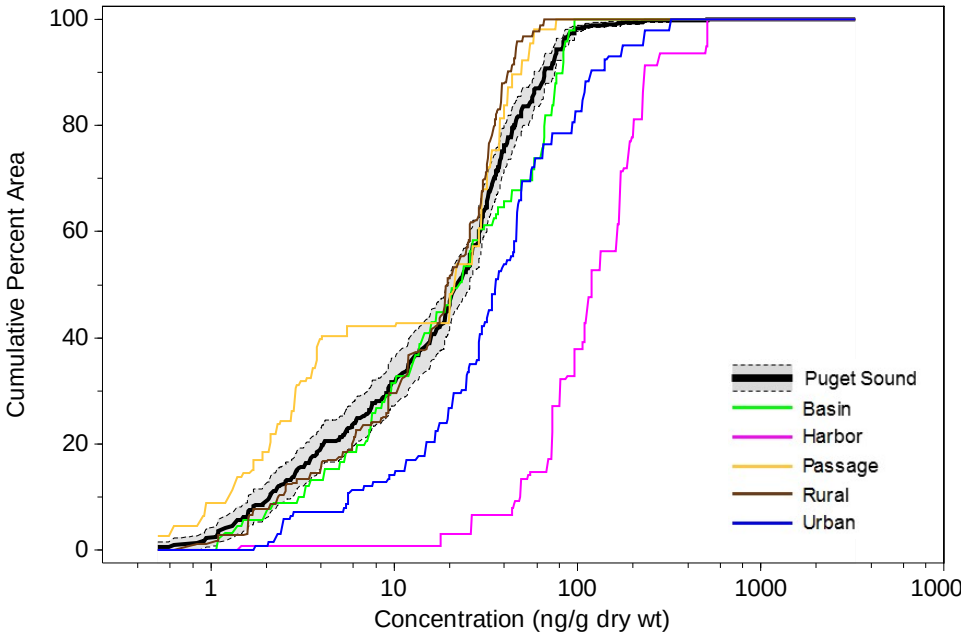
Benzo(g,h,i)perylene by Region



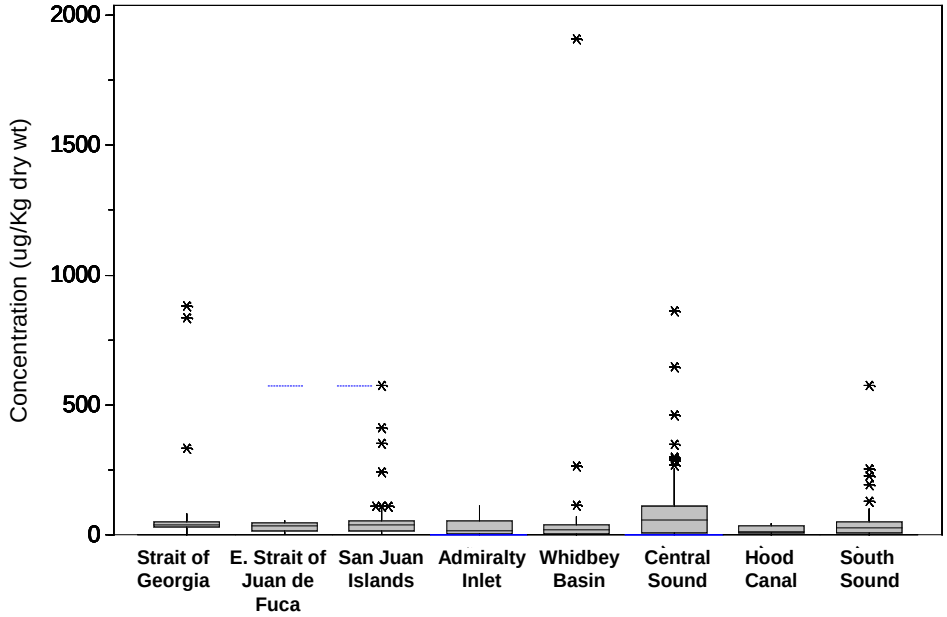


Benzo(g,h,i)perylene by Stratum

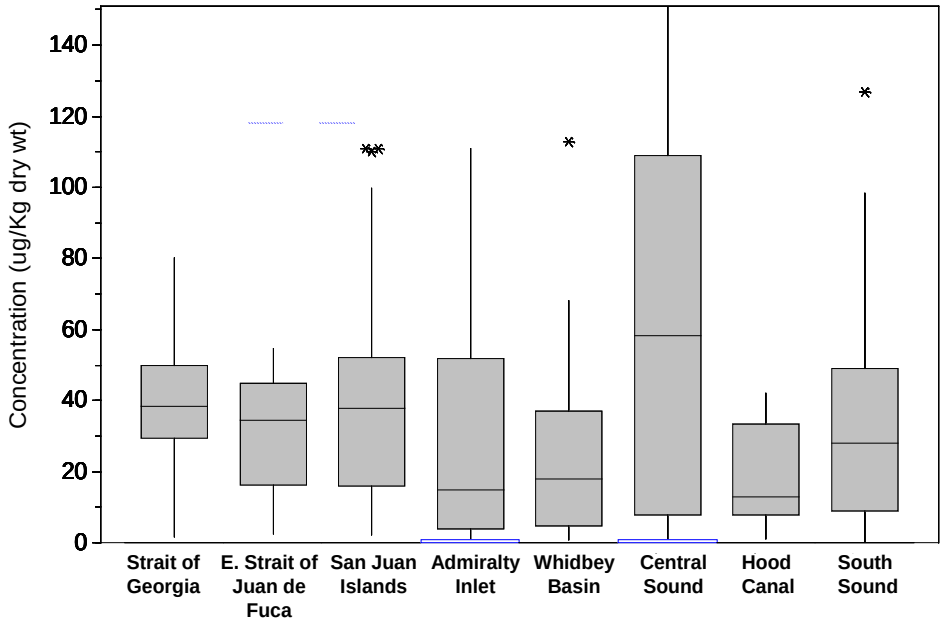


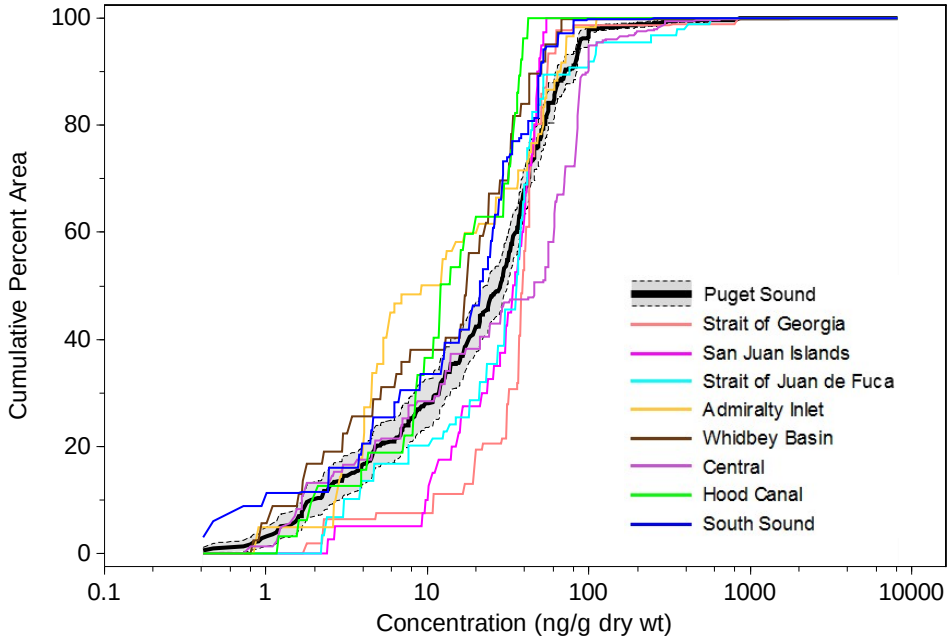


Chrysene
by Region

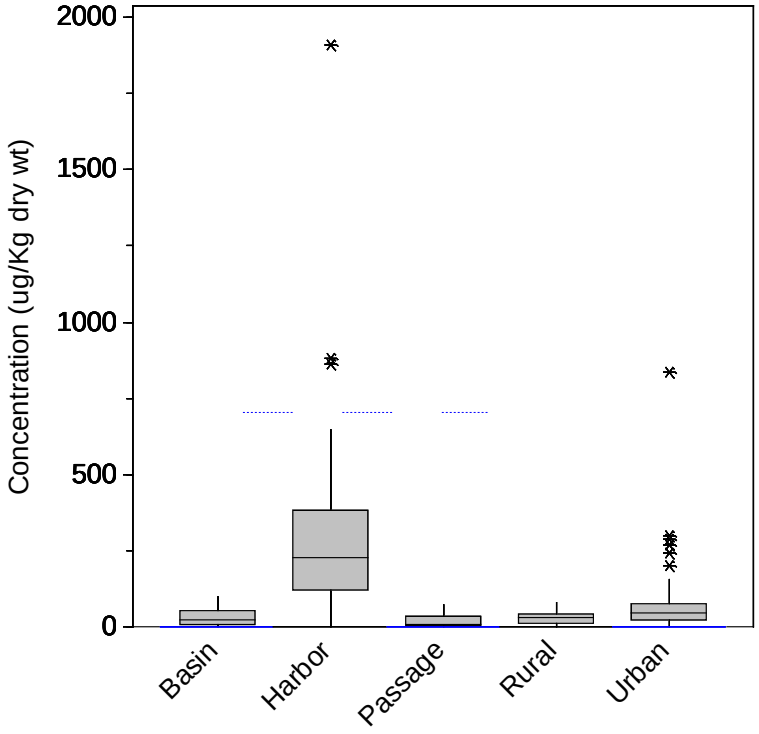


Zoomed in

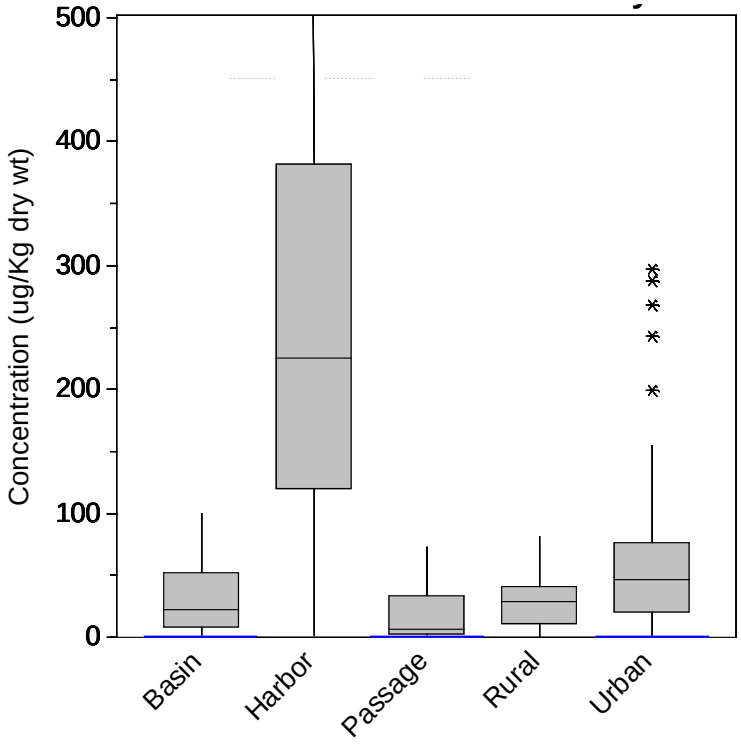


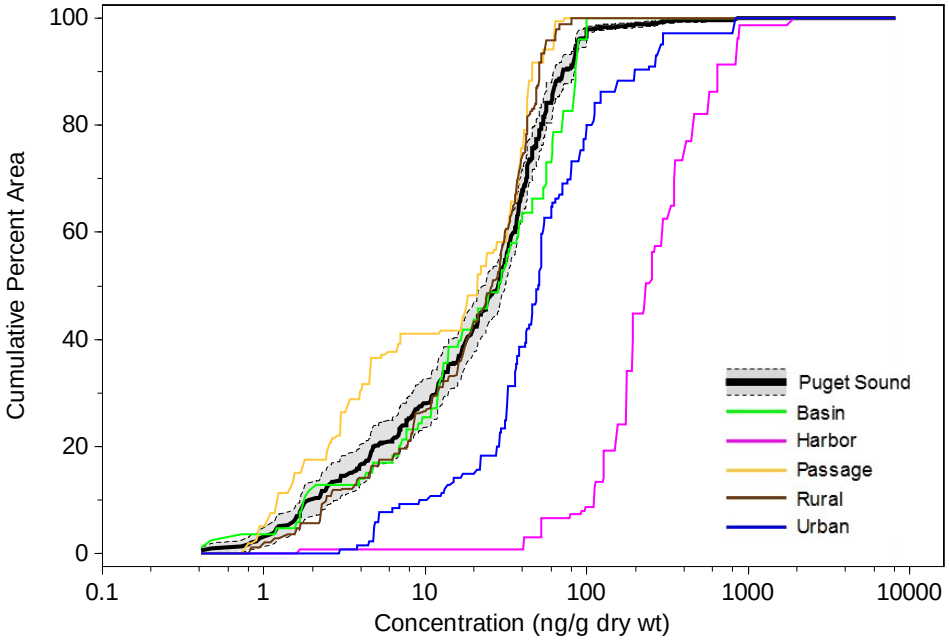

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Chrysene
by Stratum

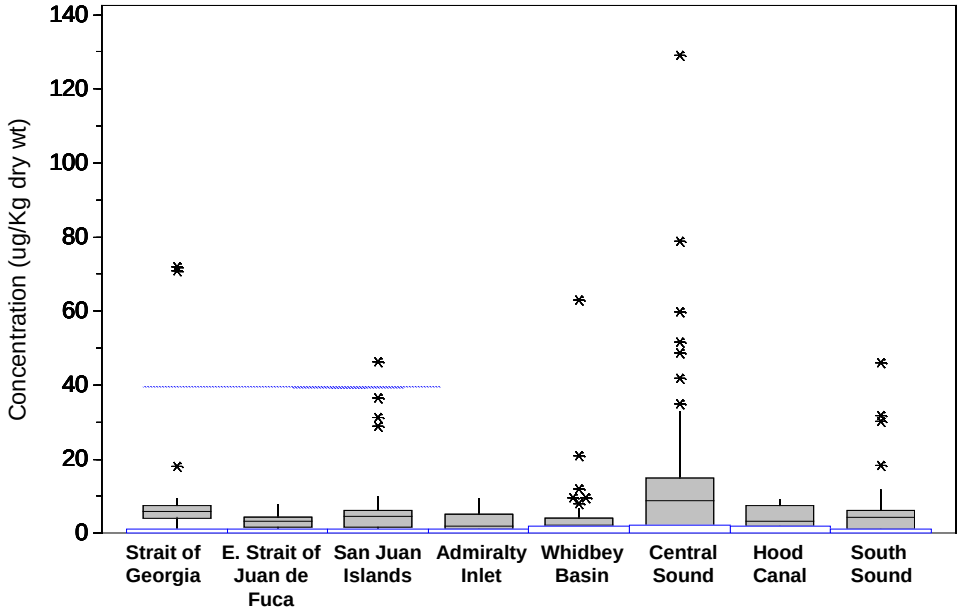


Zoomed in

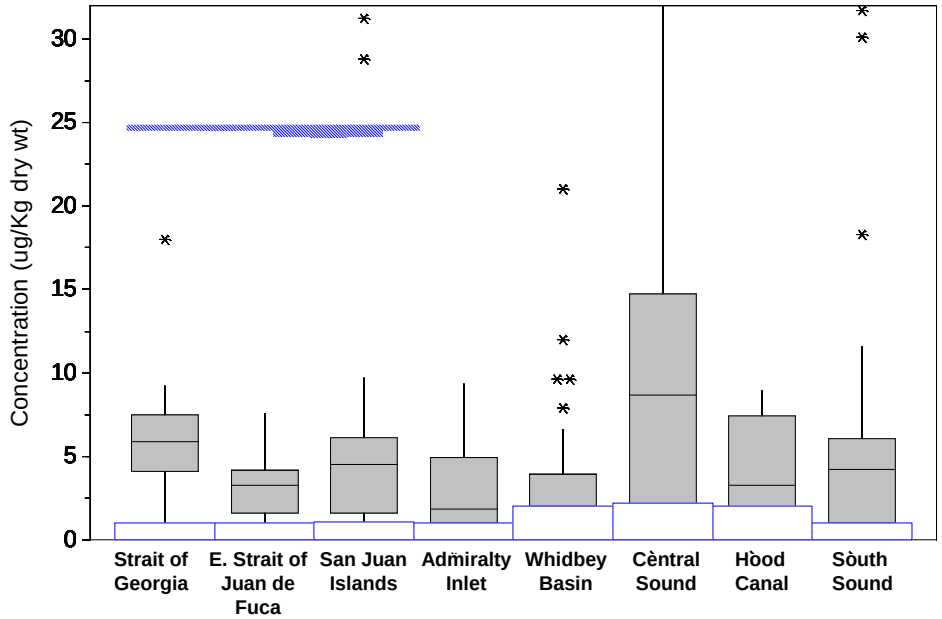


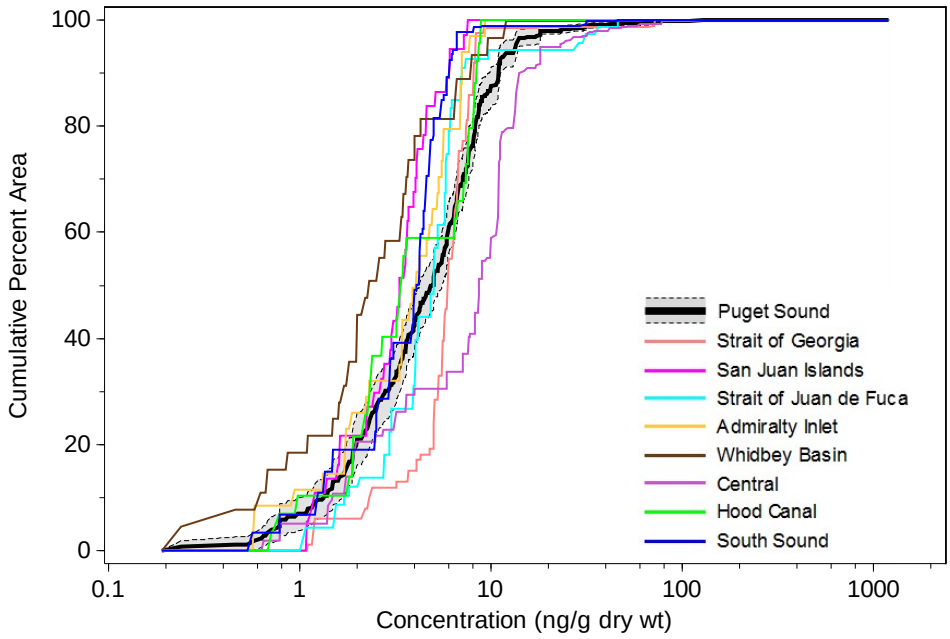

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Dibenzo(a,h)anthracene by Region

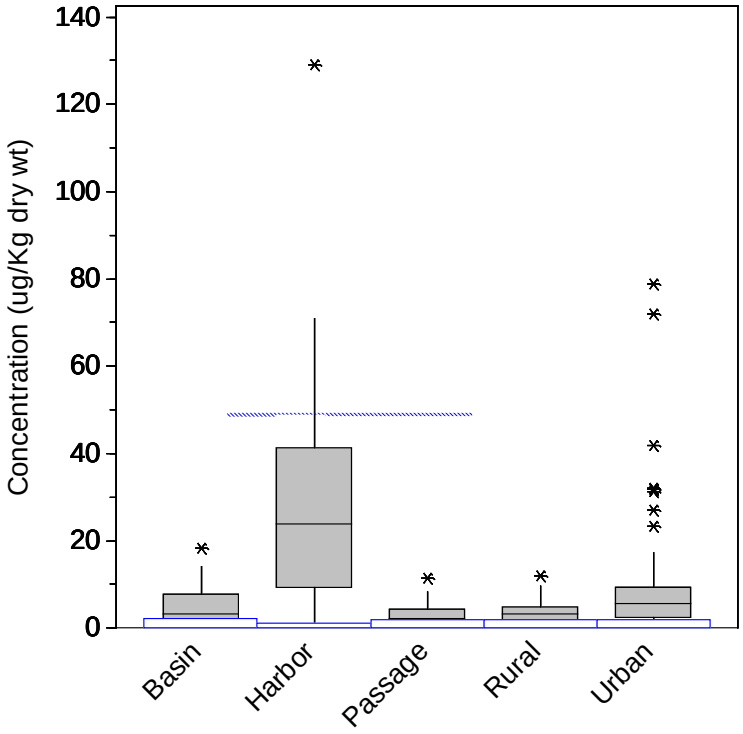


Zoomed in

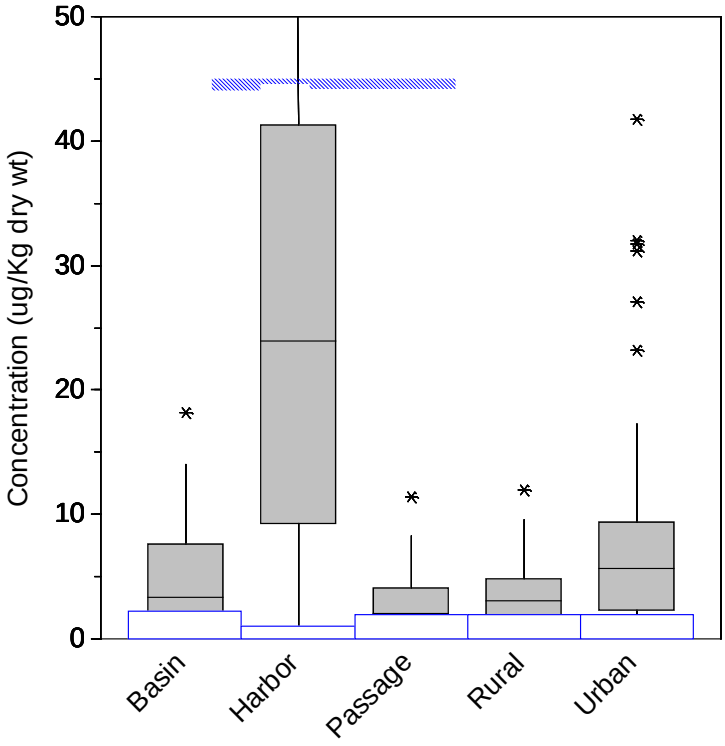


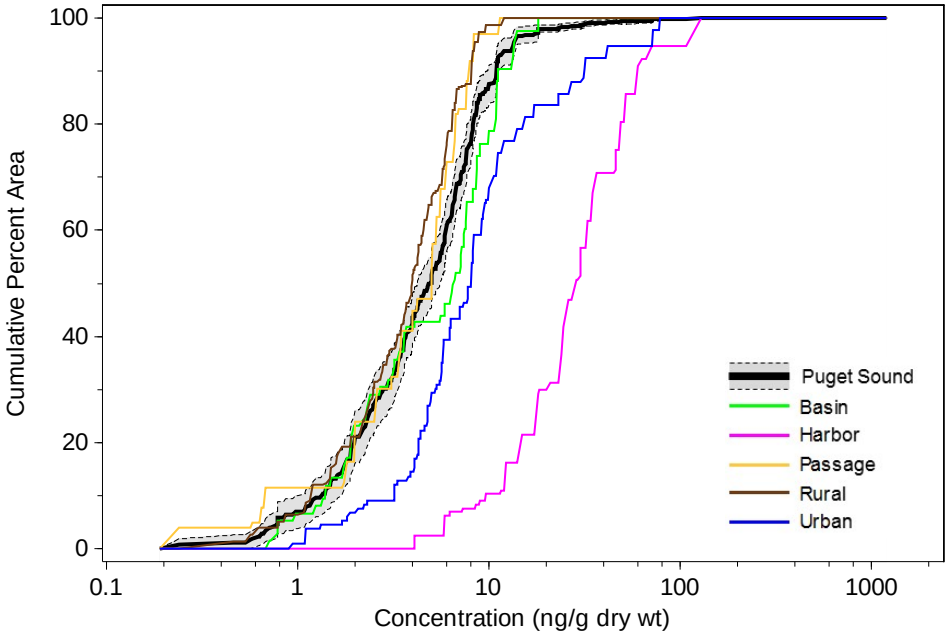

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Dibenzo(a,h)anthracene by Stratum

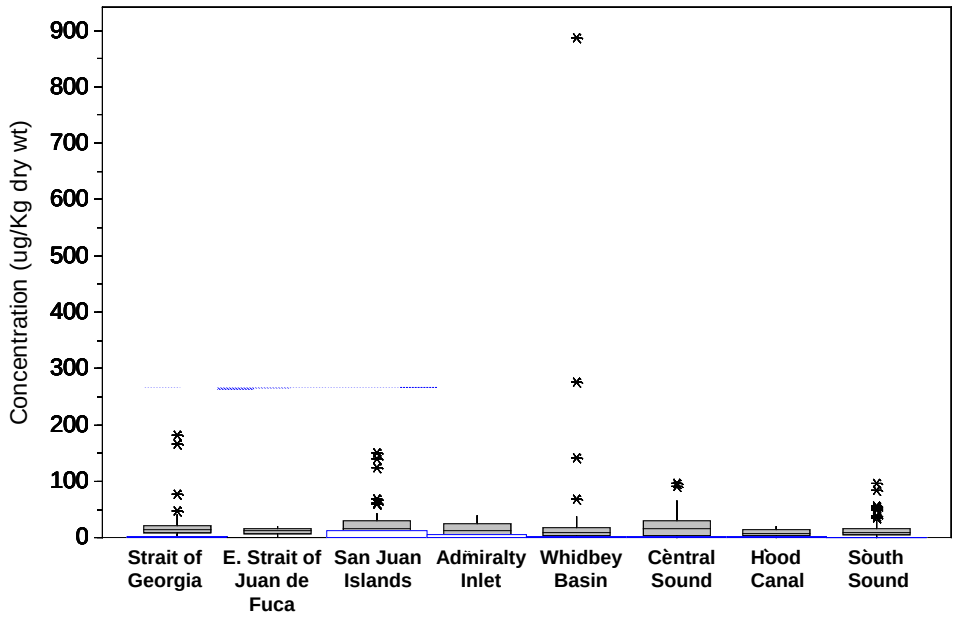


Zoomed in

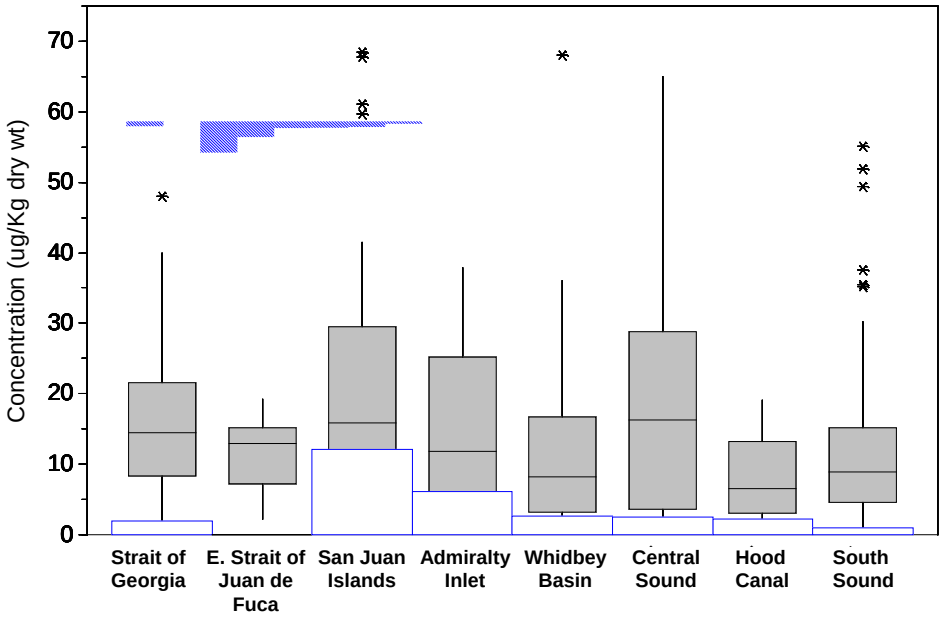


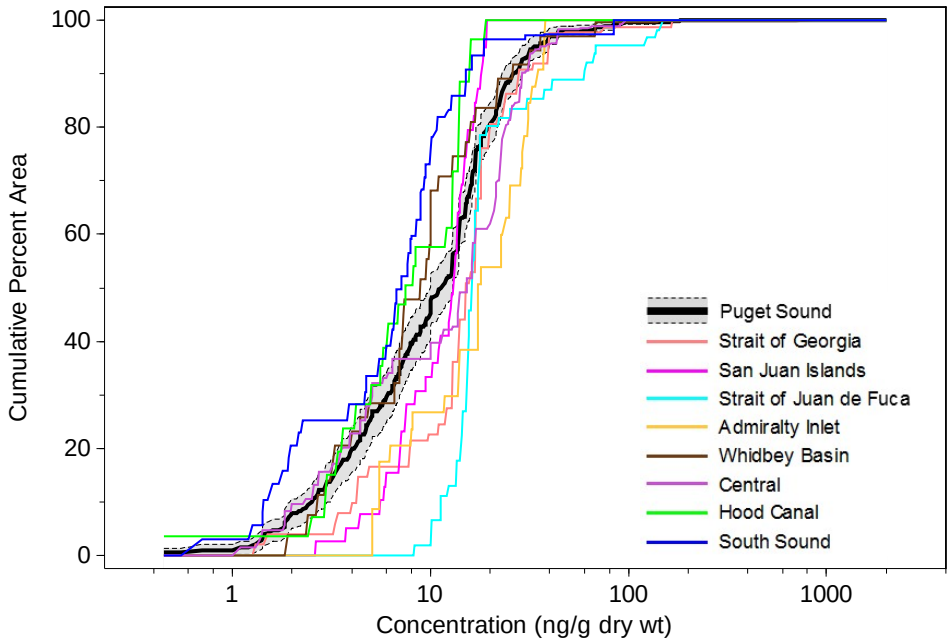

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Dibenzofuran
by Region

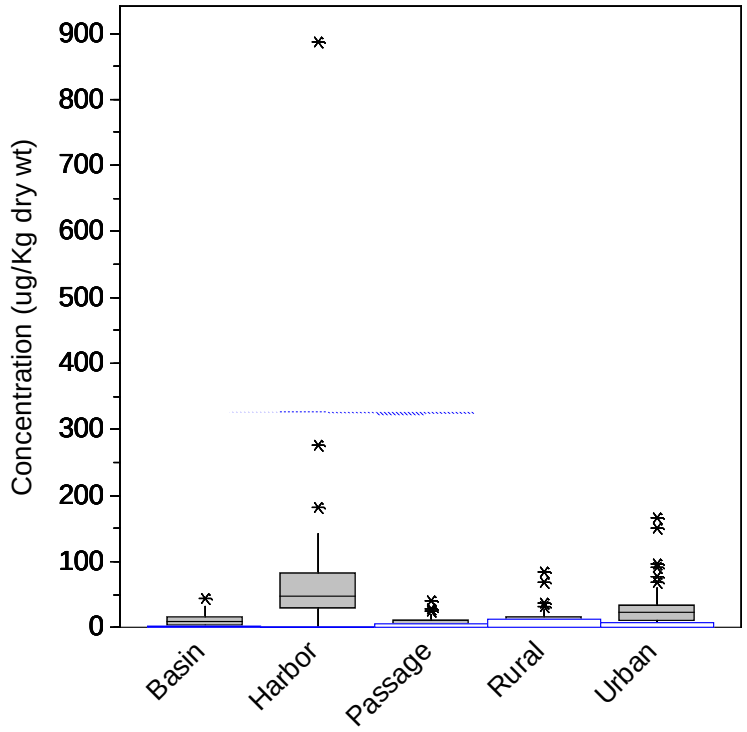


Zoomed in

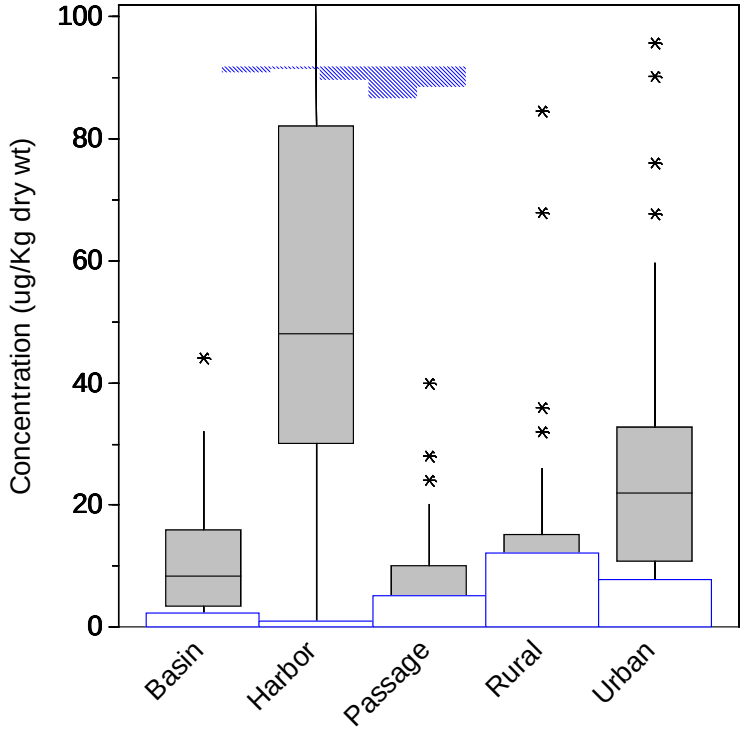


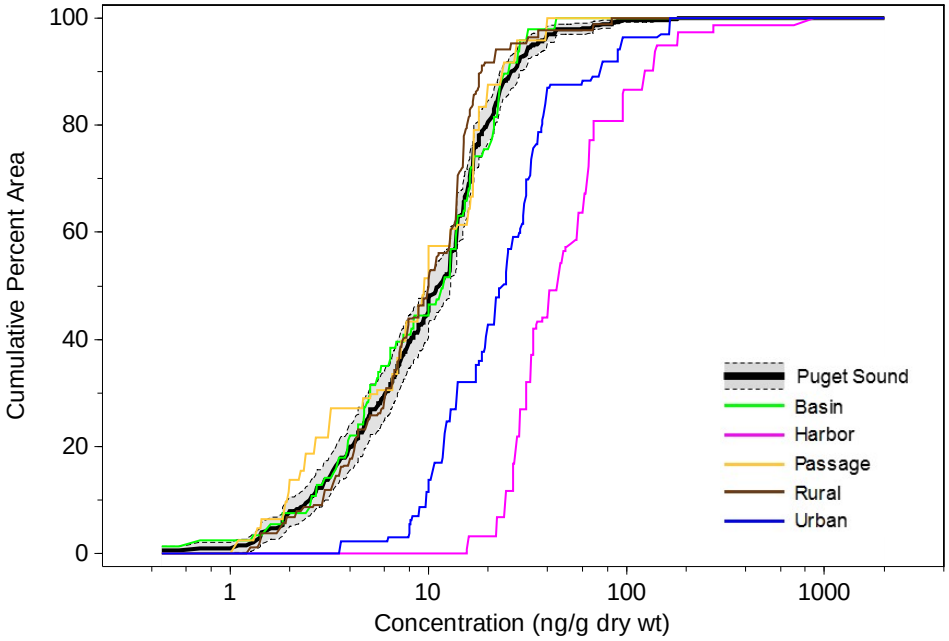

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Dibenzofuran
by Stratum

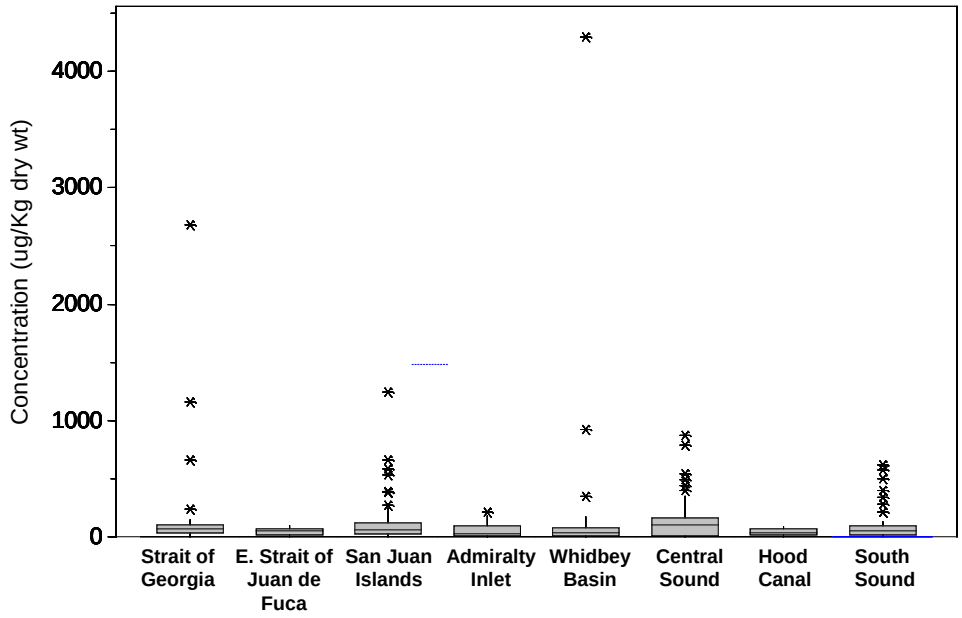


Zoomed in

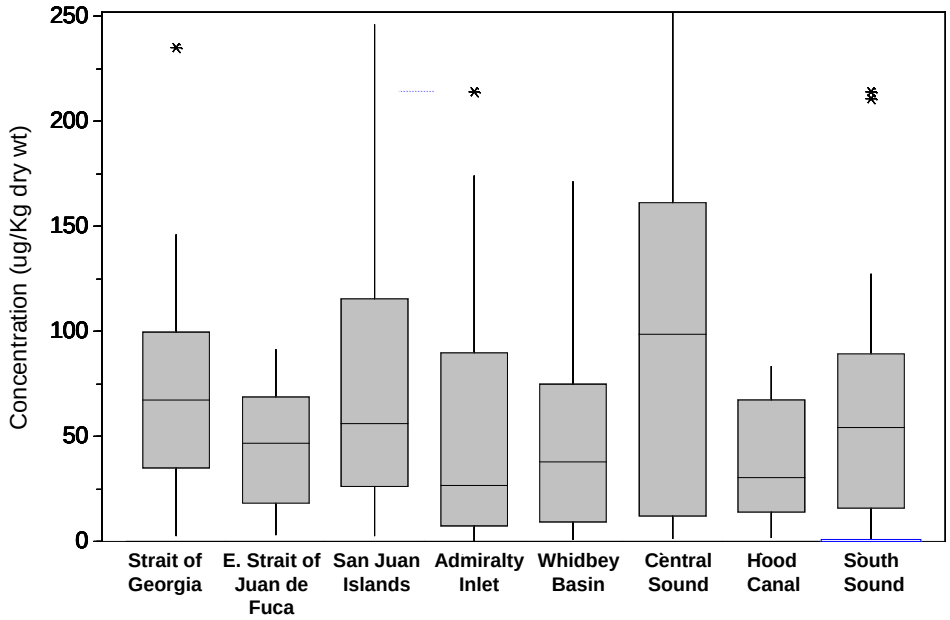


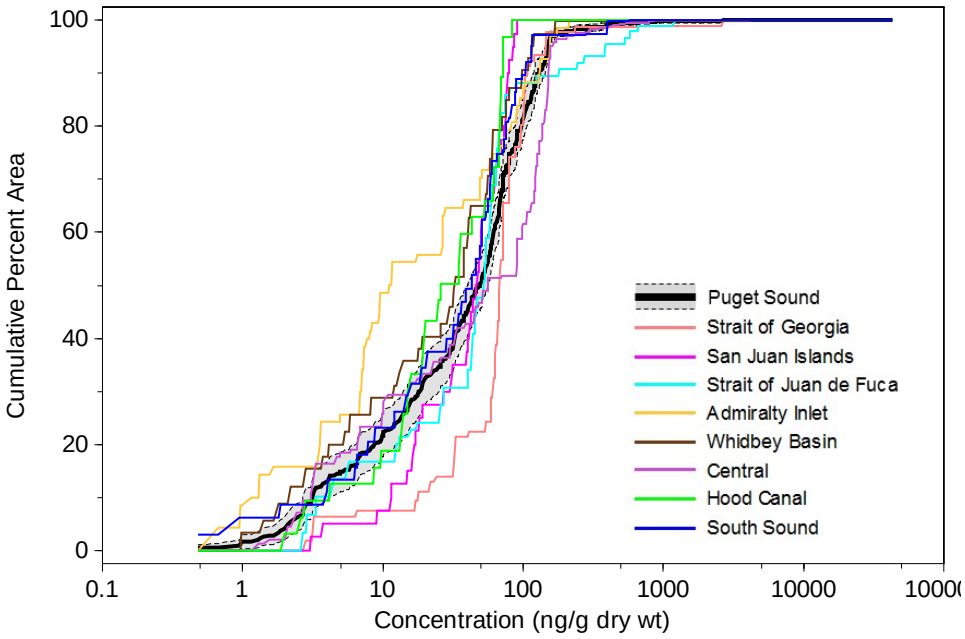

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Fluoranthene
by Region

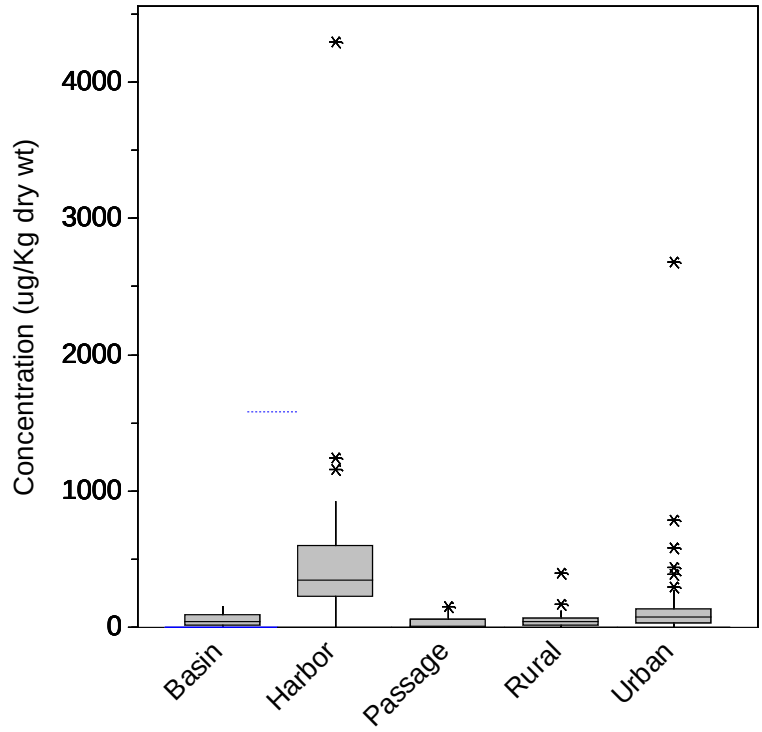


Zoomed in

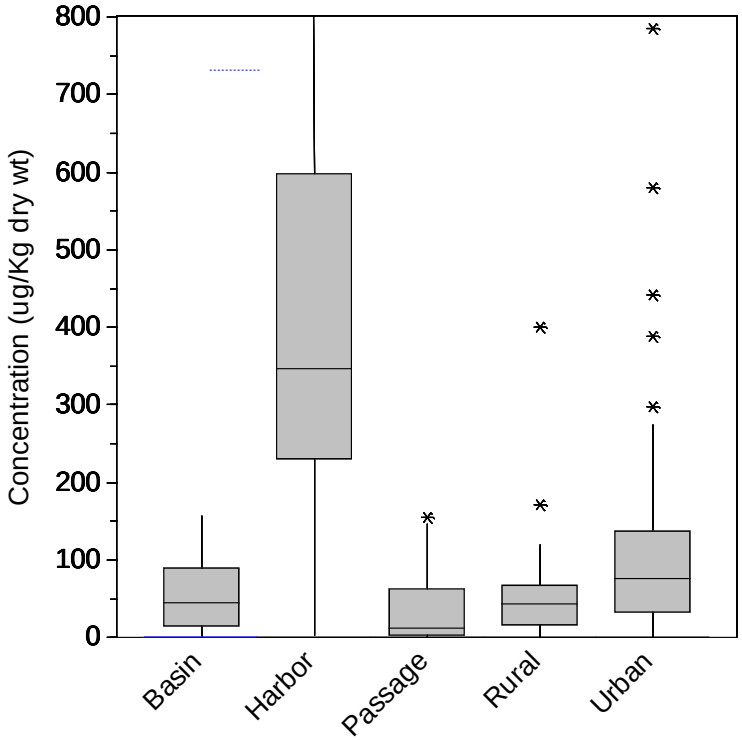


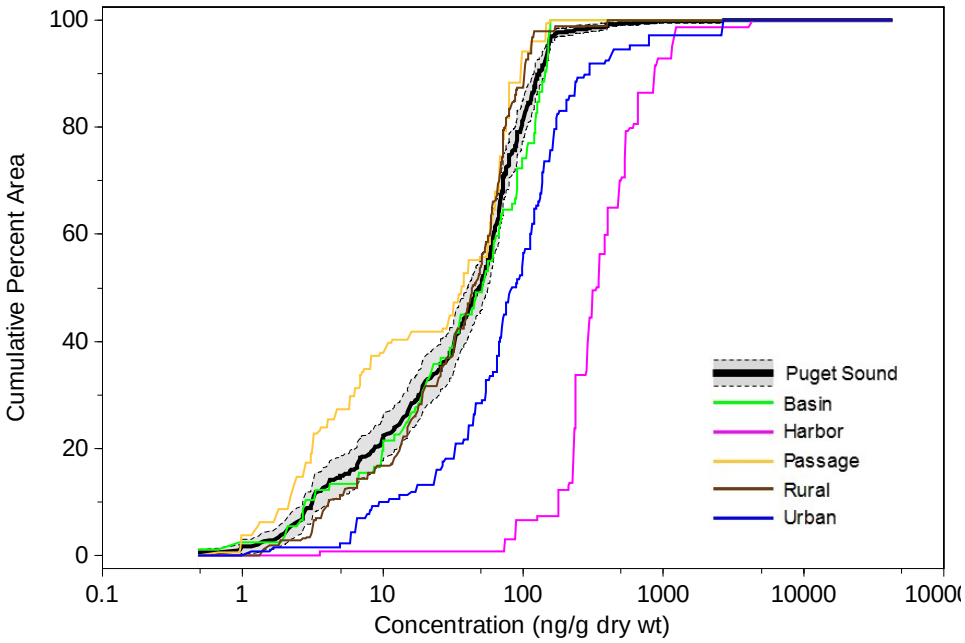

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Fluoranthene
by Stratum

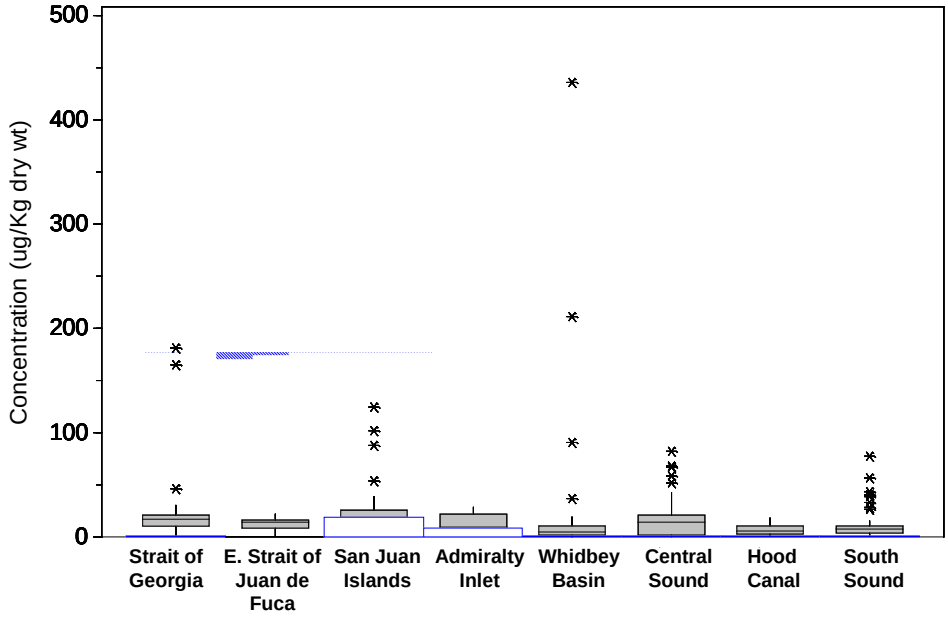


Zoomed in

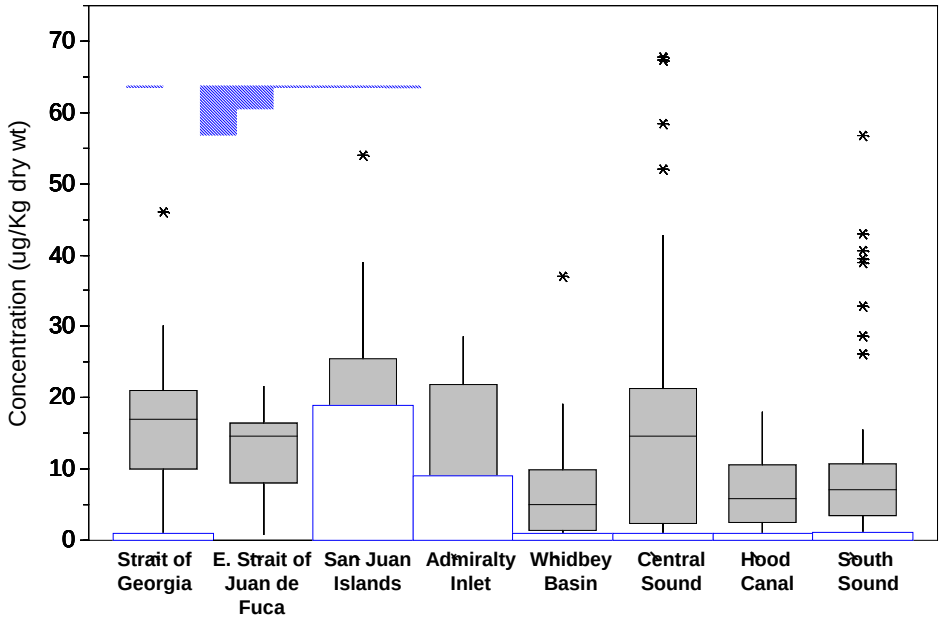


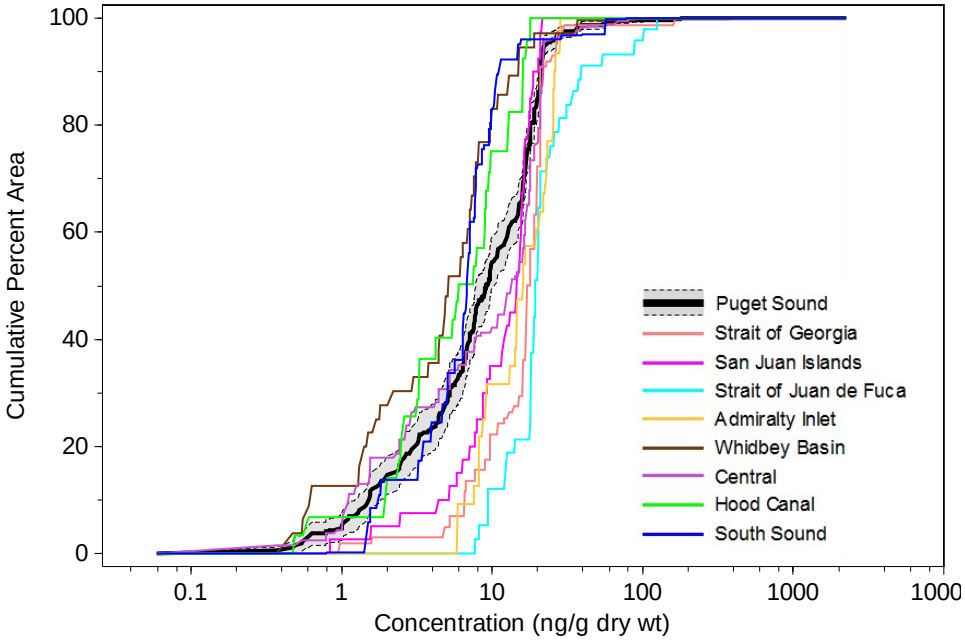

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Fluorene
by Region

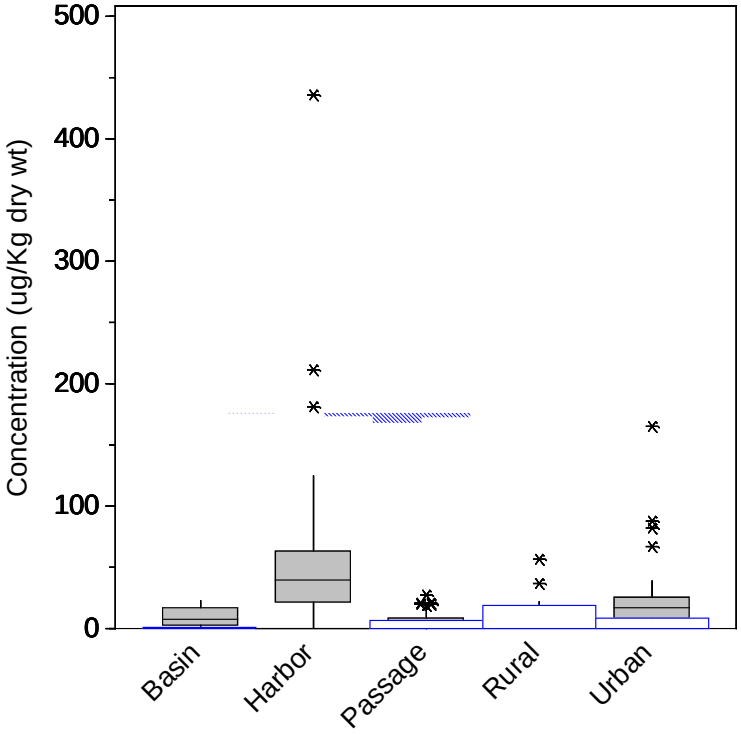


Zoomed in

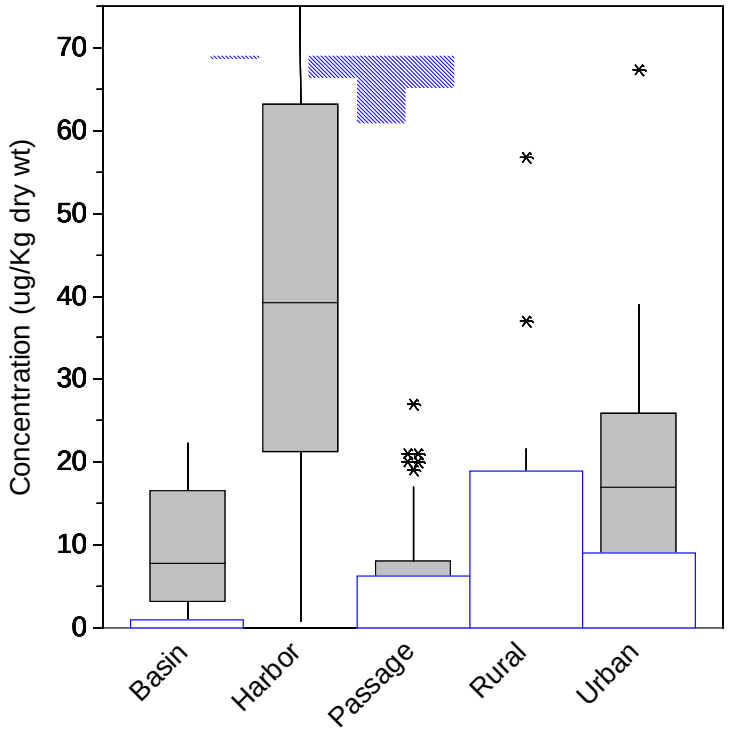


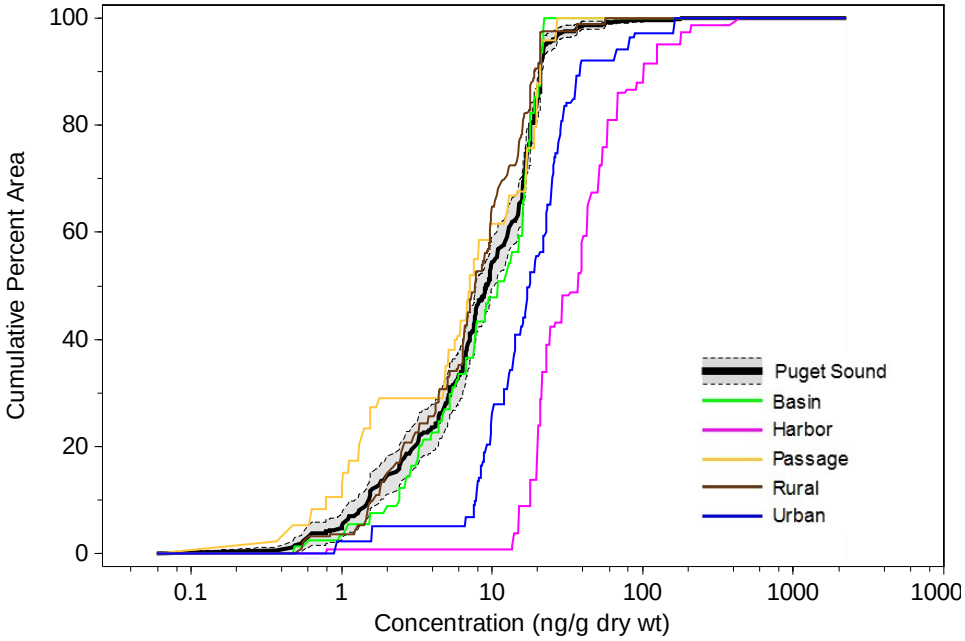

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Fluorene
by Stratum

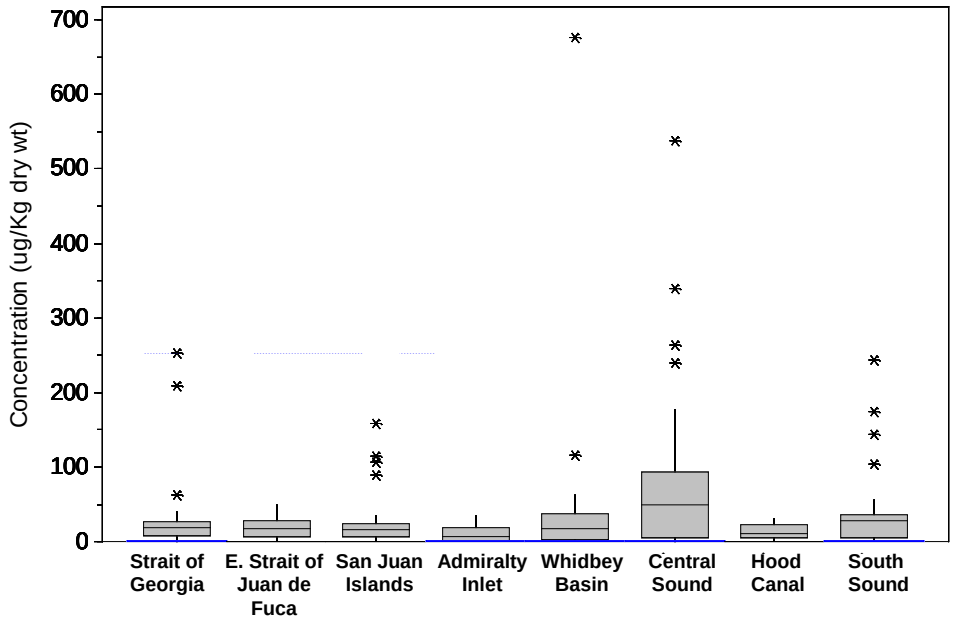


Zoomed in

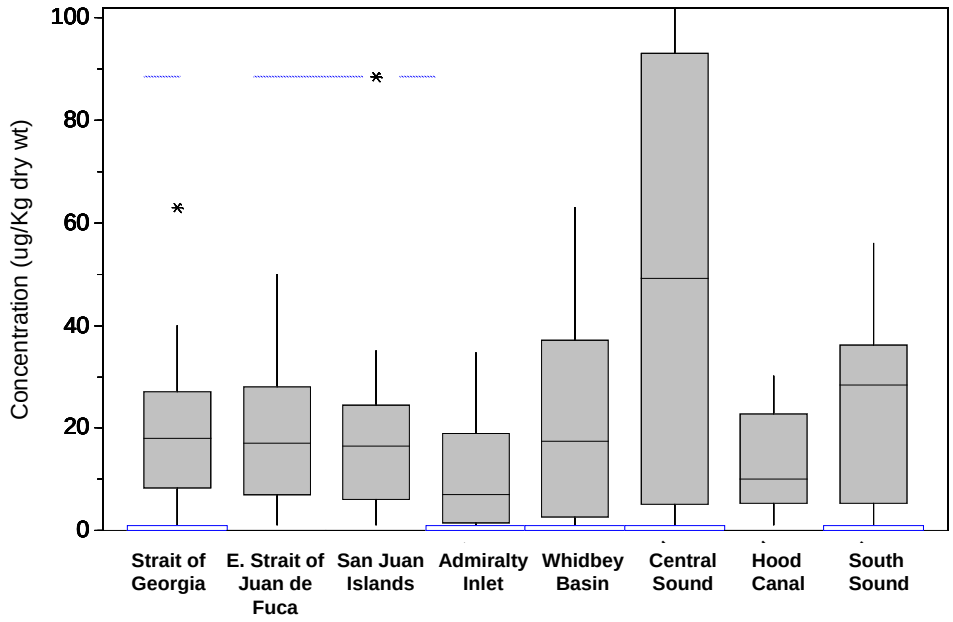


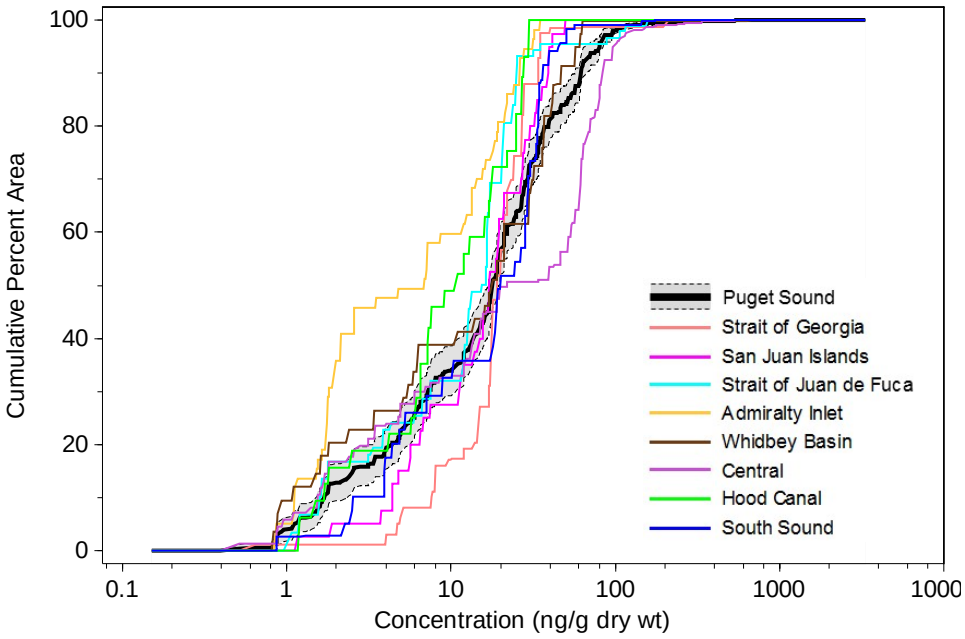

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Indeno(1,2,3-c,d)pyrene by Region

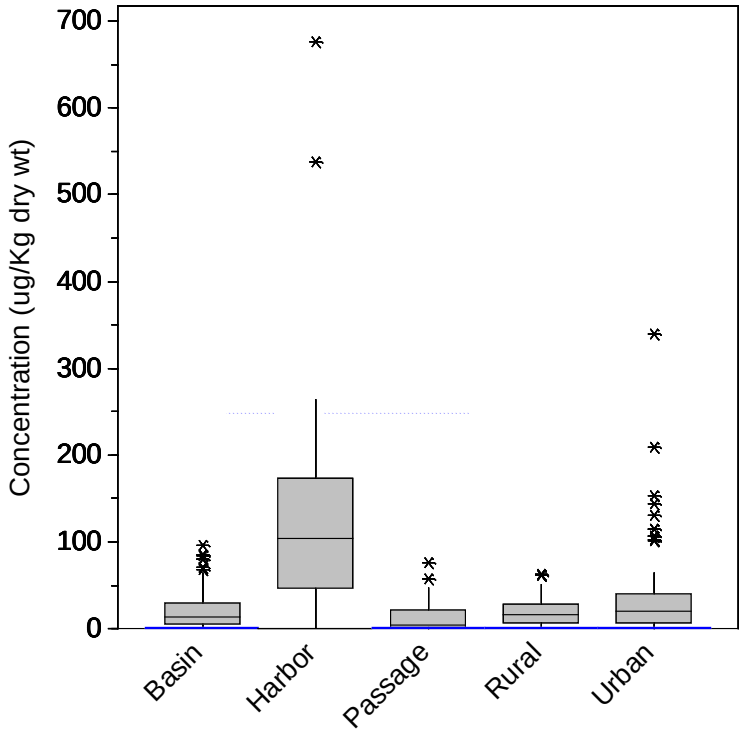


Zoomed in

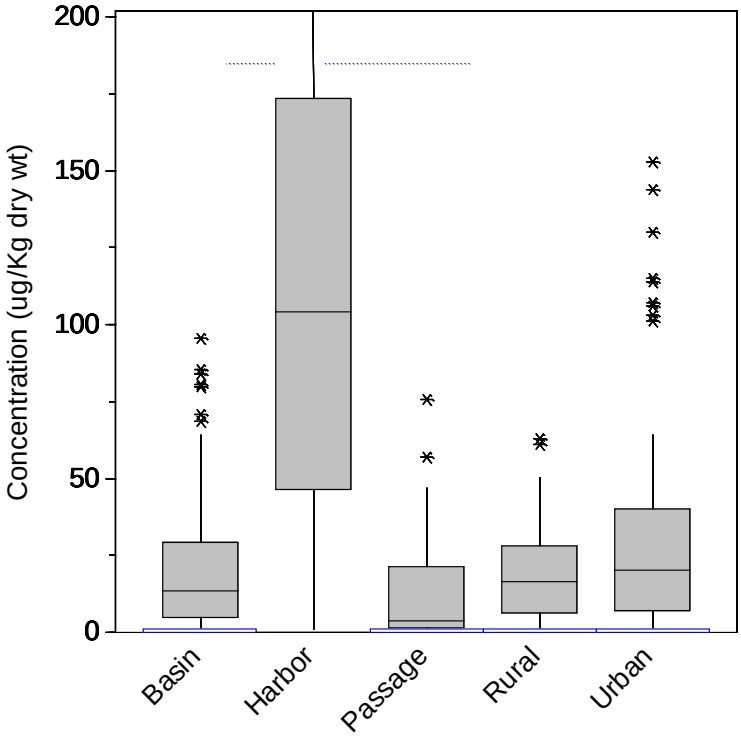


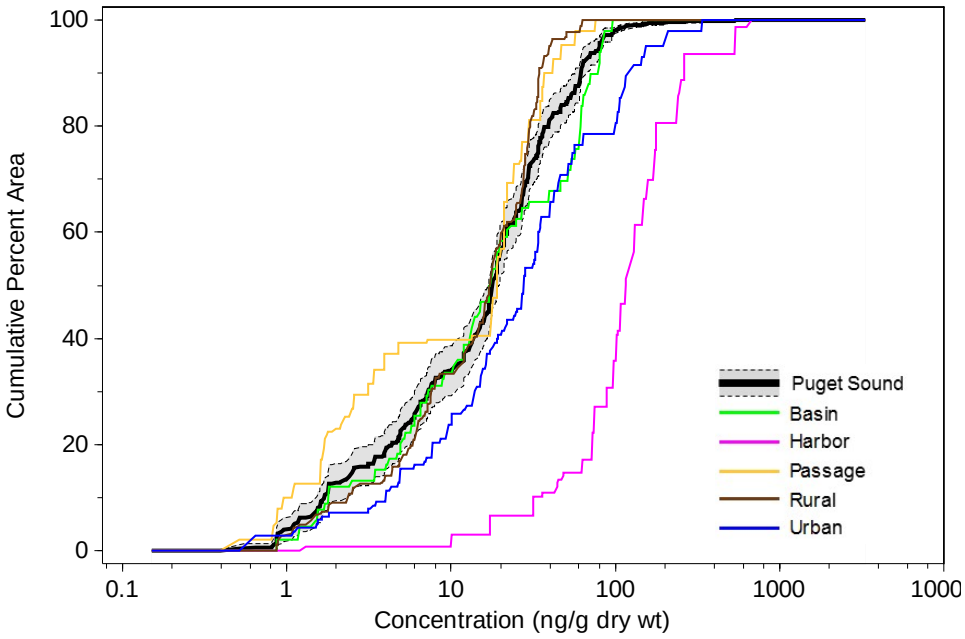

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Indeno(1,2,3-c,d)pyrene by Stratum

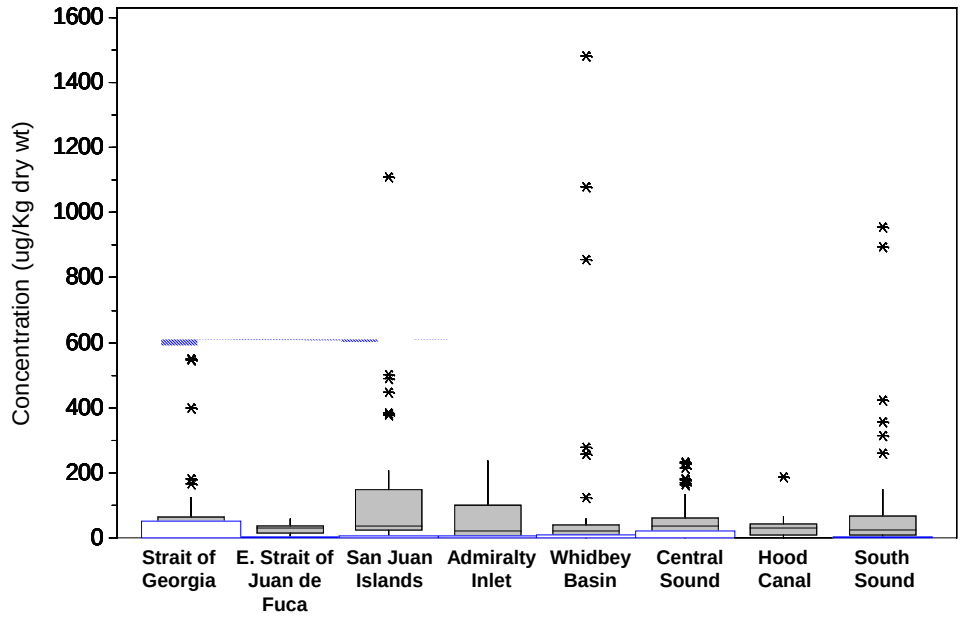


Zoomed in

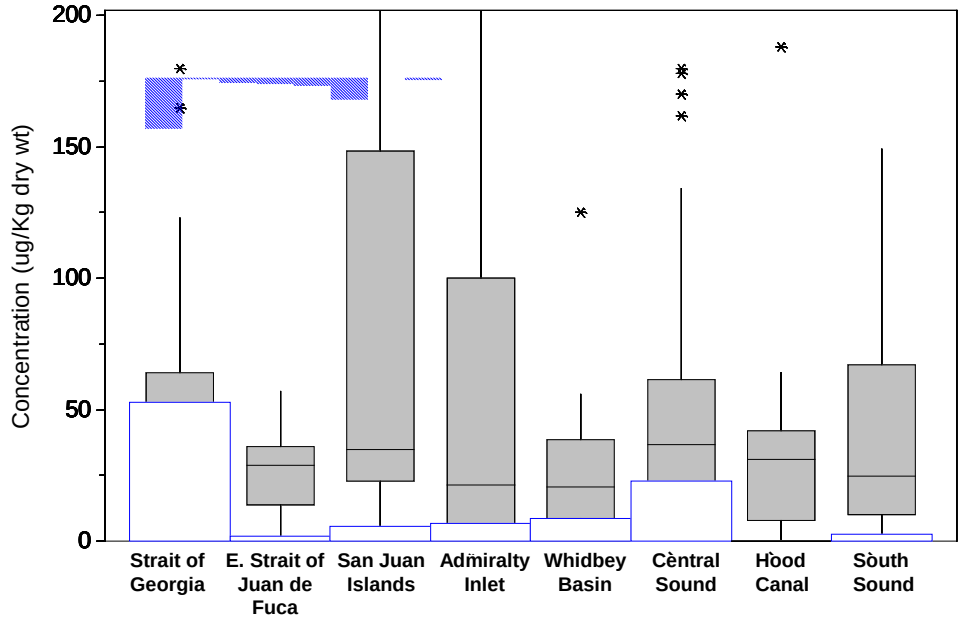


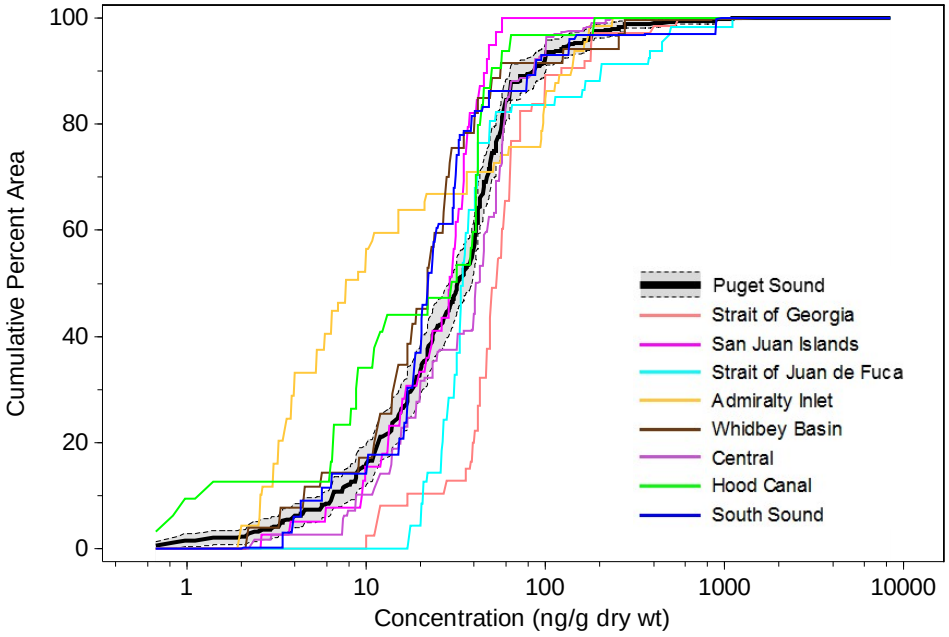

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
1000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Naphthalene
by Region

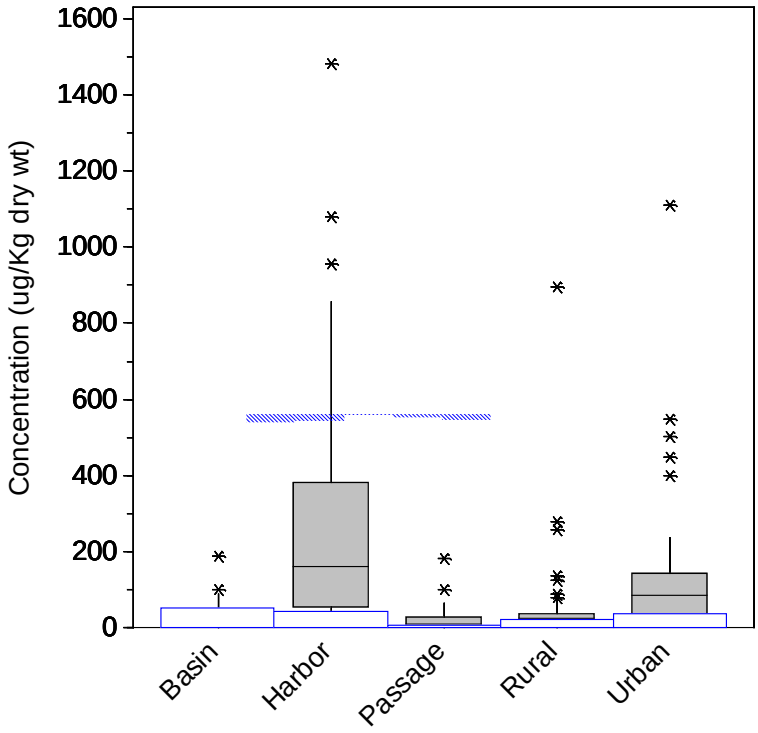


Zoomed in

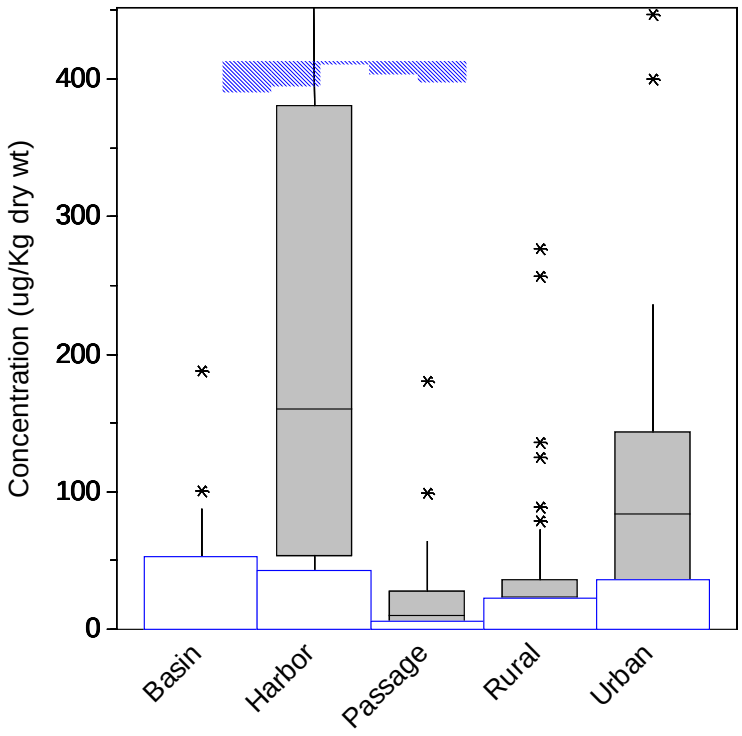


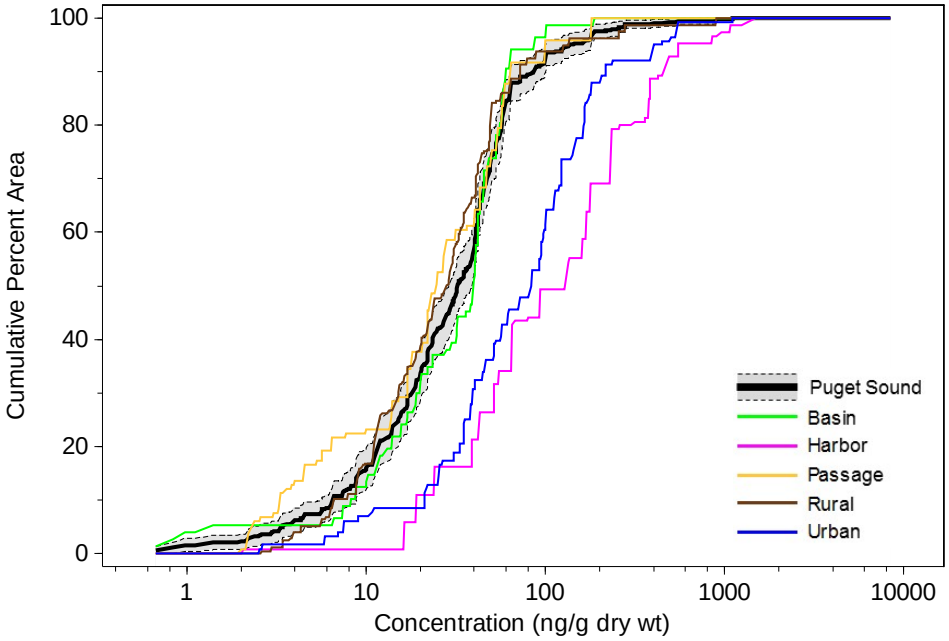

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Naphthalene
by Stratum



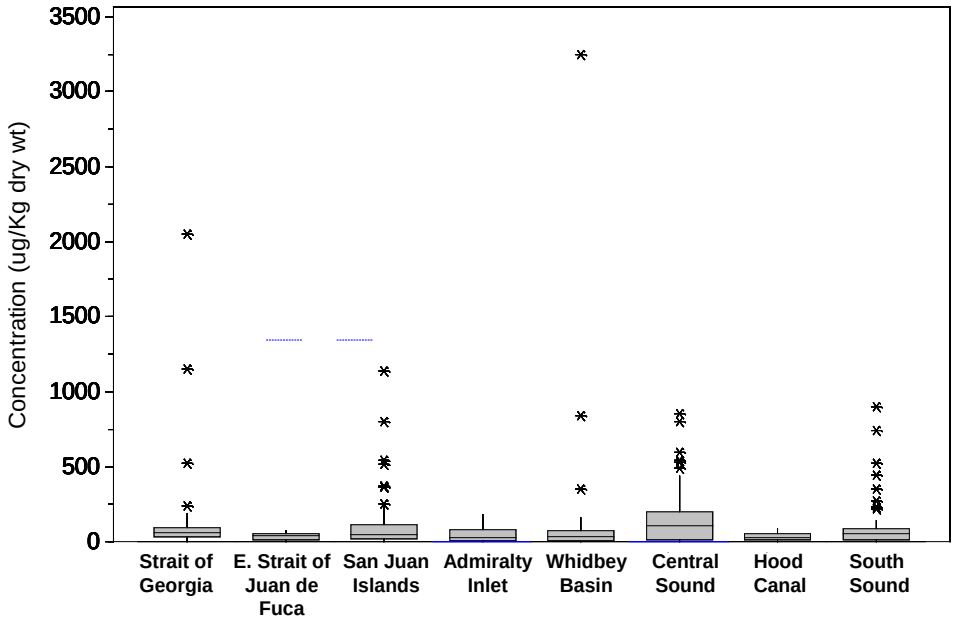
Zoomed in



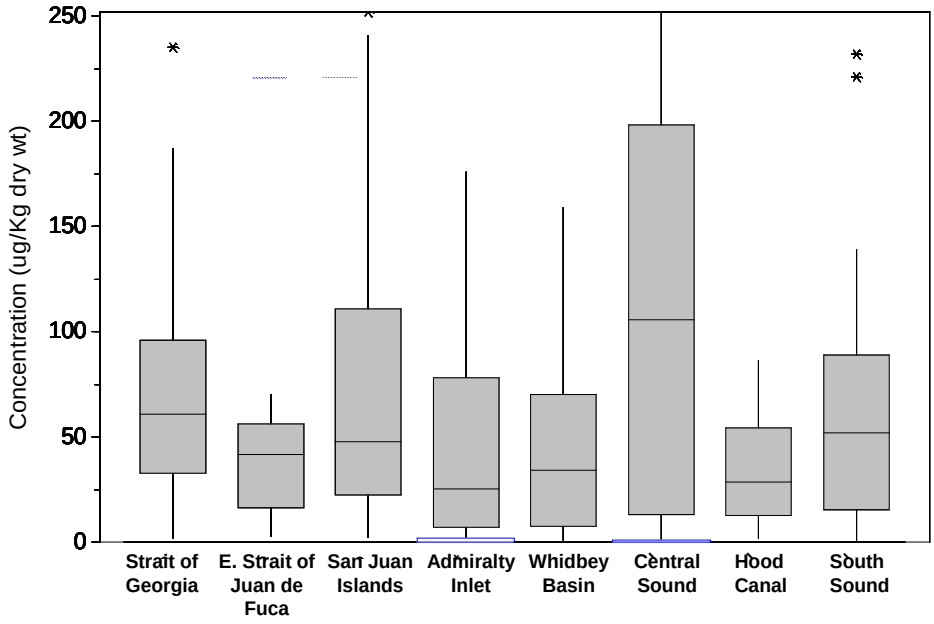

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

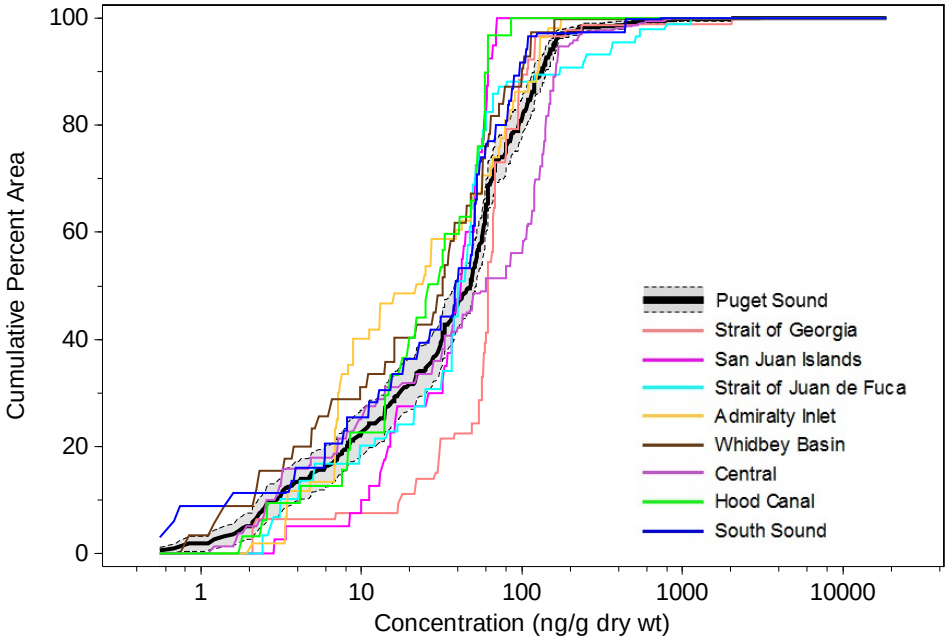
Pyrene

by Region

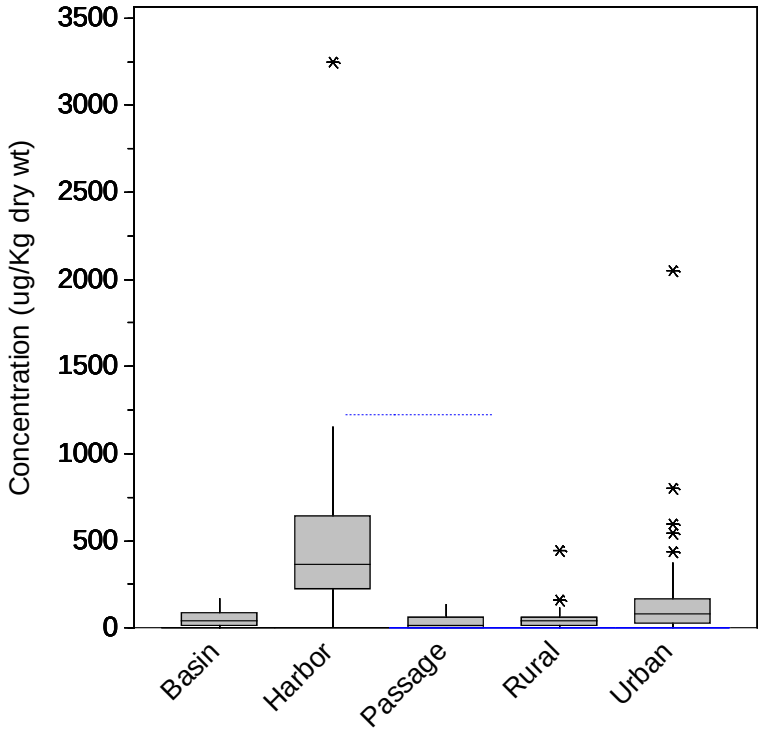


Zoomed in

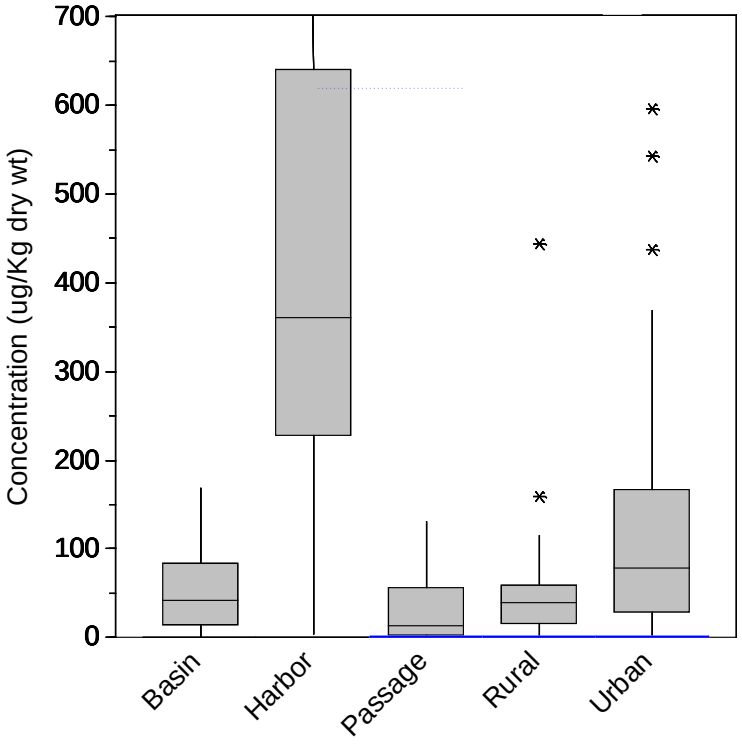


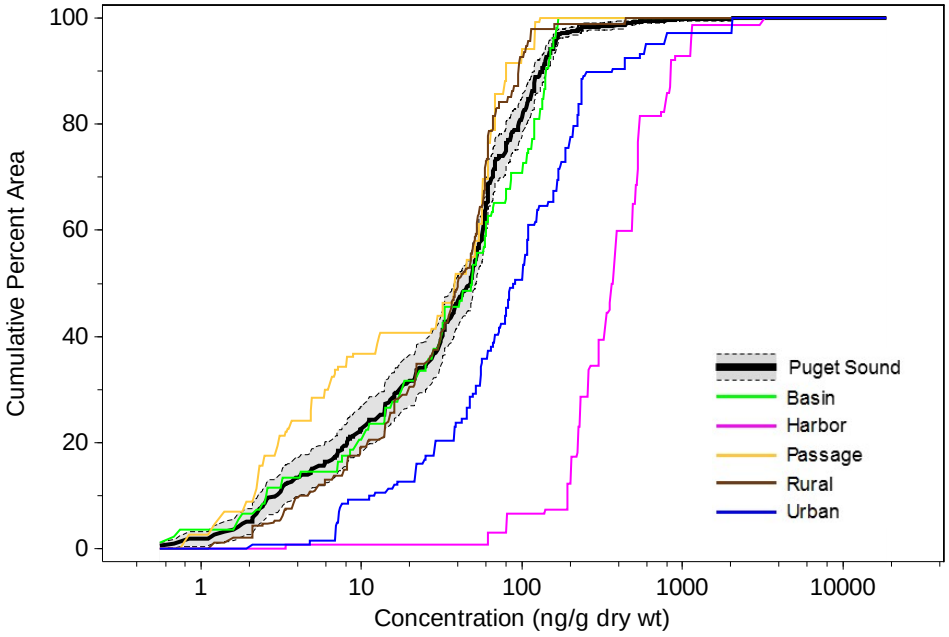

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Pyrene
by Stratum

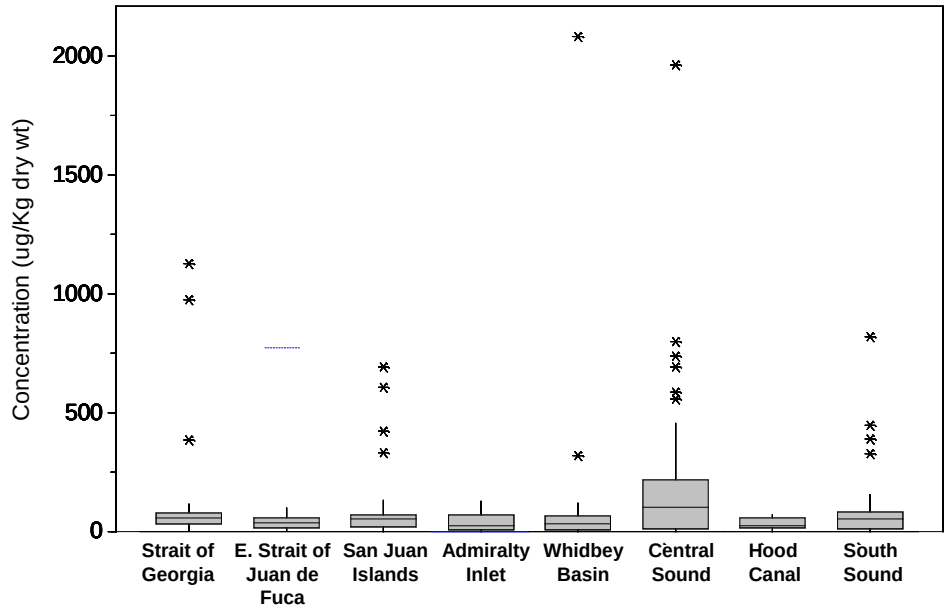


Zoomed in

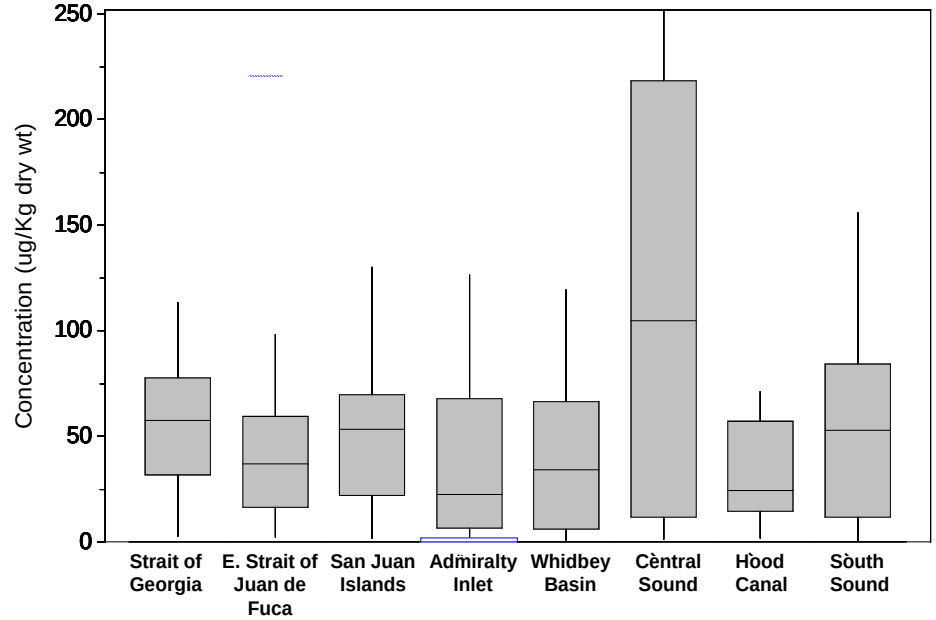


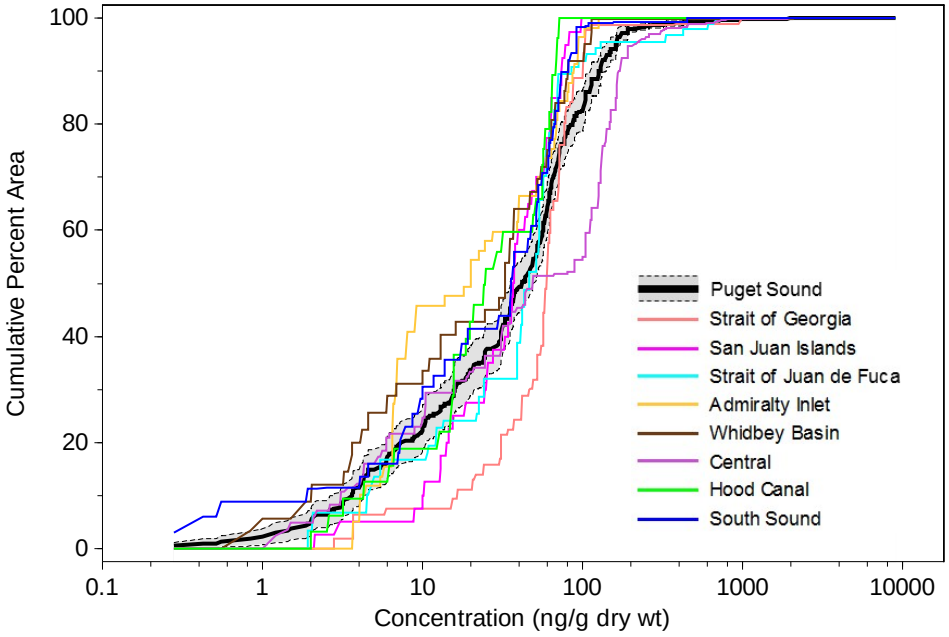

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Total Benzofluoranthenes by Region

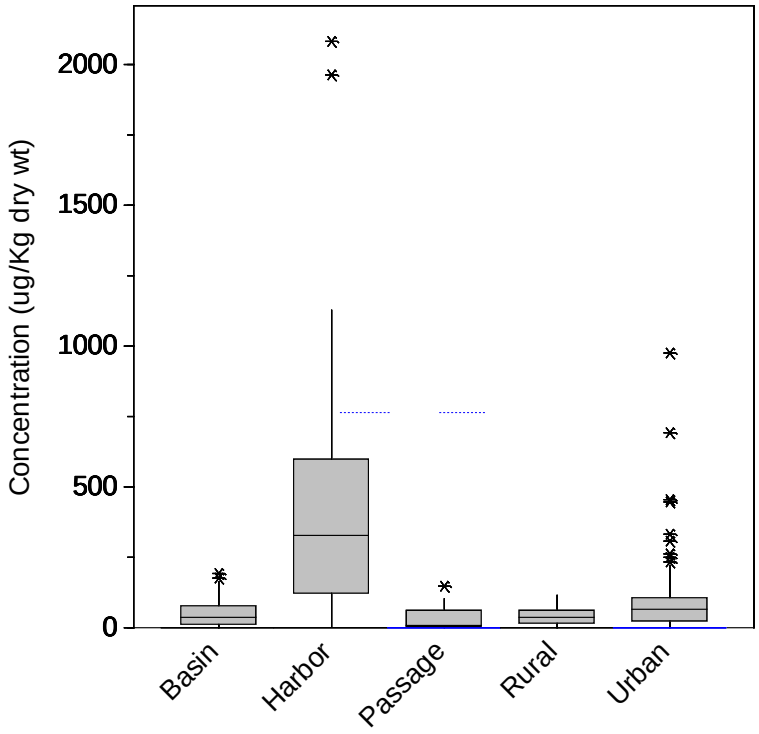


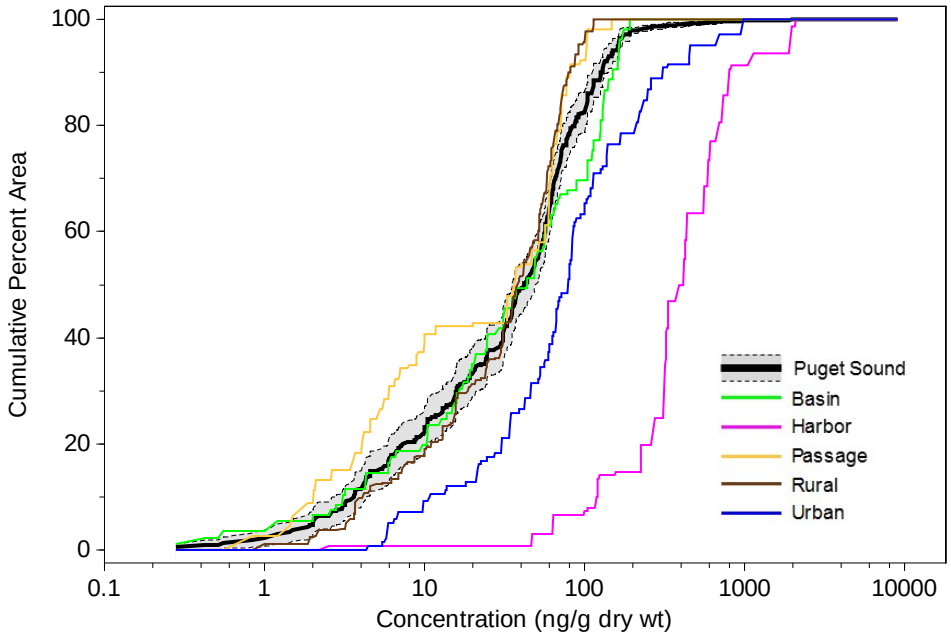
Zoomed in



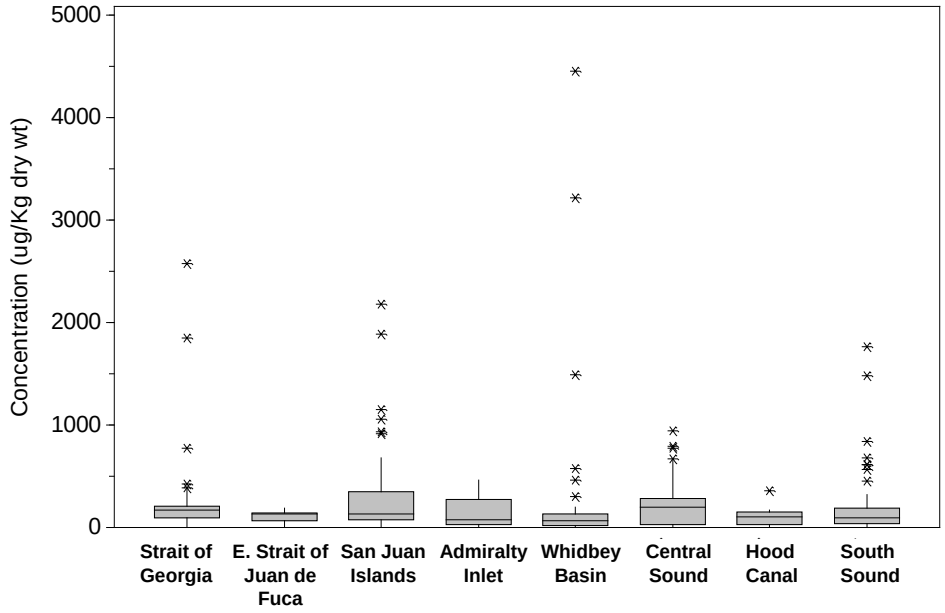

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Total Benzofluoranthenes by Stratum

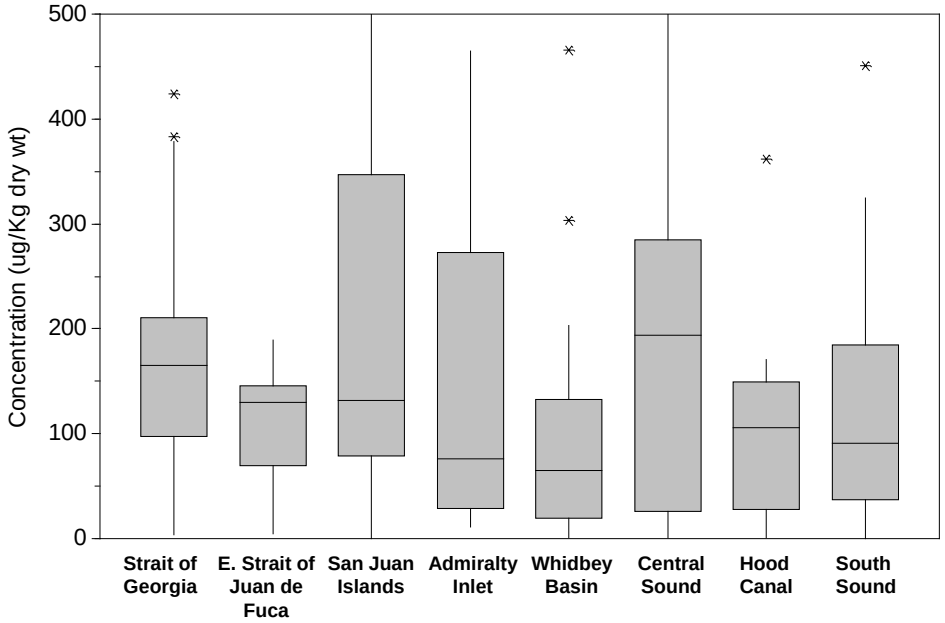


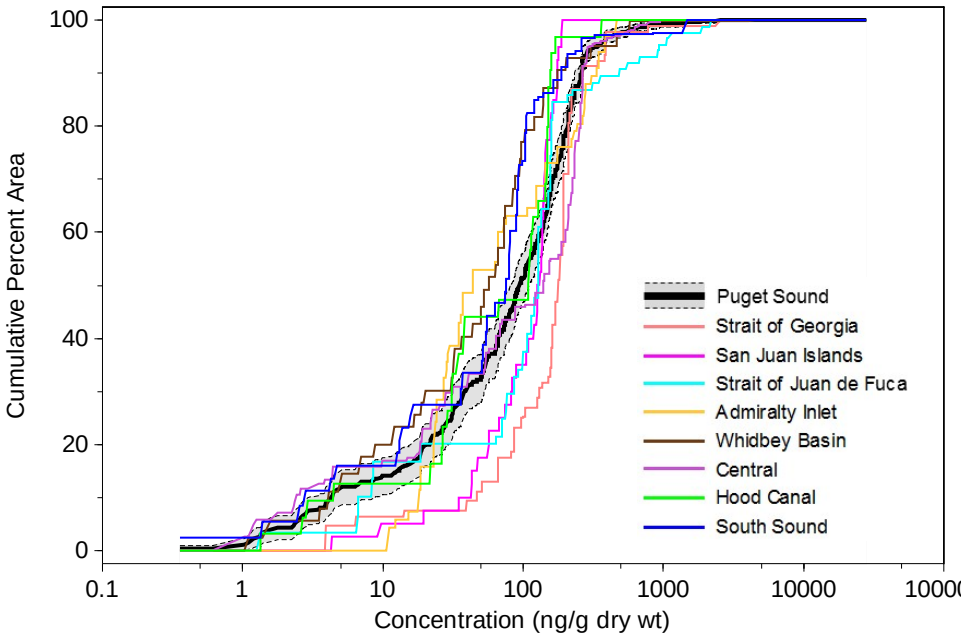


Total Low Molecular Weight PAHs by Region

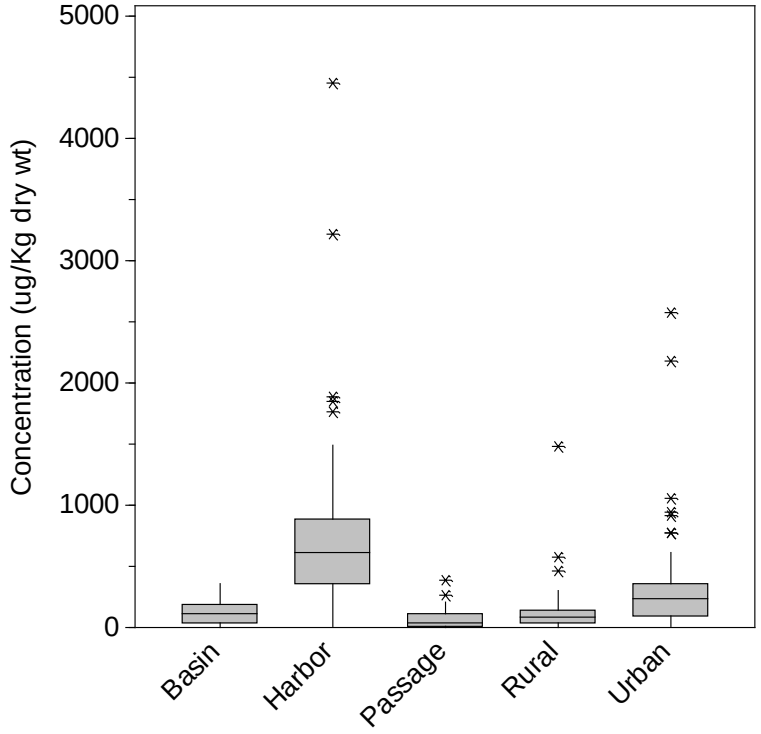


Zoomed in

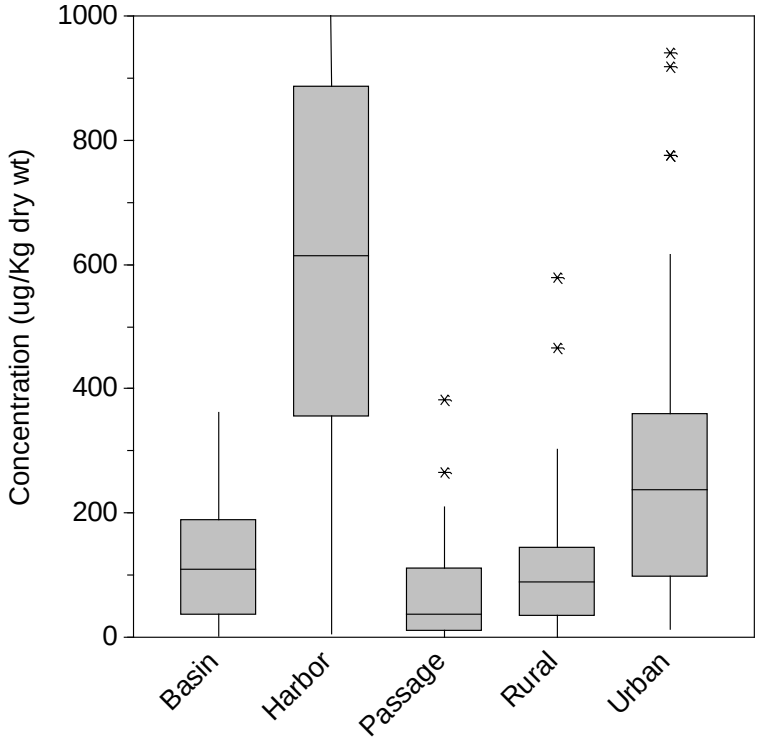


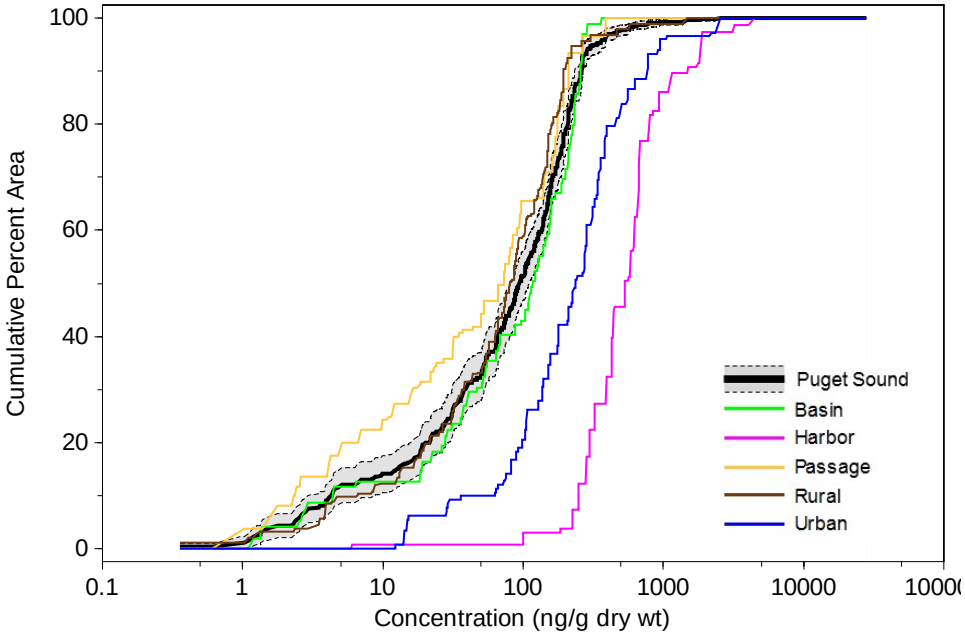

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Total Low Molecular Weight PAHs by Stratum

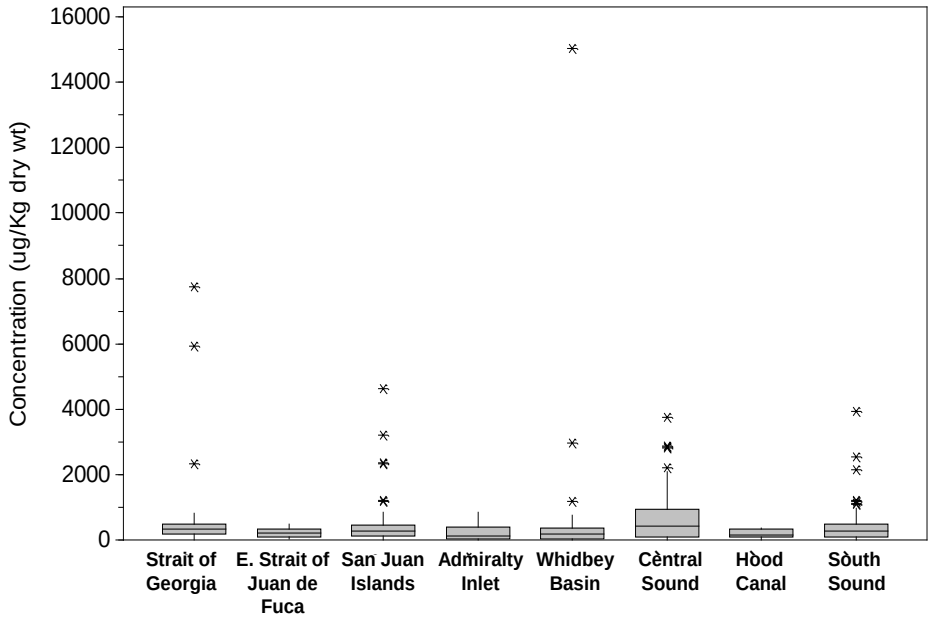


Zoomed in

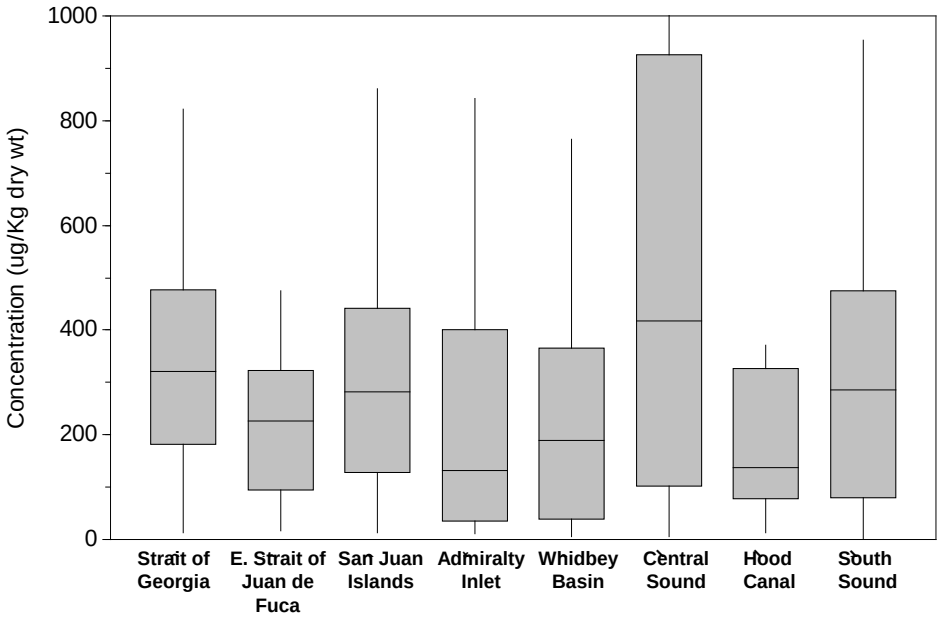


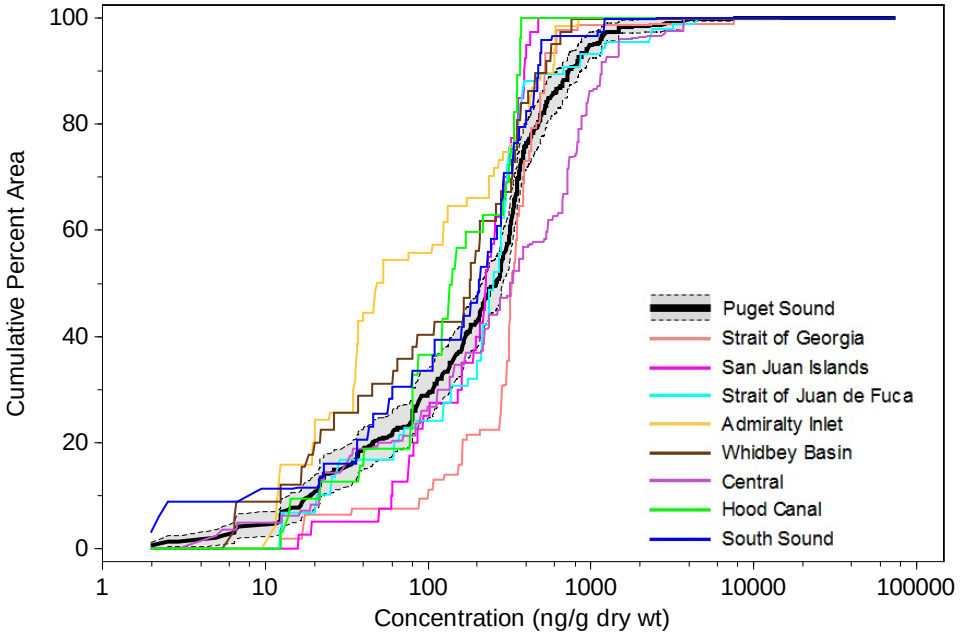

Cumulative Percent Area
100
80
60
40
20
0
0.1
1
10
100
1000
10000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

Total High Molecular Weight PAHs by Region

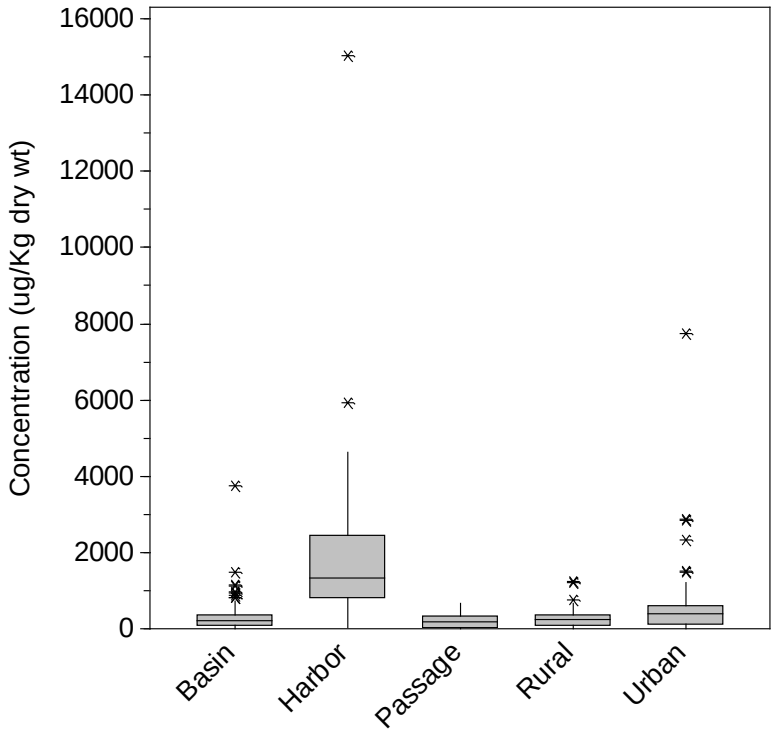


Zoomed in

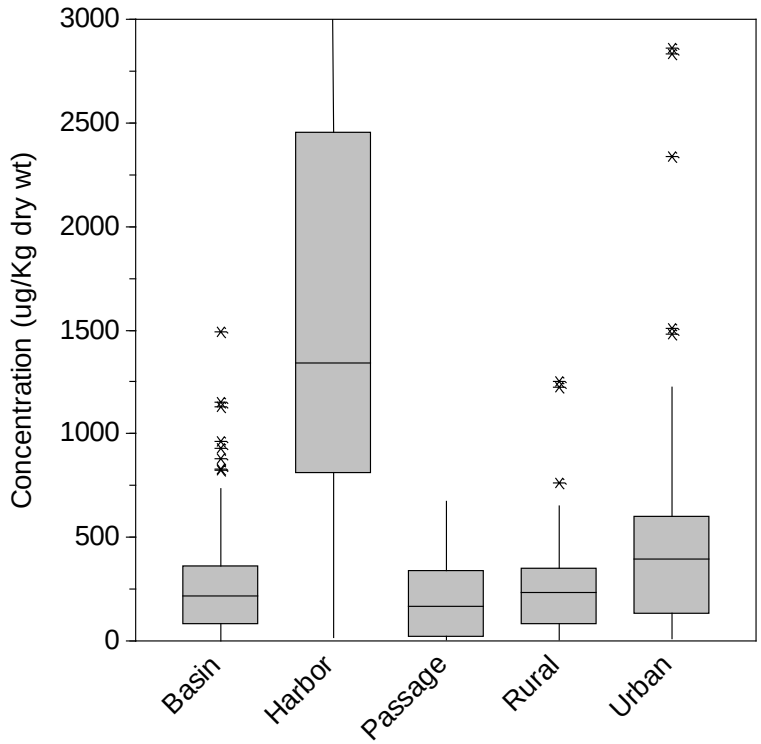


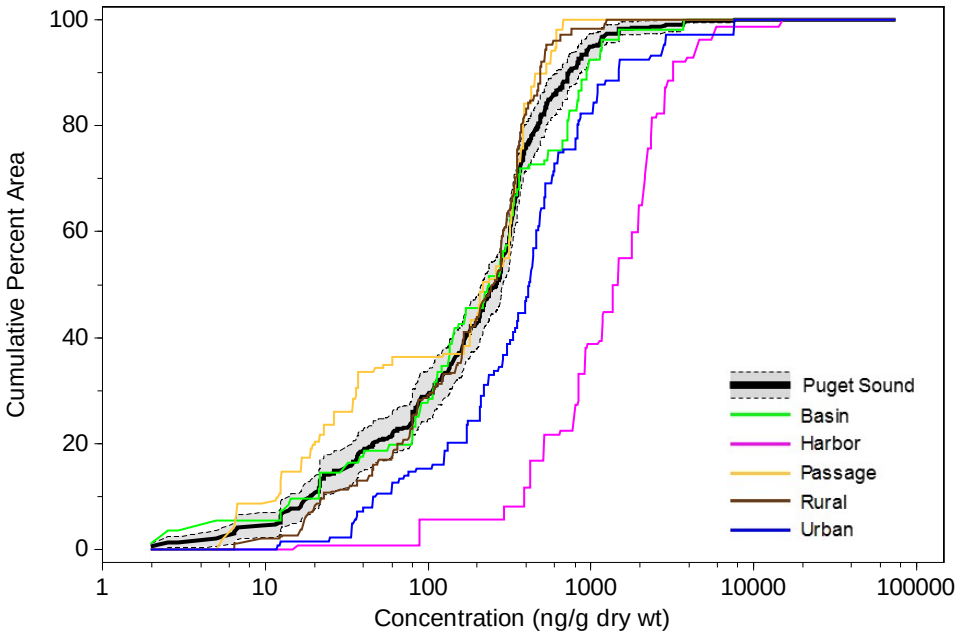

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
10000
100000
Concentration (ng/g dry wt)
Puget Sound
Strait of Georgia
San Juan Islands
Strait of Juan de Fuca
Admiralty Inlet
Whidbey Basin
Central
Hood Canal
South Sound

Total High Molecular Weight PAHs by Stratum

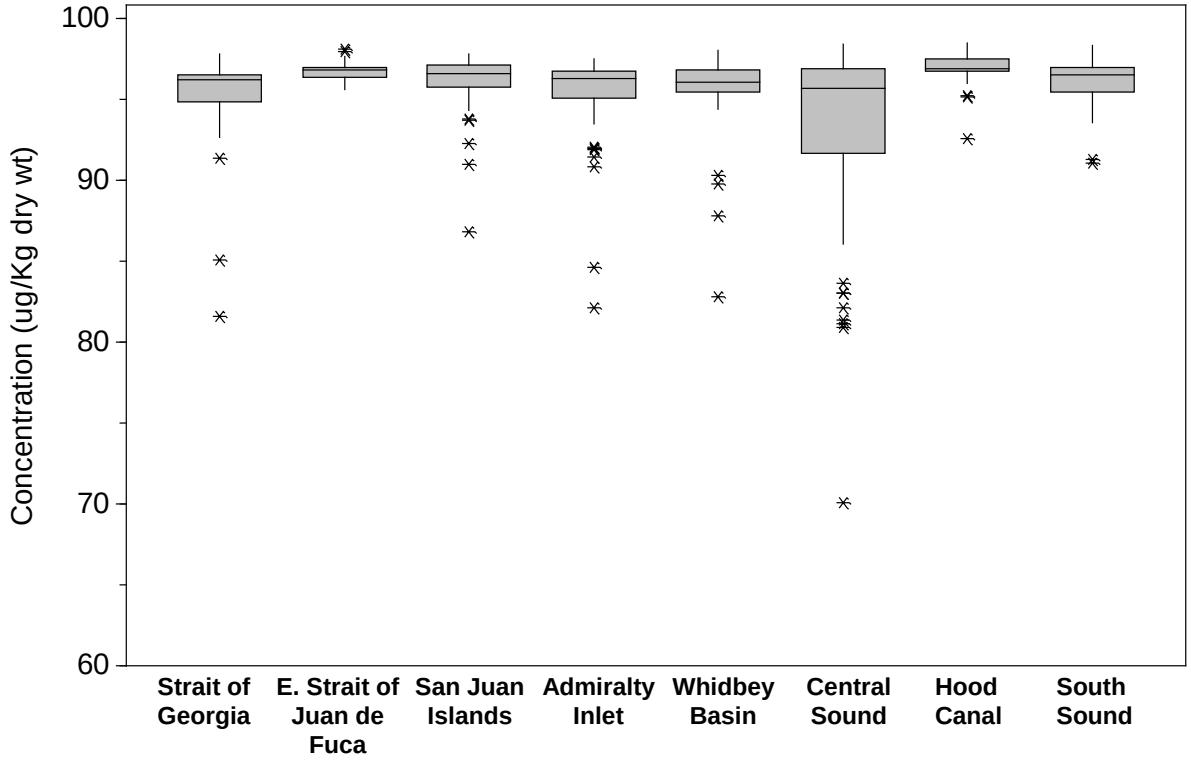


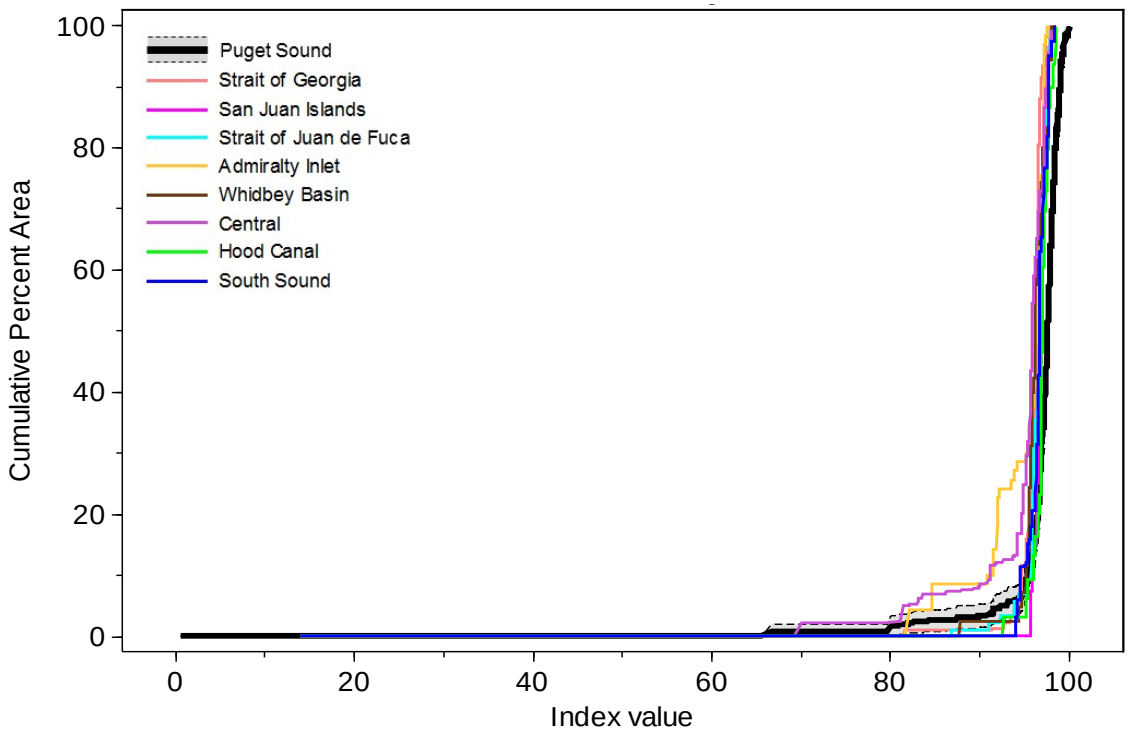
Zoomed in



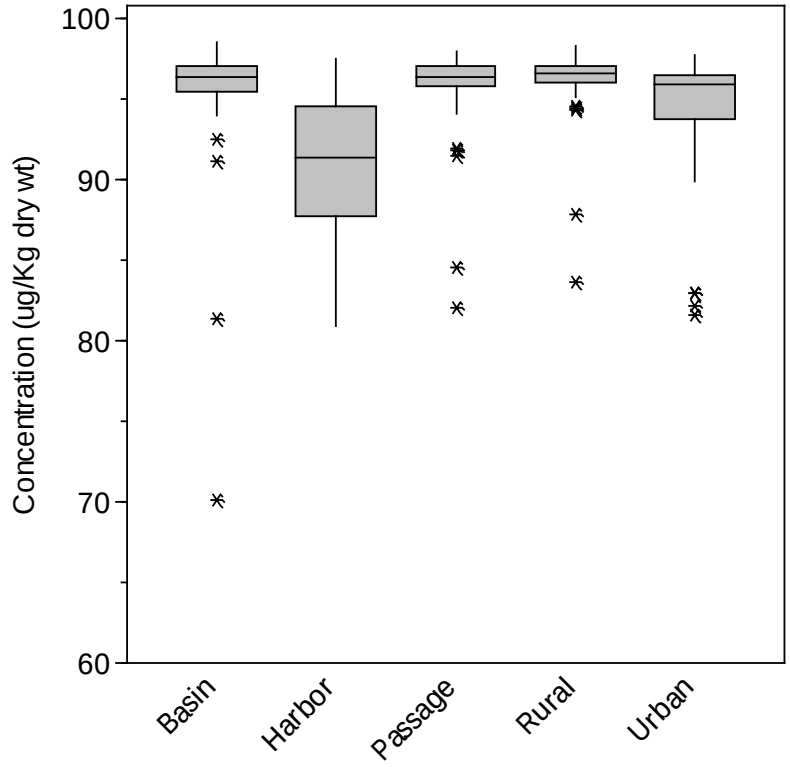

Cumulative Percent Area
100
80
60
40
20
0
1
10
100
1000
10000
100000
Concentration (ng/g dry wt)
Puget Sound
Basin
Harbor
Passage
Rural
Urban

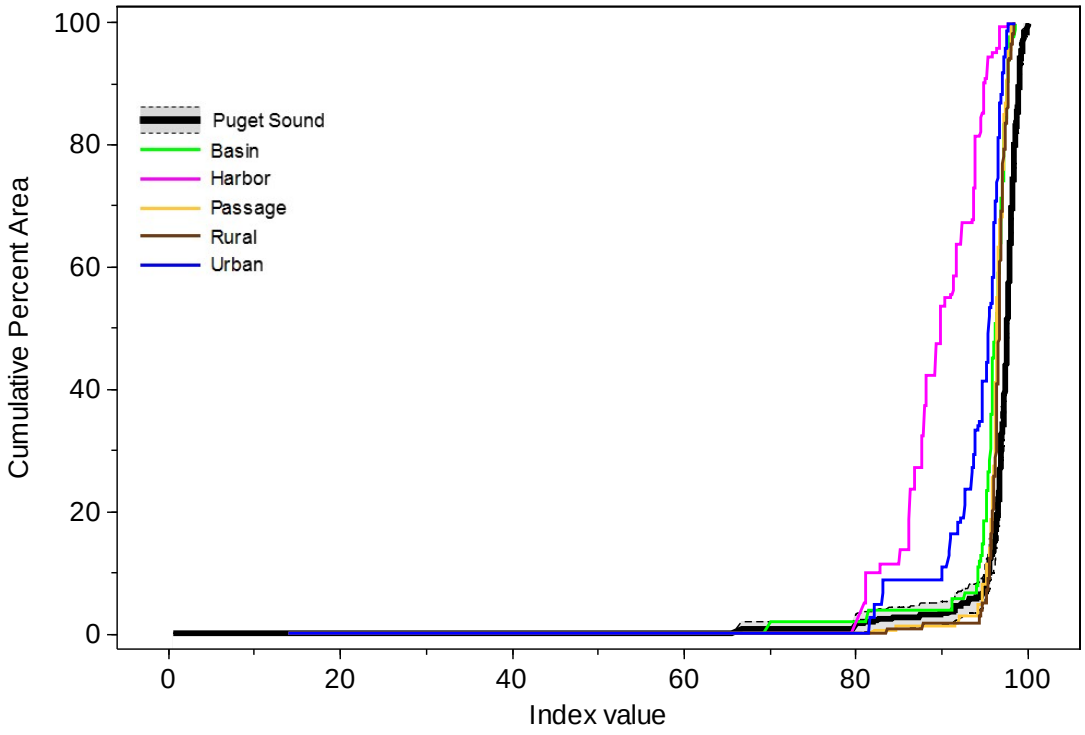
Chemistry Index by Region





Chemistry Index by Stratum





Comparisons to Sediment Quality Objectives

Incidence and spatial extent of individual chemicals not meeting (higher than) Washington Sediment Quality Objectives (Ecology, 2013) in eight sediment monitoring regions, five strata, and all of Puget Sound, for each the Baseline (1997-2003) and Second Round (2004-2014) surveys.

Region	Number of individual criteria exceeded			
	Baseline		Second Round	
	Station	Area	Station	Area
Chemical	No.	km^2	No.	km^2
Strait of Georgia	**9**		**No criteria exceeded**	
Basin	**1**	**1.2**		
Di-N-Butylphthalate	1	1.2		
Harbor	**2**	**0.6**		
Mercury	2	0.6		
Passage	**1**	**21.3**		
Di-N-Butylphthalate	1	21.3		
Rural	**2**	**12.8**		
Di-N-Butylphthalate	1	3.9		
Mercury	1	8.9		
Urban	**3**	**1.9**		
Bis(2-Ethylhexyl) Phthalate	1	0.7		
Di-N-Butylphthalate	1	0.7		
Mercury	1	0.5		
San Juan Archipelago	**1**		**No criteria exceeded**	
Rural	**1**			
Di-N-Butylphthalate	1	2.7		
Strait of Juan de Fuca	**1**		**2**	
Harbor	**1**		**2**	
Fluoranthene	1	0.9	No criteria exceeded	
Mercury	No criteria exceeded		1	0.7
Zinc	No criteria exceeded		1	0.7
Whidbey Basin	**7**		**2**	
Harbor	**5**		**1**	
Arsenic	1	0.1	No criteria exceeded	
Bis(2-Ethylhexyl) Phthalate	1	0.1		
Copper	1	0.1		
Dibenzofuran	No criteria exceeded		1	0.3
Total Aroclor (as per SMS)	1	0.1	No criteria exceeded	

Region	Number of individual criteria exceeded			
	Baseline		Second Round	
	Station	Area	Station	Area
Chemical	No.	km^2	No.	km^2
Zinc	1	0.1		
Passage	**1**		**No criteria exceeded**	
Bis(2-Ethylhexyl) Phthalate	1	10.2		
Rural	**1**		**1**	
Bis(2-Ethylhexyl) Phthalate	1		No criteria exceeded	
Hexachlorobenzene	No criteria exceeded		1	8.2
Admiralty Inlet	**No criteria exceeded**		**1**	
Passage			**1**	
Bis(2-Ethylhexyl) Phthalate			1	2.8
Central	**118**		**17**	
Basin	**1**		**3**	
Bis(2-Ethylhexyl) Phthalate	No criteria exceeded		1	15.6
Butylbenzylphthalate	1	2.8	No criteria exceeded	
Hexachlorobenzene	No criteria exceeded		1	15.6
Mercury			1	15.6
Harbor	**99**		**8**	
1,4-Dichlorobenzene	1	0.2	No criteria exceeded	
2-Methylnaphthalene	1	0.3		
Acenaphthene	5	1.0		
Arsenic	2	0.3		
Benzo(a)anthracene	1	0.1		
Benzo(a)pyrene	4	0.6		
Benzo(g,h,i)perylene	11	2.3		
Bis(2-Ethylhexyl) Phthalate	3	0.5		
Butylbenzylphthalate	2	0.4		
Chrysene	3	0.4		
Copper	1	0.0		
Dibenzo(a,h)anthracene	1	0.0		
Dibenzofuran	6	1.1		
Fluoranthene	5	0.5		
Fluorene	4	0.5		
Hexachlorobenzene	3	0.7		
Indeno(1,2,3-cd)pyrene	9	1.5		
Mercury	10	7.0	6	5.9
Naphthalene	1	0.3	No criteria exceeded	
Phenanthrene	4	0.4		
State HPAH	3	0.3		
State LPAH	2	0.3		

Region	Number of individual criteria exceeded			
	Baseline		Second Round	
	Station	Area	Station	Area
Chemical	No.	km^2	No.	km^2
Total Aroclor (as per SMS)	15	3.4	2	2.0
Total Benzofluoranthene	2	0.2	No criteria exceeded	
Passage	**1**		**No criteria exceeded**	
Total Aroclor (as per SMS)	1	3.3		
Rural	**No criteria exceeded**		**1**	
Bis(2-Ethylhexyl) Phthalate			1	5.5
Urban	**17**		**5**	
Benzo(g,h,i)perylene	2	1.4	No criteria exceeded	
Bis(2-Ethylhexyl) Phthalate	1	1.1		
Butylbenzylphthalate	1	0.3		
Dibenzo(a,h)anthracene	1	0.7		
Di-N-Butylphthalate	1	0.7		
Fluoranthene	1	1.1		
Mercury	5	7.5	3	8.3
Phenanthrene	1	0.3	No criteria exceeded	
Total Aroclor (as per SMS)	4	2.5	2	5.5
Hood Canal	**1**		**No criteria exceeded**	
Rural	**1**			
Naphthalene	1	1.6		
South Sound	**1**		**No criteria exceeded**	
Rural	**1**			
Mercury	1	5.7		
Puget Sound	**138**		**22**	

Number of stations and associated area with at least one chemical concentration not meeting (higher than) Washington Sediment Quality Objectives (Ecology, 2013) in eight sediment monitoring regions, five strata, and all of Puget Sound, for each the Baseline (1997-2003) and Second Round (2004-2014) surveys.

Region	Baseline				Second Round			
	Station		Area		Station		Area	
Stratum	No.	%	km^2	%	No.	%	km^2	%
Strait of Georgia	**9**	**(14.8)**	**37.9**	**(9.8)**	**0**	**(0.0)**	**0.0**	**(0.0)**
Basin	1	(14.3)	1.2	(1.3)	0	(0.0)	0.0	(0.0)
Harbor	2	(33.3)	0.6	(32.1)	0	(0.0)	0.0	(0.0)
Passage	1	(11.1)	21.3	(15.3)	0	(0.0)	0.0	(0.0)
Rural	2	(9.5)	12.8	(11.1)	0	(0.0)	0.0	(0.0)
Urban	3	(16.7)	1.9	(5.3)	0	(0.0)	0.0	(0.0)
San Juan Archipelago	**1**	**(3.3)**	**2.7**	**(3.3)**	**0**	**(0.0)**	**0.0**	**(0.0)**
Rural	1	(3.3)	2.7	(3.3)	0	(0.0)	0.0	(0.0)
E. Strait of Juan de Fuca	**1**	**(3.3)**	**0.9**	**(1.4)**	**1**	**(2.5)**	**0.7**	**(1.0)**
Harbor	1	(25.0)	0.9	(25.0)	1	(20.0)	0.7	(20.0)
Rural	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Urban	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Admiralty Inlet	**0**	**(0.0)**	**0.0**	**(0.0)**	**1**	**(2.3)**	**2.8**	**(4.2)**
Passage	0	(0.0)	0.0	(0.0)	1	(7.7)	2.8	(7.7)
Urban	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Whidbey Basin	**5**	**(12.8)**	**30.7**	**(9.1)**	**2**	**(5.0)**	**8.4**	**(2.4)**
Harbor	3	(33.3)	0.2	(33.3)	1	(33.3)	0.3	(33.3)
Passage	1	(8.3)	10.2	(5.9)	0	(0.0)	0.0	(0.0)
Rural	1	(5.6)	20.2	(12.3)	1	(4.5)	8.2	(4.5)
Central	**41**	**(32.0)**	**27.5**	**(4.0)**	**17**	**(21.3)**	**73.9**	**(11.1)**
Basin	1	(4.3)	2.8	(0.6)	3	(10.0)	46.7	(10.0)
Harbor	30	(78.9)	11.4	(82.6)	8	(61.5)	7.9	(61.5)
Passage	1	(4.8)	3.3	(3.9)	0	(0.0)	0.0	(0.0)
Rural	0	(0.0)	0.0	(0.0)	1	(10.0)	5.5	(10.0)
Urban	9	(24.3)	9.9	(21.1)	5	(29.4)	13.9	(29.4)
Hood Canal	**1**	**(4.8)**	**1.6**	**(0.5)**	**0**	**(0.0)**	**0.0**	**(0.0)**
Basin	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Rural	1	(6.7)	1.6	(1.6)	0	(0.0)	0.0	(0.0)
South Sound	**1**	**(2.4)**	**5.7**	**(1.7)**	**0**	**(0.0)**	**0.0**	**(0.0)**
Basin	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Harbor	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Passage	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)

Region	Baseline				Second Round			
	Station		Area		Station		Area	
Stratum	No.	%	km^2	%	No.	%	km^2	%
Rural	1	(5.6)	5.7	(3.1)	0	(0.0)	0.0	(0.0)
Urban	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Puget Sound	**59**	**(15.5)**	**106.9**	**(4.7)**	**21**	**(5.7)**	**85.8**	**(3.9)**
Basin	2	(4.8)	4.0	(0.4)	3	(4.2)	46.7	(5.7)
Harbor	36	(57.1)	13.2	(62.3)	10	(30.3)	8.9	(45.0)
Passage	3	(4.9)	34.8	(7.1)	1	(1.9)	2.8	(0.6)
Rural	6	(4.7)	43.1	(5.7)	2	(1.5)	13.6	(1.8)
Urban	12	(14.0)	11.9	(8.5)	5	(6.7)	13.9	(10.2)

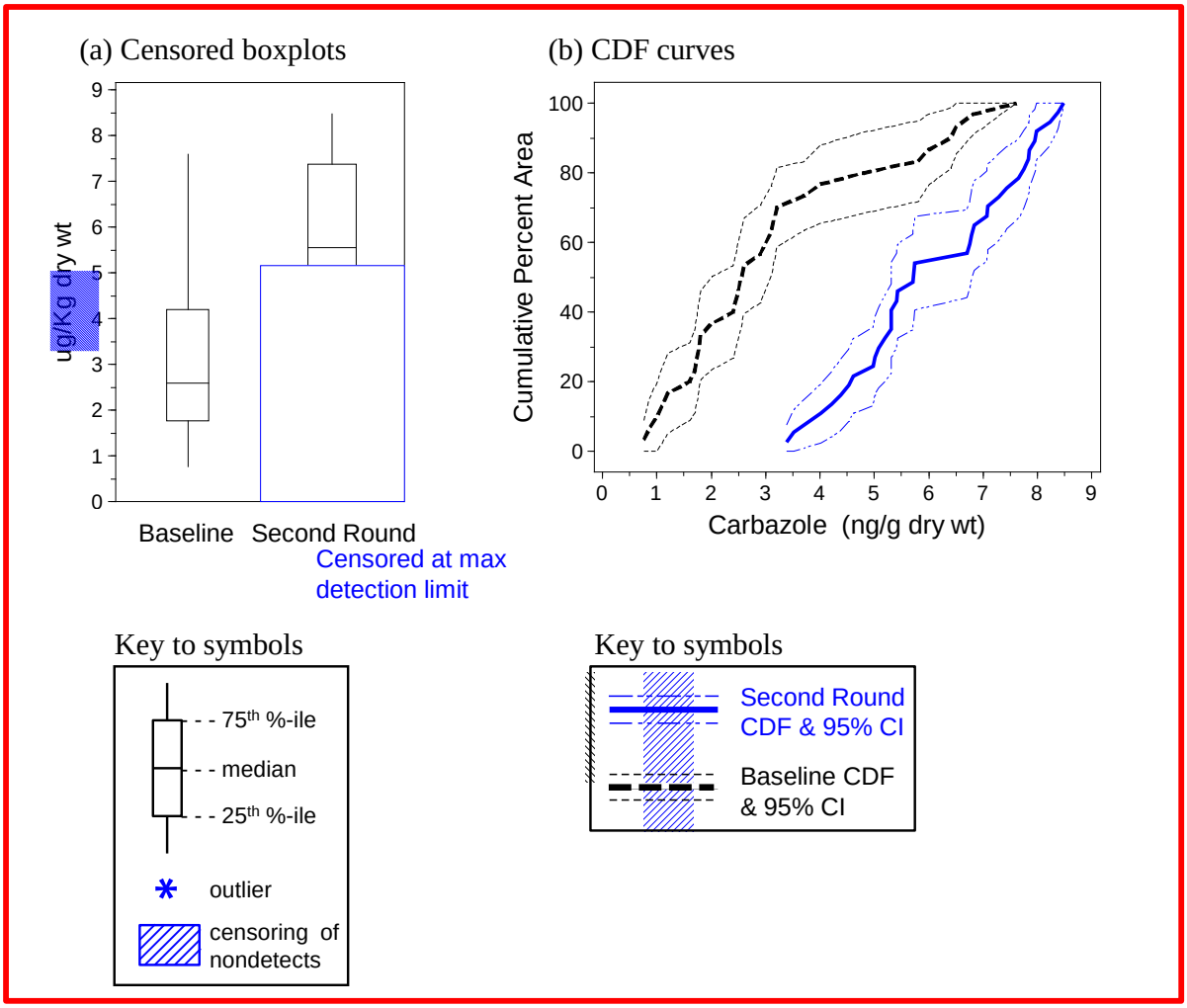
Comparisons of Surveys

Comparison of chemical concentrations in Puget Sound sediments.

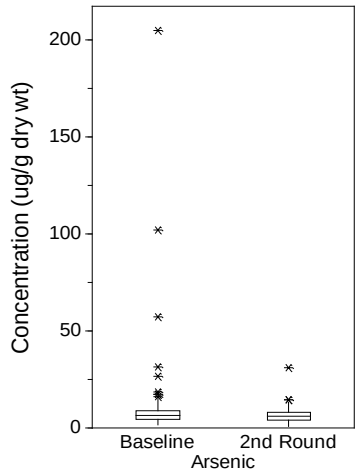
The graphical displays include two types of graphs:

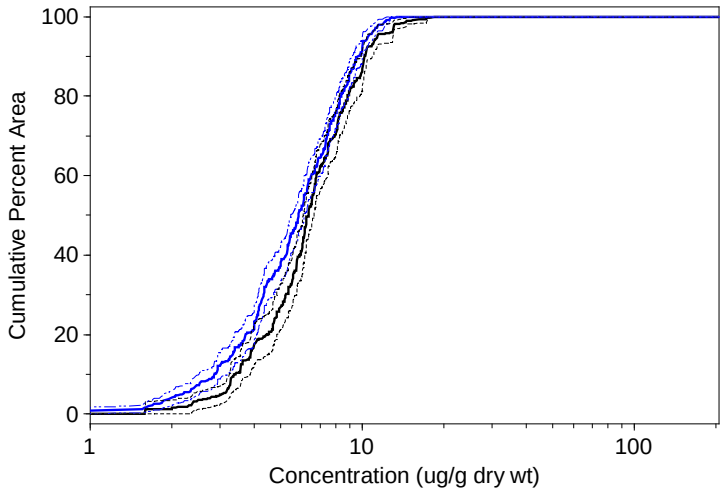
(c) Censored boxplots display the distributions of the data unweighted by sample area.
(d) Cumulative distribution function (CDF) curves display the cumulative distributions of the data weighted by sample area. CDFs are not given when there were too few detected values.

Note: 95% confidence intervals (CI) are shown for the CDFs. Non-overlapping confidence intervals indicate statistically significant differences.

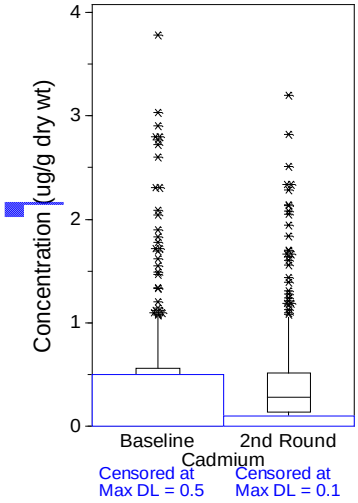


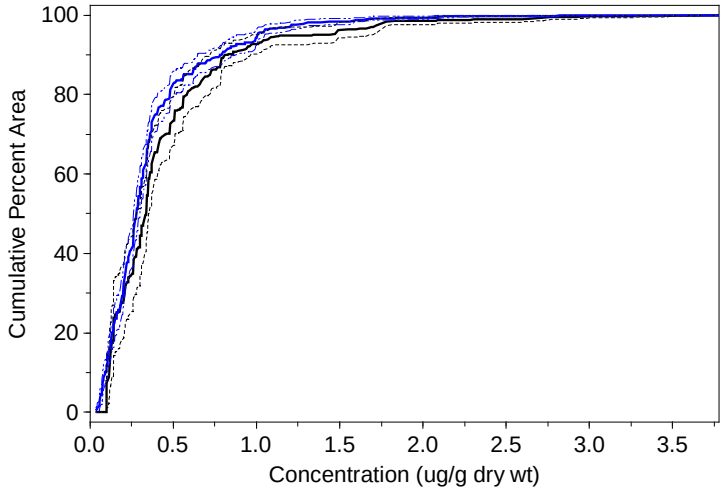
Arsenic



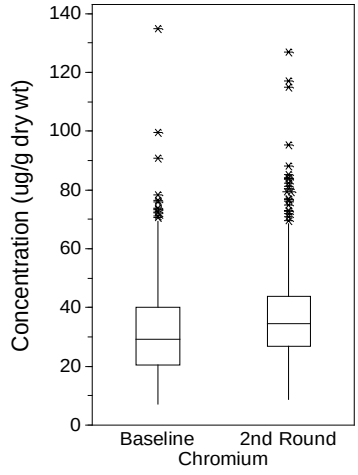


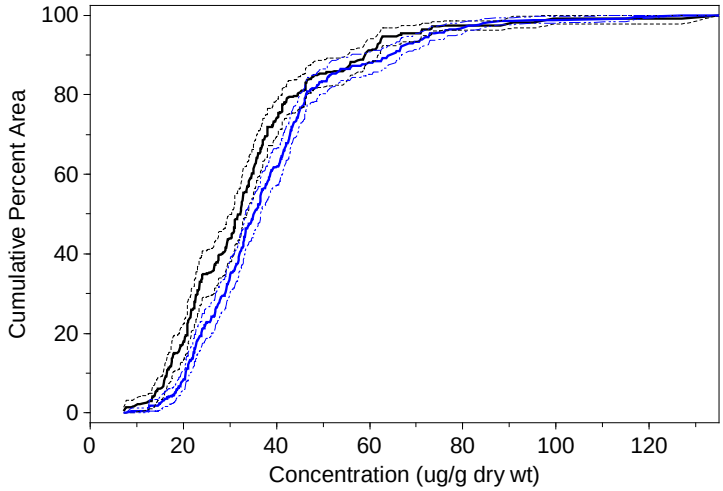
Cadmium



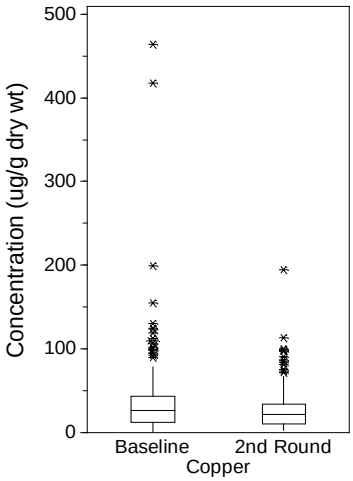


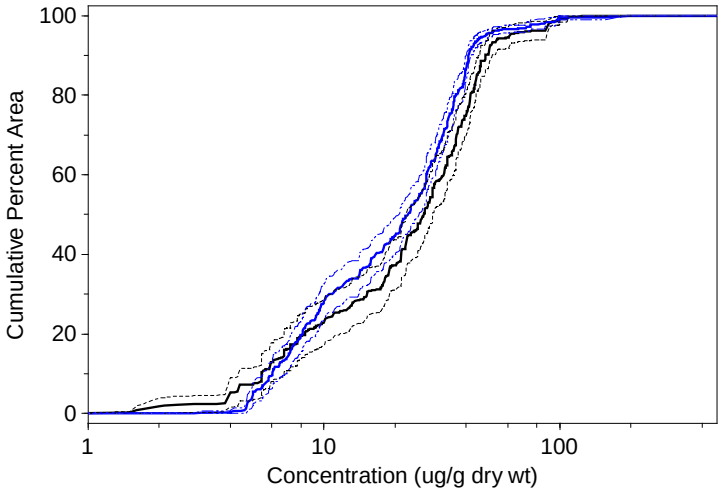
Chromium



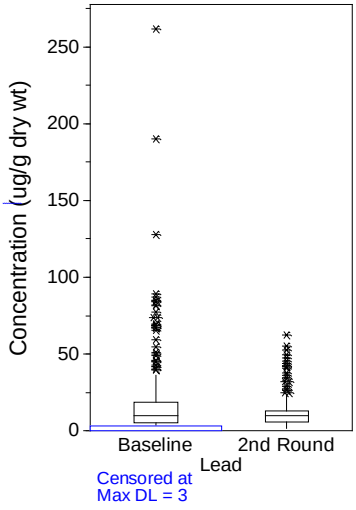


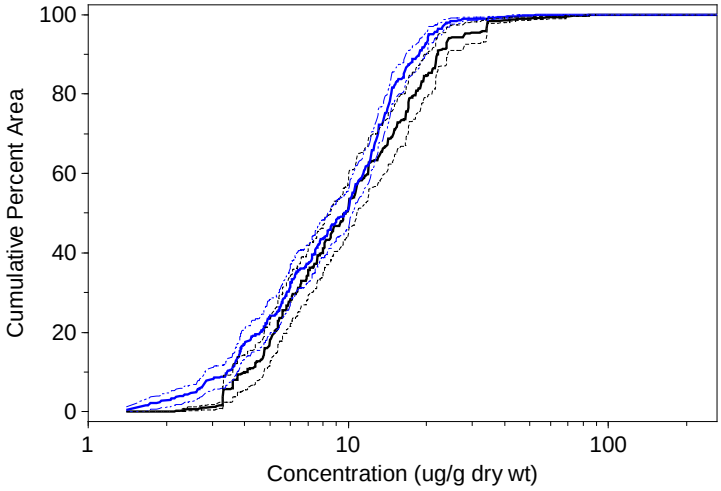
Copper



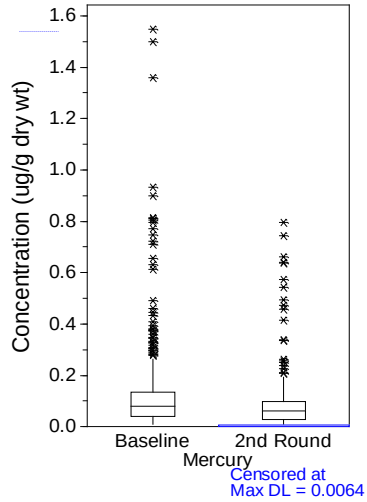


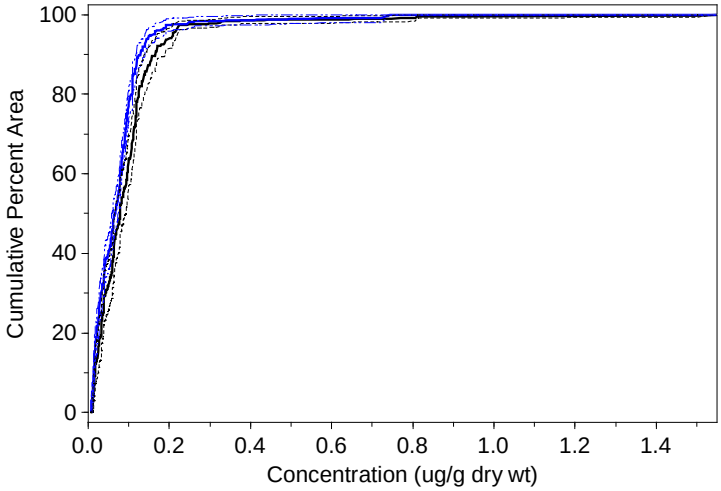
Lead





Mercury





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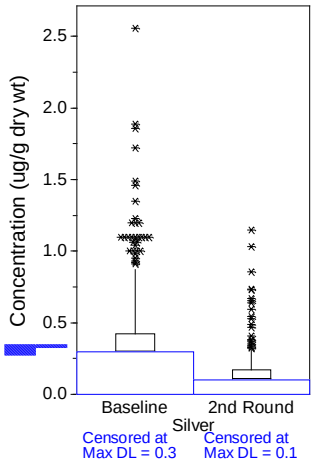

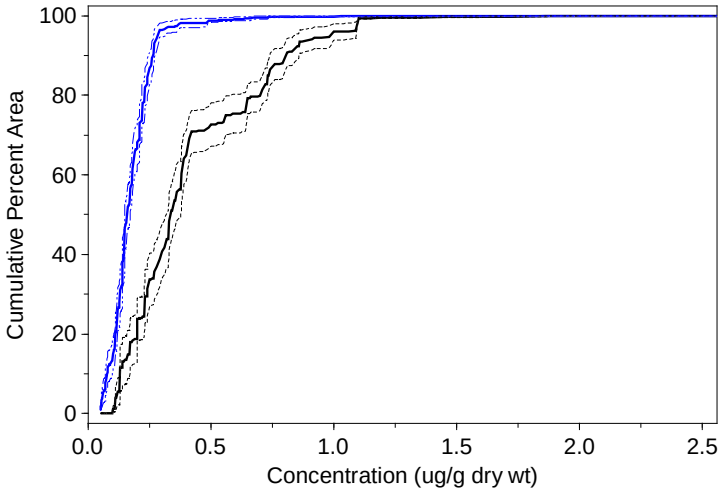

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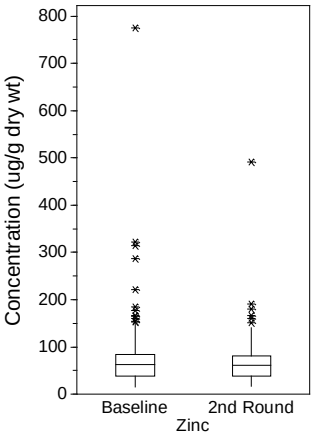
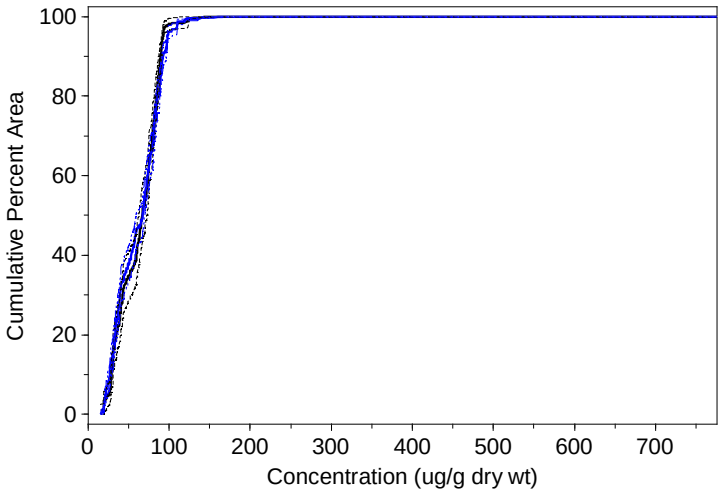
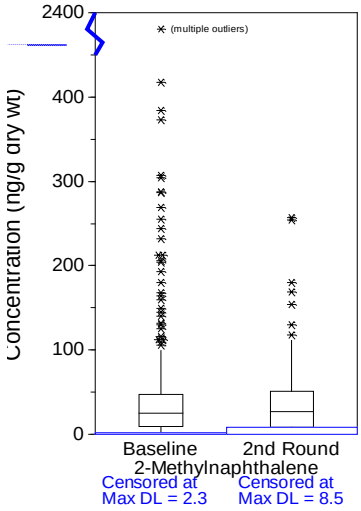
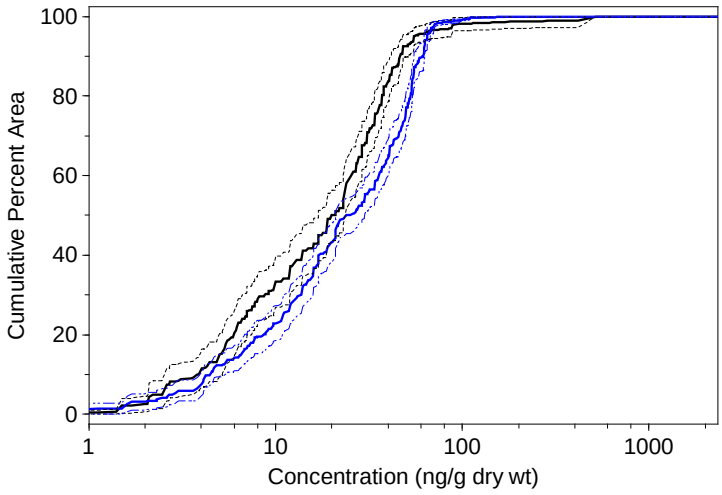


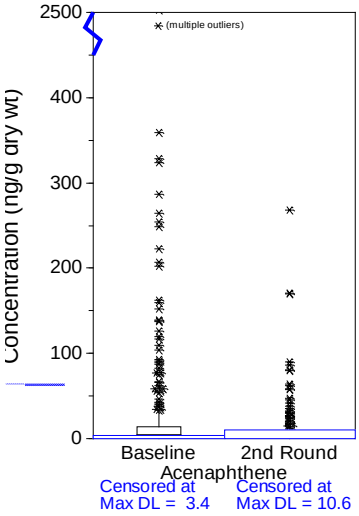


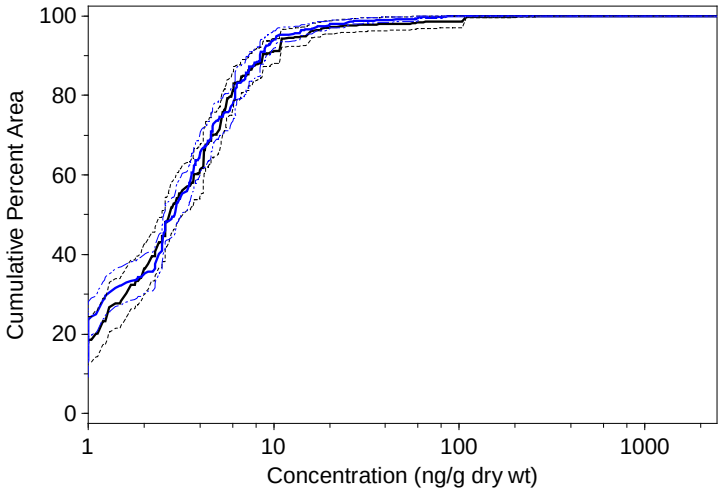
2-Methylnaphthalene



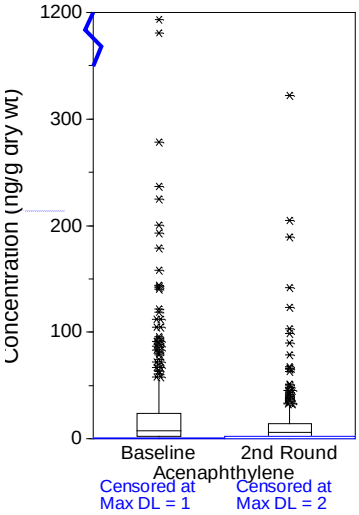


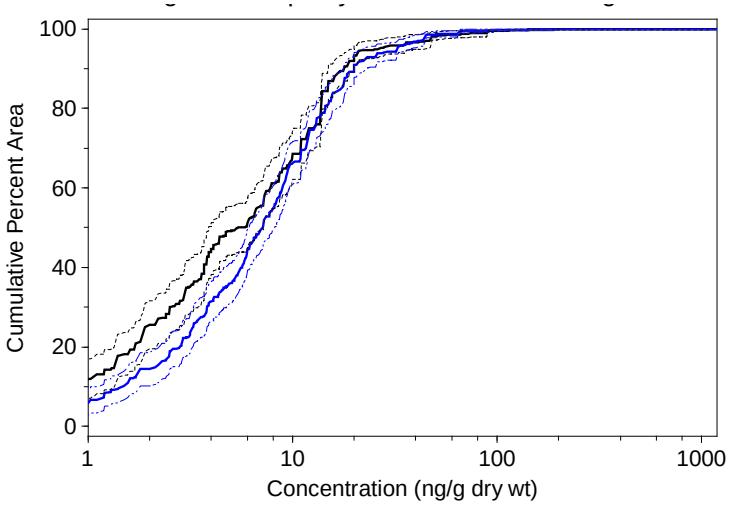
Acenaphthene



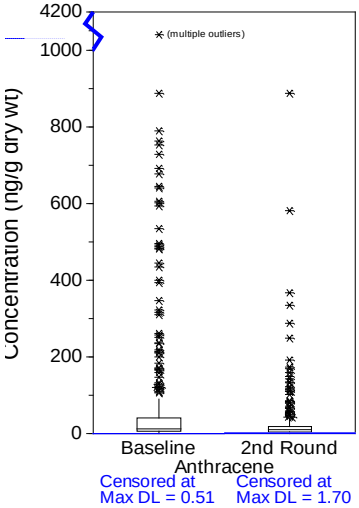


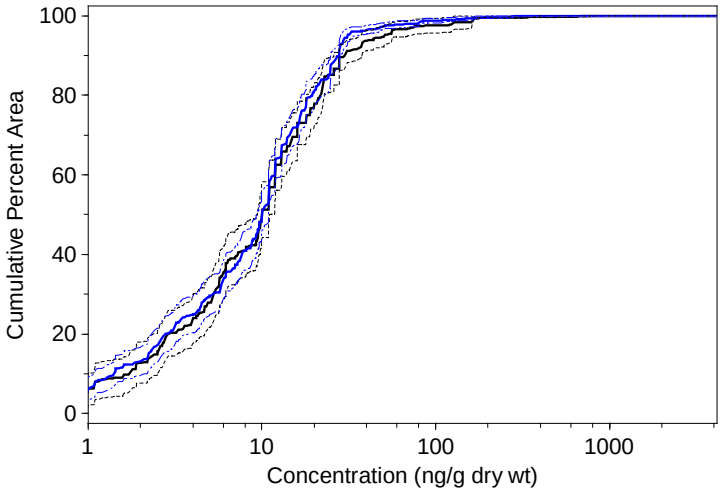
Acenaphthylene



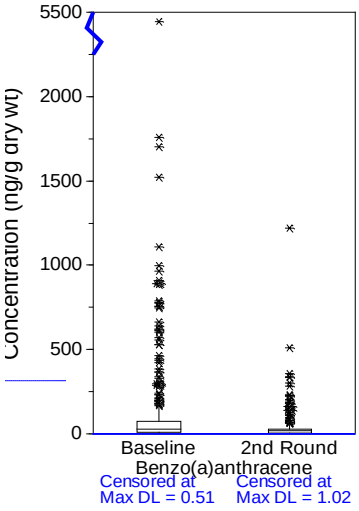


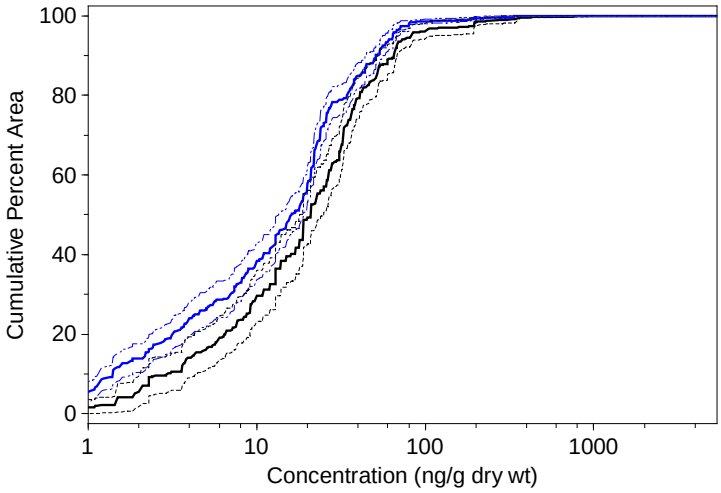
Anthracene



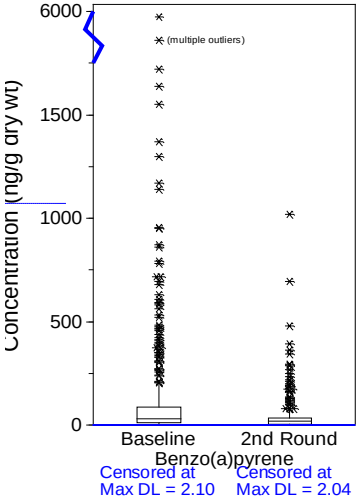


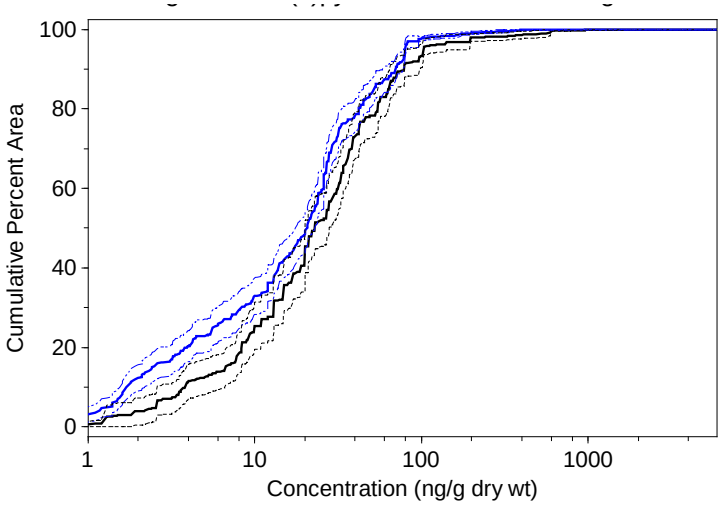
Benzo(a)anthracene



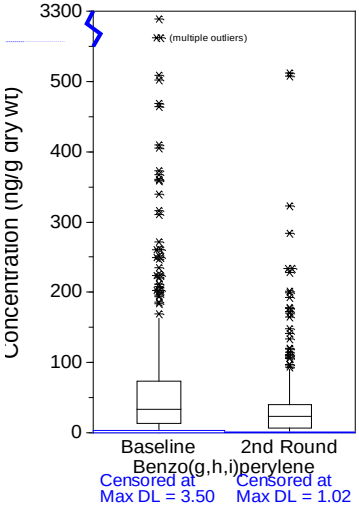


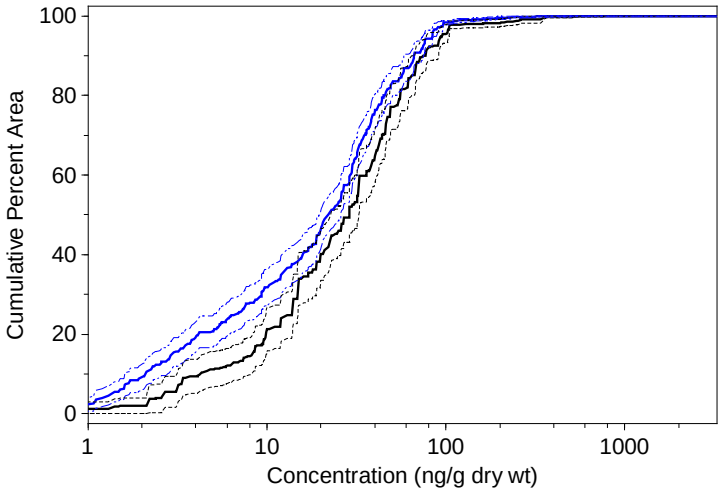
Benzo(a)pyrene



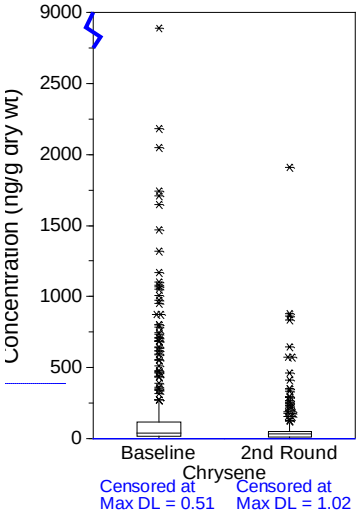


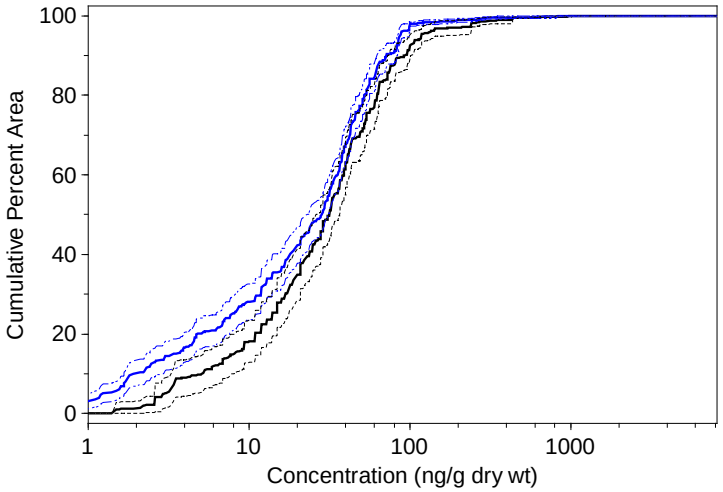
Benzo(g,h,i)perylene



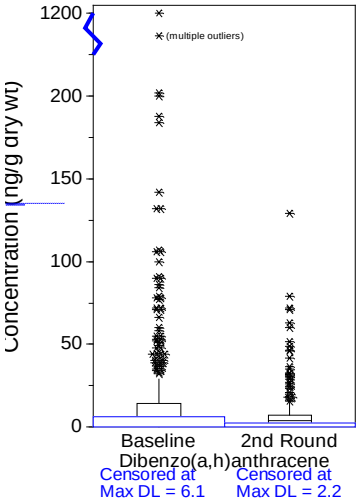


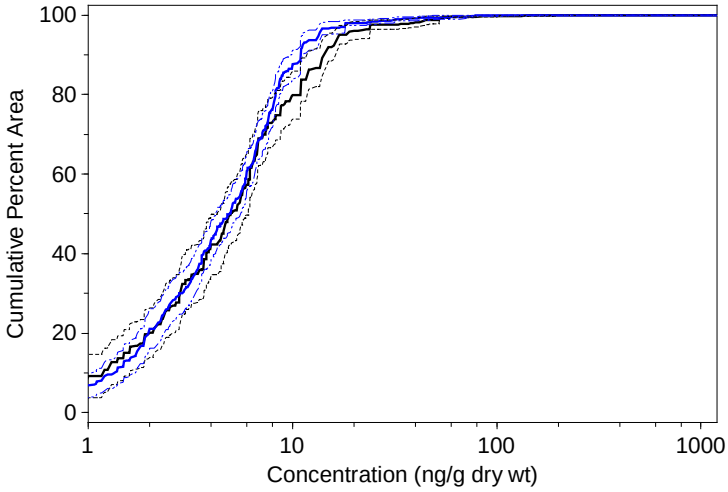
Chrysene



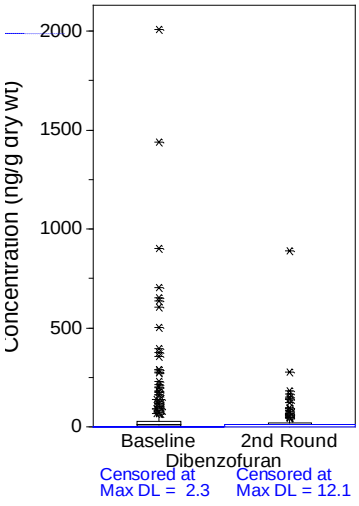


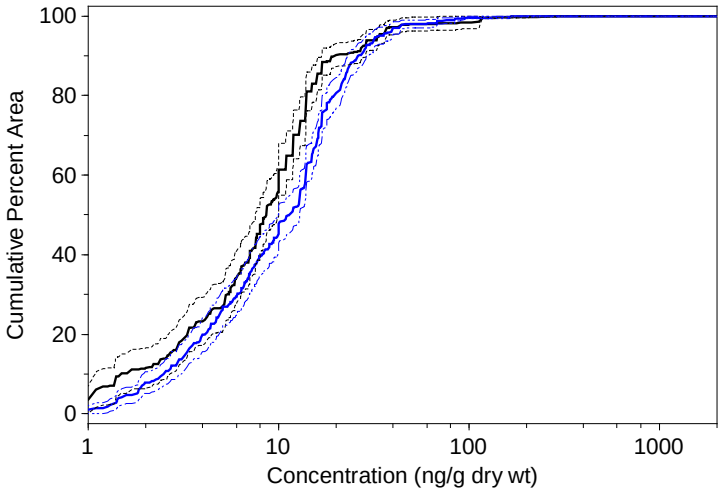
Dibenzo(a,h)anthracene



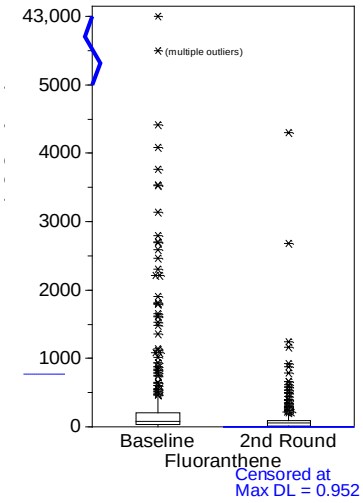


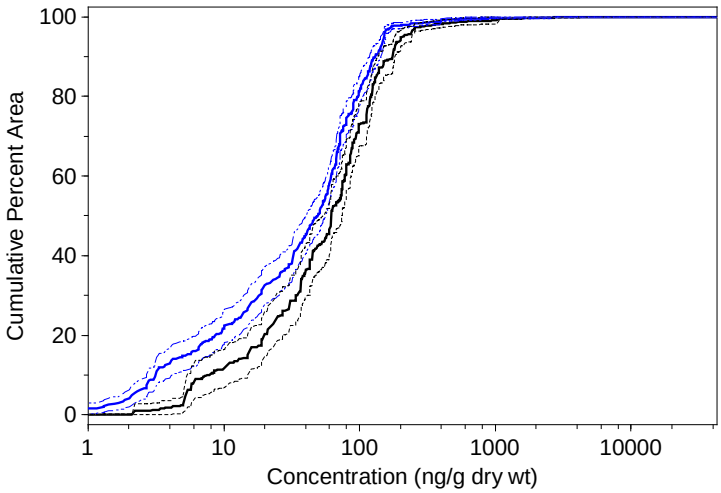
Dibenzofuran





Fluoranthene





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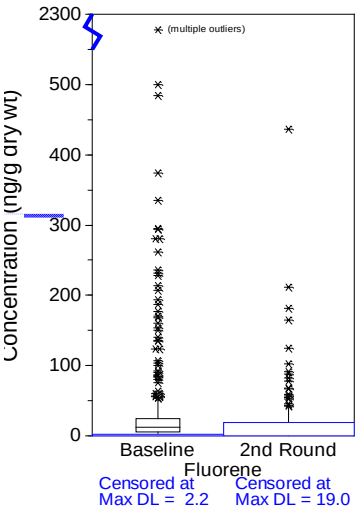
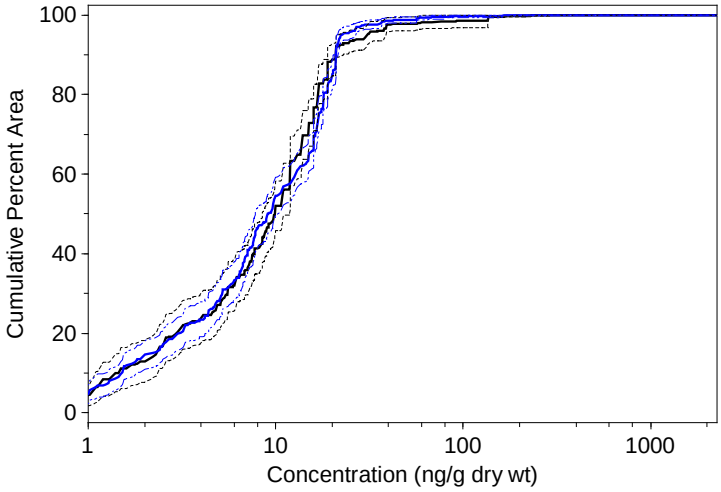
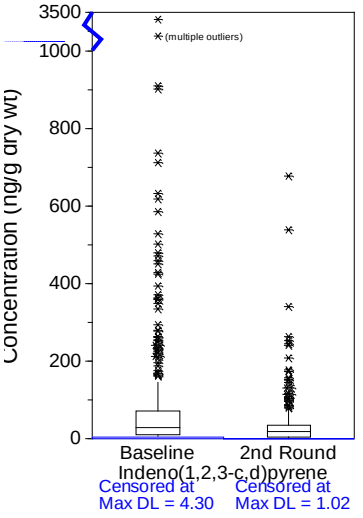
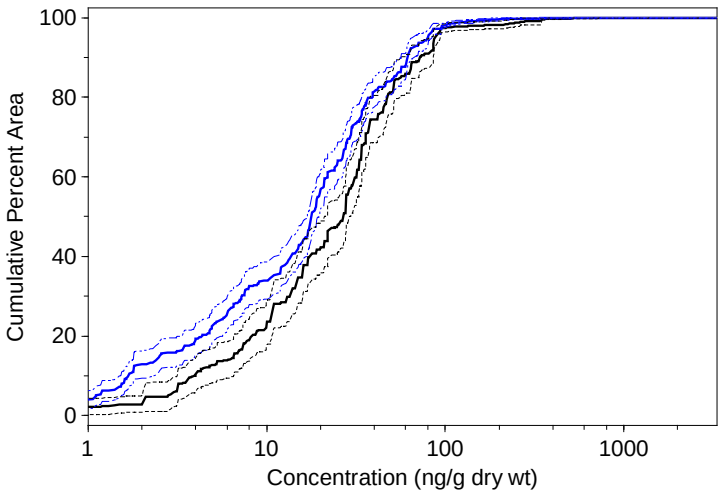


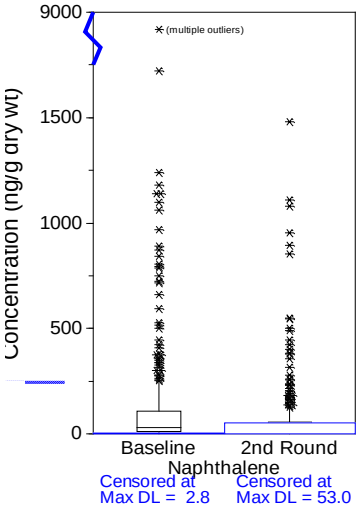


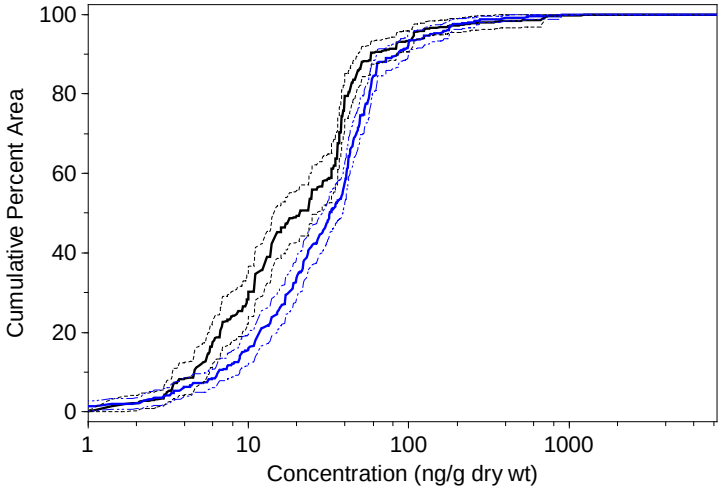
Indeno(1,2,3-c,d)pyrene



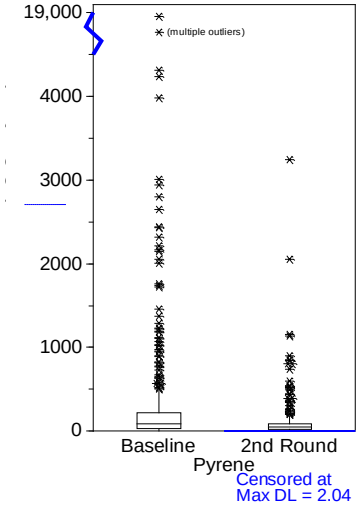


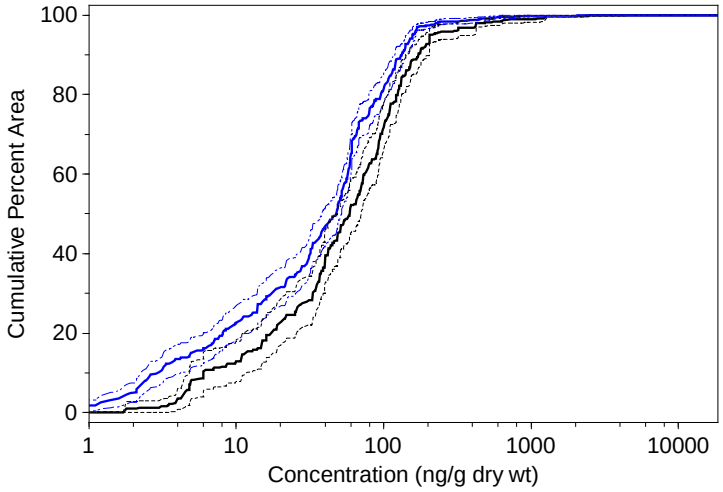
Naphthalene



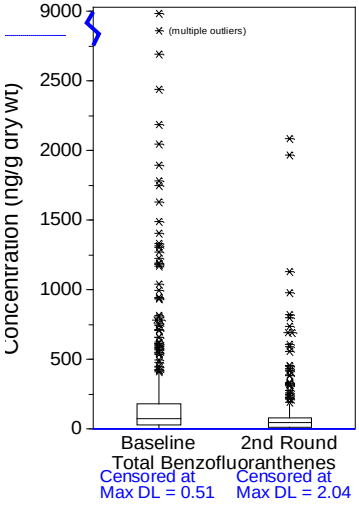


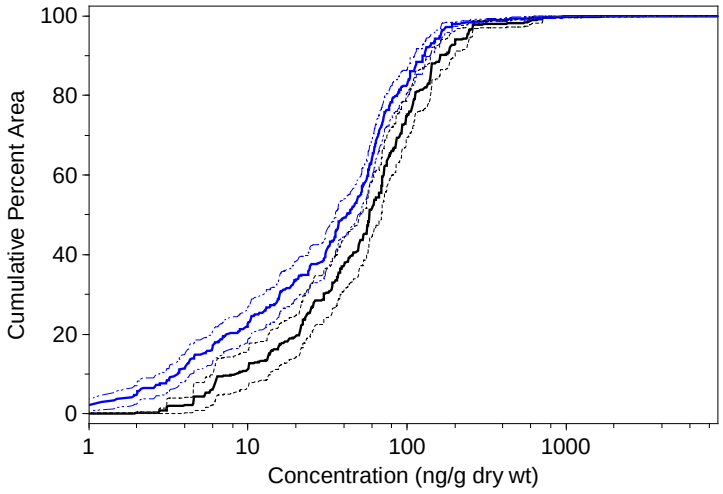
Pyrene



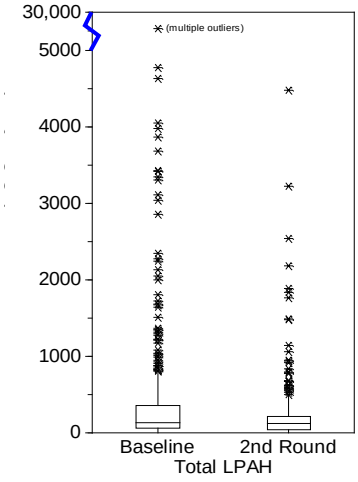


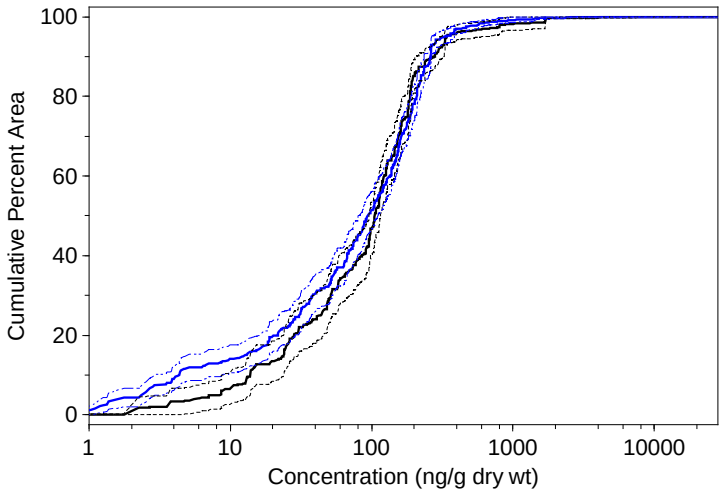
Total Benzofluoranthenes



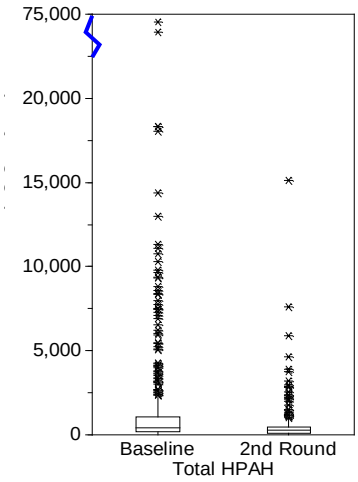


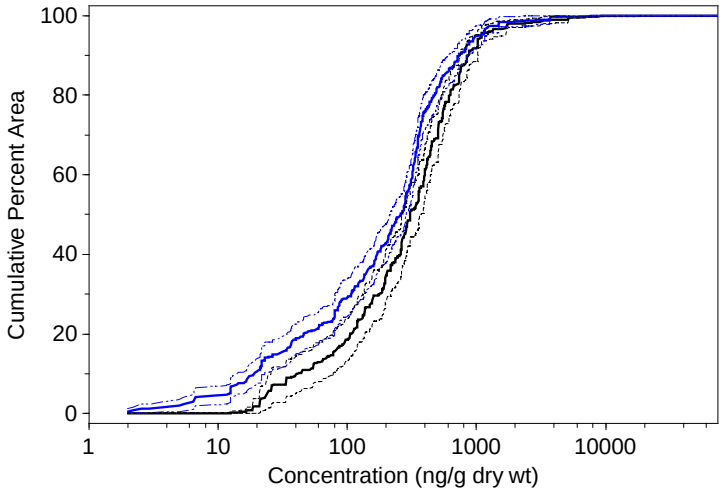
Total LPAH



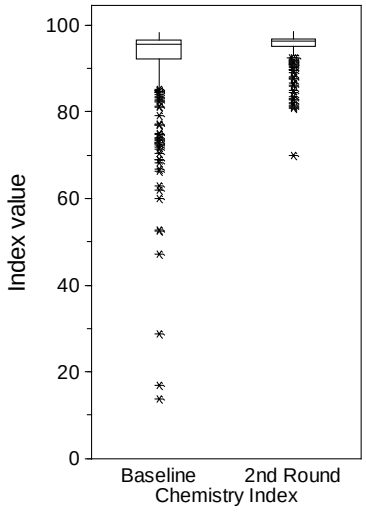


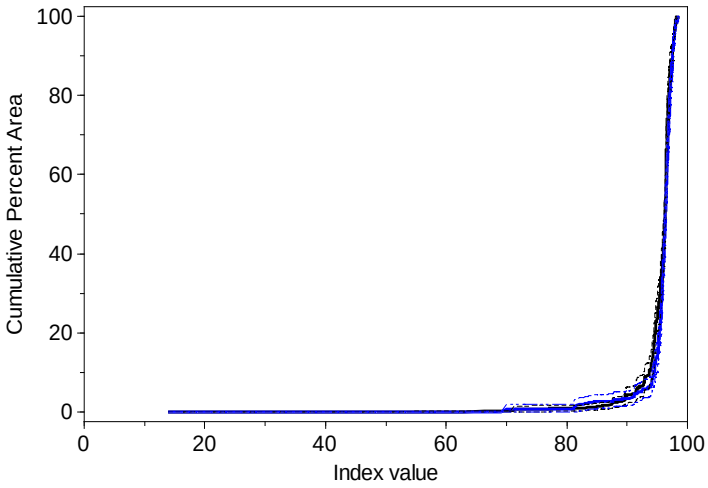
Total HPAH





Chemistry Index





Comparisons with Baseline

Changes in contaminant concentrations (unweighted[1] and weighted[2] by area) from Baseline to Second Round.

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

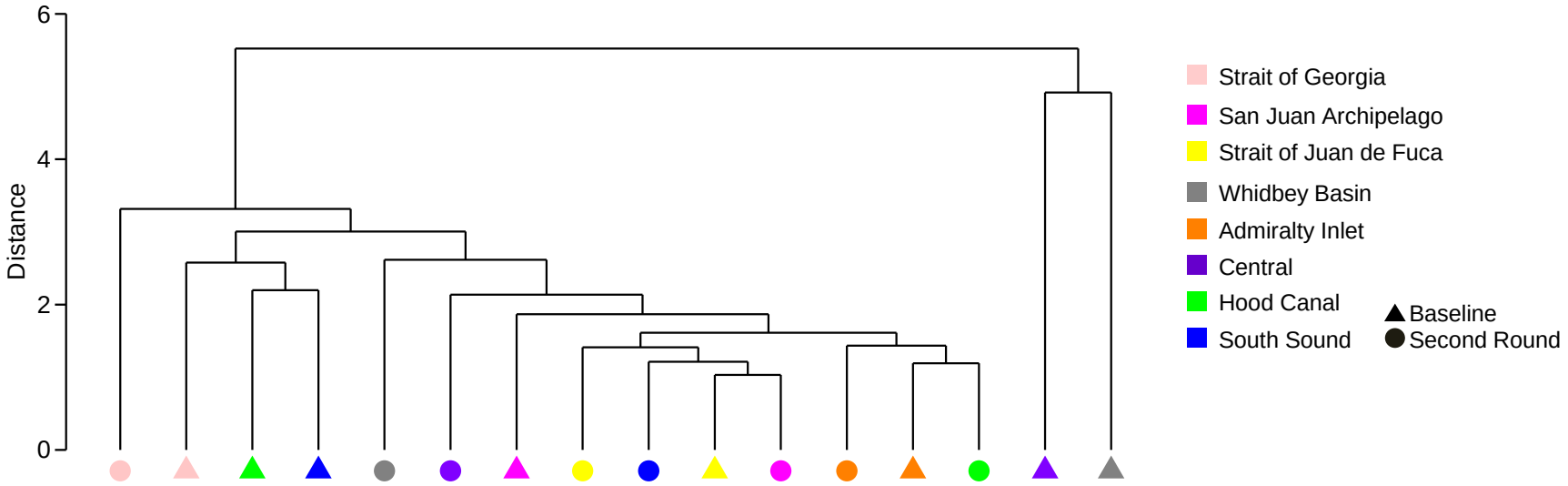
Parameter	Change from Baseline to Second Round
Metals	
Arsenic	↓
Cadmium	--
Chromium	↑
Copper	↓
Lead	↓
Mercury	↓
Silver	↓
Zinc	--
Organics	
BNAs	
Individual BNA compounds	too few detected values to test
PAHs	
2-Methylnaphthalene	--
Acenaphthene	--
Acenaphthylene	--
Anthracene	↓
Benzo(a)anthracene	↓
Benzo(a)pyrene	↓
Benzo[e]pyrene	↓
Benzo(g,h,i)perylene	↓
Chrysene	↓
Dibenzo(a,h)anthracene	↓
Dibenzofuran	--
Fluoranthene	↓
Fluorene	--
Indeno(1,2,3-c,d)pyrene	↓
Naphthalene	--
Phenanthrene	↓
Pyrene	↓
Total Benzofluoranthenes	↓
Total LPAHs	--
Total HPAHs	↓
PCBs	

Parameter	Change from Baseline to Second Round
Individual Aroclors	too few detected values to test
Individual PCB congeners	too few detected values to test
Pesticides	
Individual pesticides	too few detected values to test

[1] Medians (unweighted) compared by Kruskal-Wallis test when all results detected, or by the Generalized Wilcoxon test when nondetects are present (α = 0.05).

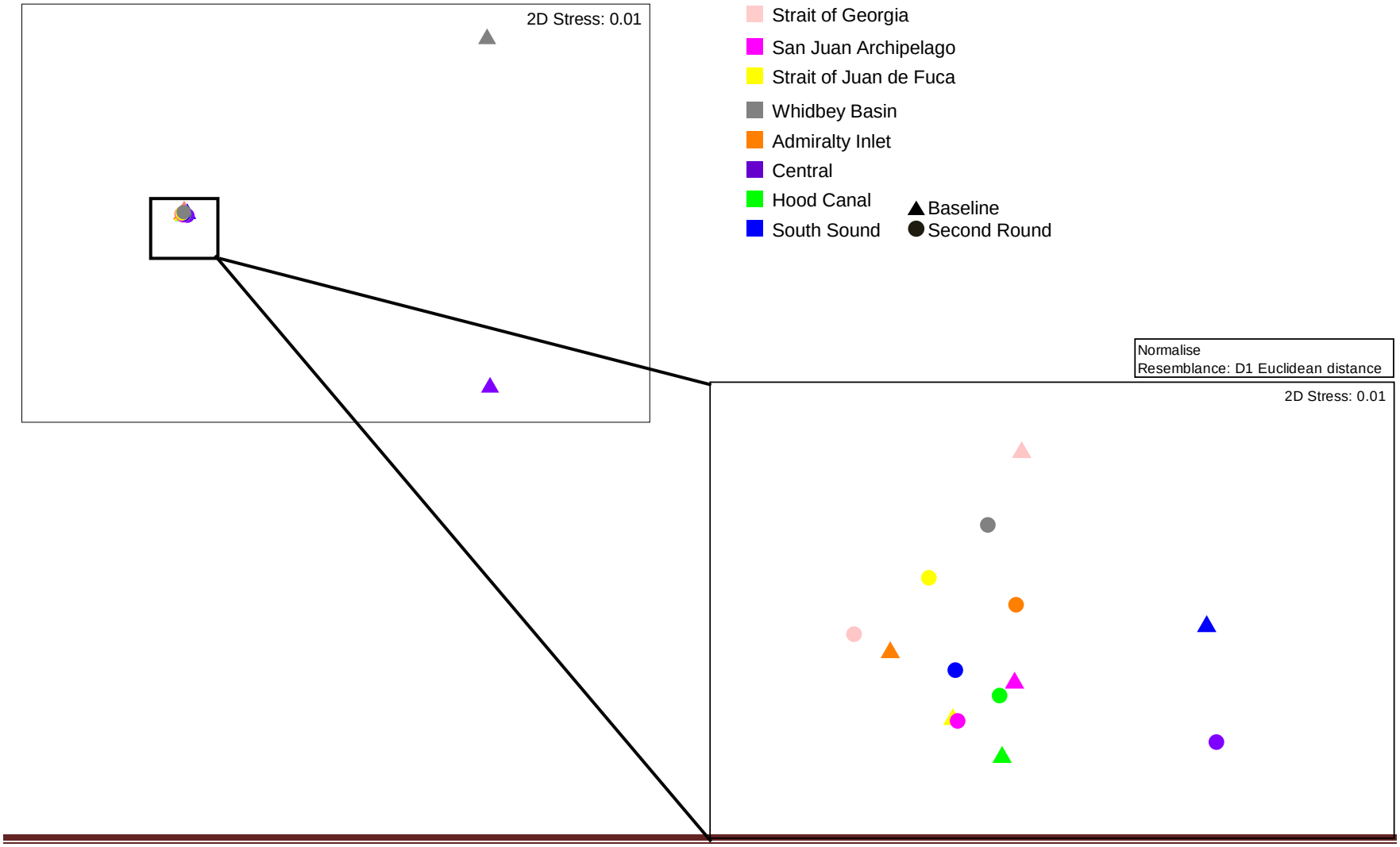
[2] CDFs (weighted) compared by Wald F test (α = 0.05).

Cluster dendrogram indicating similarities of centroids of chemical mixtures for the eight sampling regions and two surveys in Puget Sound (unweighted values normalized prior to comparison with Euclidean distance).

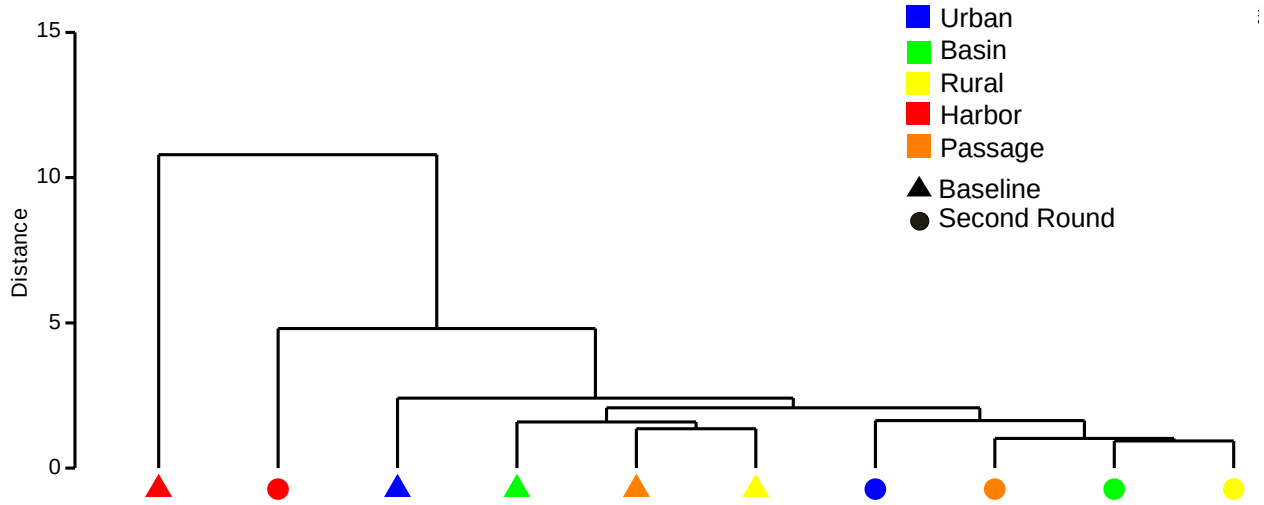


Nonmetric multidimensional scaling (MDS) diagram indicating relative similarities of centroids of stations characterized by 126 chemical parameters for the eight regions and two surveys in Puget Sound (unweighted values normalized prior to comparison with Euclidean distance).

The closer the symbols are in the diagram, the more similar their chemical mixtures are.

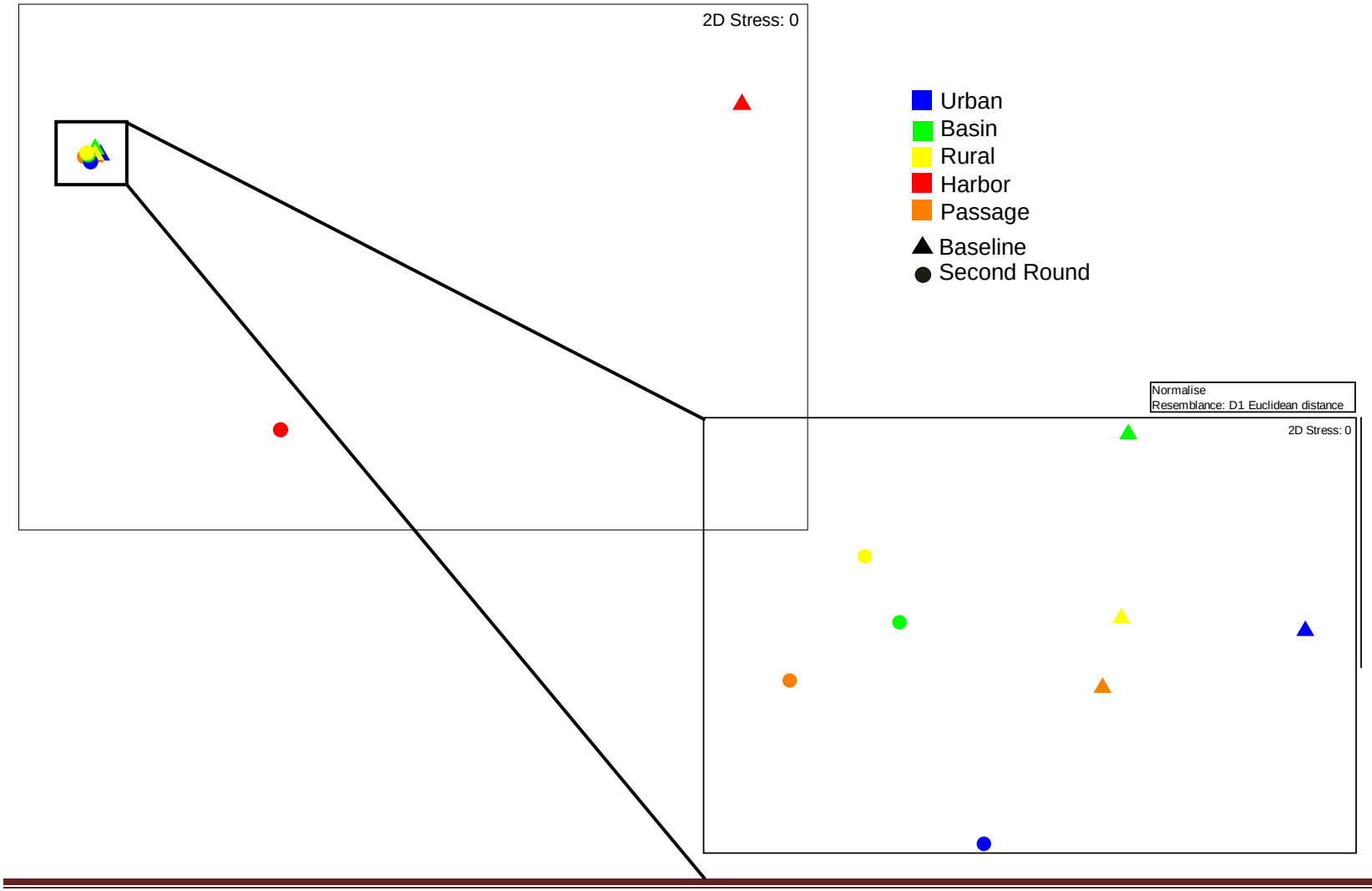


Cluster dendrogram indicating similarity of centroids of chemical mixtures for the five sampling strata and two surveys in Puget Sound (unweighted values normalized prior to comparison with Euclidean distance).



Nonmetric multidimensional scaling (MDS) diagram indicating relative similarities of centroids of stations characterized by 126 chemical parameters for the five sampling strata and two surveys in Puget Sound (unweighted values normalized prior to comparison with Euclidean distance).

The closer the symbols are in the diagram, the more similar their chemical mixtures are.

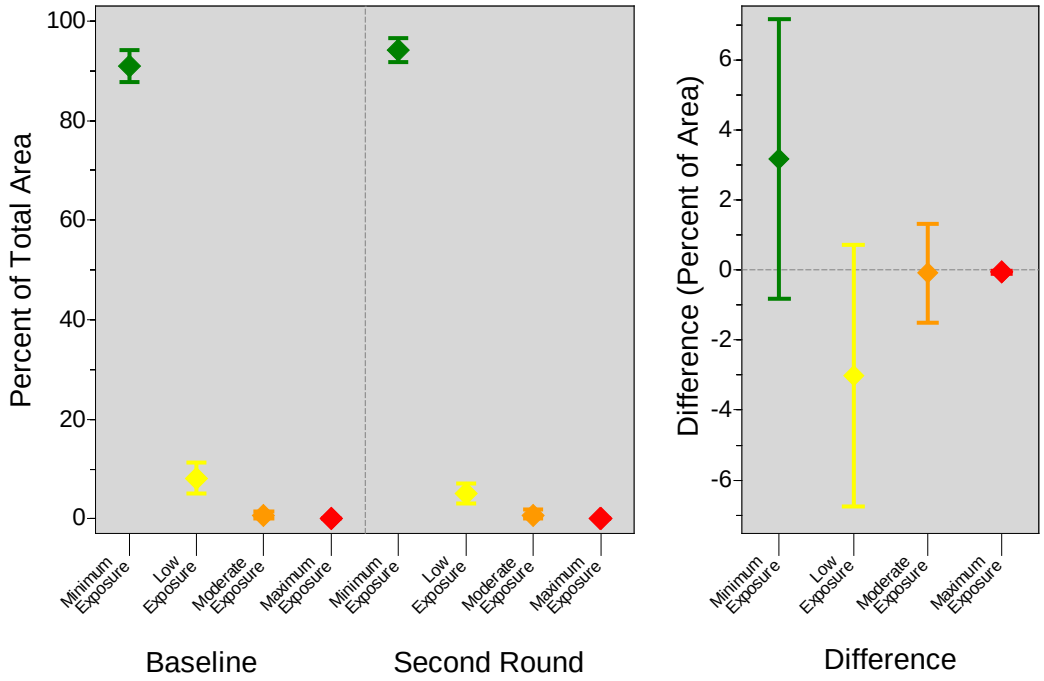


Comparison of Chemistry Index Categories by Survey

Estimated spatial extent (percent of area) and 95% confidence intervals for each of the Chemistry Index categories (Dutch et al., 2014) for the Second Round, compared to the Baseline.

The differences between the years are *not* statistically significant, as indicated by the difference confidence intervals containing the value zero.

Sediment Chemistry Index Category	Baseline (1997-2003)			Second Round (2004-2014)			Difference (2nd Round-Baseline)			* = significantly different (Kincaid, 2015, α = 0.05)
	Estimate	Confidence Limit		Estimate	Confidence Limit		Estimate	Confidence Limit		
		Lower	Upper		Lower	Upper		Lower	Upper	
Minimum exposure	90.97	87.75	94.20	94.15	91.78	96.51	3.17	-0.82	7.17	
Low exposure	8.17	5.05	11.28	5.15	3.10	7.20	-3.02	-6.75	0.71	
Moderate exposure	0.79	0.01	1.58	0.70	0.00	1.87	-0.09	-1.50	1.32	
Maximum exposure	0.07	0.03	0.11	0.00	n.a.	n.a.	-0.07	n.a.	n.a.	



Incidence and spatial extent of chemical contamination, as measured with the Chemistry Index (Dutch et al., 2014), in eight sediment monitoring regions and all of Puget Sound, for each the Baseline (1997-2003) and Second Round (2004-2014) surveys.

Sediment Chemistry Index Category	Baseline				Second Round			
	Stations		Area		Stations		Area	
	No.	(%)	km^2	(%)	No.	(%)	km^2	(%)
Strait of Georgia	61	(100.0)	386.9	(100.0)	40	(100.0)	360.6	(100.0)
Minimum exposure	46	(75.4)	345.1	(89.2)	36	(90.0)	352.3	(97.7)
Low exposure	15	(24.6)	41.8	(10.8)	4	(10.0)	8.3	(2.3)
Moderate exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Maximum exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
San Juan Archipelago	30	(100.0)	80.7	(100.0)	40	(100.0)	79.46	(100.0)
Minimum exposure	29	(96.7)	78.0	(96.7)	40	(100.0)	79.46	(100.0)
Low exposure	1	(3.3)	2.7	(3.3)	0	(0.0)	0.0	(0.0)
Moderate exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Maximum exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
E. Strait of Juan de Fuca	30	(100.0)	61.8	(100.0)	40	(100.0)	67.82	(100.0)
Minimum exposure	29	(96.7)	61.0	(98.6)	37	(92.5)	65.5	(96.6)
Low exposure	1	(3.3)	0.9	(1.4)	3	(7.5)	2.3	(3.4)
Moderate exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Maximum exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Admiralty Inlet	30	(100.0)	69.2	(100.0)	43	(100.0)	66.5	(100.0)
Minimum exposure	30	(100.0)	69.2	(100.0)	36	(83.7)	50.4	(75.8)
Low exposure	0	(0.0)	0.0	(0.0)	7	(16.3)	16.1	(24.2)
Moderate exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Maximum exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Whidbey Basin	39	(100.0)	338.1	(100.0)	40	(100.0)	353.3	(100.0)
Minimum exposure	29	(74.4)	307.0	(90.8)	36	(90.0)	344.4	(97.5)
Low exposure	6	(15.4)	20.7	(6.1)	4	(10.0)	8.9	(2.5)
Moderate exposure	3	(7.7)	10.4	(3.1)	0	(0.0)	0.0	(0.0)
Maximum exposure	1	(2.6)	0.1	(0.0)	0	(0.0)	0.0	(0.0)
Central	128	(100.0)	683.9	(100.0)	80	(100.0)	667.4	(100.0)
Minimum exposure	54	(42.2)	569.5	(83.3)	58	(72.5)	583.2	(87.4)
Low exposure	46	(35.9)	105.1	(15.4)	21	(26.3)	68.6	(10.3)
Moderate exposure	19	(14.8)	7.8	(1.1)	1	(1.3)	15.6	(2.3)
Maximum exposure	9	(7.0)	1.5	(0.2)	0	(0.0)	0.0	(0.0)
Hood Canal	21	(100.0)	331.7	(100.0)	30	(100.0)	294.8	(100.0)
Minimum exposure	16	(76.2)	324.4	(97.8)	29	(96.7)	285.6	(96.9)
Low exposure	5	(23.8)	7.3	(2.2)	1	(3.3)	9.2	(3.1)
Moderate exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Maximum exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
South Sound	42	(100.0)	341.6	(100.0)	55	(100.0)	317.7	(100.0)
Minimum exposure	36	(85.7)	332.7	(97.4)	53	(96.4)	317.4	(99.9)
Low exposure	6	(14.3)	8.9	(2.6)	2	(3.6)	0.3	(0.1)

Sediment Chemistry Index Category	Baseline				Second Round			
	Stations		Area		Stations		Area	
	No.	(%)	km^2	(%)	No.	(%)	km^2	(%)
Moderate exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Maximum exposure	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Total Study Area	381	(100.0)	2294.1	(100.0)	368	(100.0)	2207.0	(100.0)
Minimum exposure	269	(70.6)	2087.0	(91.0)	325	(88.3)	2078.3	(94.1)
Low exposure	80	(21.0)	187.36	(8.2)	42	(11.4)	113.7	(5.2)
Moderate exposure	22	(5.8)	18.15	(0.8)	1	(0.3)	15.6	(0.7)
Maximum exposure	10	(2.6)	1.57	(0.1)	0	(0.0)	0.0	(0.0)

Incidence and spatial extent of chemical contamination, as measured with the Chemistry Index (Dutch et al., 2014), in five strata, for each the Baseline (1997-2003) and Second Round (2004-2014) surveys.

Survey Strata	Minimum exposure				Low exposure				Moderate exposure				Maximum exposure			
	Station		Area		Station		Area		Station		Area		Station		Area	
	No.	%	km^2	%	No.	%	km^2	%	No.	%	km^2	%	No.	%	km^2	%
Baseline	**269**	**(70.6)**	**2087.0**	**(91.0)**	**80**	**(21.0)**	**187.4**	**(8.2)**	**22**	**(5.8)**	**18.2**	**(0.8)**	**10**	**(2.6)**	**1.6**	**(0.1)**
Basin	34	(81.0)	834.5	(93.7)	8	(19.0)	56.0	(6.3)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Harbor	10	(15.9)	4.4	(21.0)	28	(44.4)	12.1	(57.0)	15	(23.8)	3.1	(14.6)	10	(15.9)	1.6	(7.4)
Passage	53	(86.9)	443.6	(90.2)	7	(11.5)	37.9	(7.7)	1	(1.6)	10.2	(2.1)	0	(0.0)	0.0	(0.0)
Rural	117	(90.7)	695.8	(92.7)	12	(9.3)	54.7	(7.3)	0	(0.0)	0.0	(0.0)	0	(0.0)	0.0	(0.0)
Urban	55	(64.0)	108.7	(77.5)	25	(29.1)	26.7	(19.0)	6	(7.0)	4.9	(3.5)	0	(0.0)	0.0	(0.0)
Second Round	**325**	**(88.3)**	**2078.3**	**(94.1)**	**42**	**(11.4)**	**113.7**	**(5.2)**	**1**	**(0.3)**	**15.6**	**(0.7)**	**0**	**(0.0)**	**0.0**	**(0.0)**
Basin	68	(94.4)	766.1	(93.2)	3	(4.2)	40.3	(4.9)	1	(1.4)	15.6	(1.9)	No samples were in this category			
Harbor	14	(42.4)	6.5	(32.8)	19	(57.6)	13.3	(67.2)	0	(0.0)	0.0	(0.0)				
Passage	48	(90.6)	453.4	(97.0)	5	(9.4)	14.1	(3.0)	0	(0.0)	0.0	(0.0)				
Rural	133	(98.5)	748.5	(98.2)	2	(1.5)	13.6	(1.8)	0	(0.0)	0.0	(0.0)				
Urban	62	(82.7)	103.8	(76.2)	13	(17.3)	32.4	(23.8)	0	(0.0)	0.0	(0.0)				