APPENDIX E

DATA USED IN THE DEVELOPMENT OF THE SITE-SPECIFIC MERCURY BIOACCUMULATION SCREENING LEVEL

The site-specific bioaccumulation screening level was developed as part of the 2000 RI/FS. The attached data summaries were contained in that document.

Table 1 - Paired Sediment and Tissue Mercury Concentration Data, Bellingham Bay and Other Puget Sound Embayments (excluding Sinclair Inlet), 1990 to 1997

Species/Tissue Type & Location	Tissue Sample ID	Measured Mercury Tissue Conc. (Data Source) in mg/kg wet wt.	Home Range Average Sediment Mercury Conc. (Data Source) in mg/kg dry wt.
Dungeness crab muscle (a):			
Bellingham 18	97-31	0.081 (Ecology '97)	0.10 (SEDQUAL)
Bellingham 18	97-32	0.027 (Ecology '97)	0.10 (SEDQUAL)
Bellingham 18	97-33	0.031 (Ecology '97)	0.10 (SEDQUAL)
Chuckanut Bay	90-1	0.060 (Cubbage '91)	0.12 (PSAMP)
Lummi Penninsula	90-2	0.090 (Cubbage '91)	0.20 (SEDQUAL)
Post Point	97-14	0.061 (Ecology '97)	0.23 (CH2MHill '97)
Post Point	97-18	0.077 (Ecology '97)	0.23 (CH2MHill '97)
Central Bellingham Bay	97-52	0.126 (Ecology '97)	0.37 (SEDQUAL)
Central Bellingham Bay	97-54	0.056 (Ecology '97)	0.37 (SEDQUAL)
Post Point	90-4	0.110 (Cubbage '91)	0.39 (SEDQUAL)
Post Point Outfall	90-5	0.080 (Cubbage '91)	0.39 (SEDQUAL)
Georgia-Pacific Outfall	90-7-1	0.120 (Cubbage '91)	0.51 (SEDQUAL)
Georgia-Pacific Outfall	90-7-2	0.060 (SAIC '90)	0.51 (SEDQUAL)
Whatcom Waterway	97-2	0.100 (Ecology '97)	0.54 (WW Area RI)
Whatcom Waterway	97-3	0.119 (Ecology '97)	0.54 (WW Area RI)
Whatcom Waterway	97-22	0.211 (Ecology '97)	0.54 (WW Area RI)
Whatcom Waterway	97-24	0.204 (Ecology '97)	0.54 (WW Area RI)
Whatcom Waterway	97-37	0.100 (Ecology '97)	0.54 (WW Area RI)
Whatcom Waterway	97-38	0.108 (Ecology '97)	0.54 (WW Area RI)
Padden Creek	90-6	0.100 (Cubbage '91)	0.55 (SEDQUAL)
Boulevard Park	90-3	0.100 (Cubbage '91)	0.58 (SEDQUAL)
Whatcom Waterway	90-8-1	0.160 (Cubbage '91)	0.91 (SEDQUAL)
Whatcom Waterway	90-8-2	0.150 (Cubbage '91)	0.91 (SEDQUAL)
Red rock crab muscle (b):			
Port Madison	90-1	0.046 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-2	0.062 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-3	0.034 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-4	0.069 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-5	0.103 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-6	0.059 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-7	0.046 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-8	0.223 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-9	0.101 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-10	0.028 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-11	0.014 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-12	0.074 (CH2MHill '91)	0.05 (CH2MHill '91)
Port Madison	90-13	0.021 (CH2MHill '91)	0.05 (CH2MHill '91)
West Eagle Harbor	90-1	0.139 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-2	0.043 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-3	0.180 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-4	0.062 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-5	0.251 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-6	0.110 (CH2MHill '91)	0.65 (CH2MHill '91)

Table 1 - Paired Sediment and Tissue Mercury Concentration Data, Bellingham Bay and Other Puget Sound Embayments (excluding Sinclair Inlet), 1990 to 1997

Species/Tissue Type & Location	Tissue Sample ID	Measured Mercury Tissue Conc. (Data Source) in mg/kg wet wt.	Home Range Average Sediment Mercury Conc. (Data Source) in mg/kg dry wt.
West Eagle Harbor	90-7	0.078 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-8	0.046 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-9	0.138 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-10	0.098 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-11	0.041 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-12	0.032 (CH2MHill '91)	0.65 (CH2MHill '91)
West Eagle Harbor	90-13	0.057 (CH2MHill '91)	0.65 (CH2MHill '91)
Whatcom Waterway	74-1	0.459 (Nelson et al. '74)	5.94 (Nelson et al. '74)
English sole muscle (c):			
Port Madison	92-3	0.066 (O'Neill et al., '95)	0.05 (CH2MHill '91)
Port Madison	92-2	0.069 (O'Neill et al., '95)	0.05 (CH2MHill '91)
Port Madison	92-1	0.065 (O'Neill et al., '95)	0.05 (CH2MHill '91)
Vendovi Island	94-1	0.074 (O'Neill et al., '95)	0.09 (PSAMP)
Vendovi Island	94-2	0.070 (O'Neill et al., '95)	0.09 (PSAMP)
Vendovi Island	94-3	0.070 (O'Neill et al., '95)	0.09 (PSAMP)
Central Bellingham Bay	91-1	0.091 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	91-2	0.104 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	91-3	0.094 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	92-1A	0.079 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	92-2A	0.090 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	92-3A	0.084 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	93-1	0.086 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	93-2	0.080 (O'Neill et al., '95)	0.37 (PSAMP)
Central Bellingham Bay	93-3	0.076 (O'Neill et al., '95)	0.37 (PSAMP)
Duwamish River	92-1A	0.075 (O'Neill et al., '95)	0.46 (King Co. '91,'97)
Duwamish River	92-2A	0.079 (O'Neill et al., '95)	0.46 (King Co. '91,'97)
Duwamish River	92-3A	0.082 (O'Neill et al., '95)	0.46 (King Co. '91,'97)
Duwamish River	95-1	0.056 (O'Neill et al., '95)	0.46 (King Co. '91,'97)
Duwamish River	95-2	0.060 (O'Neill et al., '95)	0.46 (King Co. '91,'97)
Duwamish River	95-3	0.065 (O'Neill et al., '95)	0.46 (King Co. '91,'97)
West Eagle Harbor	91-1	0.119 (O'Neill et al., '95)	0.65 (CH2MHill '91/HC '95)
West Eagle Harbor	91-2	0.129 (O'Neill et al., '95)	0.65 (CH2MHill '91/HC '95)
West Eagle Harbor	91-3	0.142 (O'Neill et al., '95)	0.65 (CH2MHill '91/HC '95)
West Eagle Harbor	95-1	0.124 (O'Neill et al., '95)	0.65 (CH2MHill '91/HC '95)
West Eagle Harbor	95-2	0.109 (O'Neill et al., '95)	0.65 (CH2MHill '91/HC '95)
West Eagle Harbor	95-3	0.115 (O'Neill et al., '95)	0.65 (CH2MHill '91/HC '95)
Elliott Bay Waterfront	89-1	0.089 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	89-2	0.058 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	89-3	0.062 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	91-1	0.093 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	91-2	0.080 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	91-3	0.086 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	92-1A	0.092 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	92-2A	0.062 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)

Table 1 - Paired Sediment and Tissue Mercury Concentration Data, Bellingham Bay and Other Puget Sound Embayments (excluding Sinclair Inlet), 1990 to 1997

Species/Tissue Type & Location	Tissue Sample ID	Measured Mercury Tissue Conc. (Data Source) in mg/kg wet wt.	Home Range Average Sediment Mercury Conc. (Data Source) in mg/kg dry wt.
Elliott Bay Waterfront	92-3A	0.063 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	93-1	0.083 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	93-2	0.080 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	93-3	0.091 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	94-1	0.088 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	94-2	0.096 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	94-3	0.089 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	95-1	0.074 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	95-2	0.067 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Elliott Bay Waterfront	95-3	0.067 (O'Neill et al., '95)	0.69 (SEDQUAL/HC unpub.)
Composite hardshell clams:			
Eagle Harbor	EH-T-18	0.011 (CH2MHill '91)	0.03 (CH2MHill '91)
Eagle Harbor	EH-T-17	0.013 (CH2MHill '91)	0.04 (CH2MHill '91)
Eagle Harbor	EH-T-1	0.064 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-11	0.011 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-13	0.020 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-15	0.015 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-2	0.016 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-3	0.022 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-4	0.025 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-5	0.036 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-6	0.069 (CH2MHill '91)	0.05 (CH2MHill '91)
Eagle Harbor	EH-T-9	0.031 (CH2MHill '91)	0.05 (CH2MHill '91)
Semiahmoo	92-1	0.006 (Patrick '96)	0.05 (SEDQUAL)
Semiahmoo	92-2	0.006 (Patrick '96)	0.05 (SEDQUAL)
Semiahmoo	92-3	0.006 (Patrick '96)	0.05 (SEDQUAL)
Semiahmoo	93-1	0.006 (Patrick '96)	0.05 (SEDQUAL)
Semiahmoo	93-2	0.006 (Patrick '96)	0.05 (SEDQUAL)
Semiahmoo	93-3	0.006 (Patrick '96)	0.05 (SEDQUAL)
Sequim Bay	92-1	0.006 (Patrick '96)	0.05 (SEDQUAL)
Sequim Bay	92-2	0.006 (Patrick '96)	0.05 (SEDQUAL)
Sequim Bay	93-1	0.007 (Patrick '96)	0.05 (SEDQUAL)
Sequim Bay	93-2	0.007 (Patrick '96)	0.05 (SEDQUAL)
Sequim Bay	93-3	0.006 (Patrick '96)	0.05 (SEDQUAL)
Eagle Harbor	EH-T-10	0.015 (CH2MHill '91)	0.08 (CH2MHill '91)
Post Point	92-1	0.019 (Patrick '96)	0.39 (SEDQUAL)
Post Point	92-2	0.020 (Patrick '96)	0.39 (SEDQUAL)
Post Point	92-3	0.020 (Patrick '96)	0.39 (SEDQUAL)
Boulevard Park	90-3B	0.010 (Cubbage '91)	0.58 (SEDQUAL)
Eagle Harbor	92-1	0.058 (Patrick '96)	0.77 (CH2MHill '91/HC '95)
Eagle Harbor	92-2	0.056 (Patrick '96)	0.77 (CH2MHill '91/HC '95)
Eagle Harbor	92-3	0.060 (Patrick '96)	0.77 (CH2MHill '91/HC '95)
Eagle Harbor	93-1	0.081 (Patrick '96)	0.77 (CH2MHill '91/HC '95)
Eagle Harbor	93-2	0.075 (Patrick '96)	0.77 (CH2MHill '91/HC '95)

Table 1 - Paired Sediment and Tissue Mercury Concentration Data, Bellingham Bay and Other Puget Sound Embayments (excluding Sinclair Inlet), 1990 to 1997

Species/Tissue Type & Location	Tissue Sample ID	Measured Mercury Tissue Conc. (Data Source) in mg/kg wet wt.	Home Range Average Sediment Mercury Conc. (Data Source) in mg/kg dry wt.
Eagle Harbor	93-3	0.074 (Patrick '96)	0.77 (CH2MHill '91/HC '95)
Eagle Harbor	EH-T-19	0.055 (CH2MHill '91)	0.77 (CH2MHill '91/HC '95)
Eagle Harbor	EH-T-20	0.159 (CH2MHill '91)	1.30 (CH2MHill '91/HC '95)
Eagle Harbor	EH-T-8	0.091 (CH2MHill '91)	2.85 (CH2MHill '91/HC '95)
Eagle Harbor	EH-T-7	0.091 (CH2MHill '91)	12.44 (CH2MHill '91/HC '95)

NOTES:

a) Legal adult male Dungeness crabs only (greater than 160 mm carapace width)

b) Large adult male Red rock crabs only (greater than 130 mm carapace width)

c) English sole muscle tissue concentration adjusted to reflect Year-8 individuals (see Figure 6-3 and text).

Table 2 - Derivation of Bioaccumulation-Based Sediment Mercury Cleanup Screening Levels

Bioaccumulation Regression Data (a):	Number of Sample Composites	(y) y-intercept mg/kg wet	(s) slope dry/wet	Adj. r^2	P
1. Legal Dungeness crab muscle only	12	0.047	0.116	0.73	0.0002
1a. Red rock crab muscle only (b)	3	0.060	0.067	N/A	N/A
2. English sole muscle only (8-year-old fish)	15	0.070	0.027	0.04	0.2
3. Clams and Mussels only	25	0.032	0.007	0.17	0.03

a) Excluding Sinclair Inlet data, since slope estimates for Sinclair Inlet were significantly lower than other Puget Sound embayments.

b) Since the Rock crab statistics were based on few data points and were less conservative than the Dungeness crab only regression, and because of relatively low Rock crab consumption rates, Rock crab data were excluded from further bioaccumulation analyses.

Tulalip Tribe Seafood Consumption Data (c):	Consumption Rate in gms/day (c) n	Mean	UCL (d)	90%-tile
1. Dungeness crab	73	12.0	19.3	23.4
1a. Red rock crab	73	0.1	0.4	0.0
2. Total Bottomfish	73	2.3	3.2	7.8
3. Clams and mussels	73	14.4	21.8	38.5

c) Consumption rate normalized to a 70-kg adult. From Toy et al. (1996) and Pollisar, written communication (1997).

d) 95% upper confidence interval of the mean

Sediment Mercury Screening Levels Calculated for Different Consumption Scenarios (e)	Sediment Screening Levels in mg/kg dry weight Mean	UCL (d)	90%-tile
1. Crab consumption only	4.6	2.7	2.2
2. Bottomfish (8-year-old fish) consumption only	108	77	30
3. Clam and mussel consumption only	68	43	22
Total crab, bottomfish, and clams/mussels combined (f):			
Using tissue-specific regression equations	3.7	2.1	1.3
Substituting Dungeness crab for bottomfish regression	3.3	1.9	**1.2**

e) Sediment cleanup screening levels for bioaccumulation protection were calculated for different tribal consumption rates, to maintain total intake levels below the oral reference dose for methylmercury of 1×10^{-4} mg/kg-day.

f) Conservatively estimated assuming complete interdependence between crab, bottomfish, and clam/mussel consumption rates, using the following equations:

$$Intake_1 + Intake_2 + Intake_3 = 1 \times 10^{-4} \text{ mg/kg-day}$$

$$Intake_1 = c_1 \times (y_1 + s_1X) \times Z$$

$$Intake_2 = c_2 \times (y_2 + s_2X) \times Z$$

$$Intake_3 = c_3 \times (y_3 + s_3X) \times Z$$

where Intake = total mercury intake in mg/kg-day, and

c = tissue-specific consumption rate in gms wet weight/day

y = y-intercept from bioaccumulation regression in mg/kg wet weight

s = slope from bioaccumulation regression in dry/wet weight

X = sediment concentration in mg/kg dry weight

Z = proportionality constant (normalized to a 70-kg adult)

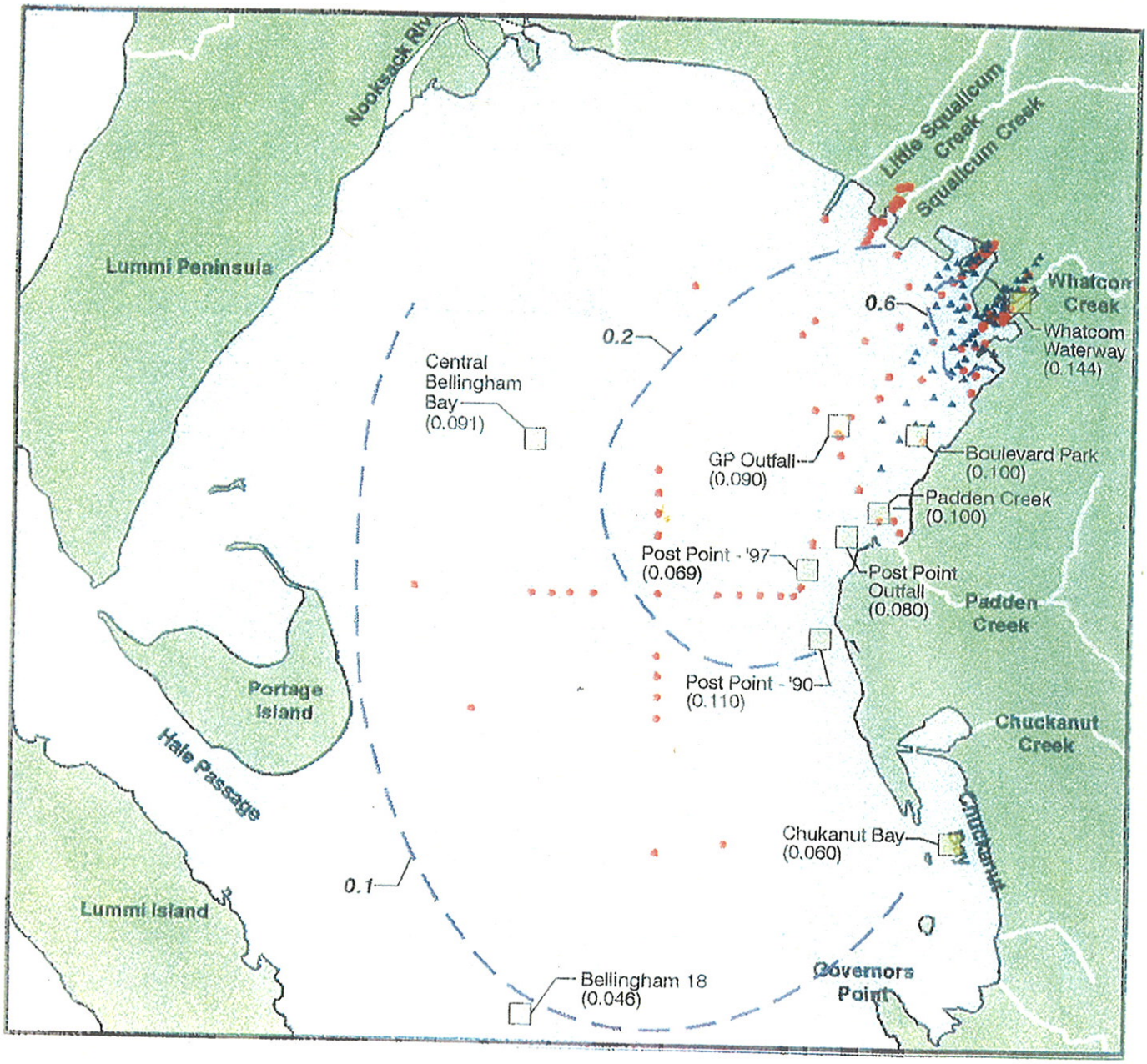
Subscripts 1, 2, and 3 denote crab, bottomfish, and clam/mussel tissues, respectively.

Since all other values were known, the above equation was then solved for X, the sediment cleanup screening level.

1.2 - bolded value denotes the sediment cleanup screening level conservatively calculated using 90%-tile consumption rates.

Mercury Concentrations in Adult Male Dungeness Crab Muscle Tissue

1990 - 1997



0.1 — Sediment Mercury Concentration Contour in mg/kg

Other Sediment Sampling Sites

RI Sediment Sampling Sites

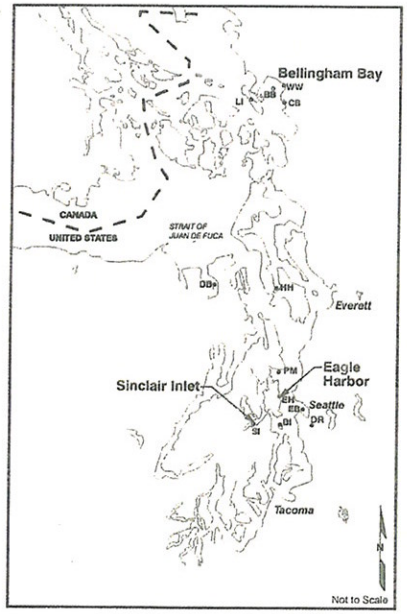
Bellingham 18 Crab Tissue Sampling Location

(0.046) Average Mercury Concentration in mg/kg

N

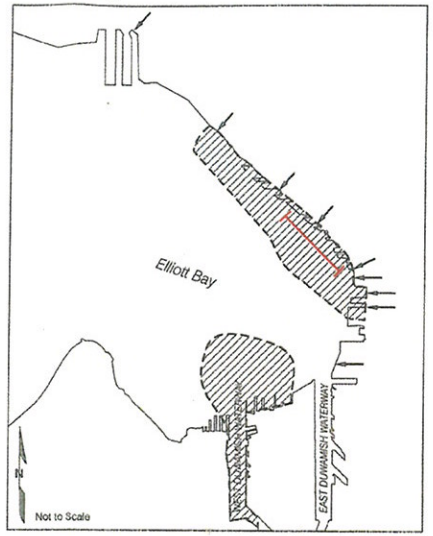
Note: Base map prepared from figure developed by Parametrix, Inc. entitled "Sediment Sampling Sites", undated.

Puget Sound Tissue Sample Location Map



BB	Bellingham Bay
BI	Blake Island
DB	Discovery Bay
DR	Duwamish River
EB	Elliott Bay
EH	Eagle Harbor
CB	Chuckenut Bay
HH	Holmes Harbor
LI	Lumni Island
PM	Port Madison
SI	Sinclair Inlet
WW	Whatcom Waterway

Elliott Bay

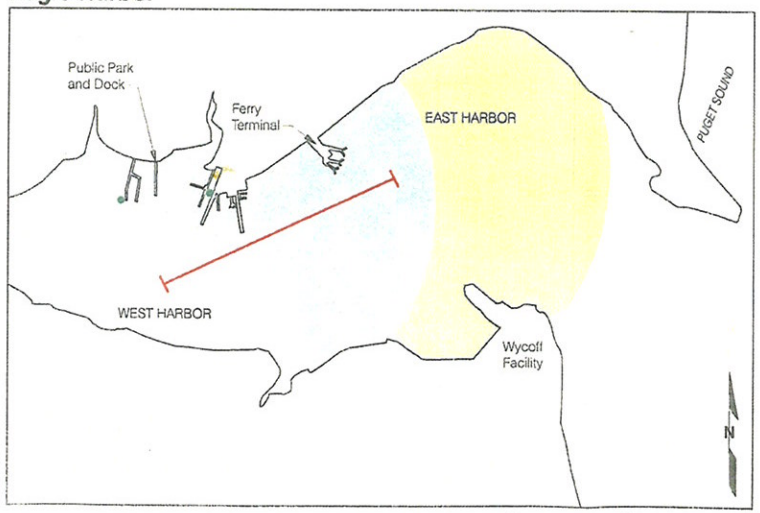


English Sole Trawls (PSAMP, 1996)

Probable Extent of Sediments Exceeding 0.59 mg/kg (Dry Weight) Mercury, based on kriging of available data

Combined Sewer Overflow and Historical Outfall Locations

Eagle Harbor



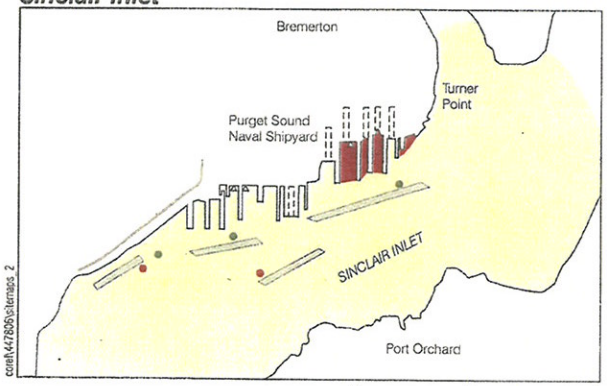
English Sole Trawls (PSAMP, 1996)

Red Rock Crab (CH_2M-Hill, 1991)

Red Rock Crab Home Range

English Sole Home Range

Sinclair Inlet



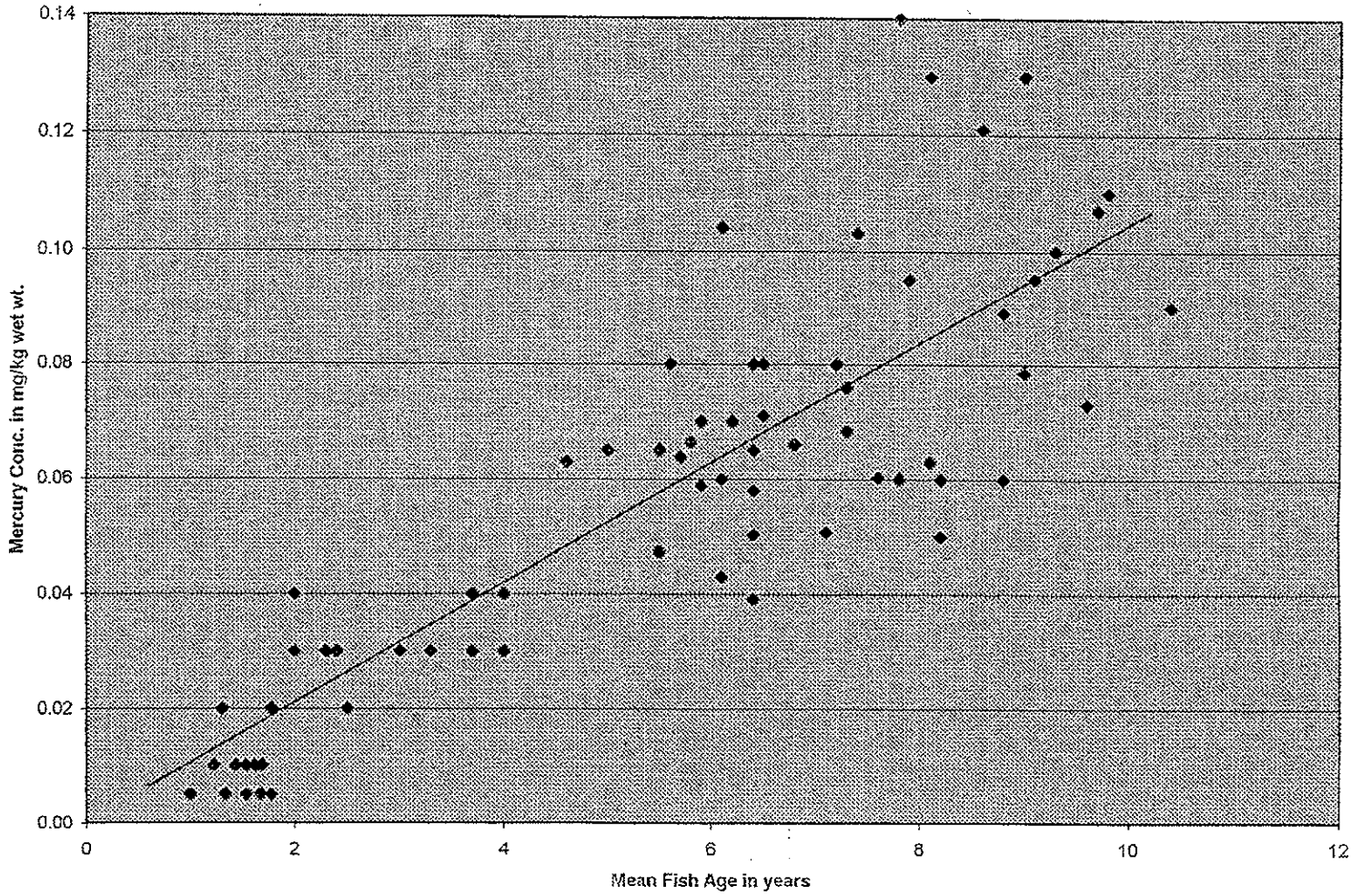
Blue Mussel (URS, 1996)

Sea Cucumber (URS, 1996)

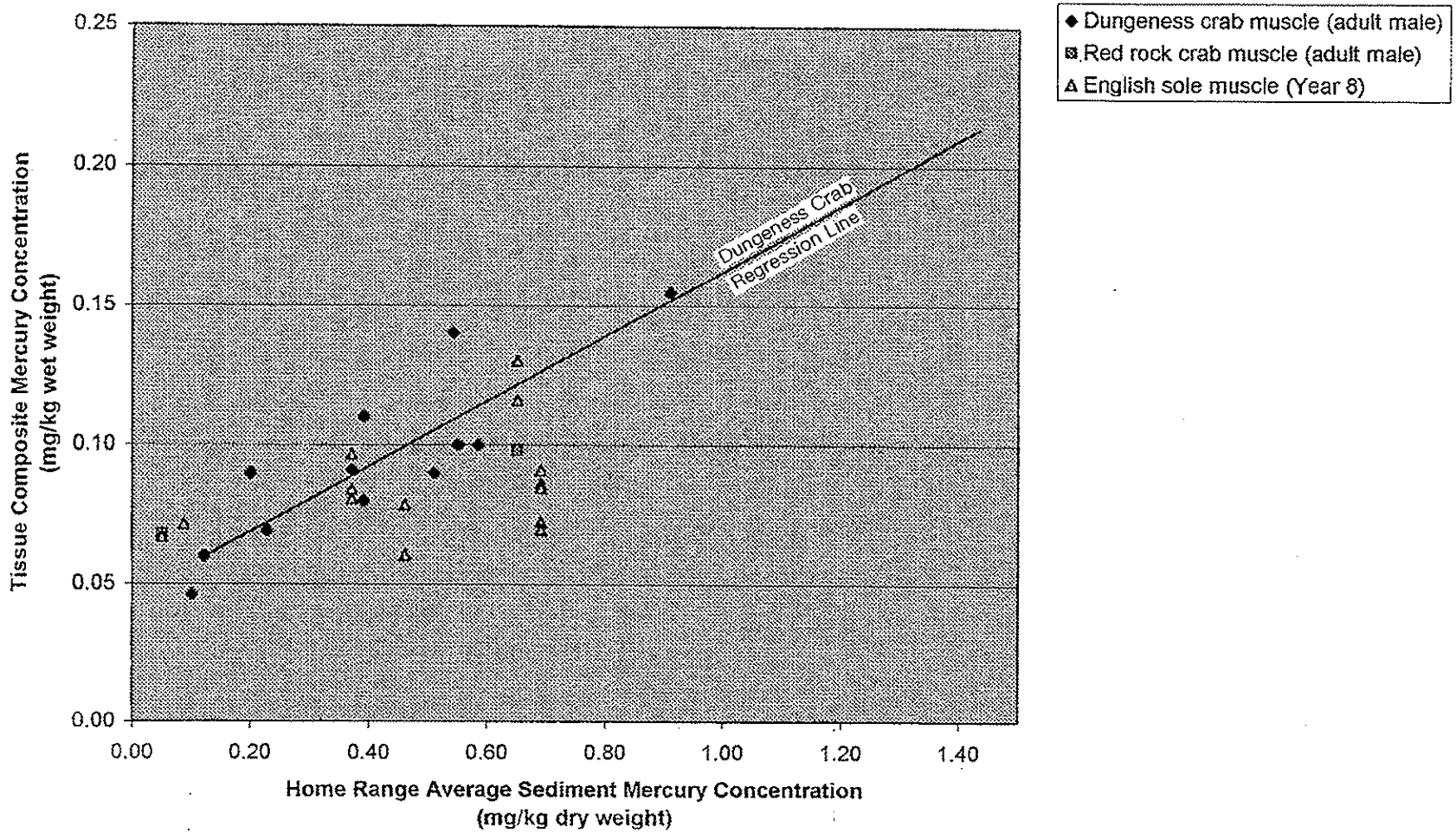
English Sole Home Range

English Sole Trawls (URS, 1996)

English Sole Muscle Tissue Mercury Concentration Increases with Fish Age Puget Sound Embayments with Elevated Sediment Mercury Concentration



Crab and Bottomfish Muscle Tissue Mercury Concentrations Correlation with Sediment Level



Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle
Sample-ID	3	4	5	6	7	8	8-Dup	PSDDA-B
Sampling Date	8/21/90	8/20/90	9/05/90	8/21/90	9/05/90	8/22/90	8/22/90	8/21/90
Source	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	Cubbage'91	SAIC'91
Metals in mg/kg wet wt.								
Arsenic	2.74	1.86	5.11	3.3	2.85	4.19	4.27	0.9
Cadmium	0	0	0.01 U	0.01	0.01	0.01 U	0	0.07
Copper								
Lead	0.16	0.11	0.05	0.26	0.29	0.2 U	0.2 U	0.16 U
Mercury	0.1	0.11	0.08	0.1	0.12	0.15	0.16	0.03
Zinc								
Pesticide/PCBs in µg/kg wet wt.								
alphá-BHC	2 U	2 U	2 U	4 U	4 U	4 U		
gamma-BHC (Lindane)	2 U	2 U	2 U	4 U	4 U	4 U		0.3 U
Chlordane	20 U	20 U	20 U	20 U	20 U	20 U		1 U
Dieldrin	2 U	2 U	2 U	4 U	4 U	4 U		0.4 U
Total DDE+DDD+DDT								
Total PCBs								
Semivolatiles in µg/kg wet wet.								
Benzoic Acid								
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate								
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	Crab Muscle	E. Sole Muscle
Sample-ID	PTI-1991-2	Sta. 4-B	Sta. 7-B	T3-30N F-B	T4-30N M-B	T4-30N New-B	T4-30Na-B	BH-SM1
Sampling Date	Mar-91	8/21/90	8/21/90	8/21/90	8/21/90	8/21/90	8/21/90	1991
Source	PTI'91	SAIC'91	SAIC'91	SAIC'91	SAIC'91	SAIC'91	SAIC'91	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic		1.8	0.9	1.3	1.9	1.6	1.4	3.6
Cadmium		0.06	0.1	0.09	0.11	0.08	0.1	
Copper								0.17
Lead		0.19 U	0.32	0.16	0.15 U	0.14 U	0.19 U	0.03
Mercury		0.07	0.06	0.06	0.09	0.03	0.05	0.03
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC								
gamma-BHC (Lindane)		0.4 U	0.3 U	0.3 U	0.3 U	0.6 U	0.3 U	
Chlordane		4.2 U	1 U	1 U	1 U	1.9 U	1	
Dieldrin		0.5 U	0.4 U	0.4 U	0.4 U	0.8 U	0.4 U	
Total DDE+DDD+DDT								
Total PCBs								
Semivolatiles in µg/kg wet wet								
Benzoic Acid								36 U
Benzyl Alcohol								14 E
Bis[2-ethylhexyl] phthalate								3.6 U
Di-n-butyl phthalate								3.6 U
Fluoranthene								
Phenanthrene								3.6 U
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents	0.28							

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle
Sample-ID	BH-SM1	BH-SM1A	BH-SM2	BH-SM2	BH-SM2A	BH-SM3	BH-SM3	BH-SM3A
Sampling Date	1993	1992	1991	1993	1992	1991	1993	1992
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	4.3	3.9	2.9	3.5	2.9	3.4	3.3	2.9
Cadmium								
Copper	0.39	0.25	0.36	0.67	0.27	0.25	0.49	0.24
Lead	0.03 U	0.03 U	0.03 U	0.03 U	0.03 U	0.03	0.03 U	0.03 U
Mercury	0.04 E	0.02 E	0.04	0.03 E	0.03 E	0.03	0.03 E	0.03 E
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC								
gamma-BHC (Lindane)								
Chlordane								
Dieldrin								
Total DDE+DDD+DDT								
Total PCBs	2			2			2.9	
Semivolatiles in µg/kg wet wet								
Benzoic Acid	36 U	36 U	114 E	36 U	36 U	51 E	36 U	36 U
Benzyl Alcohol	3.6 U	3.6 U	18 E	3.6 U	3.6 U	15 E	3.6 U	3.6 U
Bis[2-ethylhexyl] phthalate	100 U	40 E	4.2 U	100 U	3.6 U	115 E	100 U	360 E
Di-n-butyl phthalate	4 U	3.6 U	4.2 U	4 U	70 E	4.2 U	4 U	90 E
Fluoranthene								
Phenanthrene	3.6 U	3.6 U	4.2 U	3.6 U	3.6 U	4.2 U	3.6 U	3.6 U
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	E. Sole Muscle	E. Sole Muscle	E. Sole Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	BH-SOLE1	BH-SOLE2	BH-SOLE3	NR-T1	NR-T1	NR-T1	NR-T1	NR-T10
Sampling Date	1989	1989	1989	1993	1992	1994	1995	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	5.4 E	1.8 E	4.2 E	0.6 E	0.8	0.84 E		
Cadmium								
Copper	0.25	0.22	0.21	0.6	0.47	0.92		
Lead	0.04 U	0.04 U	0.04 U	0.03 U	0.02 U	0.03 U		
Mercury	R	R	R	0.1	0.08	0.09		
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC				0.5 U	0.85	0.5 U	0.52 U	0.52 U
gamma-BHC (Lindane)				0.5 U	0.5	0.5 U	0.52 U	0.52 U
Chlordane								
Dieldrin				0.5 U	1.1	0.5 U	0.67 U	0.67 U
Total DDE+DDD+DDT				17	35.2	34.1	13.5	7.88
Total PCBs				23.4	50	42.6	42.8	21
Semivolatiles in µg/kg wet wet								
Benzoic Acid	500 U	500 U	500 U	260 U	300 U	260 U		
Benzyl Alcohol	17 U	66 U	42 U					
Bis[2-ethylhexyl] phthalate	16.8 U	11 U	11 U	65 U	60 U	65 U		
Di-n-butyl phthalate	20 U	22 U	22 U					
Fluoranthene								
Phenanthrene	8.3 U	11 U	6.9 U					
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-T2	NR-T2	NR-T2	NR-T2	NR-T3	NR-T3	NR-T3	NR-T3
Sampling Date	1993	1992	1994	1995	1993	1992	1994	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	1 E	1.1	0.85 E		0.7 E	1.2	0.88 E	
Cadmium								
Copper	0.5	0.43	0.99		0.44	0.41	1.08	
Lead	0.03 U	0.02 U	0.03 U		0.03 U	0.02 U	0.03 U	
Mercury	0.08	0.07	0.06		0.09	0.08	0.07	
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.5 U	1.1	0.5 U	0.52 U	0.5 U	0.98	0.5 U	0.52 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U	0.53	0.5 U	0.52 U
Chlordane								
Dieldrin	0.5 U	1.2	0.5 U	0.67 U	0.5 U	1.1	0.5 U	0.67 U
Total DDE+DDD+DDT	11.2	19.9	25.9	14.3	11.8	37.4	27.8	17.9
Total PCBs	26	29	44	43.1	20.5	45	36.5	56.7
Semivolatiles in µg/kg wet wet								
Benzoic Acid	260 U	300 U	260 U		260 U	300 U	260 U	
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	65 U	440 E	65 U		65 U	60 U	65 U	
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-T4	NR-T4	NR-T4	NR-T4	NR-T5	NR-T5	NR-T5	NR-T5
Sampling Date	1993	1992	1994	1995	1993	1992	1994	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.9 E	0.86	0.92 E		0.6 E	0.6 E	0.8 E	
Cadmium								
Copper	0.47	0.43	1.2		0.5	0.42	0.88	
Lead	0.03 U	0.02 U	0.03 U		0.03 U	0.02 U	0.03 U	
Mercury	0.1	0.1	0.06		0.07	0.11	0.09	
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.5 U	1	0.5 U	0.52 U	0.5 U	0.66	0.5 U	0.52 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U
Chlordane								
Dieldrin	0.5 U	1	0.5 U	0.67 U	0.5 U	0.77	0.5 U	0.67 U
Total DDE+DDD+DDT	5.76	35.1	20	11.3	12.8	19.7	31.6	19.3
Total PCBs	15.9	38	31.3	33.5	63	34	35.2	43.2
Semivolatiles in µg/kg wet wet								
Benzoic Acid	260 U	300 U	260 U		260 U	300 U	260 U	
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	65 U	60 U	65 U		65 U	60 U	65 U	
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-T6	NR-T6	NR-T6	NR-T6	NR-T7	NR-T8	NR-T9	NR-X1
Sampling Date	1993	1992	1994	1995	1995	1995	1995	1993
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	1 E	1.2	0.96 E					0.6 E
Cadmium								
Copper	0.45	0.49	1.13					0.42
Lead	0.03 U	0.02 U	0.03 U					0.03 U
Mercury	0.11	0.1	0.1					0.04 E
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.5 U	0.73	0.5 U	0.52 U	0.52 U	0.52 U	0.52 U	0.5 U
gamma-BHC (Lindane)	0.5 U	0.5	0.5 U	0.52 U	0.52 U	0.52 U	0.52 U	0.5 U
Chlordane								
Dieldrin	0.5 U	0.72	0.5 U	0.67 U	0.67 U	0.67 U	0.67 U	0.5 U
Total DDE+DDD+DDT	9	24.6	46	15.8	13.4	12.2	10.1	1.9
Total PCBs	16.2	30	52.2	51.7	37.8	40.1	31.4	5
Semivolatiles in µg/kg wet wet								
Benzoic Acid	260 U	300 U	260 U					260 U
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	65 U	60 U	65 U					65 U
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-X1	NR-X1	NR-X1	NR-X2	NR-X2	NR-X2	NR-X2	NR-X3
Sampling Date	1992	1994	1995	1993	1992	1994	1995	1993
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.6 E	0.47 E		0.5 E	0.7 E	0.55 E		0.5 E
Cadmium								
Copper	0.47	0.87		0.41	0.46	0.71		0.42
Lead	0.03 U	0.03 U		0.03 U	0.03 U	0.03 U		0.03 U
Mercury	0.03 E	0.03		0.03 E	0.05	0.05		0.03 E
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.85	0.5 U	0.52 U	0.5 U	0.57	0.5 U	0.52 U	0.5 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U
Chlordane								
Dieldrin	0.79	0.5 U	0.67 U	0.5 U	0.5	0.5 U	0.67 U	0.5 U
Total DDE+DDD+DDT	7	9.22	7.25	1.3	7	13.5	11	3
Total PCBs	20	16.7	27.1	4	16	23	28.4	7.2
Semivolatiles in µg/kg wet wet								
Benzoic Acid	300 U	260 U		260 U	300 U	260 U		260 U
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	60 U	65 U		360 E	60 U	65 U		65 U
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-X3	NR-X3	NR-X3	NR-X4	NR-X4	NR-X4	NR-X4	NR-X5
Sampling Date	1992	1994	1995	1993	1992	1994	1995	1993
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.7 E	0.38 E		0.5 E	0.6 E	0.53 E		0.7 E
Cadmium								
Copper	0.48	0.68		0.41	0.48	0.72		0.45
Lead	0.03 U	0.03 U		0.03 U	0.03 U	0.03 U		0.03 U
Mercury	0.03 E	0.03		0.04 E	0.06	0.03		0.05
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.91	0.5 U	0.52 U	0.5 U	0.93	0.5 U	0.52 U	0.5 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U	0.5 U
Chlordane								
Dieldrin	0.59	0.5 U	0.67 U	0.5 U	0.82	0.5 U	0.67 U	0.5 U
Total DDE+DDD+DDT	4.71	8.5	5.91	1.7	10.6	11.2	8	3.4
Total PCBs	10	14.7	24.1	4	24	21.9	24.9	8.6
Semivolatiles in µg/kg wet wet								
Benzoic Acid	300 U	260 U		260 U	300 U	260 U		260 U
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	60 U	65 U		65 U	60 U	65 U		65 U
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle	Salmon Muscle
Sample-ID	NR-X5	NR-X5	NR-X5	NR-X6	NR-X6	NR-X6	NR-X6	NR-X7
Sampling Date	1992	1994	1995	1993	1992	1994	1995	1995
Source	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96	O'Neill'96
Metals in mg/kg wet wt.								
Arsenic	0.6 E	0.72 E		0.5 E	0.5 E	0.43 E		
Cadmium								
Copper	0.44	0.75		0.42	0.48	0.67		
Lead	0.03 U	0.03 U		0.03 U	0.02 U	0.03 U		
Mercury	0.05	0.04		0.06	0.04	0.05		
Zinc								
Pesticide/PCBs in µg/kg wet w								
alpha-BHC	0.89	0.5 U	0.52 U	0.5 U	0.63	0.5 U	0.52 U	0.52 U
gamma-BHC (Lindane)	0.5 U	0.5 U	0.52 U	0.5 U	0.5 U	0.5 U	0.52 U	0.52 U
Chlordane								
Dieldrin	0.59	0.5 U	0.67 U	0.5 U	0.59	0.5 U	0.67 U	0.67 U
Total DDE+DDD+DDT	9.4	8.2	9.55	2	7.36	16	10.9	12
Total PCBs	22	13	27.1	2.7	20	18.9	33.3	32.8
Semivolatiles in µg/kg wet wet								
Benzoic Acid	300 U	260 U		260 U	300 U	260 U		
Benzyl Alcohol								
Bis[2-ethylhexyl] phthalate	60 U	65 U		65 U	60 U	65 U		
Di-n-butyl phthalate								
Fluoranthene								
Phenanthrene								
Pyrene								
Dioxins in ng/kg wet wt.								
Total TCDD Equivalents								

Analytical Results for Bellingham Bay Tissue Samples

Tissue Type	Whole Clam	Whole Clam	Whole Clam	Whole Clam	Whole Clam	Whole Clam
Sample-ID	3B	EPA-1987	NOAA-87	Post Point 1	Post Point 2	Post Point 3
Sampling Date	12/14/90	1987	1986	4/01/92	4/01/92	4/01/92
Source	Cubbage'91	EPA'87	NOAA'87	Patrick'96	Patrick'96	Patrick'96
Metals in mg/kg wet wt.						
Arsenic	1.11		1.28 E	2.4	2.6	2.3
Cadmium	0.22		0.45 E	0.24	0.27	0.24
Copper			1.5 E	1.2	1.3	1.2
Lead	0.02		0.13 E	0.09	0.09	0.09
Mercury	0.01		0.04 E	0.02	0.02	0.02
Zinc			21.5 E	10	11	10
Pesticide/PCBs in µg/kg wet w						
alpha-BHC	1.9 U			0.1 U	0.1 U	0.1 U
gamma-BHC (Lindane)	1.9 U			0.1 U	0.1 U	0.1 U
Chlordane						
Dieldrin	1.9 U			0.1 U	0.1 U	0.1 U
Total DDE+DDD+DDT						
Total PCBs						
Semivolatiles in µg/kg wet wet						
Benzoic Acid				5900	4500	1400
Benzyl Alcohol				22 U	22 U	22 U
Bis[2-ethylhexyl] phthalate				88 U	51 U	4.4 U
Di-n-butyl phthalate				32 E	81 U	182 E
Fluoranthene	10 J			4.4 U	4.4 U	4.4 U
Phenanthrene	6 J			4.4 U	4.4 U	4.4 U
Pyrene	10 J			4.4 U	4.4 U	4.4 U
Dioxins in ng/kg wet wt.						
Total TCDD Equivalents		0.59				