

TRACE METALS IN CLAMS (*MACOMA BALTHICA*) AND SEDIMENTS AT THE PALO ALTO  
MUDFLAT IN SOUTH SAN FRANCISCO BAY: MAY, 1991 - MAY, 1992

By Samuel N. Luoma, Daniel J. Cain, Cynthia Brown and Michelle Hornberger

---

U. S. GEOLOGICAL SURVEY

OPEN FILE REPORT 92-456

Prepared in cooperation with

CITY OF PALO ALTO, CALIFORNIA

Menlo Park, California

1992

U. S. DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

U. S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

---

For additional information  
write to:

Samuel N. Luoma, MS 465  
U.S. Geological Survey  
345 Middlefield Road  
Menlo Park, CA 94025

Copies of this report may be  
purchased from:

U. S. Geological Survey  
Books and Open-File Reports Section  
Federal Center, Building 810  
Box 25425  
Denver, CO 80225

## CONTENTS

---

	Page
Abstract .....	1
Introduction .....	1
Purpose .....	1
Study Site .....	2
Sampling Procedures .....	2
Results of Analyses .....	3
References Cited .....	5

## ILLUSTRATIONS

---

Figure 1. Map showing transect stations along the Palo Alto shoreline where sediments and clams ( <i>Macoma balthica</i> ) were collected by Thomson and others (1984) .....	7
2. Graph showing silver concentrations in <i>Macoma balthica</i> clams as observed at near-monthly intervals between May and May in 1991 to 1992 and 1990 to 1991 .....	8
3. Graph showing copper concentrations in <i>Macoma balthica</i> clams as observed at near-monthly intervals between May and May in 1991 to 1992 and 1990 to 1991 .....	9
4. Graph showing annual mean concentrations of silver in clams from May to May of each year from 1985-86 to 1991-92 .....	10
5. Graph showing annual mean concentrations of silver in clams from May to May of each year from 1988-89 to 1991-92 .....	11
6. Graph showing annual mean concentrations of copper in clams from May to May of each year from 1985-86 to 1991-92 .....	12
7. Graph showing annual mean concentrations of silver in effluent from Palo Alto POTW between 1986 and 1992 .....	13

## TABLES

---

Table 1. Monthly data for Ag and Cu in sediments and clams: May 1991 to May 1992	14
2. Annual mean copper concentrations in clams and sediments: 1977 to 1992 . .	15
3. Annual mean silver concentrations in clams and sediments from Palo Alto Mudflat: 1977-1992 . . . . .	16

## CONVERSION FACTORS

<i>Multiply</i>	<i>By</i>	<i>To obtain</i>
Micrometer	$2.54 \times 10^{-6}$	Inch
Millimeter	$2.54 \times 10^{-3}$	Inch
Centimeter	$2.54 \times 10^{-2}$	Inch
Kilometer	1.609	Mile
Microgram	$2.83 \times 10^{-5}$	Ounce
Milligram	$2.83 \times 10^{-2}$	Ounce
Gram	28.3	Ounce
Millimeter	$5.5 \times 10^{-2}$	pint

TRACE METALS IN CLAMS (*MACOMA BALTHICA*) AND SEDIMENTS  
AT THE PALO ALTO MUDFLAT IN SOUTH SAN FRANCISCO BAY:  
MAY 1991 THROUGH MAY 1992

---

By Samuel N. Luoma, Daniel J. Cain, Cynthia Brown and Michelle Hornberger

ABSTRACT

---

This report presents trace element concentrations analyzed on samples of sediment and clams (*Macoma balthica*) collected from a mudflat one kilometer south of the discharge of the Palo Alto sewage treatment works. Samples were collected on ten occasions between May, 1991 and May 1992, at near monthly intervals. A previous report compared concentrations of silver and copper from this mudflat with values observed at other stations in San Francisco Bay in earlier studies (Luoma and others, 1991). Changes in concentrations of these metals were also compared from near monthly collections between 1977 and 1991. In this report we update this data set, emphasizing the recent data, changes observed between 1986 and 1992, and the seasonality of copper and silver concentrations in 1991 and 1992.

INTRODUCTION

Sediments and benthic organisms are commonly employed to determine spatial distributions and temporal trends of trace metal contamination in estuarine waters. Sediments bind metals strongly, removing them from solution. The result is that sediments may progressively accumulate the metals released to an environment, and concentrations of metals may be indicative of anthropogenic releases to an environment, integrated over time.

Metals in sediments are also indicative of the exposure of animals in contact with benthic and suspended particulate materials. However, it is not well known what proportion of sediment-bound metal is passed on to living organisms. In order to better estimate bioavailable metal exposures, the tissues of the organisms themselves may be analyzed for trace metals. Most species concentrate metals to levels higher than occur in solution, but different species concentrate metals to different degrees. Nevertheless, analysis of one species has been successfully employed to indicate trace element exposures to the food web of the organism. For example, Ag, Cu and Se contamination originally observed in clams (*Macoma balthica*) at a Palo Alto mudflat was later also found in diving ducks, snails, and mussels from that area.

Purpose

The purpose of this study is to present trace metal concentrations observed in sediments and clams at a mudflat in south San Francisco Bay. The station, termed here the Palo Alto mudflat, is located one kilometer south of the intertidal discharge point of the Palo Alto publically-owned treatment works (POTW). The data reported here are from samples collected on ten dates

between May 15, 1991 and May 6, 1992. These data and data collected from earlier studies will be used to approach three questions:

1. What are concentrations of Ag, Cd, Cr, Cu, Ni, Pb, V and Zn in clams that reside in sediments at the Palo Alto mudflat and in sediments from that site?
2. How do concentrations of metals in clams and sediments at Palo Alto in 1991-92 compare with concentrations observed in 1990-91?
3. What are the trends in copper and silver concentrations at the Palo Alto mudflat between 1986 and 1992? Specifically, are concentrations of these elements in 1991-92 changing compared to concentrations observed at this locality in recent years?

### Study Site

The data from this study were collected from site 3 (fig. 1) of the transect conducted by Thomson and others (1984) along the Palo Alto shoreline. Although the highest concentrations of copper and silver were observed in clams and sediments adjacent to the Palo Alto POTW discharge (site 5 in fig. 1) in that study, contamination also was observed at site 3. The influence of the POTW on metal concentrations at site 3 also was demonstrated by Cain and Luoma (1990). They showed a similarity in temporal trends at site 3 between metal discharge from the POTW and concentrations in clam tissues. Results from both studies thus indicated that environmental metal concentrations at site 3 were indicative of POTW metal discharges.

Another important conclusion from Cain and Luoma (1990) and Luoma and others (1985) was that concentrations of metals fluctuated on nearly monthly time scales in the Palo Alto mudflat environment. Thus frequent sampling within a year (at near monthly intervals) was necessary to characterize contamination for that year. The data presented in this report follow those procedures.

### SAMPLING PROCEDURES

All samples were collected from the exposed mudflat at low tide. Sediment samples were scraped from the surface oxidized layers (1 -2 cm) of mudflat. Thus, these samples represent recently deposited sediments, or sediments affected by recent chemical reactions. Sediments were immediately returned to the laboratory in Menlo Park after collection. There they were sieved through 100 micrometer polyethylene mesh with ocean water adjusted to ambient salinity to remove large grains that might bias interpretation of concentrations. The mesh size was chosen by the largest grains typically found in the digestive tract of the indicator organism *Macoma balthica*. Previous studies have shown little difference between sieved and unsieved sediments in the silt-clay type sediment that predominates at this station, but this procedure reduces the likelihood that changes are the result of sampling sediments of different character. The sediments that passed through the sieve were allowed to settle overnight. The water was then decanted, leaving a slurry of sediment of particle size less than 100 micrometers. Subsamples of wet sediment were collected from the slurry using a pipette while swirling. Replicate subsamples were further washed to remove salts then dried at 60° celsius to obtain a representative dry weight. Subsamples from different collections ranged from 86 to 153 milligrams in weight. Replicates agreed within 10 percent of mean sample weight. Replicate subsamples were digested for "total" metal analysis by refluxing in 10 milliliters of concentrated

nitric acid until the digest was clear. Samples were then evaporated to dryness and reconstituted in dilute (5 percent) hydrochloric acid for analysis. The hydrochloric acid matrix was specifically chosen because it mobilizes Ag into solution through creation of Ag-chloro complexes. Another set of replicate samples was subjected to a partial weak acid extraction, as a crude chemical estimate of bioavailable metal. These subsamples were extracted for 2 hours with 10 ml of five percent hydrochloric acid at room temperature (Luoma and Bryan, 1981). The extract was then pressure filtered through a 0.45 micrometer membrane filter.

The deposit feeding clam *Macoma balthica* was collected simultaneously with the sediment samples. More than 40 individuals were collected at each sampling, and the range of sizes (shell length) was maximized by intensive field sampling. Animals were returned to the laboratory and held for 48 hours in ocean water diluted to the ambient salinity at the time of sampling. This was done to depurate undigested material from their digestive tracts. After depuration the individual clams were separated into size classes (determined by differences of one millimeter shell length). Each size class was composited for a single sample, and soft tissues were removed. Samples for each date thus were composed of eight to twelve replicate composites, with each composite consisting of animals of a similar shell length. Animal samples were dried, weighed and refluxed in concentrated nitric acid until the digest was clear. Digests were then dried and reconstituted in dilute (5 percent) hydrochloric acid for analysis.

All metal analyses were conducted by Inductively Coupled Argon Plasma Emission Spectroscopy (ICAPES). Selected tissue samples were also analyzed by Atomic Absorption Spectroscopy to compare with the results of ICAPES analysis. Data from the two types of analyses were not significantly different ( $p > 0.10$ ). Analyses of NBS reference materials (bovine liver, oyster tissue) were also routinely conducted to assure adequate recovery and accurate analyses. Values were all within the acceptable range reported by NITS. Peaks were censored from the data if they did not exceed 10 standard deviations of the background noise (limit of quantification), with the exception of silver in sediments. Silver peaks were censored if they did not exceed 3 standard deviations (limit of detection). Most detectable silver concentrations from sediments fell between the limit of detection and limit of quantification.

## RESULTS OF ANALYSES

Although our procedures do not allow a rigorous quantitative estimate of population size, it was noticeable from late 1991 through May 1992 that the abundance of *M. balthica* had increased dramatically from earlier years. We have observed in the past that clam populations at the Palo Alto mudflat were noticeably reduced during years of very low freshwater input to San Francisco Bay (1976 through 1977; 1985 through early 1991). The recovery of abundances in 1992 was an exception. In our 1990 to 1991 sampling, 5 person hours were typically required to collect forty to sixty animals. This number could easily be collected in one to two person hours in 1992. Our on-going work will include analyses of clam "condition" to assess if the physiological status of this population is indeed changing.

Appendix 1 lists all sediment analyses, and Appendix 2 lists all metal analyses of clam tissues conducted from the May 1991 to May 1992 samples. Analytical data and detection limits also are given for each sample to aid in verification of peaks. Statistical data indicates size influences on tissue concentrations, and content calculations are reported with summary statistics in Appendix 2.



Table 1 lists monthly variability in mean silver and copper concentrations observed in clams and sediments from the study site between May 1991 and May 1992. Figures 2 and 3 compare the seasonality observed in 1991 to 1992 with seasonality observed in 1990 to 1991. Tables 2 and 3 compare the 1991 - 92 data to long-term temporal trends observed in the copper and silver concentrations of clams since 1977. These data are annual mean concentrations calculated from the 7 to 11 samples collected between May of one year and April of the next. Figures 4, 5 and 6 illustrate the trends in these data in recent years, so as to better put perspective on changes in 1991 to 1992. From these figures and tables the data collected in 1991-92 can be compared with earlier levels of contamination at this station.

## REFERENCES CITED

- Cain, D. J. and Luoma, S. N., 1990, Influence of seasonal growth, age and environmental exposure on Cu and Ag in a bivalve indicator, *Macoma balthica* in San Francisco Bay: Marine Ecology Progress Series, v. 60, p. 45 - 55.
- Luoma, S. N., Cain, D. J., Brown, C. and Axtmann, E. V., 1991, Trace Metals in Clams (*Macoma balthica*) and sediments at the Palo Alto Mudflat in South San Francisco Bay: April, 1990 - April, 1991. U. S. Geological Survey Open File Report 91-460. Menlo Park, California. 47pp.
- Luoma, S. N., Cain, D. J. and Johansson, C. E., 1985, Temporal fluctuations of silver, copper and zinc in the bivalve *Macoma balthica* at five stations in South San Francisco Bay: Hydrobiologia, v. 129, p. 109 - 120.
- Thomson, E. A., Luoma, S. N., Johansson, C. E., and Cain, D. J., 1984, Comparison of sediments and organisms in identifying sources of biologically available trace metal contamination: Water Resources Research, v. 18, p. 755 - 765.

## LIST OF FIGURES

Figure 1. Transect stations along the Palo Alto shoreline where sediments and clams (*Macoma balthica*) were collected by Thomson and others (1984). Vertical bars show concentrations of copper and zinc in micrograms per gram dry weight (parts per million), as indicated. Site 3 is the Palo Alto mudflat considered in the present report.

Figure 2. Silver concentrations in *Macoma balthica* clams (in micrograms per gram dry weight of soft tissues) as observed at near-monthly intervals between May and May in 1991 to 1992 and 1990 to 1991. Letters on x-axis signify month of the year. Vertical bars represent  $\pm$  one standard deviation from replicate composite samples.

Figure 3. Copper concentrations in *Macoma balthica* clams (in micrograms per gram dry weight of soft tissues) as observed at near-monthly intervals between May and May in 1991 to 1992 and 1990 to 1991. Letters on x-axis signify month of the year. Vertical bars represent  $\pm$  one standard deviation from replicate composite samples.

Figure 4. Annual mean concentrations of silver in clams (in micrograms per gram dry weight soft tissue) from May to May of each year from 1985-86 to 1991-92. Each annual mean is derived from seven to eleven collections at near-monthly intervals in each year. Vertical bars represent  $\pm$  one standard deviation from replicate composite samples.

Figure 5. Annual mean concentrations of silver in clams (in micrograms per gram dry weight soft tissue) from May to May of each year from 1988-89 to 1991-92. Each annual mean is derived from seven to eleven collections at near-monthly intervals in each year. Vertical bars represent  $\pm$  one standard deviation from replicate composite samples.

Figure 6. Annual mean concentrations of copper in clams (in micrograms per gram dry weight soft tissue) from May to May of each year from 1985-86 to 1991-92. Each annual mean is derived from seven to eleven collections at near-monthly intervals in each year. Vertical bars represent  $\pm$  one standard deviation from replicate composite samples.

Figure 7. Mean annual silver concentrations in effluent from the Palo Alto municipal sewage works for the years 1986 through 1992, in micrograms per liter. Vertical bars represent the standard deviation for each year.

Figure 1.

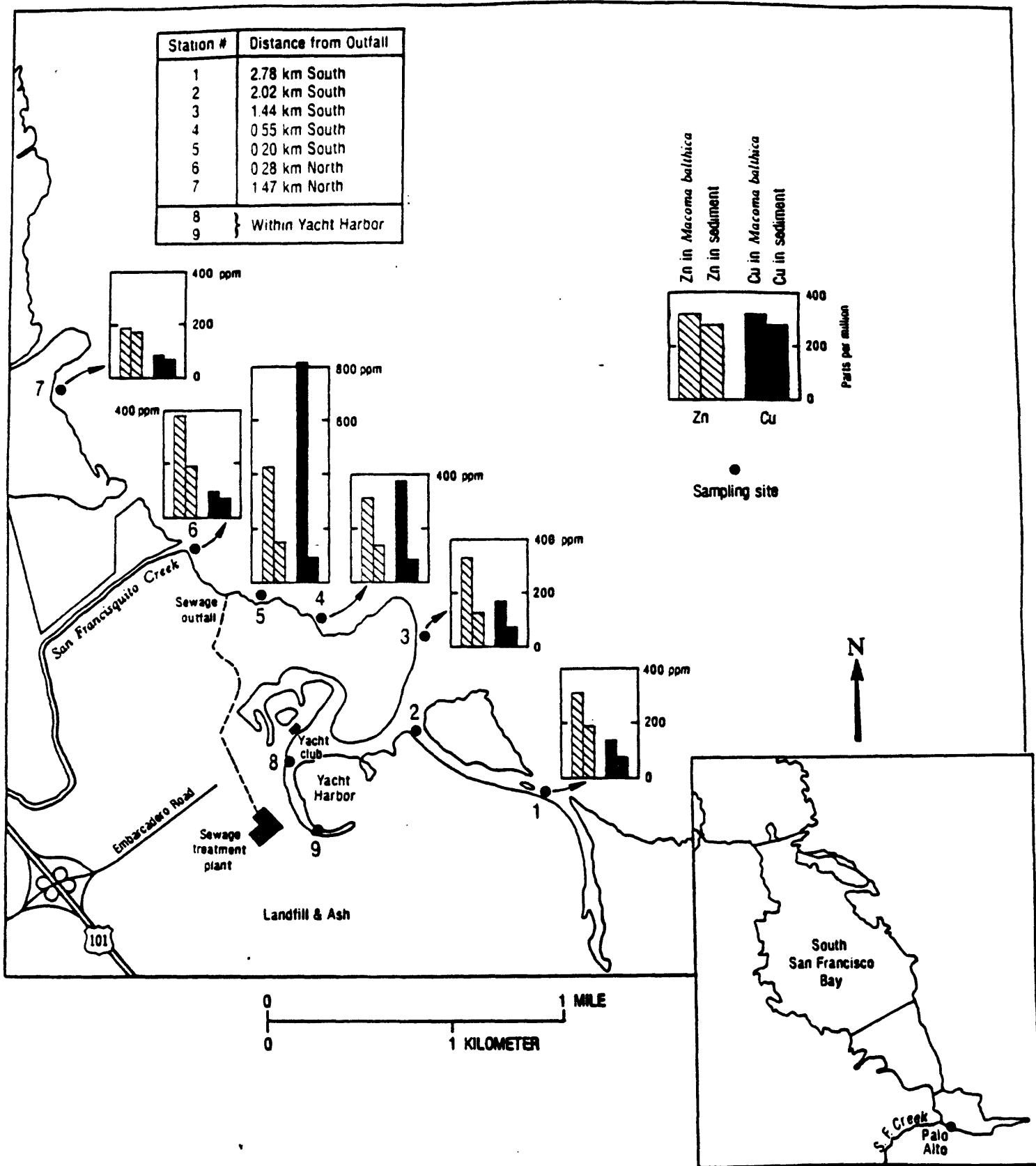


Figure 2.

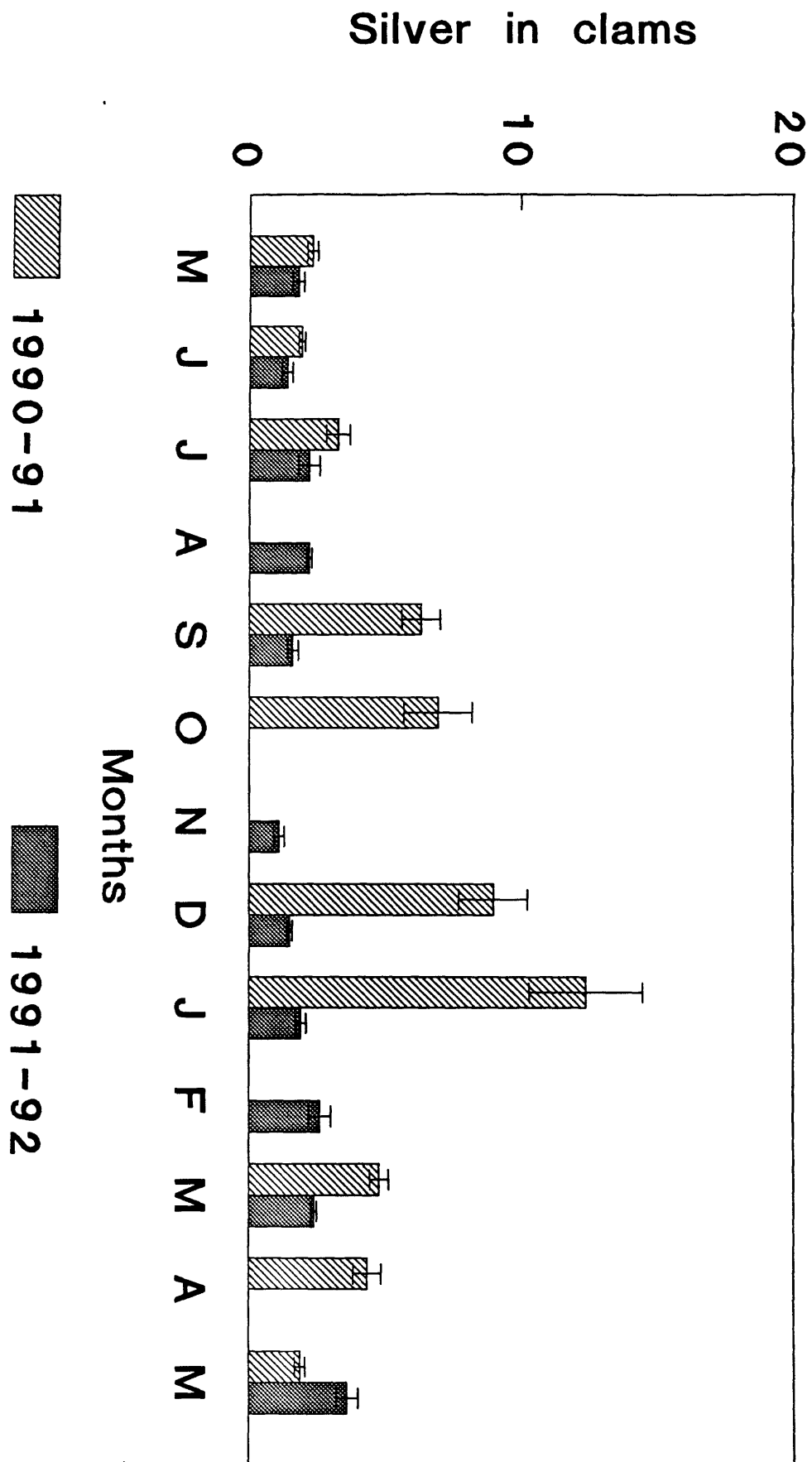


Figure 3.

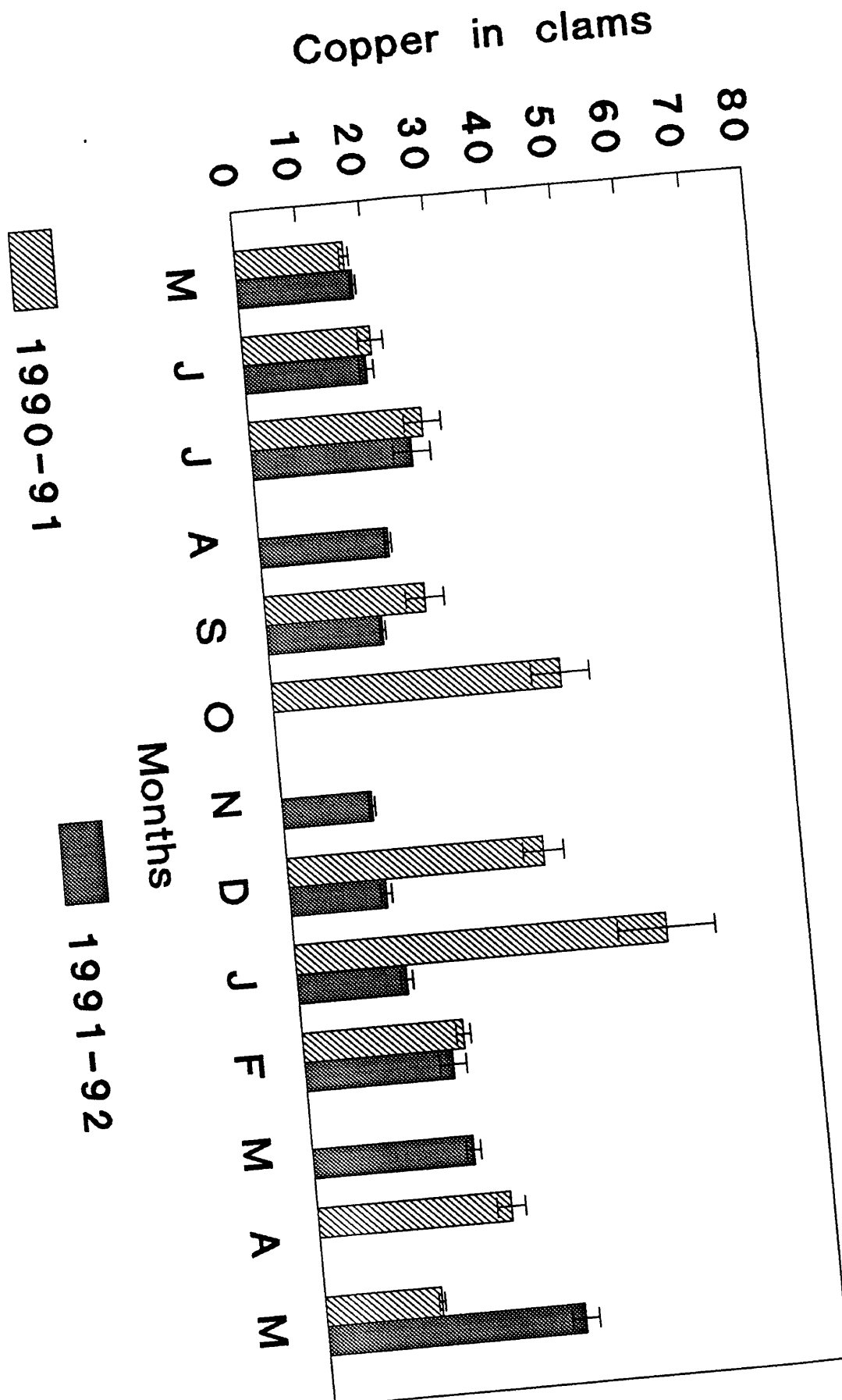


Figure 4.

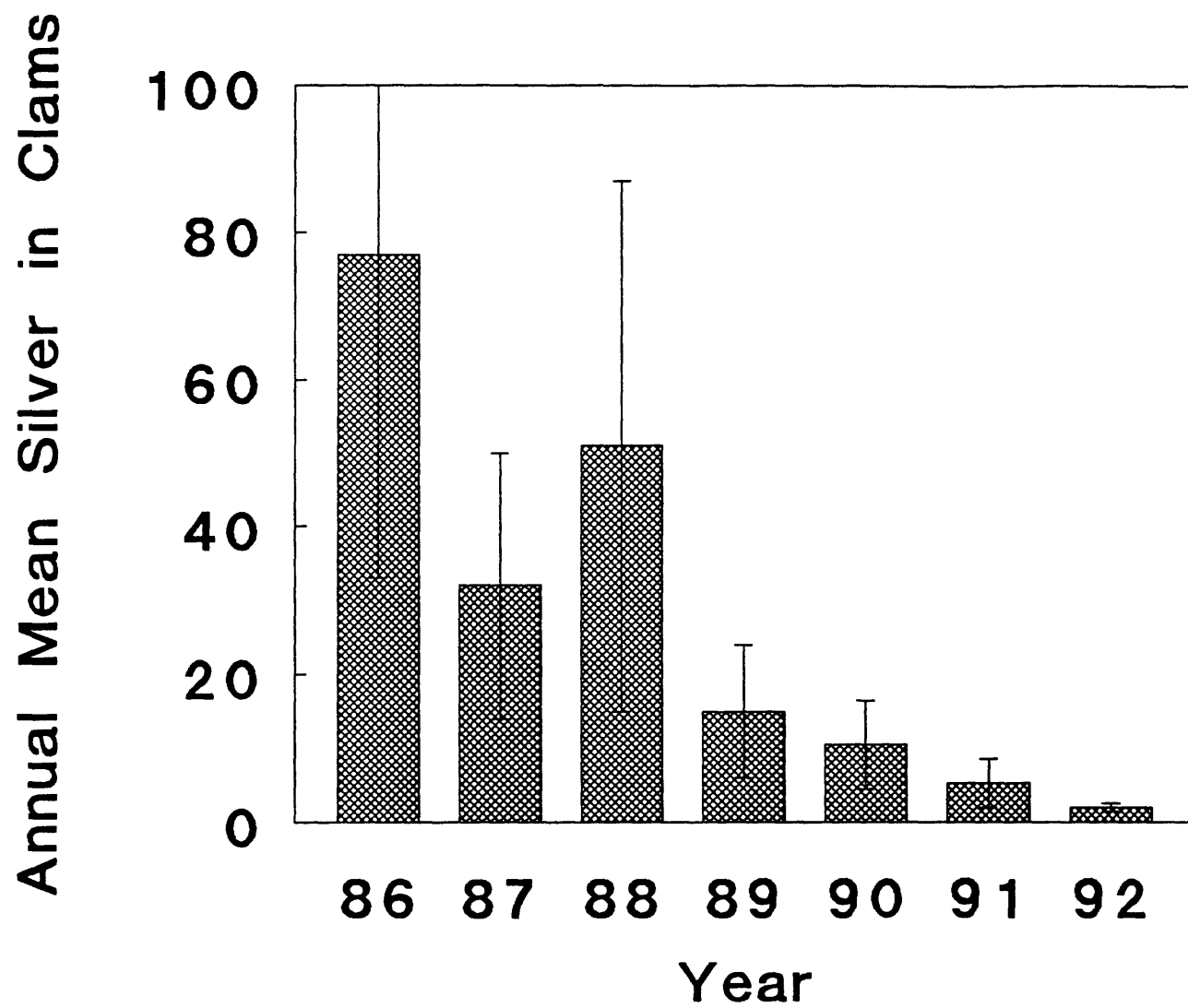


Figure 5.

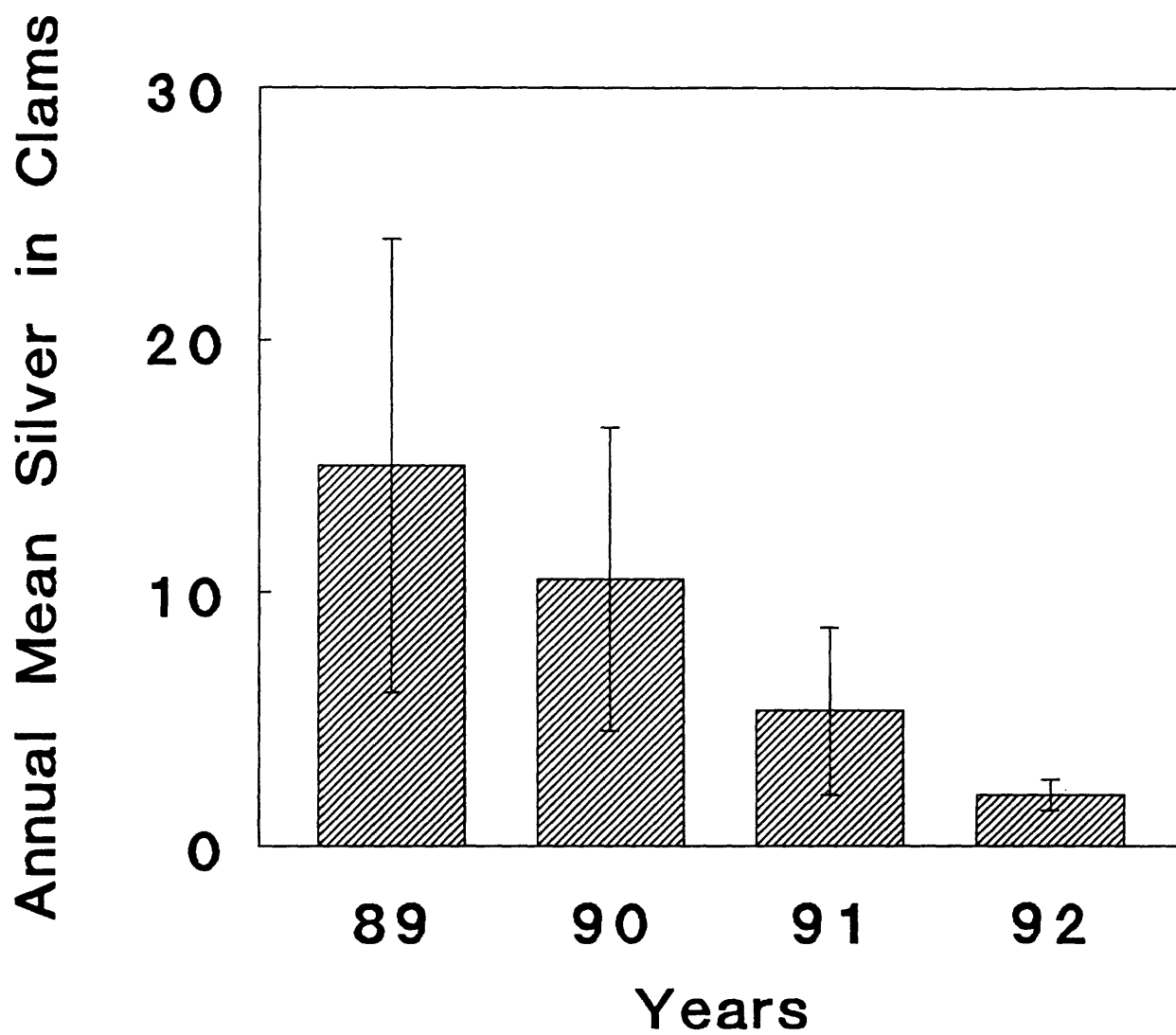




Figure 6.

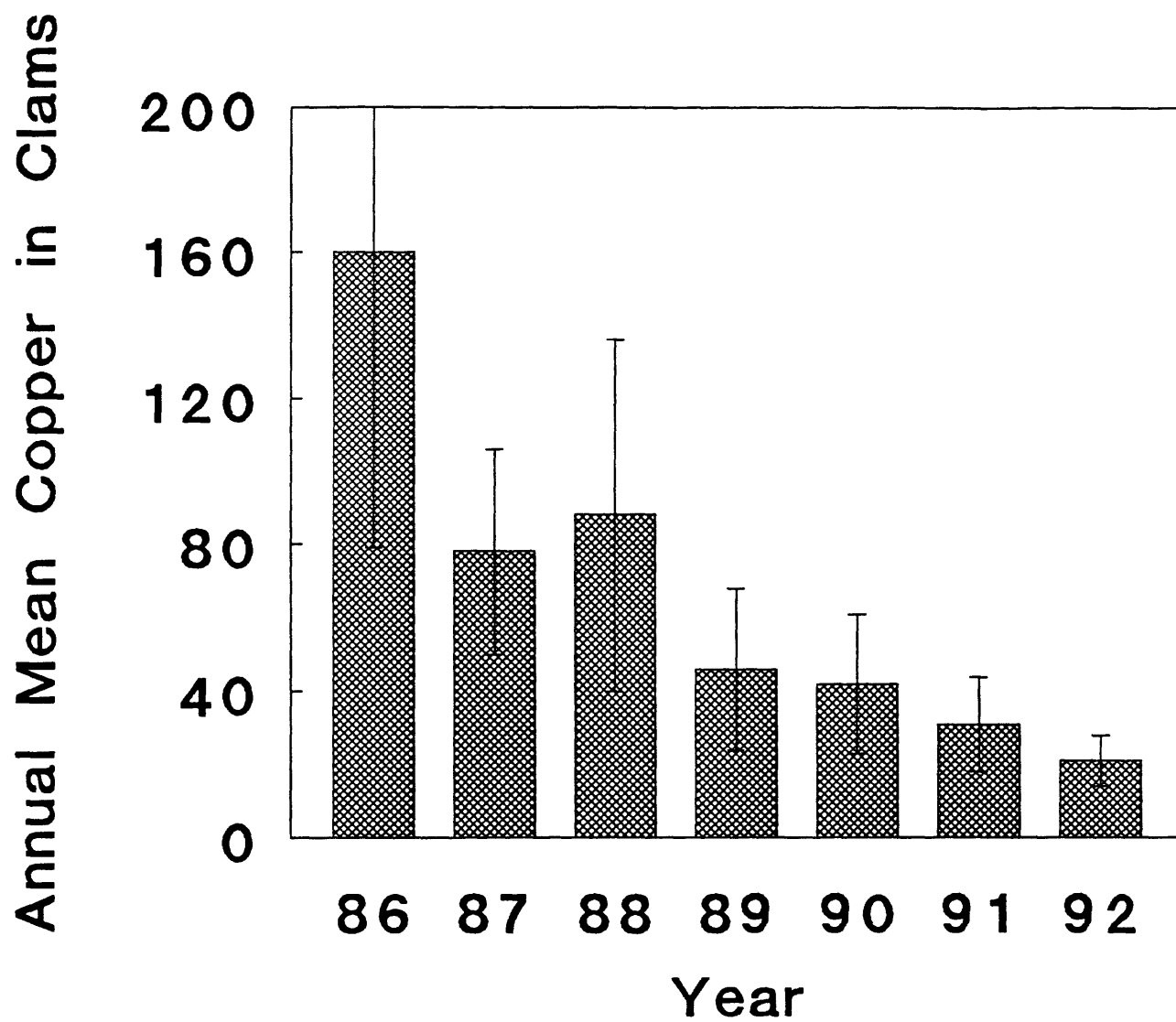


Figure 7

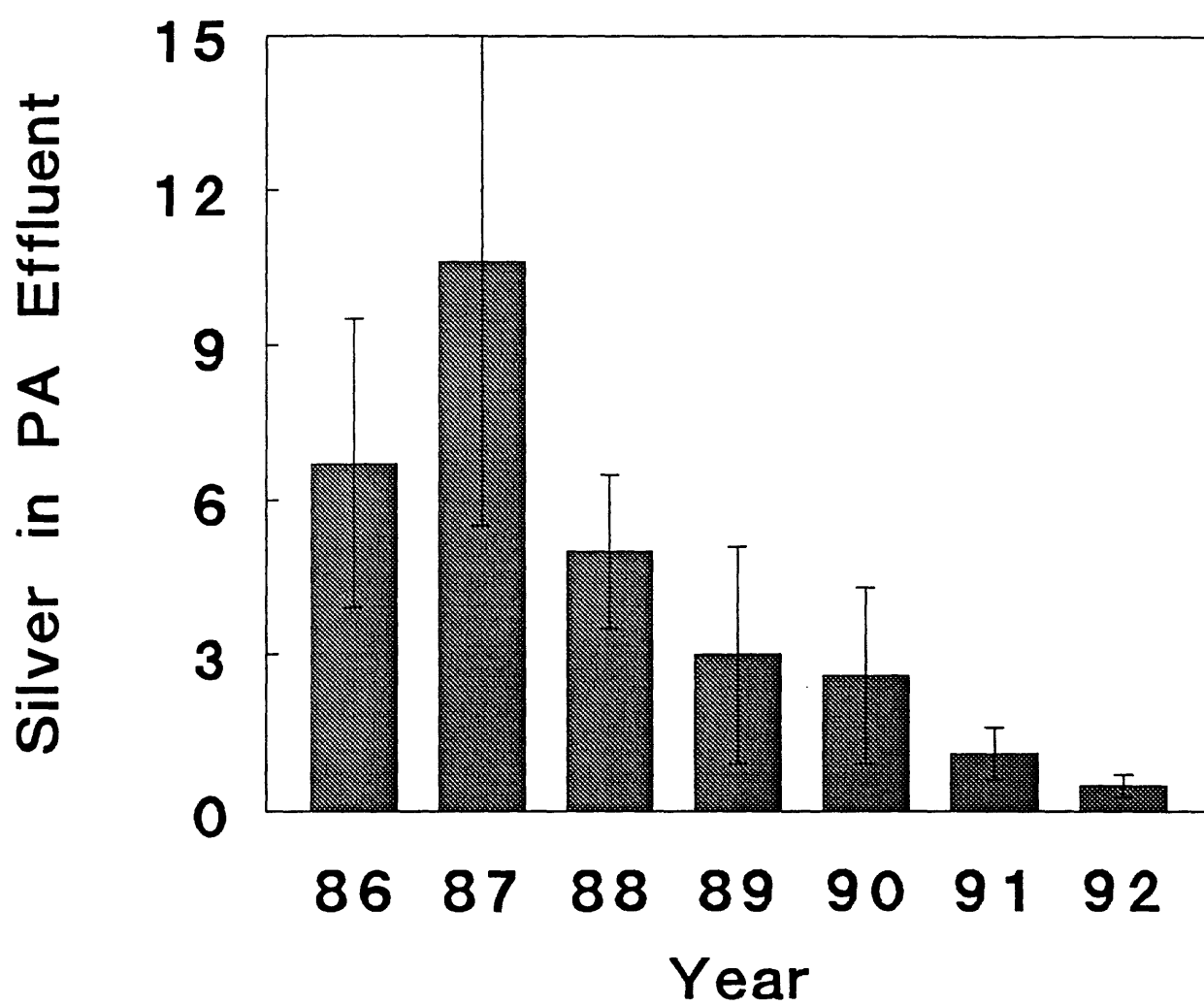


Table 1. Concentrations of silver and copper in clams and sediments from the Palo Alto mudflat observed between May 1991 and May 1992.

[Values are concentrations in micrograms per gram dry weight and represent the mean of replicates shown in appendices and the standard error of the mean for clam samples. Sediment concentrations are for the hydrochloric acid extracts of sediments, which encompasses the bioavailable form of the metals.]

Date	Silver in Sediment (HCl)	Silver in Clams		Copper in Sediment (HCl)	Copper in Clams	
		mean	SEM		mean	SEM
5/91	<0.14	1.8	0.2	25	18	0.5
6/91	<0.20	1.4	0.2	29	19	1.1
7/91	<0.17	2.2	0.4	24	25	2.9
8/91	<0.14	2.2	0.1	21	20	0.5
9/91	<0.25	1.6	0.2	21	18	0.5
11/91	0.30	1.1	0.2	21	14	0.5
12/91	0.44	1.5	0.1		15	0.9
1/92	0.36	1.9	0.2	28	17	0.9
2/92	<0.22	2.6	0.4	27	23	2.1
3/92	0.56	2.4	0.1	48	25	1.1
5/92	0.35	3.6	0.4	25	40	2.1

Table 2. Annual mean copper concentrations in clams and sediments: 1977 to 1992.

[Values are annual means from 7 to 12 collections per year and standard deviations. Units are microgram per gram dry weight of soft tissue for clams (*Macoma balthica*) and microgram per gram dry weight for sediment.]

Year (May to April)	Copper in sediment (micrograms per gram)		Copper in clams (micrograms per gram)
	HCl	Total	
1977 to 1978	38 ± 16	56 ± 20	151 ± 24
1978 to 1979	51 ± 20	70 ± 19	378 ± 104
1979 to 1980	50 ± 8	84 ± 25	255 ± 124
1980 to 1981	46 ± 9	63 ± 11	267 ± 107
1981 to 1982	43 ± 8	71 ± 11	173 ± 63
1982 to 1983	31 ± 7	64 ± 11	158 ± 62
1983 to 1984	29 ± 7	58 ± 8	156 ± 62
1984 to 1985	32 ± 11	52 ± 8	141 ± 81
1985 to 1986	26 ± 4	51 ± 12	160 ± 81
1986 to 1987	22 ± 4	48 ± 9	78 ± 28
1987 to 1988	23 ± 7	48 ± 10	88 ± 48
1988 to 1989	27 ± 5	54 ± 6	46 ± 22
1989 to 1990	24 ± 3	47 ± 12	42 ± 19
1990 to 1991	23 ± 4	53 ± 7	31 ± 13
1991 to 1992	27 ± 8	51 ± 7	21 ± 7

Table 3. Annual mean silver concentrations in clams and sediments from Palo Alto mudflat: 1977 to 1992.

[Values are annual means from 7 to 12 collections per year and standard deviations. Units are microgram per gram dry weight of soft tissue for clams (*Macoma balthica*) and microgram per gram dry weight for sediment. Silver in sediment is from the hydrochloric acid extract. Mean for 1990 to 1991 silver in sediment was calculated from values where silver was above the instrumental level of detection.]

Year (May to April)	Silver in sediment (micrograms per gram)	Silver in clams (micrograms per gram)
1977 to 1978	1.44 $\pm$ 0.92	102 $\pm$ 47
1978 to 1979	1.44 $\pm$ 0.51	125 $\pm$ 49
1979 to 1980	1.58 $\pm$ 0.30	75 $\pm$ 51
1980 to 1981	1.27 $\pm$ 0.21	90 $\pm$ 41
1981 to 1982	1.29 $\pm$ 0.36	45 $\pm$ 24
1982 to 1983	0.82 $\pm$ 0.14	42 $\pm$ 26
1983 to 1984	0.73 $\pm$ 0.22	54 $\pm$ 26
1984 to 1985	0.75 $\pm$ 0.13	53 $\pm$ 24
1985 to 1986	0.71 $\pm$ 0.24	77 $\pm$ 44
1986 to 1987	0.62 $\pm$ 0.21	32 $\pm$ 18
1987 to 1988		51 $\pm$ 36
1988 to 1989		15 $\pm$ 9
1989 to 1990		10.5 $\pm$ 6
1990 to 1991	0.38 $\pm$ 0.12	5.3 $\pm$ 3.3
1991 to 1992	<0.5	2.0 $\pm$ 0.6

**APPENDIX 1.** Metal concentrations in sediments collected at the Palo Alto mudflat. Each monthly collection is reported on a separate page. Concentrations observed in the reconstituted samples or extracts (in micrograms per milliliter or ug/ml) are reported at the top of each page, along with the sediment weight and dilution factor. The latter are employed to determine concentrations in sediments (reported as microgram per gram dry sediment or ug/g). Replicate subsamples were analyzed from each collection. Mean and standard deviation for the replicate samples are reported for the total and hydrochloric acid extracts.

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1309	10.50	HCl	<0.002	<0.004	0.104	0.308	100.80	9.525	0.136	0.365	0.195	0.683
			<0.002	<0.004	0.102	0.316	101.90	10.120	0.135	0.405	0.200	0.710
	11.00	Total	<0.002	0.009	2.950	1.198	1118.00	26.570	2.463	0.823	2.317	3.744
			<0.002	<0.004	2.851	1.163	1087.00	26.050	2.467	1.015	2.158	3.654
		HCl	0.000	0.000	8.37	24.70	8085.6	764.04	10.90	29.25	15.62	54.76
			0.000	0.000	8.19	25.37	8173.8	811.76	10.84	32.49	16.07	56.98
		Total	0.000	0.382	123.95	50.34	46974.8	1116.39	103.49	34.58	97.35	157.31
			0.000	0.000	119.79	48.87	45672.3	1094.54	103.66	42.65	90.67	153.53
		HCl	<0.144	<0.321	8.28	25.03	8129.7	787.90	10.87	30.87	15.84	55.87
		STD	0.000	0.000	0.12	0.48	62.4	33.75	0.04	2.30	0.32	1.57
		Total	<0.084	0.382	121.87	49.60	46323.5	1105.46	103.57	38.61	94.01	155.42
		STD	0.000	0.000	2.94	1.04	921.0	15.45	0.12	5.70	4.72	2.67

Palo Alto 6-12-91

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1242	10.50	HCl	0.003	<0.004	0.109	0.381	115.60	11.540	0.160	0.489	0.210	0.911
			0.002	<0.004	0.086	0.300	91.95	9.201	0.128	0.393	0.166	0.711
	11.00	Total	<0.002	<0.004	3.277	1.152	1112.00	24.570	2.432	0.876	2.690	3.488
			<0.002	<0.004	3.265	1.160	1089.00	23.990	2.405	0.832	2.672	3.392
		HCl	0.243	0.000	9.21	32.18	9772.9	975.60	13.55	41.34	17.73	76.97
			0.158	0.000	7.26	25.33	7773.6	777.86	10.83	33.23	14.05	60.08
		Total	0.000	0.000	145.12	51.01	49243.2	1088.04	107.70	38.79	119.12	154.46
			0.000	0.000	144.59	51.37	48224.6	1062.36	106.50	36.84	118.33	150.21
		HCl	0.201	<0.338	8.23	28.75	8773.2	876.73	12.19	37.29	15.89	68.53
		STD	0.060	0.000	1.37	4.84	1413.8	139.82	1.92	5.73	2.60	11.94
		Total	<0.089	<0.177	144.85	51.19	48733.9	1075.20	107.10	37.82	118.72	152.33
		STD	0.000	0.000	0.38	0.25	720.2	18.16	0.85	1.38	0.56	3.01



Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1226	10.50	HCl	<0.002	<0.004	0.104	0.300	96.60	7.844	0.139	0.359	0.171	0.690
			<0.002	<0.004	0.082	0.258	81.09	6.832	0.113	0.308	0.145	0.592
11.00		Total	<0.002	<0.004	3.199	1.088	1017.00	21.020	2.148	0.753	2.664	2.793
			<0.002	<0.004	3.124	1.086	1007.00	20.820	2.152	0.725	2.627	2.790
		HCl	0.000	0.000	8.93	25.72	8273.2	671.79	11.89	30.70	14.66	59.12
			0.000	0.000	7.03	22.07	6944.9	585.12	9.64	26.36	12.39	50.69
		Total	0.000	0.000	143.51	48.81	45624.0	942.99	96.36	33.78	119.51	125.30
			0.000	0.000	140.15	48.72	45175.4	934.01	96.54	32.52	117.85	125.16
		HCl	MEAN <0.171	<0.343	7.98	23.89	7609.1	628.46	10.77	28.53	13.53	54.91
			STD 0.000	0.000	1.34	2.58	939.3	61.29	1.59	3.07	1.60	5.96
		Total	MEAN <0.090	<0.179	141.83	48.76	45399.7	938.50	96.45	33.15	118.68	125.23
			STD 0.000	0.000	2.38	0.06	317.2	6.34	0.13	0.89	1.17	0.10

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1532	10.50	HCl	<0.002	<0.004	0.105	0.323	106.90	8.457	0.147	0.442	0.184	0.855
			<0.002	<0.004	0.097	0.291	98.01	7.700	0.137	0.393	0.167	0.745
	11.00	Total	<0.002	<0.004	3.018	1.241	1137.00	22.920	2.583	0.946	2.418	2.952
			<0.002	<0.004	2.915	1.182	1084.00	21.810	2.442	0.959	2.311	2.788
		HCl	0.000	0.000	7.18	22.15	7326.7	579.62	10.05	30.28	12.58	58.63
			0.000	0.000	6.66	19.97	6717.4	527.74	9.38	26.93	11.46	51.07
		Total	0.000	0.000	108.35	44.55	40819.2	822.85	92.73	33.96	86.81	105.98
			0.000	0.000	104.65	42.43	38916.4	783.00	87.67	34.43	82.97	100.09

HCl	MEAN	<0.137	<0.274	6.92	21.06	7022.0	553.68	9.72	28.60	12.02	54.85
	STD	0.000	0.000	0.37	1.55	430.8	36.69	0.48	2.37	0.79	5.34
Total	MEAN	<0.072	<0.144	106.50	43.49	39867.8	802.92	90.20	34.20	84.89	103.04
	STD	0.000	0.000	2.61	1.50	1345.4	28.18	3.58	0.33	2.72	4.16

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.0856	10.50	HCl	<0.002	<0.004	0.055	0.170	59.19	4.053	0.080	0.202	0.093	0.432
			<0.002	<0.004	0.059	0.174	61.45	4.191	0.083	0.222	0.098	0.435
	11.00	Total	<0.002	<0.004	1.780	0.659	650.80	12.710	1.354	0.497	1.458	2.007
			<0.002	<0.004	1.782	0.665	647.00	12.730	1.309	0.560	1.418	2.094
		HCl	0.000	0.000	6.76	20.79	7260.5	497.16	9.83	24.78	11.37	53.02
			0.000	0.000	7.25	21.33	7537.7	514.08	10.17	27.26	11.98	53.40
		Total	0.000	0.000	114.37	42.34	41815.4	816.65	87.00	31.93	93.68	128.95
			0.000	0.000	114.50	42.75	41571.3	817.93	84.11	35.98	91.11	134.54
		HCl	MEAN	<0.245	7.00	21.06	7399.1	505.62	10.00	26.02	11.68	53.21
			STD	0.000	0.35	0.38	196.0	11.97	0.24	1.75	0.43	0.27
		Total	MEAN	<0.129	114.43	42.55	41693.3	817.29	85.55	33.96	92.39	131.75
			STD	0.000	0.09	0.29	172.6	0.91	2.04	2.86	1.82	3.95

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1032	10.50	HCl	0.003	<0.004	0.050	0.186	55.95	5.873	0.075	0.239	0.094	0.483
			0.003	<0.004	0.059	0.219	63.32	6.662	0.086	0.259	0.109	0.613
	11.00	Total	<0.002	<0.004	1.857	0.847	790.40	19.020	1.703	0.597	1.527	2.214
			<0.002	<0.004	1.670	0.790	732.90	17.750	1.573	0.561	1.415	2.109
		HCl	0.271	0.000	5.10	18.97	5692.6	597.54	7.62	24.27	9.58	49.09
			0.323	0.000	6.01	22.24	6442.4	677.82	8.72	26.37	11.05	62.32
		Total	0.000	0.000	98.97	45.16	42124.0	1013.66	90.76	31.82	81.38	117.99
			0.000	0.000	89.00	42.08	39059.6	945.98	83.83	29.90	75.41	112.40

HCl	MEAN	0.297	<0.407	5.56	20.60	6067.5	637.68	8.17	25.32	10.32	55.70
	STD	0.037	0.000	0.65	2.32	530.2	56.76	0.78	1.49	1.04	9.35
Total	MEAN	<0.107	<0.213	93.98	43.62	40591.8	979.82	87.30	30.86	78.40	115.20
	STD	0.000	0.000	7.05	2.17	2166.9	47.86	4.90	1.36	4.22	3.96

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1005	10.50	HCl	0.004	<0.004	0.064	0.238	69.65	13.320	0.092	0.314	0.145	0.565
			0.004	<0.004	0.067	0.247	72.63	13.750	0.096	0.319	0.151	0.559
11.00		Total	<0.002	<0.004	2.455	1.055	965.40	33.190	2.103	0.840	2.420	1.801
			<0.002	<0.004	2.392	1.092	984.80	34.180	2.172	0.858	2.334	1.856
		HCl	0.449	0.000	6.66	24.82	7276.9	1391.64	9.56	32.77	15.19	59.02
			0.439	0.000	6.96	25.79	7588.2	1436.57	9.99	33.36	15.73	58.35
		Total	0.000	0.000	134.35	57.74	52832.8	1816.37	115.09	45.97	132.44	98.56
			0.000	0.000	130.91	59.76	53894.5	1870.55	118.87	46.96	127.73	101.57

HCl	MEAN	0.444	<0.418	6.81	25.30	7432.5	1414.10	9.77	33.07	15.46	58.69
	STD	0.007	0.000	0.21	0.68	220.2	31.77	0.30	0.41	0.38	0.47
Total	MEAN	<0.109	<0.219	132.63	58.75	53363.7	1843.46	116.98	46.46	130.08	100.07
	STD	0.000	0.000	2.44	1.43	750.7	38.31	2.67	0.70	3.33	2.13

Palo Alto 1-15-92

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.121	10.50	HCl	0.004	<0.004	0.106	0.335	100.10	14.340	0.135	0.411	0.199	0.844
			0.004	<0.004	0.086	0.322	90.36	14.070	0.114	0.397	0.183	0.818
	11.00	Total	<0.002	<0.004	3.426	1.470	1278.00	38.720	2.812	1.070	2.776	3.765
			<0.002	<0.004	3.255	1.385	1225.00	37.140	2.726	1.174	2.698	3.584
		HCl	0.382	0.000	9.16	29.05	8686.4	1244.38	11.70	35.68	17.30	73.27
			0.347	0.000	7.42	27.92	7841.2	1220.95	9.88	34.49	15.84	71.00
		Total	0.000	0.000	155.73	66.82	58090.9	1760.00	127.82	48.64	126.18	171.14
			0.000	0.000	147.95	62.95	55681.8	1688.18	123.91	53.36	122.64	162.91
		HCl	0.364	<0.347	8.29	28.49	8263.8	1232.67	10.79	35.08	16.57	72.13
			0.025	0.000	1.23	0.80	597.7	16.57	1.29	0.85	1.04	1.60
		Total	<0.091	<0.182	151.84	64.89	56886.4	1724.09	125.86	51.00	124.41	167.02
			0.000	0.000	5.50	2.73	1703.5	50.78	2.76	3.34	2.51	5.82

Palo Alto 2-25-92

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.0916	10.50	HCl	<0.002	<0.004	*	0.213	56.66	9.850	0.089	0.302	0.124	0.403
			<0.002	<0.004	0.156	0.266	59.23	9.926	0.088	0.290	0.129	0.451
11.00		Total	<0.002	<0.004	2.398	0.996	898.30	27.330	2.000	0.751	1.932	2.701
			<0.002	<0.004	2.511	1.020	922.50	28.060	2.075	0.939	2.015	2.832
		HCl	0.000	0.000		24.44	6494.9	1129.09	10.24	34.63	14.24	46.15
			0.000	0.000	17.88	30.45	6789.5	1137.81	10.09	33.29	14.81	51.72
		Total	0.000	0.000	143.98	59.80	53937.2	1640.99	120.09	45.09	116.00	162.18
			0.000	0.000	150.77	61.24	55390.3	1684.83	124.59	56.38	120.99	170.04
		HCl	MEAN	<0.229	<0.459	17.88	27.44	6642.2	1133.45	10.16	14.52	48.94
			STD	0.000	0.000	ERR	4.25	208.3	6.16	0.11	0.41	3.94
		Total	MEAN	<0.120	<0.240	147.38	60.52	54663.8	1662.91	122.34	118.50	166.11
			STD	0.000	0.000	4.80	1.02	1027.5	30.99	3.18	3.52	5.56

\*Sample lost

Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1239	10.50	HCl	0.007	<0.004	0.156	0.532	164.40	16.730	0.233	0.661	0.312	1.301
			0.007	<0.004	0.178	0.618	187.80	19.220	0.264	0.748	0.359	1.556
	11.00	Total	<0.002	<0.004	2.482	1.251	1103.00	26.220	2.471	1.090	2.137	3.637
			<0.002	<0.004	2.435	1.213	1098.00	26.220	2.465	1.081	2.017	3.584
		HCl	0.551	0.000	13.20	45.08	13932.2	1417.80	19.75	56.00	26.46	110.25
			0.568	0.000	15.11	52.41	15915.3	1628.81	22.36	63.36	30.43	131.86
		Total	0.000	0.000	110.18	55.53	48962.9	1163.92	109.69	48.39	94.86	161.45
			0.000	0.000	108.09	53.85	48740.9	1163.92	109.42	47.99	89.54	159.10
		HCl	0.559	<0.339	14.16	48.74	14923.7	1523.31	21.06	59.68	28.44	121.06
		STD	0.012	0.000	1.35	5.18	1402.2	149.21	1.85	5.21	2.81	15.28
		Total	<0.089	<0.178	109.13	54.69	48851.9	1163.92	109.56	48.19	92.20	160.27
		STD	0.000	0.000	1.48	1.19	156.9	0.00	0.19	0.28	3.77	1.66



Sed Wt (g)	Dilution(ml)	Extractant	Ag	Cd	Cr	Cu	Fe	Mn	Ni	Pb	V	Zn
0.1343	10.50	HCl	0.004	<0.004	0.098	0.309	100.00	17.680	0.138	0.386	0.180	0.797
			0.005	<0.004	0.107	0.323	105.10	18.120	0.147	0.395	0.189	0.820
	11.00	Total	<0.002	<0.004	2.409	1.251	1159.00	43.180	2.662	0.941	1.990	3.752
			<0.002	<0.004	2.313	1.314	1116.00	41.970	2.558	1.044	1.889	3.746
		HCl	0.289	0.000	7.62	24.15	7818.3	1382.28	10.80	30.17	14.07	62.30
			0.407	0.000	8.38	25.26	8217.1	1416.68	11.46	30.84	14.78	64.14
		Total	0.000	0.000	98.66	51.23	47464.6	1768.35	109.02	38.54	81.50	153.66
			0.000	0.000	94.72	53.81	45703.6	1718.80	104.76	42.76	77.36	153.41
		HCl	0.348	<0.313	8.00	24.71	8017.7	1399.48	11.13	30.51	14.42	63.22
		STD	0.083	0.000	0.54	0.79	281.9	24.32	0.46	0.48	0.51	1.30
		Total	<0.082	<0.164	96.69	52.52	46584.1	1743.58	106.89	40.65	79.43	153.53
		STD	0.000	0.000	2.78	1.82	1245.2	35.04	3.01	2.98	2.92	0.17

**APPENDIX 2.** Metal concentrations in the clam *Macoma balthica* collected at the Palo Alto Mudflat. Each monthly collection is reported on two pages. The first page contains summary statistics:

Mean concentrations in microgram per gram dry tissue weight (ug/g).

STD is the standard deviation of the mean.

SEM is the standard error of the mean.

CV percent is the coefficient of variation.

$r_{wt \times []}$  is the correlation coefficient for the concentration versus weight correlation for each element.

X 100mg is the concentration interpolated from the above regression for a 100 mg animal.

$r_{l \times []}$  is the correlation coefficient for the concentration versus shell length regression.

X 20 mm and X 25 mm are concentrations interpolated from the regression for 20mm and 25 mm animals.

Content (a measure of metal bioaccumulation that is independent of mass) is also shown for 20 and 25 mm animals, as is the weight determined for animals of 15 mm and 20 mm shell length.

The second page for each month shows each analysis of each composite sample, the number of animals composited in each, concentration as calculated from sample dry weight and the dilution factor and the metal content for each sample.

*Pal Alto*  
Macoma balthica 5-15-91

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	1.8843	0.1808	1.1349	18.3003	3.4671	1.2820	1.1084	167.502
STD	0.5585	0.0556	0.3231	1.5012	0.3557	0.2138	0.1956	35.4135
SEM	0.186	0.019	0.108	0.500	0.119	0.071	0.065	11.805
CV%	29.638	30.774	28.468	8.203	10.258	16.679	17.648	21.142
r wt x [ ]	0.190	0.295	0.812	0.411	0.103	0.385	0.742	0.401
X 100mg	1.877	0.180	1.153	18.257	3.470	1.288	1.119	168.498
r l x [ ]	0.082	0.437	0.658	0.361	0.076	0.233	0.586	0.475
X 20mm	1.872	0.174	1.192	18.154	3.460	1.296	1.139	172.053
X 25mm	1.820	0.147	1.432	17.544	3.429	1.352	1.269	191.014

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1676	0.0156	0.1090	1.6967	0.3227	0.1202	0.1060	16.0118
25mm	0.3465	0.0296	0.2685	3.5603	0.6871	0.2666	0.2478	37.7627

Estimated weight for 15mm clam

Estimated weight for 20mm clam

0.035 gm  
34.861 mg

0.094 gm  
93.984 mg

Macoma balthica 5-15-91

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES							
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
MB1-1	27.2	0.2870	0.2870	5	0.0646	0.0086	0.1122	0.9396	0.2156	0.0893	0.0880	9.4012
MB2-1	23.9	0.1725	0.1725	5	0.0943	0.0071	0.0379	0.6549	0.1148	0.0468	0.0401	8.7519
MB3-2	21.4	0.2224	0.1112	5	0.0949	0.0055	0.0436	0.8115	0.1523	0.0515	0.0466	7.5009
MB4-7	17.4	0.3998	0.0571	5	0.1267	0.0110	0.0743	1.3628	0.2366	0.0816	0.0715	13.1087
MB5-8	17.3	0.4492	0.0562	5	0.1296	0.0157	0.0753	1.5379	0.2693	0.0865	0.0767	11.9375
MB6-7	16.8	0.3820	0.0546	5	0.1152	0.0149	0.0885	1.3750	0.2665	0.0912	0.0878	10.9306
MB7-6	16.3	0.2635	0.0439	5	0.1101	0.0078	0.0574	1.1085	0.1916	0.0719	0.0555	7.7662
MB8-5	15.4	0.1916	0.0383	5	0.1025	0.0071	0.0415	0.7687	0.1348	0.0598	0.0425	6.9287
MB9-5	13.5	0.1263	0.0253	5	0.0422	0.0078	0.0274	0.4510	0.1035	0.0345	0.0297	3.8737
Detection Lim					.003	.004	.005	.002	.01	.025	.001	.005
Sample #												
Concentration (ug/g) ==>				MB1-1	1.1254	0.1502	1.9542	16.3686	3.7561	1.5554	1.5322	163.783
				MB2-1	2.7322	0.2043	1.0988	18.9812	3.3272	1.3565	1.1632	253.679
				MB3-2	2.1331	0.1232	0.9804	18.2451	3.4245	1.1578	1.0477	168.634
				MB4-7	1.5840	0.1372	0.9286	17.0434	2.9589	1.0209	0.8947	163.941
				MB5-8	1.4430	0.1745	0.8382	17.1185	2.9980	0.9624	0.8534	132.875
				MB6-7	1.5072	0.1949	1.1586	17.9974	3.4880	1.1932	1.1492	143.071
				MB7-6	2.0896	0.1488	1.0899	21.0334	3.6355	1.3638	1.0524	147.367
				MB8-5	2.6738	0.1840	1.0817	20.0595	3.5185	1.5611	1.1091	180.812
				MB9-5	1.6702	0.3104	1.0835	17.8559	4.0974	1.3674	1.1742	153.353
Sample #												
Content (ug) ==>				MB1-1	0.3230	0.0431	0.5609	4.6978	1.0780	0.4464	0.4398	47.0058
				MB2-1	0.4713	0.0353	0.1896	3.2743	0.5740	0.2340	0.2007	43.7597
				MB3-2	0.2372	0.0137	0.1090	2.0289	0.3808	0.1288	0.1165	18.7522
				MB4-7	0.0904	0.0078	0.0530	0.9732	0.1690	0.0583	0.0511	9.3610
				MB5-8	0.0811	0.0098	0.0471	0.9621	0.1685	0.0541	0.0480	7.4676
				MB6-7	0.0823	0.0106	0.0633	0.9827	0.1904	0.0651	0.0627	7.8117
				MB7-6	0.0917	0.0065	0.0478	0.9234	0.1596	0.0599	0.0462	6.4694
				MB8-5	0.1024	0.0070	0.0414	0.7683	0.1348	0.0598	0.0425	6.9251
				MB9-5	0.0423	0.0079	0.0274	0.4518	0.1037	0.0346	0.0297	3.8798

*Polo AHO*  
Macoma balthica 6-12-91

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	1.3356	0.1114	0.7518	18.8104	3.0814	1.9421	0.6821	127.778
STD	0.2259	0.02798	0.51668	3.75352	0.79343	0.64905	0.33769	27.9289
SEM	0.065	0.011	0.149	1.084	0.229	0.187	0.097	8.062
CV%	16.913	25.120	68.724	19.954	25.749	33.420	49.505	21.857
r wt x [ ]	0.248	0.189	0.444	0.434	0.405	0.502	0.460	0.214
X 100mg	1.353	0.072	0.825	19.330	3.184	2.046	0.732	129.685
r l x [ ]	0.170	0.103	0.407	0.398	0.319	0.633	0.456	0.046
X 20mm	1.349	0.073	0.824	19.323	3.168	2.083	0.735	128.219
X 25mm	1.308	0.079	0.600	17.729	2.898	1.645	0.571	126.846

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1092	1.0000	0.0578	1.5512	0.2516	0.1596	0.0549	10.3316
25mm	0.2345	1.0000	0.0918	3.1464	0.5105	0.2841	0.0944	22.2039

Estimated weight for 15mm clam

0.029 gm  
29.384 mg

Estimated weight for 20mm clam

0.082 gm  
82.171 mg

Macoma balthica 6-12-91

Sample #	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES								
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn	
mb1	30.0	0.3173	0.3173	5	0.06564	0.00922	0.02038	1.08981	0.13382	0.06147	0.02079	10.8145	
mb2	27.3	0.2609	0.2609	5	0.07899	0.0067	0.02519	1.1408	0.1833	0.07665	0.02475	5.14438	
mb3	25.8	0.2080	0.2980	5	0.05431		0.01816	0.48058	0.10321	0.08797	0.02407	3.04979	
mb4	24.6	0.1666	0.1666	5	0.04078		0.00955	0.59838	0.07207	0.05674	0.01272	3.82425	
mb5	23.5	0.2020	0.1010	5	0.07243		0.02704	0.67897	0.14628	0.0652	0.02587	5.75432	
mb6	21.6	0.3366	0.1122	5	0.06652		0.04087	1.09362	0.15678	0.13775	0.03763	10.9965	
mb7	20.4	0.3534	0.0884	5	0.09806	0.00502	0.1605	1.79223	0.34649	0.18634	0.11654	9.74044	
mb8	19.2	0.2043	0.0681	5	0.05213		0.03204	0.77538	0.1486	0.04448	0.02592	4.65731	
mb9	18.2	0.2369	0.0592	5	0.06984	0.00502	0.03822	0.82344	0.15215	0.11995	0.03411	6.62237	
mb10	17.4	0.3774	0.0539	5	0.08525	0.0067	0.0506	1.34622	0.21017	0.12222	0.04883	7.94334	
mb11	16.4	0.2926	0.0418	5	0.0862	0.00754	0.05023	1.181	0.183	0.14	0.0428	8.5747	
mb12	14.9	0.1108	0.0277	5	0.03168		0.01835	0.54065	0.06869	0.06918	0.01867	2.8173	
Detection Lim					.003	.004	.005	.002	.01	.025	.001	.005	
Sample #													
Concentration (ug/g) ==>					mb1	1.0344	0.1453	0.3211	17.1732	2.1087	0.9686	0.3276	170.415
					mb2	1.5138	0.1284	0.4828	21.8628	3.5128	1.4690	0.4743	98.589
					mb3	1.3055		0.4365	11.5524	2.4810	2.1147	0.5786	73.312
					mb4	1.2239		0.2866	17.9586	2.1630	1.7029	0.3818	114.773
					mb5	1.7928		0.6693	16.8062	3.6208	1.6139	0.6403	142.434
					mb6	0.9881		0.6071	16.2451	2.3289	2.0462	0.5590	163.347
					mb7	1.3874	0.0710	2.2708	25.3570	4.9022	2.6364	1.6488	137.810
					mb8	1.2758		0.7841	18.9765	3.6368	1.0886	0.6344	113.982
					mb9	1.4740	0.1060	0.8067	17.3795	3.2113	2.5317	0.7199	139.771
					mb10	1.1294	0.0888	0.6704	17.8355	2.7844	1.6192	0.6469	105.238
					mb11	1.4730	0.1288	0.8583	20.1811	3.1271	2.3923	0.7314	146.526
					mb12	1.4296		0.8281	24.3976	3.0997	3.1218	0.8425	127.134
Sample #													
Content (ug) ==>					mb1	0.3282	0.0461	0.1019	5.4491	0.6691	0.3074	0.1040	54.0726
					mb2	0.3950	0.0335	0.1260	5.7040	0.9165	0.3833	0.1238	25.7219
					mb3	0.3890	0.0000	0.1301	3.4426	0.7393	0.6302	0.1724	21.8471
					mb4	0.2039	0.0000	0.0478	2.9919	0.3604	0.2837	0.0636	19.1213
					mb5	0.1811	0.0000	0.0676	1.6974	0.3657	0.1630	0.0647	14.3858
					mb6	0.1109	0.0000	0.0681	1.8227	0.2613	0.2296	0.0627	18.3275
					mb7	0.1226	0.0063	0.2007	2.2416	0.4334	0.2331	0.1458	12.1824
					mb8	0.0869	0.0000	0.0534	1.2923	0.2477	0.0741	0.0432	7.7622
					mb9	0.0873	0.0063	0.0478	1.0289	0.1901	0.1499	0.0426	8.2745
					mb10	0.0609	0.0048	0.0361	0.9613	0.1501	0.0873	0.0349	5.6723
					mb11	0.0616	0.0054	0.0359	0.8436	0.1307	0.1000	0.0306	6.1248
					mb12	0.0396	0.0000	0.0229	0.6758	0.0859	0.0865	0.0233	3.5216
0					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Macoma balthica Palo Alto 7-16-91

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	2.234	0.348	0.983	24.599	4.226	1.159	0.756	138.1
STD	1.099	0.301	0.648	8.734	0.946	0.225	0.391	41.6
SEM	0.366	0.100	0.229	2.911	0.315	0.112	0.130	13.9
CV%	49.187	86.303	65.889	35.505	22.381	19.410	51.687	30.125
r wt x [ ]	0.477	0.651	0.215	0.699	0.423	0.000	0.322	0.742
X 100mg	2.168	0.324	0.984	23.829	4.175	0.000	0.772	134.250
r l x [ ]	0.636	0.867	0.117	0.869	0.600	0.000	0.301	0.685
X 20mm	2.102	0.299	0.983	23.163	4.118	0.000	0.778	132.751
X 25mm	1.589	0.108	1.047	17.597	3.702	0.000	0.865	111.848

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1353	0.0160	0.0567	1.5859	0.2958	1.0000	0.0524	9.1958
25mm	0.2373	0.0226	0.1270	2.7950	0.5678	1.0000	0.1173	16.9020

Estimated weight for 15mm clam

0.029 gm  
29.353 mg

Estimated weight for 20mm clam

0.075 gm  
74.877 mg

Macoma balthica Palo Alto 7-16-91

Sample #-n	Average Length (mm)	Total Dry Wt (gm)	Average Dry Wt (gm)	Recon Amt (ml)	Concentration (ug/ml) - Blank Corrected from ICP-AES							
					Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
mb 1	28.2	0.2364	0.2364	5	0.07412	0.00419	0.05095	0.7071	0.197	0.01081	0.04316	3.51706
mb 2	26.8	0.2249	0.2249	5	0.05739	0.0067	0.0686	0.82344	0.15696	0.04991	0.04705	3.90455
mb 3	23.5	0.3819	0.1273	5	0.22505	0.01592	0.05536	1.74798	0.28883	0.09707	0.05695	12.031
mb 4	19.9	0.1997	0.0666	5	0.06341	0.00838	0.00527	0.67809	0.1203	-0.017	0.00939	7.72739
mb 5	18.2	0.1599	0.0533	5	0.08154	0.00922	0.06977	0.83868	0.17387	0.02776	0.04932	3.65398
mb 6	17.5	0.2293	0.0459	5	0.04068	0.01089	0.02587	1.1241	0.16782	0.06363	0.02521	6.0692
mb 7	15.7	0.1968	0.0328	5	0.06423	0.01173	0.02071	0.79765	0.14432	0.00683	0.01876	5.12227
mb 8	10.6	0.0414	0.0083	5	0.03182	0.00502	0.00939	0.31296	0.0436	0.01292	0.00703	1.46252
mb 9	8.0	0.0359	0.0045	5	0.02741	0.00754	0.00398	0.28336	0.03986	-0.0079	0.00322	1.27621
Detection Lim					.003	.004	.005	.002	.01	.025	.001	.005
Sample #												
Concentration (ug/g) ==>					mb 1	1.5677	0.0886	1.0776	14.9556	4.1667	0.9129	74.388
					mb 2	1.2759	0.1490	1.5251	18.3068	3.4896	1.1096	86.806
					mb 3	2.9465	0.2084	0.7248	22.8853	3.7815	1.2709	157.515
					mb 4	1.5876	0.2098	0.1319	16.9777	3.0120	0.2351	193.475
					mb 5	2.5497	0.2883	2.1817	26.2251	5.4368	0.8680	114.258
					mb 6	0.8870	0.2375	0.5641	24.5116	3.6594	1.3875	132.342
					mb 7	1.6319	0.2980	0.5262	20.2655	3.6667	0.4766	130.139
					mb 8	3.8430	0.6063	1.1341	37.7971	5.2657	0.8490	176.633
					mb 9	3.8175	1.0501		39.4652	5.5515	0.4485	177.745
Sample #												
Content (ug) ==>					mb 1	0.3706	0.0210	0.2548	3.5355	0.9850	0.0000	17.5853
					mb 2	0.2870	0.0335	0.3430	4.1172	0.7848	0.2496	19.5228
					mb 3	0.3751	0.0265	0.0923	2.9133	0.4814	0.1618	20.0516
					mb 4	0.1057	0.0140	0.0088	1.1307	0.2006	0.0000	12.8854
					mb 5	0.1359	0.0154	0.1163	1.3978	0.2898	0.0463	6.0900
					mb 6	0.0407	0.0109	0.0259	1.1251	0.1680	0.0637	6.0745
					mb 7	0.0535	0.0098	0.0173	0.6647	0.1203	0.0000	4.2686
					mb 8	0.0319	0.0050	0.0094	0.3137	0.0437	0.0000	1.4661
					mb 9	0.0172	0.0047	0.0000	0.1776	0.0250	0.0000	0.7999



Macoma balthica Palo Alto 8.12.91

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	2.243	0.1970	1.714	20.03	3.801	1.638	1.095	166.2
STD	0.565	0.1128	0.544	4.68	0.590	0.366	0.219	37.9463
SEM	0.179	0.040	0.172	1.480	0.187	0.122	0.069	12.000
CV%	25.178	57.228	31.720	23.366	15.529	22.364	20.024	22.838
r wt x [ ]	0.120	0.246	0.638	0.467	0.310	0.636	0.560	0.452
X 100mg	2.253	0.179	1.663	19.709	3.774	1.628	1.076	163.617
r l x [ ]	0.233	0.450	0.762	0.522	0.327	0.748	0.624	0.440
X 20mm	2.267	0.179	1.638	19.584	3.765	1.628	1.069	163.089
X 25mm	2.365	0.137	1.332	17.774	3.623	1.410	0.968	150.727

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1700	0.0112	0.1151	1.4181	0.2795	0.1177	0.0786	11.7289
25mm	0.3601	0.0201	0.2033	2.6720	0.5481	0.2156	0.1488	22.1272

Estimated weight for 15mm clam

0.031 gm  
30.505 mg

Estimated weight for 20mm clam

0.076 gm  
75.876 mg

Macoma balthica Palo Alto 8.12.91

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES								
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn	
mb1	28.4	0.2404	0.2404	5	0.1035	0.00965	0.05192	0.72632	0.19848	0.05562	0.0435	8.29399	
mb2	27.8	0.2164	0.2164	5	0.09147	0.00676	0.06296	0.78574	0.11316	0.06795	0.04053	3.42307	
mb3	23.3	0.1237	0.1237	5	0.08501	0.00289	0.04007	0.61584	0.10355	0.04199	0.02696	5.35215	
mb4	21.4	0.1888	0.0944	5	0.06672	0.00482	0.06256	0.65096	0.14356	0.04867	0.03902	5.6011	
mb5	20.2	0.1437	0.0719	5	0.05526	0.00482	0.04702	0.54562	0.12375	0.04801	0.03333	5.10112	
mb6	18.7	0.3827	0.0638	5	0.17984	0.00869	0.0802	0.89271	0.24124	0.11281	0.06501	10.5478	
mb7	15.6	0.0995	0.0332	5	0.05778	bd	0.03139	0.44108	0.06609	0.02916	0.0199	3.47031	
mb8	11.8	0.1415	0.0142	5	0.06797	0.00676	0.05115	0.76387	0.12513	0.06335	0.03637	5.47134	
mb9	10.8	0.0743	0.0106	5	0.02647	0.00676	0.03776	0.34601	0.06276	0.03239	0.02381	2.50476	
mb10	9.6	0.0468	0.0078	5	0.01502	bd	0.02549	0.20447	0.03608	bd	0.01015	1.81305	
Detection Lim					.003	.004	.005	.002	.01	.025	.001	.005	
Sample #													
Concentration (ug/g) ==>					mb1	2.1527	0.2007	1.0799	15.1065	4.1281	1.1568	0.9047	172.504
					mb2	2.1134	0.1562	1.4547	18.1548	2.6146	1.5700	0.9365	79.091
					mb3	3.4361	0.1168	1.6196	24.8925	4.1855	1.6973	1.0897	216.336
					mb4	1.7669	0.1276	1.6568	17.2394	3.8019	1.2889	1.0334	148.334
					mb5	1.9228	0.1677	1.6360	18.9847	4.3058	1.6705	1.1597	177.492
					mb6	2.3496	0.1135	1.0478	11.6633	3.1518	1.4739	0.8494	137.807
					mb7	2.9035		1.5774	22.1648	3.3211	1.4653	1.0000	174.387
					mb8	2.4018	0.2389	1.8074	26.9919	4.4216	2.2385	1.2852	193.334
					mb9	1.7813	0.4549	2.5410	23.2847	4.2234	2.1797	1.6023	168.557
					mb10	1.6047		2.7233	21.8451	3.8547		1.0844	193.702
Sample #													
Content (ug) ==>					mb1	0.5175	0.0483	0.2596	3.6316	0.9924	0.2781	0.2175	41.4700
					mb2	0.4574	0.0338	0.3148	3.9287	0.5658	0.3398	0.2026	17.1154
					mb3	0.4251	0.0145	0.2004	3.0792	0.5178	0.2100	0.1348	26.7608
					mb4	0.1668	0.0120	0.1564	1.6274	0.3589	0.1217	0.0976	14.0028
					mb5	0.1382	0.0121	0.1176	1.3650	0.3096	0.1201	0.0834	12.7617
					mb6	0.1499	0.0072	0.0669	0.7441	0.2011	0.0940	0.0542	8.7921
					mb7	0.0964		0.0524	0.7359	0.1103	0.0486	0.0332	5.7897
					mb8	0.0341	0.0034	0.0257	0.3833	0.0628	0.0318	0.0182	2.7453
					mb9	0.0189	0.0048	0.0269	0.2468	0.0448	0.0231	0.0170	1.7867
					mb10	0.0125	0.0000	0.0212	0.1704	0.0301	0.0000	0.0085	1.5109

*Pale Alto*  
Macoma balthica 9.91

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	1.5628	0.1980	1.3633	17.6432	4.1693	1.7873	1.1983	*****
STD	0.54208	0.04337	0.40323	1.36032	0.8395	0.27397	0.28149	23.472
SEM	0.181	0.015	0.134	0.453	0.280	0.091	0.094	7.824
CV%	34.688	21.903	29.578	7.710	20.135	15.329	23.490	15.510
r wt x [ ]	0.906	0.332	0.276	0.051	0.813	0.508	0.105	0.372
X 100mg	2.094	0.184	1.243	17.568	3.431	1.637	1.230	141.893
r l x [ ]	0.895	0.431	0.295	0.023	0.873	0.591	0.087	0.362
X 20mm	1.988	0.184	1.259	17.616	3.527	1.645	1.220	143.885
X 25mm	2.599	0.158	1.109	17.576	2.604	1.441	1.251	133.168

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1722	0.0160	0.1104	1.5623	0.3133	0.1453	0.1076	12.6549
25mm	0.4430	0.0283	0.2043	3.0715	0.5278	0.2638	0.2193	23.6533

Estimated weight for 15mm clam

0.037 gm  
37.080 mg

Estimated weight for 20mm clam

0.089 gm  
89.258 mg

Macoma balthica

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES								
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn	
mb1	22.6	0.3630	0.1210	5	0.20304	0.01395	0.0771	1.44814	0.22906	0.11017	0.08056	8.37477	
mb2	20.7	0.3149	0.1050	5	0.12077	0.01395	0.1034	0.94861	0.2255	0.1252	0.09583	8.29489	
mb3	19.8	0.2708	0.0903	5	0.09065	0.0082	0.05932	0.92066	0.19374	0.08075	0.06277	10.3532	
mb4	18.0	0.1893	0.0631	5	0.05469	0.00574	0.04067	0.6712	0.15592	0.05984	0.03844	5.54788	
mb5	15.8	0.3809	0.0423	5	0.11209	0.01559	0.1186	1.31779	0.29561	0.1341	0.10826	12.5688	
mb6	14.6	0.3423	0.0342	5	0.09815	0.01066	0.07968	1.28346	0.2717	0.12767	0.06143	10.0051	
mb7	13.6	0.2885	0.0289	5	0.06755	0.01395	0.07237	0.98903	0.2412	0.08922	0.05832	7.58733	
mb8	12.6	0.2165	0.0217	5	0.05179	0.01148	0.09869	0.80125	0.2312	0.09286	0.07355	7.25235	
mb9	11.0	0.1401	0.0140	5	0.02691		0.032	0.48646	0.16038	0.06144	0.02667	4.68409	
Detection Lim					.003	.004	.005	.002	.01	.025	.001	.005	
Sample #													
Concentration (ug/g) ==>					mb1	2.7967	0.1921	1.0620	19.9468	3.1551	1.5175	1.1096	115.355
					mb2	1.9176	0.2215	1.6418	15.0621	3.5805	1.9879	1.5216	131.707
					mb3	1.6737	0.1514	1.0953	16.9989	3.5772	1.4910	1.1590	191.159
					mb4	1.4445	0.1516	1.0742	17.7285	4.1183	1.5806	1.0153	146.537
					mb5	1.4714	0.2046	1.5568	17.2984	3.8804	1.7603	1.4211	164.989
					mb6	1.4337	0.1557	1.1639	18.7476	3.9687	1.8649	0.8973	146.146
					mb7	1.1707	0.2418	1.2542	17.1409	4.1802	1.5463	1.0107	131.496
					mb8	1.1961	0.2651	2.2792	18.5046	5.3395	2.1446	1.6986	167.491
					mb9	0.9604		1.1420	17.3612	5.7238	2.1927	0.9518	167.170
Sample #													
Content (ug) ==>					mb1	0.3384	0.0233	0.1285	2.4136	0.3818	0.1836	0.1343	13.9580
					mb2	0.2013	0.0233	0.1724	1.5815	0.3760	0.2087	0.1598	13.8292
					mb3	0.1511	0.0137	0.0989	1.5350	0.3230	0.1346	0.1047	17.2617
					mb4	0.0912	0.0096	0.0678	1.1187	0.2599	0.0997	0.0641	9.2465
					mb5	0.0622	0.0087	0.0659	0.7317	0.1641	0.0745	0.0601	6.9790
					mb6	0.0490	0.0053	0.0398	0.6412	0.1357	0.0638	0.0307	4.9982
					mb7	0.0338	0.0070	0.0362	0.4954	0.1208	0.0447	0.0292	3.8002
					mb8	0.0260	0.0058	0.0495	0.4016	0.1159	0.0465	0.0369	3.6345
					mb9	0.0134	0.0000	0.0160	0.2431	0.0801	0.0307	0.0133	2.3404

Macoma balthica 11 • 91

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	1.0817	0.1854	1.3070	13.7764	3.4941	1.3013	1.1112	168.684
STD	0.57287	0.05947	0.68247	1.79957	0.70506	0.41632	0.45584	24.3327
SEM	0.173	0.019	0.216	0.543	0.213	0.132	0.137	7.337
CV%	52.961	32.071	52.215	13.063	20.179	31.993	41.023	14.425
r wt x [ ]	0.736	0.475	0.459	0.135	0.638	0.669	0.466	0.269
X 100mg	1.187	0.190	1.254	13.716	3.381	1.255	1.058	167.042
r l x [ ]	0.654	0.473	0.378	0.097	0.647	0.713	0.332	0.228
X 20mm	1.196	0.191	1.257	13.723	3.355	1.244	1.065	166.989
X 25mm	1.564	0.219	0.996	13.552	2.907	0.943	0.916	161.536

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.0904	0.0153	0.0857	1.1361	0.2689	0.0939	0.0779	13.6647
25mm	0.2278	0.0350	0.1321	2.2502	0.4752	0.1457	0.1317	26.2855

Estimated weight for 15mm clam

0.034 gm  
34.335 mg

Estimated weight for 20mm clam

0.083 gm  
83.320 mg

Macoma balthica

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES								
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn	
mb1	29.3	0.2756	0.2756	5	0.12596	0.0123	0.01747	0.69338	0.13166	0.03531	0.01849	9.14237	
mb2	24.4	0.1372	0.1372	5	0.01482	0.00656	0.03834	0.35459	0.07796	0.02027	0.03312	4.91331	
mb3	22.0	0.2691	0.1342	5	0.1023	0.01477	0.07074	0.8371	0.19249	0.08626	0.05864	5.75995	
mb4	19.4	0.1444	0.0722	5	0.02631	0.00328	0.02413	0.38285	0.07706	0.02518	0.0262	4.89353	
mb5	18.3	0.2925	0.0585	5	0.08106	0.0123	0.15121	0.93737	0.26528	0.10841	0.11599	10.3076	
mb6	17.5	0.1624	0.0541	5	0.02544	0.00492	0.02176	0.34395	0.09437	0.04157	0.02503	5.84357	
mb7	16.4	0.1924	0.0481	5	0.03085	0.00328	0.07443	0.57154	0.15413	0.05044	0.06071	7.78749	
mb8	15.3	0.2176	0.0363	5	0.04953	0.00984	0.08	0.68153	0.19053	0.06757	0.06715	7.06548	
mb9	14.4	0.1843	0.0307	5	0.03832	0.00574	0.02934	0.52292	0.1329	0.0604	0.02973	5.98787	
mb10	13.4	0.1403	0.0234	5	0.01256	0.00492	0.03881	0.40958	0.1065	0.04276	0.03145	5.37268	
mb11	12.5	0.0604	0.0201	5	0.00804			0.13673	0.04513		0.01066	1.92535	
Detection Lim					.003	.004	.005	.002	.01	.025	.001	.005	
Sample #													
Concentration (ug/g) ==>					mb1	2.2852	0.2231	0.3169	12.5795	2.3886	0.6406	0.3354	165.863
					mb2	0.5401	0.2391	1.3972	12.9224	2.8411	0.7387	1.2070	179.056
					mb3	1.9008	0.2744	1.3144	15.5537	3.5766	1.6027	1.0896	107.022
					mb4	0.9110	0.1136	0.8355	13.2566	2.6683	0.8719	0.9072	169.444
					mb5	1.3856	0.2103	2.5848	16.0234	4.5347	1.8532	1.9827	176.198
					mb6	0.7833	0.1515	0.6700	10.5896	2.9055	1.2799	0.7706	179.913
					mb7	0.8017	0.0852	1.9343	14.8529	4.0055	1.3108	1.5777	202.378
					mb8	1.1381	0.2261	1.8382	15.6602	4.3780	1.5526	1.5430	162.350
					mb9	1.0396	0.1557	0.7960	14.1867	3.6055	1.6386	0.8066	162.449
					mb10	0.4476	0.1753	1.3831	14.5966	3.7954	1.5239	1.1208	191.471
					mb11	0.6656			11.3187	3.7359		0.8825	159.383
Sample #													
Content (ug) ==>					mb1	0.6298	0.0615	0.0874	3.4669	0.6583	0.1766	0.0925	45.7119
					mb2	0.0741	0.0328	0.1917	1.7730	0.3898	0.1014	0.1656	24.5666
					mb3	0.2551	0.0368	0.1764	2.0873	0.4800	0.2151	0.1462	14.3624
					mb4	0.0658	0.0082	0.0603	0.9571	0.1927	0.0630	0.0655	12.2338
					mb5	0.0811	0.0123	0.1512	0.9374	0.2653	0.1084	0.1160	10.3076
					mb6	0.0424	0.0082	0.0362	0.5729	0.1572	0.0692	0.0417	9.7333
					mb7	0.0386	0.0041	0.0930	0.7144	0.1927	0.0631	0.0759	9.7344
					mb8	0.0413	0.0082	0.0667	0.5685	0.1589	0.0564	0.0560	5.8933
					mb9	0.0319	0.0048	0.0244	0.4355	0.1107	0.0503	0.0248	4.9872
					mb10	0.0105	0.0041	0.0324	0.3416	0.0888	0.0357	0.0262	4.4804
					mb11	0.0134			0.2275	0.0751		0.0177	3.2036

Macoma balthica Palo Alto 12-16-91

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	1.480	0.1756	4.030	14.910	4.296	1.951	2.070	192.39
STD	0.268	0.05744	2.022	2.796	1.084	0.737	1.076	32.38
SEM	0.089	0.023	0.674	0.932	0.361	0.261	0.359	10.79
CV%	18.142	32.715	50.171	18.755	25.237	37.800	51.976	16.828
r wt x [ ]	0.002	0.000	0.753	0.134	0.609	0.000	0.457	0.582
X 100mg	1.479	0.000	1.368	14.254	3.141	0.000	1.211	159.463
r l x [ ]	0.065	0.000	0.786	0.201	0.620	0.000	0.449	0.557
X 20mm	1.496	0.000	2.496	14.367	3.647	0.000	1.603	174.972
X 25mm	1.522	0.000	0.163	13.540	2.660	0.000	0.894	148.494

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1104	1.0000	0.1701	1.0291	0.2633	1.0000	0.1069	12.7614
25mm	0.2249	1.0000	0.2041	1.9309	0.4347	1.0000	0.1599	22.6808

Estimated weight for 15mm clam

0.031 gm  
30.656 mg

Estimated weight for 20mm clam

0.074 gm  
73.711 mg

Macoma balthica Palo Alto 12-16-91

Sample #-n	Average Length (mm)	Total Dry Wt (gm)	Average Dry Wt (gm)	Recon Amt (ml)	Concentration (ug/ml) - Blank Corrected from ICP-AES							
					Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
MB 1	23.4	0.4532	0.1133	5	0.142	0.016	0.136	1.338	0.271	0.1	0.086	14.46
MB 2	19.4	0.3303	0.0661	5	0.093	0.012	0.239	1.057	0.284	0.139	0.162	11.1
MB 3	18.4	0.3127	0.0625	5	0.07	0.007	0.13	0.892	0.226	0.08	0.091	9.465
MB 4	17.4	0.2290	0.0458	5	0.069	0.013	0.144	0.375	0.168	0.085	0.079	9.207
MB 5	16.1	0.1243	0.0414	5	0.04	0.003	0.075	0.413	0.095	0.039	0.027	6.23
MB 6	15.4	0.1339	0.0335	5	0.05	0.004	0.179	0.487	0.172	0.093	0.114	5.036
MB 7	14.6	0.2332	0.0292	5	0.071	0.007	0.159	0.676	0.176	0.087	0.097	8.828
MB 8	13.6	0.0619	0.0206	5	0.021	0	0.068	0.196	0.055	0.021	0.018	2.868
MB 9	12.1	0.0635	0.0159	5	0.013	0.001	0.093	0.201	0.071	0.03	0.04	2.437

Detection Limit	.003	.004	.005	.002	.01	.025	.001	.005
-----------------	------	------	------	------	-----	------	------	------

Sample #

Concentration (ug/g) ==>

MB 1	1.5662	0.1735	1.4991	14.7657	2.9918	1.102	0.9522	159.579
MB 2	1.4040	0.1820	3.6249	16.0008	4.2970	2.104	2.4516	168.070
MB 3	1.1146	0.1183	2.0726	14.2635	3.6178	1.286	1.4528	151.350
MB 4	1.5076	0.2828	3.1419	8.1799	3.6596	1.851	1.7199	201.017
MB 5	1.5901		3.0149	16.6307	3.8146	1.582	1.1014	250.616
MB 6	1.8757	0.1382	6.6770	18.2031	6.4298	3.472	4.2562	188.065
MB 7	1.5199	0.1587	3.4112	14.5034	3.7676	1.867	2.0881	189.278
MB 8	1.7108		5.4887	15.8126	4.4677		1.4281	231.628
MB 9	1.0268		7.3425	15.8339	5.6165	2.343	3.1803	191.895

Sample #

Content (ug) ==>

MB 1	0.1775	0.0197	0.1699	1.6730	0.3390	0.1248	0.1079	18.0803
MB 2	0.0928	0.0120	0.2396	1.0577	0.2840	0.1391	0.1620	11.1094
MB 3	0.0697	0.0074	0.1295	0.8915	0.2261	0.0804	0.0908	9.4594
MB 4	0.0691	0.0129	0.1439	0.3746	0.1676	0.0848	0.0788	9.2066
MB 5	0.0658	0.0000	0.1248	0.6885	0.1579	0.0655	0.0456	10.3755
MB 6	0.0628	0.0046	0.2237	0.6098	0.2154	0.1163	0.1426	6.3002
MB 7	0.0444	0.0046	0.0996	0.4235	0.1100	0.0545	0.0610	5.5269
MB 8	0.0352	0.0000	0.1131	0.3257	0.0920	0.0000	0.0294	4.7715
MB 9	0.0163	0.0000	0.1167	0.2518	0.0893	0.0373	0.0506	3.0511



Macoma balthica Palo Alto 1-15-92

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	1.888	0.1650	1.597	17.36	4.331	1.991	2.012	201.1
STD	0.648	0.06724	0.980	2.92	0.969	0.467	0.637	41.3
SEM	0.205	0.024	0.327	0.92	0.323	0.148	0.201	13.1
CV%	34.305	40.757	61.371	16.846	22.383	23.452	31.648	20.530
r wt x [ ]	0.600	0.000	0.614	0.161	0.782	0.712	0.365	0.592
X 100mg	2.271	0.000	1.068	16.895	3.665	1.664	1.783	177.038
r l x [ ]	0.658	0.000	0.432	0.078	0.693	0.606	0.117	0.335
X 20mm	2.090	0.000	1.455	17.466	4.105	1.858	1.976	194.578
X 25mm	2.649	0.000	0.826	17.764	3.108	1.487	1.879	176.422

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1344	1.0000	0.0738	1.1442	0.2597	0.1178	0.1242	12.4108
25mm	0.3544	1.0000	0.0994	2.4219	0.4582	0.2073	0.2476	23.6600

Estimated weight for 15mm clam

0.026 gm  
26.054 mg

Estimated weight for 20mm clam

0.064 gm  
64.492 mg

Macoma balthica Palo Alto 1-15-92

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES								
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn	
mb1	26.3	0.1375	0.1375	5	0.043	0.003	-0.01	0.119	0.085	-0.00	0.042	1.280	
mb2	24.5	0.2950	0.1475	5	0.131	0.007	0.032	0.887	0.149	0.081	0.065	6.062	
mb3	22.5	0.1101	0.1101	5	0.073	0.000	0.015	0.300	0.088	0.033	0.048	4.578	
mb4	21.4	0.1735	0.0868	5	0.061	0.005	0.018	0.735	0.116	0.048	0.048	6.862	
mb5	19.2	0.2080	0.0520	5	0.070	0.004	0.129	0.929	0.246	0.120	0.119	9.966	
mb6	18.3	0.2581	0.0430	5	0.075	0.008	0.145	0.906	0.233	0.108	0.155	11.91	
mb7	17.5	0.3451	0.0314	5	0.163	0.010	0.162	1.163	0.320	0.149	0.165	15.83	
mb8	16.6	0.3382	0.0338	5	0.141	0.009	0.111	1.243	0.302	0.137	0.112	14.48	
mb9	15.4	0.2042	0.0292	5	0.068	0.009	0.068	0.738	0.189	0.085	0.081	7.869	
mb10	14.4	0.1231	0.0246	5	0.030	0.007	0.027	0.425	0.122	0.051	0.054	5.695	
mb11	12.2	0.0779	0.0156	5	0.018	0.001	-0.02	0.208	0.051	0.036	0.021	2.571	
Detection Lim					.003	.004	.005	.002	.01	.025	.001	.005	
Sample #													
Concentration (ug/g) ==>					mb1								
					mb2	2.2153	0.1254	0.5427	15.0290	2.5202	1.3676	1.1058	102.753
					mb3	3.3220		0.6594	13.6108	3.9946	1.5209	2.1653	207.888
					mb4	1.7478	0.1331	0.5161	21.1839	3.3380	1.3781	1.3885	197.746
					mb5	1.6909	0.0889	3.0974	22.3332	5.9137	2.8928	2.8692	239.571
					mb6	1.4452	0.1612	2.7999	17.5564	4.5120	2.0982	2.9955	230.788
					mb7	2.3647	0.1473	2.3515	16.8550	4.6430	2.1556	2.3935	229.306
					mb8	2.0912	0.1368	1.6440	18.3767	4.4641	2.0238	1.6507	214.124
					mb9	1.6748	0.2265	1.6665	18.0642	4.6388	2.0855	1.9814	192.670
					mb10	1.2011	0.3006	1.0955	17.2502	4.9582	2.0658	2.1897	231.305
					mb11	1.1309			13.3254		2.3222	1.3768	164.995
Sample #													
Content (ug) ==>					mb1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
					mb2	0.3268	0.0185	0.0801	2.2168	0.3717	0.2017	0.1631	15.1561
					mb3	0.3658	0.0000	0.0726	1.4986	0.4398	0.1675	0.2384	22.8885
					mb4	0.1517	0.0116	0.0448	1.8388	0.2897	0.1196	0.1205	17.1643
					mb5	0.0879	0.0046	0.1611	1.1613	0.3075	0.1504	0.1492	12.4577
					mb6	0.0621	0.0069	0.1204	0.7549	0.1940	0.0902	0.1288	9.9239
					mb7	0.0743	0.0046	0.0738	0.5292	0.1458	0.0677	0.0752	7.2002
					mb8	0.0707	0.0046	0.0556	0.6211	0.1509	0.0684	0.0558	7.2374
					mb9	0.0489	0.0066	0.0487	0.5275	0.1355	0.0609	0.0579	5.6260
					mb10	0.0295	0.0074	0.0269	0.4244	0.1220	0.0508	0.0539	5.6901
					mb11	0.0176	0.0000	0.0000	0.2079	0.0000	0.0362	0.0215	2.5739

Macoma balthica PALO ALTO 2/25/92

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	2.619	0.141	1.159	23.022	4.068	1.664	1.307	324.3
STD	1.031	0.019	0.724	5.446	0.479	0.446	0.350	73.71
SEM	0.390	0.011	0.296	2.058	0.181	0.182	0.132	27.86
CV%	39.354	13.715	62.467	23.657	11.782	26.770	26.752	22.73
r wt x [ ]	0.820	0.000	0.000	0.105	0.776	0.000	0.157	0.205
X 100mg	4.530	0.000	0.000	24.313	4.909	0.000	1.431	290.042
r l x [ ]	0.832	0.000	0.000	0.150	0.682	0.000	0.060	0.252
X 20mm	3.107	0.000	0.000	23.486	4.254	0.000	1.319	313.708
X 25mm	4.209	0.000	0.000	24.534	4.674	0.000	1.346	289.865

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1592	1.0000	1.0000	1.2279	0.2247	1.0000	0.0680	16.2305
25mm	0.4085	1.0000	1.0000	2.4011	0.4539	1.0000	0.1307	28.6405

Estimated weight for 15mm clam

0.024 gm  
23.575 mg

Estimated weight for 20mm clam

0.053 gm  
53.134 mg

Macoma balthica PALO ALTO 2/25/92

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES							
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
MB1	23.8	0.0836	0.0836	5	0.0783	0.00223	0.00539	0.36239	0.07936	0.02301	0.02169	4.55504
MB2	21.2	0.1345	0.0673	5	0.07073	0.00149	0.0351	0.52976	0.12257	0.06099	0.04324	10.9786
MB3	19.2	0.1938	0.0485	5	0.08669	0.00522	0.04744	1.33096	0.16006	0.04601	0.05364	10.5968
MB4	17.5	0.2518	0.0360	5	0.14407	0.00821	0.01619	1.17894	0.17269	0.05579	0.0404	12.175
MB6	15.5	0.1774	0.0253	5	0.09341	0.00447	0.05821	0.78761	0.1376	0.0599	0.05602	10.8663
MB7	14.5	0.0764	0.0191	5	0.02657	0.00373	-0.0012	0.25992	0.0549	0.02758	0.01304	6.70602
MB8	12.8	0.0991	0.0165	5	0.03079	-0.003	0.0424	0.45239	0.08216	0.03828	0.03227	6.52119
				Detection Lim	.003	.004	.005	.002	.01	.025	.001	.005
				Sample #								
		Concentration (ug/g) ==>		MB1	4.6830		0.3224	21.6740	4.7464		1.2972	272.431
				MB2	2.6294		1.3048	19.6937	4.5565	2.2673	1.6074	408.126
				MB3	2.2366	0.1347	1.2239	34.3385	4.1295	1.1870	1.3839	273.395
				MB4	2.8608	0.1630	0.3215	23.4102	3.4291	1.1078	0.8022	241.760
				MB6	2.6328	0.1260	1.6406	22.1987	3.8782	1.6883	1.5789	306.265
				MB7	1.7389			17.0105	3.5929	1.8050	0.8534	438.876
				MB8	1.5535		2.1393	22.8249	4.1453	1.9314	1.6282	329.021
				Sample #								
		Content (ug) ==>		MB1	0.3915		0.0270	1.8120	0.3968		0.1085	22.7752
				MB2	0.1770		0.0878	1.3254	0.3067	0.1526	0.1082	27.4669
				MB3	0.1085	0.0065	0.0594	1.6654	0.2003	0.0576	0.0671	13.2596
				MB4	0.1030	0.0059	0.0116	0.8428	0.1234	0.0399	0.0289	8.7034
				MB6	0.0666	0.0032	0.0415	0.5616	0.0981	0.0427	0.0399	7.7485
				MB7	0.0332			0.3249	0.0686	0.0345	0.0163	8.3825
				MB8	0.0256		0.0353	0.3766	0.0684	0.0319	0.0269	5.4288

Macoma balthica Palo Alto 3/23/94

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	2.413	0.291	2.448	25.02	5.622	2.327	2.163	373.8
STD	0.392	0.087	0.754	3.25	1.281	0.575	0.478	93.75
SEM	0.131	0.029	0.251	1.08	0.427	0.192	0.159	31.25
CV%	16.229	29.789	30.795	12.98	22.791	24.707	22.101	25.08
r wt x [ ]	0.054	0.519	0.648	0.734	0.841	0.780	0.836	0.862
X 100mg	2.372	0.378	3.395	29.636	7.709	3.196	2.937	530.357
r l x [ ]	0.087	0.444	0.577	0.709	0.786	0.726	0.816	0.857
X 20mm	2.401	0.304	2.598	25.811	5.969	2.471	2.298	401.559
X 25mm	2.367	0.343	3.038	28.135	6.986	2.892	2.692	482.708

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1134	0.0141	0.1204	1.2336	0.2816	0.1165	0.1097	19.0140
25mm	0.1943	0.0268	0.2375	2.2859	0.5495	0.2297	0.2204	38.4234

Estimated weight for 15mm clam

0.024 gm  
23.508 mg

Estimated weight for 20mm clam

0.048 gm  
47.991 mg

Macoma balthica Palo Alto 3/23/97/2

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES								
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn	
MB1	28.7	0.1076	0.1076	5	0.0514	0.0097	0.07886	0.70816	0.19037	0.0766	0.06566	13.1198	
MB2	22.4	0.1384	0.0692	5	0.07265	0.00746	0.08934	0.64741	0.16153	0.07175	0.06963	9.562	
MB3	19.7	0.2475	0.0495	5	0.0834	0.01343	0.09852	1.1751	0.25605	0.10517	0.10549	17.7709	
MB4	18.4	0.2253	0.0376	5	0.12283	0.01343	0.07785	1.15928	0.21072	0.09121	0.09529	18.5943	
MB5	17.3	0.2436	0.0348	5	0.12671	0.01194	0.12378	1.19908	0.26589	0.11049	0.11957	17.373	
MB6	16.4	0.1427	0.0285	5	0.05802	0.00746	0.07627	0.71471	0.15488	0.06981	0.05819	9.24254	
MB7	15.6	0.1407	0.0281	5	0.08156	0.00671	0.0491	0.62567	0.13387	0.05014	0.04508	9.3765	
MB8	14.1	0.1070	0.0178	5	0.04535	0.00373	0.03202	0.47045	0.10143	0.0339	0.03127	6.58838	
MB9	12.0	0.0544	0.0136	5	0.02872	0.00447	0.03231	0.27751	0.06182	0.02789	0.02282	3.43601	
				Detection Lim	.003	.004	.005	.002	.01	.025	.001	.005	
				Sample #									
				Concentration (ug/g) ==>	MB1	2.3885	0.4507	3.6645	32.9071	8.8462	3.5595	3.0511	609.655
					MB2	2.6246	0.2695	3.2276	23.3891	5.8356	2.5921	2.5155	345.448
					MB3	1.6848	0.2713	1.9903	23.7394	5.1727	2.1246	2.1311	359.007
					MB4	2.7259	0.2980	1.7277	25.7275	4.6764	2.0242	2.1147	412.657
					MB5	2.6008	0.2451	2.5406	24.6117	5.4575	2.2679	2.4542	356.589
					MB6	2.0329	0.2614	2.6724	25.0424	5.4268	2.4460	2.0389	323.845
					MB7	2.8984	0.2385	1.7448	22.2342	4.7573	1.7818	1.6020	333.209
					MB8	2.1192	0.1743	1.4963	21.9836	4.7397	1.5841	1.4612	307.868
					MB9	2.6397	0.4108	2.9697	25.5064	5.6820	2.5634	2.0974	315.810
				Sample #									
				Content (ug) ==>	MB1	0.2570	0.0485	0.3943	3.5408	0.9519	0.3830	0.3283	65.5989
					MB2	0.1816	0.0187	0.2234	1.6185	0.4038	0.1794	0.1741	23.9050
					MB3	0.0834	0.0134	0.0985	1.1751	0.2561	0.1052	0.1055	17.7709
					MB4	0.1025	0.0112	0.0650	0.9674	0.1758	0.0761	0.0795	15.5159
					MB5	0.0905	0.0085	0.0884	0.8565	0.1899	0.0789	0.0854	12.4093
					MB6	0.0579	0.0074	0.0762	0.7137	0.1547	0.0697	0.0581	9.2296
					MB7	0.0814	0.0067	0.0490	0.6248	0.1337	0.0501	0.0450	9.3632
					MB8	0.0377	0.0031	0.0266	0.3913	0.0844	0.0282	0.0260	5.4801
					MB9	0.0359	0.0056	0.0404	0.3469	0.0773	0.0349	0.0285	4.2950

Macoma balthica Palo Alto 5-6-92

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mean(ug/g)	3.583	0.258	1.682	39.57	4.714	1.766	1.121	312.1
STD	1.325	0.074	0.385	6.38	0.951	0.663	0.331	91.1
SEM	0.442	0.025	0.128	2.13	0.317	0.221	0.110	30.4
CV%	37.0	28.7	22.9	16.1	20.2	37.6	29.5	29.2
r wt x [ ]	0.826	0.138	0.518	0.764	0.545	0.635	0.599	0.165
X 100mg	5.170	0.272	1.971	46.633	5.466	2.377	1.408	333.915
r l x [ ]	0.841	0.171	0.527	0.806	0.627	0.663	0.613	0.197
X 20mm	3.720	0.259	1.707	40.204	4.788	1.820	1.146	314.345
X 25mm	4.976	0.274	1.936	46.001	5.460	2.316	1.374	334.553

Estimated content (ug) for 20mm and 25mm clam

	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
20mm	0.1877	0.0128	0.0873	2.0879	0.2470	0.0911	0.0581	15.5299
25mm	0.4559	0.0236	0.1707	4.2234	0.4983	0.1974	0.1192	27.5463

Estimated weight for 15mm clam

Estimated weight for 20mm clam

0.024 gm  
24.379 mg

0.052 gm  
51.925 mg

Macoma balthica Palo Alto 5-6-92

Sample #-n	Average	Total	Average	Recon	Concentration (ug/ml) - Blank Corrected from ICP-AES							
	Length (mm)	Dry Wt (gm)	Dry Wt (gm)	Amt (ml)	Ag	Cd	Cr	Cu	Ni	Pb	V	Zn
Mb1	27.8	0.1138	0.1138	5	0.14437	0.00796	0.05978	1.25142	0.14737	0.07756	0.04429	11.4212
Mb2	24.7	0.1956	0.0978	5	0.1503	0.00796	0.05398	1.475	0.15328	0.05628	0.03619	6.1235
Mb3	21.5	0.1799	0.0600	5	0.14421	0.00996	0.0508	1.54232	0.22112	0.06192	0.03936	9.25586
Mb4	19.2	0.1982	0.0496	5	0.17457	0.00398	0.07223	1.57063	0.16726	0.05098	0.0395	11.2345
Mb5	18.2	0.1591	0.0398	5	0.07758	0.01062	0.05456	1.2066	0.15123	0.06534	0.03621	11.1612
Mb6	17.3	0.1926	0.0385	5	0.14634	0.01062	0.05499	1.38317	0.17581	0.05336	0.0348	12.8643
Mb7	16.4	0.1515	0.0303	5	0.0684	0.00863	0.0459	1.14563	0.12255	0.04875	0.02515	9.6314
Mb8	15.6	0.1686	0.0280	5	0.10174	0.00863	0.05265	1.10988	0.14798	0.05747	0.04026	10.6233
Mb9	14.4	0.1392	0.0199	5	0.05965	0.00664	0.04684	1.01424	0.10917	0.03583	0.02948	8.14757
				Detection Lim	.003	.004	.005	.002	.01	.025	.001	.005
				Sample #								
Concentration (ug/g) ==>				Mb1	6.3431	0.3497	2.6265	54.9833	6.4750	3.4077	1.9460	501.811
				Mb2	3.8420	0.2035	1.3799	37.7045	3.9182	1.4387	0.9251	156.531
				Mb3	4.0081	0.2768	1.4119	42.8660	6.1456	1.7210	1.0939	257.250
				Mb4	4.4039	0.1004	1.8221	39.6224	4.2195	1.2861	0.9965	283.412
				Mb5	2.4381	0.3338	1.7146	37.9195	4.7527	2.0534	1.1380	350.761
				Mb6	3.7991	0.2757	1.4276	35.9078	4.5641	1.3853	0.9034	333.964
				Mb7	2.2574	0.2848	1.5149	37.8096	4.0446	1.6089	0.8300	317.868
				Mb8	3.0172	0.2559	1.5614	32.9146	4.3885	1.7043	1.1940	315.045
				Mb9	2.1426	0.2385	1.6825	36.4310	3.9213	1.2870	1.0589	292.657
				Sample #								
Content (ug) ==>				Mb1	0.7219	0.0398	0.2989	6.2571	0.7369	0.3878	0.2215	57.1061
				Mb2	0.3758	0.0199	0.1350	3.6875	0.3832	0.1407	0.0905	15.3088
				Mb3	0.2405	0.0166	0.0847	2.5720	0.3687	0.1033	0.0656	15.4350
				Mb4	0.2184	0.0050	0.0904	1.9653	0.2093	0.0638	0.0494	14.0572
				Mb5	0.0970	0.0133	0.0682	1.5092	0.1892	0.0817	0.0453	13.9603
				Mb6	0.1463	0.0106	0.0550	1.3825	0.1757	0.0533	0.0348	12.8576
				Mb7	0.0684	0.0086	0.0459	1.1456	0.1226	0.0488	0.0252	9.6314
				Mb8	0.0845	0.0072	0.0437	0.9216	0.1229	0.0477	0.0334	8.8213
				Mb9	0.0426	0.0047	0.0335	0.7250	0.0780	0.0256	0.0211	5.8239