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ENVIRONMENT CANADA  
CONSERVATION AND PROTECTION  
ENVIRONMENTAL PROTECTION  
PACIFIC AND YUKON REGION

BENTHIC SEDIMENT CHEMISTRY  
WEST COAST SURVEY  
PHASE II  
JUNE 1988  
REGIONAL DATA REPORT DR-90-05

BY

D.E. Brothers

JUNE 1990

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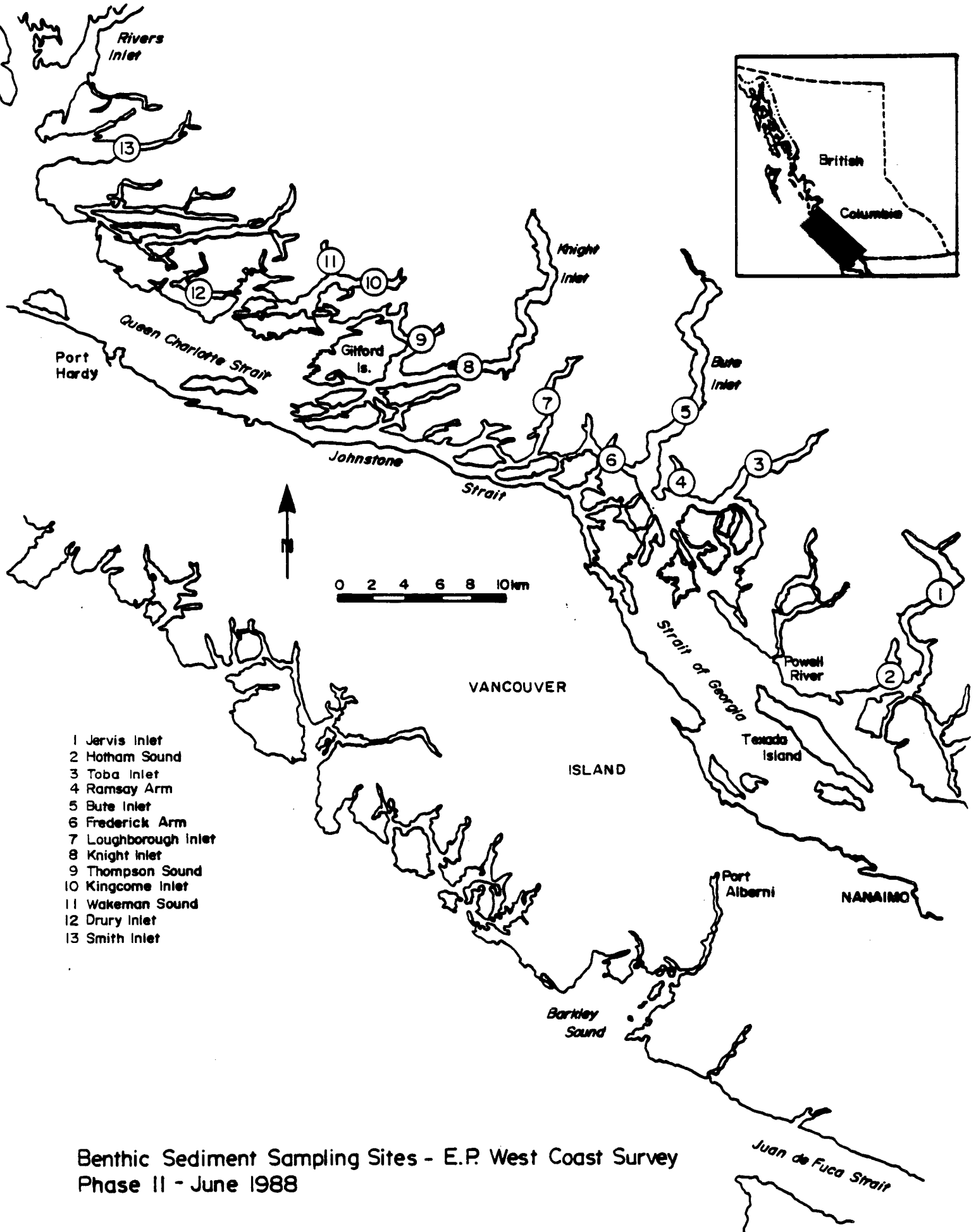
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## 1.0 INTRODUCTION

In June 1988 phase II of a benthic sediment chemistry study was conducted on the west coast of British Columbia between Jervis Inlet and Cape Caution using the survey vessel CSS Vector (Figure 1). The study was initiated at the request of the Regional Ocean Dumping Advisory Committee (RODAC) and was designed to examine the "background" concentrations of various metals in inlets and water ways removed from anthropogenic inputs. This survey is a continuation of EP West Coast Survey Phase I, June 1987. (Regional Data Report Dr-90-04)



Benthic Sediment Sampling Sites - E.P. West Coast Survey  
Phase II - June 1988

## 2.0 MATERIAL & METHODS

Grab samples were taken using a Smith McIntyre sampler; core samples using a 2 metre Benthos gravity corer.

Three grabs were taken at each station. Upon retrieval, water was siphoned from the sediment surface, if necessary. Three samples, 0 cm to 5 cm sediment depth, were taken from the first grab; two samples, one 0 cm to 5 cm, the other 0 cm to 2 cm, were taken from the second grab; and one sample, 0 cm to 5 cm, was taken from the third.

One core was also taken at each station. The core was extruded into a plastic trough, held at a gentle incline and washed to remove the outer disturbed layer, and sampled at the following depths: 30-40 cm, 60-70 cm and 90-100 cm.

Cadmium, mercury, lead, copper and zinc concentrations are presented in the tables, along with the mean and standard deviation.

All analyses were conducted by Conservation and Protection Laboratories in West Vancouver. The raw data represents a single analysis for each sample after drying and homogenizing. Cu, Pb, and analysed using Inductively Coupled Argon Plasma Atomic Emission (ICAP-AE), Cd using Graphite Furnace Atomic Absorption (GFAA), and Hg using flameless AA.

The accuracy data for each lab submission are given in Appendix I. The raw data printouts, giving the complete ICAP semi-quantitative scan and particle size data, are included in Appendix II, and can be located by matching the sample and lab submission numbers given on the data tables. Precision data for the lab submissions are provided on the data tables, and represent analyses of separate aliquots of dried, homogenized sediments from the sample bag.

JERVIS INLET - STATION 1METALS  
PARTICLE SIZELAB # 880905  
LAB # 880905

DATE SAMPLED: JUNE 20, 1988.

STN	DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
				Hg	Cd	Pb	Cu	Zn
376		1*	0-5	.094	.36	10	62.6	151.0
376		2	0-5	.073	.43	10	63.6	155.0
376		3	0-5	.074	.49	20	61.9	165.0
374		4	0-5	.076	.44	10	65.8	156.0
374		5*	0-2	.078	.39	10	64.7	176.0
367		6	0-5	.075	.39	10	63.0	162.0
MEAN				.078	.42	12	63.6	160.8
STD DEV				.008	.05	4	1.4	9.0
367		7*	30-40	.037	.72	ND (8)	58.3	112.0
		8*	60-70	.039	.85	ND (8)	58.0	117.0
		9*	90-100	.036	.60	ND (8)	55.9	115.0

NOTE: numbers in brackets are limits of detection

ND - not detected

\* denotes particle size data in appendix

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
10	.170	.93	31	101.0	250.0
105	.183	1.20	30	97.5	241.0
125	.173	1.20	10	97.2	239.0
126	.160	1.40	18	95.1	237.0
127	.160	1.40	20	93.7	239.0
MEAN	.169	1.23	22	96.9	241.2
STD DEV	0.10	.19	9	2.8	5.1
20	.063	.30	ND (8)	114.0	167.0
106	.060	.52	ND (8)	114.0	167.0
128	.046	.32	ND (8)	110.0	163.0
129	.046	.35	ND (8)	111.0	160.0
130	.042	.29	ND (8)	111.0	161.0
MEAN	.051	.36		112.0	163.6
STD DEV	.009	.09		1.9	3.3

NOTE: numbers in brackets are limits of detection

(cf: SCPJV1-1)

TABLE 2

HOTHAM SOUND - STATION 2

METALS LAB # 880905

PARTICLE SIZE LAB # 880905

DATE SAMPLED: JUNE 20, 1988.

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
508	10*	0-5	.170	.93	31.0	101.0	250.0
508	11	0-5	.160	1.00	26.0	98.0	225.0
508	12	0-5	.181	1.00	28.0	98.1	257.0
508	13	0-5	.186	.96	28.0	96.0	225.0
508	14*	0-2	.174	.80	27.0	92.0	224.0
510	15	0-5	.175	.86	30.0	92.5	226.0
		MEAN	.174	.93	28.3	96.3	234.5
		STD DEV	.009	.08	1.9	3.5	14.9
500	16*	30-40	.100	1.74	10.0	75.7	145.0
	17*	60-70	.088	1.50	9.0	74.9	142.0
	18*	90-100	.081	1.68	10.0	76.1	133.0

NOTE: numbers in brackets are limits of detection

ND - not detected

\* denotes particle size data in appendix

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
10	.170	.93	31	101.0	250.0
105	.183	1.20	30	97.5	241.0
125	.173	1.20	10	97.2	239.0
126	.160	1.40	18	95.1	237.0
127	.160	1.40	20	93.7	239.0
MEAN	.169	1.23	22	96.9	241.2
STD DEV	0.10	.19	9	2.8	5.1
20	.063	.30	ND (8	114.0	167.0
106	.060	.52	ND (8	114.0	167.0
128	.046	.32	ND (8	110.0	163.0
129	.046	.35	ND (8	111.0	160.0
130	.042	.29	ND (8	111.0	161.0
MEAN	.051	.36		112.0	163.6
STD DEV	.009	.09		1.9	3.3

NOTE: Numbers in brackets are limits of detection

(cf: SCPHDD-2)



TABLE 3

TOBA INLET (STATION 3)

DATE SAMPLED: JUNE 20, 1988 METALS LAB # 880905  
 PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
497	19*	0-5	.065	.25	ND(B)	112.0	167.0
497	20	0-5	.063	.30	ND(B)	114.0	167.0
497	21	0-5	.059	.23	ND(B)	112.0	158.0
492	22	0-5	.059	.26	8	115.0	174.0
492	23*	0-2	.055	.20	ND(B)	117.0	187.0
491	24	0-5	.062	.22	10	113.0	169.0
MEAN			.061	.24		113.8	170.3
STD DEV			.004	.04		1.9	9.7

NOTE: numbers in brackets are limits of detection

ND - not detected

\* denotes particle size data in appendix

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
10	.170	.93	31	101.0	250.0
105	.183	1.20	30	97.5	241.0
125	.173	1.20	10	97.2	239.0
126	.160	1.40	18	95.1	237.0
127	.160	1.40	20	93.7	239.0
MEAN	.169	1.23	22	96.9	241.2
STD DEV	0.10	.19	9	2.8	5.1
20	.063	.30	ND (8)	114.0	167.0
106	.060	.52	ND (8)	114.0	167.0
128	.046	.32	ND (8)	110.0	163.0
129	.046	.35	ND (8)	111.0	160.0
130	.042	.29	ND (8)	111.0	161.0
MEAN	.051	.36		112.0	163.6
STD DEV	.009	.09		1.9	3.3

NOTE: numbers in brackets are limits of detection.

ND - not detected

(cf: SCPHCH-3)

TABLE 4

RAMSAY ARM - STATION 4

DATE SAMPLED: JUNE 21, 1988.

METALS LAB #880905  
PARTICLE SIZE LAB #880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
432	25*	0-5	.089	.62	17	75.7	135.0
432	26	0-5	.093	.50	10	73.6	135.0
432	27	0-5	.097	.48	18	71.5	140.0
431	28	0-5	.091	.60	19	74.3	139.0
431	29*	0-2	.094	.59	18	72.2	142.0
433	30	0-5	.093	.46	22	74.4	143.0
MEAN			.093	.54	17	73.6	139.0
STD DEV			.003	.07	4	1.5	3.4
420	31*	30-40	.052	.67	10	59.1	101.0
	32*	60-70	.038	.84	ND(8)	61.0	97.1
	33*	90-100	.039	.70	ND(8)	59.6	91.2

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
30	.093	.46	22	74.4	143.0
107	.095	.67	10	77.2	151.0
131	.077	.45	ND(8)	74.1	145.0
132	.076	.48	ND(8)	72.1	136.0
133	.078	.50	ND(8)	73.4	147.0
MEAN	.084	.51		74.2	144.4
STD DEV	.009	.09		1.9	5.5

NOTE: numbers in brackets are limits of detection. (cf:SCPRAMA4).

ND - not detected

\* denotes particle size data in appendix.

BUTE INLET - STATION 5

DATE SAMPLED: JUNE 21, 1988.

METALS LAB #880905  
PARTICLE SIZE LAB #880905

DEPTH	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
669	34*	0-5	.026	.10	ND(8)	90.1	113.0
669	35	0-5	.029	.10	ND(8)	92.4	114.0
669	36	0-5	.026	.10	ND(8)	88.6	107.0
669	37	0-5	.029	.10	ND(8)	93.3	115.0
669	38*	0-2	.031	.10	ND(8)	100.0	141.0
667	39	0-5	.029	.10	ND(8)	93.6	122.0
MEAN			.028	.10		93.0	118.7
STD DEV			.002	0		3.9	11.9

NOTE: numbers in brackets are limits of detection. (cf:SCPBUTES).

ND - not detected

\* denotes particle size data in appendix.

TABLE 6

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FREDERICK ARM - STATION 6

DATE SAMPLED: JUNE 21, 1988.

METALS            LAB # 880905  
PARTICLE SIZE LAB# 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
350	40*	0-5	.023	.20	ND(8)	26.4	68.6
350	41	0-5	.024	.20	ND(8)	25.7	70.0
350	42	0-5	.028	.10	ND(8)	24.1	66.2
336	43	0-5	.036	.20	ND(8)	29.3	68.1
336	44*	0-2	.037	.19	ND(8)	28.8	65.2
341	45	0-5	.038	.10	ND(8)	27.5	66.5
MEAN			.031	.17		27.0	67.4
STD DEV			.007	.05		2.0	1.8

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
40	.023	.20	ND(8)	26.4	68.6
108	.023	.28	ND(8)	25.6	63.3
134	.023	.10	ND(8)	23.3	65.9
135	.023	.10	ND(8)	22.0	68.2
136	.020	.09	ND(8)	23.0	72.0
MEAN	.022	.15		24.1	67.6
STD DEV	.001	.08		1.9	3.2

NOTE: numbers in brackets are limits of detection. (cf:SCPFRED6)

ND - not detected

\* denotes particle size data in appendix.

TABLE 7

LOUGHBOROUGH INLET - STATION 7

DATE SAMPLED: JUNE 21, 1988.

METALS LAB # 880905  
PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
263	46*	0-5	.150	.83	23	60.5	179.0
263	47	0-5	.120	.73	19	62.3	158.0
263	48	0-5	.130	.78	23	62.2	140.0
261	49	0-5	.120	.78	17	61.9	165.0
261	50*	0-2	.120	.81	24	58.6	163.0
259	51	0-5	.120	.72	20	61.7	148.0
MEAN			.127	.78	21	61.2	158.8
STD DEV			.012	.04	3	1.4	13.7
255	52*	30-40	.068	.73	ND(8)	56.7	93.5
	53*	60-70	.055	.89	ND(8)	52.9	87.8
	54*	90-100	.050	.91	ND(8)	53.7	89.3

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
50	.120	.81	24	58.6	163.0
109	.120	.85	17	61.7	168.0
137	.100	.62	10	60.2	177.0
138	.110	.65	10	59.7	172.0
139	.110	.57	10	59.6	#N/A!
MEAN	.112	.70	14	60.0	170
STD DEV	.008	.12	6	1.1	5.9

NOTE: numbers in brackets are limits of detection. (cf:SCPLOUB7)

ND - not detected

\* denotes particle size data in appendix.

KNIGHT INLET - STATION 8

DATE SAMPLED: JUNE 22, 1988.

METALS                    LAB # 880905  
PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
384	55*	0-5	.084	.33	20	75.5	164.0
384	56	0-5	.090	.32	10	75.8	152.0
348	57	0-5	.084	.29	10	78.1	157.0
386	58	0-5	.091	.34	16	77.2	154.0
386	59*	0-2	.089	.32	10	76.9	157.0
395	60	0-5	.064	.23	10	75.6	158.0
		MEAN	.084	.31	13	76.5	157.0
		STD DEV	.010	.04	4	1.0	4.1
376	61*	30-40	.051	.21	10	75.9	122.0
	62*	60-70	.035	.27	ND(8)	72.6	119.0
	63*	90-100	.032	.22	ND(8)	67.3	114.0

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
60	.064	.23	10	75.6	158.0
110	.081	.48	ND(8)	77.4	159.0
140	.074	.24	ND(8)	75.4	158.0
141	.070	.25	ND(8)	75.1	158.0
142	.070	.26	ND(8)	75.0	159.0
MEAN	.072	.29		75.7	158.4
STD DEV	.006	.11		1.0	.5

NOTE: numbers in brackets are limits of detection. (cf: SCPKNIG8)

ND - not detected

\* denotes particle size data in appendix.

TABLE 9

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THOMPSON SOUND - STATION 9

DATE SAMPLED: JUNE 22, 1988.

METALS LAB # 880905  
PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
217	64*	0-5	.084	.21	10	45.8	121.0
217	65	0-5	.087	.22	10	44.7	117.0
217	66	0-5	.088	.31	10	45.3	117.0
214	67	0-5	.083	.32	10	44.3	111.0
214	68*	0-2	.087	.28	18	45.1	117.0
202	69	0-5	.098	.25	20	44.8	120.0
		MEAN	.088	.27	13	45.0	117.2
		STD DEV	.005	.05	5	.5	3.5
	70*	30-40	.077	.29	8	43.5	89.6
	71*	60-70	.062	.25	9	39.8	77.5
	72*	90-100	.052	.31	ND(8)	39.0	74.7

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
70	.077	.29	8	43.5	89.6
111	.091	.62	8	48.2	100.0
143	.078	.36	ND(8)	42.8	92.4
144	.077	.36	ND(8)	40.9	91.1
145	.079	.38	ND(8)	41.9	97.8
MEAN	.080	.40		43.5	94.2
STD DEV	.006	.13		2.8	4.5

NOTE: numbers in brackets are limits of detection. (cf:SCPTM9)

ND - not detected

\* denotes particle size data in appendix.

TABLE 10

-13-

KINGCOME INLET - STATION 10

DATE SAMPLED: JUNE 22, 1988.

METALS LAB # 880905  
PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
336	73*	0-5	.022	.06	ND(8)	52.5	119.0
336	74	0-5	.019	.06	ND(8)	52.7	119.0
334	75	0-5	.020	.03	ND(8)	53.6	116.0
334	76	0-5	.022	.09	ND(8)	54.9	117.0
334	77*	0-2	.021	.10	ND(8)	53.9	126.0
342	78	0-5	.029	.10	ND(8)	59.5	131.0
		MEAN	.022	.07		54.5	121.3
		STD DEV	.004	.03		2.6	5.9
	79*	30-40	.020	.10	ND(8)	66.6	116.0

NOTE: numbers in brackets are limits of detection. (cf:SCPKN10)

ND - not deleted

\* denotes particle size data in appendix.



WAKEMAN SOUND - STATION 11

DATE SAMPLED: JUNE 22, 1988.

METALS LAB # 880905

PARTICLE SIZE LAB # 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
417	80*	0-5	.010	.10	ND(8)	34.2	102.0
417	81	0-5	.010	.10	ND(8)	35.0	103.0
417	82	0-5	.010	.10	ND(8)	35.9	100.0
405	83	0-5	.008	.10	ND(8)	32.4	94.1
405	84*	0-2	.010	.10	ND(8)	33.3	94.1
422	85	0-5	.010	.10	ND(8)	37.0	108.0
MEAN			.010	.10		34.6	100.2
STD DEV			.001	0		1.7	5.4
	86*	30-37	ND(.008)	.10	ND(8)	34.4	96.5

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
80	.010	.10	ND(8)	34.2	102.0
112	.017	.29	ND(8)	33.7	107.0
146	.020	.10	ND(8)	31.5	110.0
147	.010	.10	ND(8)	30.8	99.8
148	.010	.10	ND(8)	28.4	105.0
MEAN	.013	.14		31.7	104.8
STD DEV	.005	.08		2.3	4.0

NOTE: numbers in brackets are limits of detection. (cf:SCPWAK11)

Nd - not detected

\* denotes particle size data in appendix.

TABLE 12

DRURY INLET - STATION 12

DATE SAMPLED: JUNE 22, 1988.

METALS LAB # 880905  
PARTICLE SIZE LAB# 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
73	87*	0-5	.088	2.60	ND(8)	27.5	90.8
73	88	0-5	.100	3.40	ND(8)	28.1	95.4
73	89	0-5	.093	2.80	ND(8)	25.8	95.4
71	90	0-5	.110	5.23	ND(8)	28.4	91.8
71	91*	0-2	.120	4.90	ND(8)	30.1	92.4
66	92	0-5	.099	4.67	ND(8)	28.0	87.6
MEAN			.102	3.93		28.0	92.2
STD DEV			.012	1.14		1.4	3.0
	93*	30-40	.037	3.50	ND(8)	30.6	67.2
	94*	60-70	.041	6.14	ND(8)	61.7	77.9
	95*	90-100	.035	5.15	ND(8)	34.0	80.7

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
90	.110	5.23	ND(8)	28.4	91.8
113	.110	4.59	ND(8)	30.5	91.0
150	.100	4.65	ND(8)	27.1	98.0
151	.110	4.34	ND(8)	25.1	87.8
152	.110	3.99	ND(8)	25.0	86.9
MEAN	.108	4.56		27.2	91.1
STD DEV	.004	.46		2.3	4.4

NOTE: numbers in brackets are limits of detection. (cf: SCPDRU12)  
 ND - not detected  
 \* denotes particle size data in appendix.

SMITH INLET - STATION 13

DATE SAMPLED: JUNE 23, 1988.

METALS LAB # 880905  
PARTICLE SIZE LAB# 880905

DEPTH (m)	SAMPLE	SEDIMENT DEPTH (cm)	UG/G DRY WEIGHT				
			Hg	Cd	Pb	Cu	Zn
388	96*	0-5	.120	.92	ND(8)	37.2	145.0
388	97	0-5	.120	.98	ND(8)	38.5	125.0
388	98	0-5	.120	.89	ND(8)	38.9	136.0
384	99	0-5	.120	.96	9	38.4	114.0
384	100*	0-2	.120	.95	ND(8)	37.7	131.0
381	101	0-5	.120	.99	ND(8)	37.1	118.0
MEAN			.120	.95		38.0	128.2
STD DEV			0	.04		.7	11.5
	102*	30-40	.097	.89	ND(8)	36.3	114.0
	103*	60-70	.077	1	ND(8)	34.2	74.3
	104*	90-100	.062	1	ND(8)	33.0	70.9

PRECISION DATA

SAMPLE	Hg	Cd	Pb	Cu	Zn
100	.120	.95	ND(8)	37.7	131.0
114	.120	1.00	ND(8)	37.6	130.0
152	.110	.58	ND(8)	34.1	126.0
153	.120	.69	ND(8)	35.6	125.0
154	.120	.75	ND(8)	35.6	138.0
MEAN	.118	.79		36.1	130.0
STD DEV	.004	.18		1.5	5.1

NOTE: numbers in brackets are limits of detection. (cf:SCPSMI13)

ND - not detected

\* denotes particle size data in appendix.

APPENDIX I

ACCURACY DATA

ACCURACY DATA

LAB #680905

	Hg	Cd	Pb	Cu	Zn
<u>MESS-1</u>					
CERTIFIED:	0.171	0.59	34.0	25.1	191
	+/-	+/-	+/-	+/-	+/-
	0.014	0.10	6.1	3.8	17
FOUND:	.220	.67	31	26.8	192.0
	.195	.60	30	30.0	185.0
	.188	.65	29	29.0	186.0
	.200	.64	28	28.0	187.0
	.198	.64	29	29.0	192.0
MEAN	.200	.64	29	28.6	188.4
STD DEV	.012	.06	1	1.2	3.4

BCSS-1

CERTIFIED:	0.129	0.25	22.7	18.5	119
	+/-	+/-	+/-	+/-	+/-
	.012	.04	3.4	2.7	12
FOUND:	.150	.24	18	17.8	112.0
	.160	.26	19	17.4	112.0
	.150	.28	20	17.6	115.0
	.150	.27	20	18.0	113.0
	.150	.25	17	17.6	113.0
MEAN	.152	.26	19	17.7	113.0
STD DEV	.004	.02	1	.2	1.2

(cf: AC880905)

NOTE: numbers in brackets are limits of detection.  
 ND - not detected



APPENDIX II

RAW DATA: E.P. WEST COAST  
SURVEY, PHASE II - JUNE 1988